

Biology Syllabus

Grades 7 and 8

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Introduction

Biology is a life science that allows students to acquire knowledge and understanding about themselves and the organisms in their environment. It allows students to appreciate the harmony, contrast, and beauty of nature around them. Biology as an experimental science involves critical thinking, reasoning and problem solving in everyday contexts.

The Biology syllabus 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 syllabus has also considered international content standards for a similar age and grade level of learners. The specific objectives and contents are derived from the minimum learning competencies designed for the two grade levels. Agriculture, technology and AIDS are integrated in a much broader manner in response to the recommendations of the needs assessment. The needs assessment has indicated areas in the curriculum where contents are too difficult for children and grade levels where contents are overloaded. This syllabus has removed some difficult contents and retained others by simplifying them. The content overload has also been addressed by limiting details of contents and reducing the highly prescriptive methodology. Large content details and highly prescriptive methodology were proved to result in big volumes of textbooks which teachers found difficult to complete in an academic year.

In general, the main changes that are made during the revision of the biology curriculum revolved around:

- Addressing content overload
- Addressing content difficulty
- Strengthening active learning
- Integrating technology
- Integrating agriculture
- Considering international standards
- Strengthening horizontal and vertical relationships
- Strengthening relationships with TVET and further education
- Ensuring relevance of contents to the life and need of students and
- Organizing teaching around learning competencies

The learning competencies developed are based on 3 broad outcomes that were developed and defined for the areas knowledge, skills and values and attitudes. They read as follows:

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.

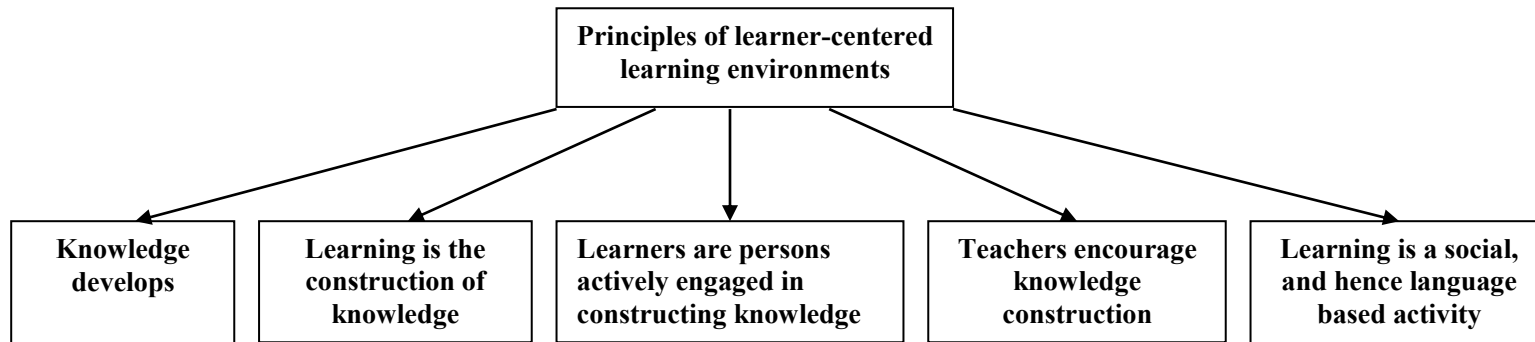
The developed competencies relate directly to these broad outcomes. The approach is based on the constructivist theory of teaching and learning. Constructivism underpins the concept of Competency Base Education. This education strategy supports teaching and learning in different environments. Constructivism emphasizes on two important dimensions:

- Learners actively acquire existing human knowledge (language, cultural wisdom, technical skills, school disciplines etc.) as their own system of knowing.
- Learners actively construct their own novel ways of knowing in the face of unfamiliar problems.

Therefore: Learners construct and re-construct knowledge. This is an active process of the learner and, thus gaining knowledge must be a learner-centered process. The learner-centered approach challenges both learners and teachers. The constructivist learning theory is very obvious since the knowledge of human kind was developed in this way: People engaged in understanding, explaining and working in the real world. The construction of knowledge is individual. Every learner, in particular the child as a learner, undergoes a process of acquiring knowledge. Knowledge is invented and re-invented. Therefore, knowledge cannot be transmitted from the teacher to the learner; it is re-constructed by the learner engaged in a culture of learning in school.

The main principle of constructivism in the classroom is to create an environment that gets learners engaged in the processes and development of thinking (cognition). To learn means to think about life, culture and work in increasingly complex ways in order to act more and more competently. A school (especially the classroom) is a particular important learning environment, because it makes systematic learning possible. The principles of learner-centered learning are summarized in the following diagram.

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 teachers 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 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 teachers' freedom of using them flexibly. A teacher who finished the content before the allocated time could freely use the remaining periods for the succeeding content and so on.



The above diagram shows that ONE; Knowledge is a body of information, ideas and practices that change and develop over time; TWO: the construction of knowledge is closely related to the activities in the classroom which include reasoning and critical thinking, problem-solving, retrieval, understanding and use of information, relating learning to one's existing knowledge, belief and attitudes, and thoughtful reflection on experience. THREE: Only a person that is enabled to engage actively in learning can be considered as a learner. This happens individually and collectively. FOUR: Teachers have to emphasize on authentic and meaningful tasks in real-world settings. This will enable the learners to construct context- and content-dependent knowledge. And FIVE: Constructivist learning environments support collaborative construction of knowledge through social negotiation and dialog between learner and teacher and among learners. Therefore language plays an important role and should be given particular attention.

The curriculum framework has clearly indicated that continuous assessment should be part of the teaching learning process and be done using oral, written and practical work. Therefore, this syllabus expects teachers to conduct continuous assessment throughout each term in the form of classroom exercises (written or oral), tests, homework/assignments, assessment of practical and field works, reports of project activities and personal inventories. In this syllabus, at the end of each unit, are given assessment descriptions, based on competencies, in order to help teachers focus their continuous assessments around them and make sure whether the ones set as standard competencies are achieved or not. In the assessment, the statement "minimum requirement level" should not be misleading the should be understood as the "standard 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. Teachers 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.

This syllabus is not the only curricular material for biology. It is preceded by the flow chart and the minimum learning competencies (MLCs) and is expected to be succeeded by students textbook, students' workbook, teachers guide, and practical activities manual. **The flowchart** is a document that

presents the contents listed in a sequence that gives a guideline on the topics to be taught and arranging them in such a way that they build on each other in a spiral progression. The flowchart begets the MLC. **The MLC** is a document that indicates the minimum that a student must learn in each grade level in terms of content and skills and it builds on the themes or competency areas identified for the subject. The MLC begets the syllabus. **The syllabus** is a document that is preplanned, preordained, pre-sequenced, inventory of specifications that serves as a road map to teachers, students and textbook writers. It is made up of unit outcomes, competencies, contents, and hints for teaching and assessment. The syllabus begets the students' textbook and workbook and to the teachers guide and practical activities manual. **The textbook** is a standard book used in schools for a given subject and grade level and which serves as a primary learning instrument for students. **The workbook** is a booklet used by a student in which answers and workings may be entered besides questions and exercises. The booklet is designed in such a way that it has enough spaces for solving problems or recording activities. **The teacher's guide** is a book for the teacher that consists of written instructions for the teacher giving specific directions for teaching the various parts of a lesson. **The practical activities manual** is a manual for the teacher giving instructions on the 'how to' of conducting experiments and simple activities inside and outside the classroom, preparing equipments and chemicals, arranging and performing field trips and visits, making teaching aids and constructing models.

Finally, it should be underlined that the key players in the proper implementation of the biology curriculum are not only students and teachers. Parents, school management, community and government (both central and regional) have important roles. Parents should provide opportunities for their children to practice at home the knowledge and skills they have learnt at school. They should give necessary advice and supervision of their activities. The school management should provide moral and material support for biology activities in the school such as plot of land for agricultural activities and establishing linkages between the community, relevant institutions and activities initiated by the subject such as tree planting. The community should avail community resources for the teaching of biology especially when students are required to demonstrate active participation in community undertakings.

Biology Syllabus: Grades 7 and 8

This document of grades 7 and 8 biology syllabuses was developed by a workshop (January 8- May 8, 2008) held at the premises of the Curriculum Framework Development Department of the MOE and at which 12 teachers

from nine regions of the country participated. Following is a list of team of experts and teachers who developed this document:

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 - Terefe Leta (Oromia)
 - Teshome Habte (SNNPR)
 - Tessema Tofu (Addis Ababa)

**Allotment of Periods
for Units and Sub-units of Biology
Grades 7 and 8**

Grade	Unit	Sub-unit	Number of Periods	
			Sub-unit	Total
7	Unit 1: Biology and Technology	1.1 What is biology?	2	10
		1.2 Industries that utilize biological knowledge	2	
		1.3 Relevance of biology to society	2	
		1.4 Biology and technological innovations	2	
		1.5 Values in biology education	2	
	Unit 2: Cell Biology	2.1 Microscope and its use	5	13
2.2 The cell		3		
2.3 Looking at cells		4		
2.4 Cell type, shape and size		1		
Unit 3: Human Biology and Health	3.1 The muscular and skeletal system	10	15	
	3.2 Human dentition	5		
Unit 4: Plants	4.1 Diversity of plants	3	25	
	4.2 Flowering plants	22		
Unit 5: Animals	5.1 Diversity of animals	2	23	
	5.2 Life histories of some insects	4		
	5.3 Some economically important insects	6		
	5.4 Social insects	11		
Unit 6: Environment	6.1 Habitats	3	16	
	6.2 Studying a habitat	8		
	6.3 Food relationships	5		
8	Unit 1: Biology and Technology	1.1 Biology for development	3	7
		1.2 Technological products used in biology	4	
	Unit 2: Cell Biology	2.1 Looking at unicellular organisms	5	23
2.2 Single celled organisms		12		
2.3 levels of organization in multi-cellular organisms		6		
Unit 3: Human Biology and Health	3.1 The reproductive system	14	24	
	3.2 HIV and AIDS	10		
Unit 4: Plants	4.1 Food manufacture in green plants	7	17	
	4.2 Growing trees	10		
Unit 5: Animals	5.1 Keeping farm animals	13	13	
	6.1 Ecosystem	3		
	6.2 Biological associations	3		
Unit 6: Environment	6.3 physical factors of the ecosystem	12	18	

Biology Grade 7

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.

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> • define biology as the study of life • list some branches of biology • state what each of these branches of biology study about • indicate that all natural sciences are interrelated 	<p>1. Biology and Technology 1.1 What is biology? <i>(2 periods)</i></p> <ul style="list-style-type: none"> • Branches of biology • botany; zoology; taxonomy; cytology; ecology; physiology • Relationship of biology with other natural sciences 	<p>Students should be asked what they think biology is. Write terms on the board like:</p> <ul style="list-style-type: none"> • Natural science • Study of living things • Study of places where plants and animals are found • Study of the interaction between plants and animals <p>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.</p> <p>Students should identify different branches of biology and have a brief understanding of what each is about. This should include:</p> <ul style="list-style-type: none"> • 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 thing work <p>Students should appreciate that biology is one of a group of natural sciences and that this group also includes chemistry, geology and physics.</p> <p>Students could be asked to write one sentence about each natural science saying exactly what areas or aspects of nature are studied e.g.</p> <ul style="list-style-type: none"> • 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 <p>Students should appreciate that there are regions of overlap between the disciplines e.g.</p> <ul style="list-style-type: none"> • Chemical reactions that take place in the cells of living things combine biology and chemistry

Biology: Grade 7

Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> describe how biological knowledge is utilized in the fields of agriculture, medicine and food 	<p>1.2 Industries that utilize biological knowledge (2 periods)</p> <ul style="list-style-type: none"> Agriculture Medicine Food 	<ul style="list-style-type: none"> 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 <p>Students could be asked to identify other topics where the different scientific areas overlap, and particularly those which overlap into biology.</p> <p>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:</p> <ul style="list-style-type: none"> Agriculture Medicine Food <p>Students should discuss each of these areas in some detail, identifying biological aspects of each. These could include:</p> <p>Agriculture:</p> <ul style="list-style-type: none"> Soil composition Use of agro-chemicals including fertilizers and pesticides Requirements for growth Crop rotation Soil preservation <p>Medicine:</p> <ul style="list-style-type: none"> Effects of drugs on the body Use of drugs to fight diseases Use of drugs to relieve pain Abuse of drugs <p>Food:</p> <ul style="list-style-type: none"> 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

Biology: Grade 7

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • explain the relevance of biology to the society 	<p>1.3 Relevance of biology to society (2 periods)</p> <ul style="list-style-type: none"> • Health • Nutrition • Environment • Population 	<p>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.</p> <p>Students should discuss the relevance that biology has to some different aspects of life. These could include:</p> <p>Health:</p> <ul style="list-style-type: none"> • The use of drugs to combat disease • The abuse of drugs • The physiology of healthy and unhealthy people • The importance of antiseptics and disinfectants <p>Nutrition:</p> <ul style="list-style-type: none"> • Groups of foods • Types of nutrients • Sources of nutrients • Balanced diet <p>Environment:</p> <ul style="list-style-type: none"> • 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 <p>Population:</p> <ul style="list-style-type: none"> • Growth of world population • Problems of providing sufficient medical care • Immunization • Harmful traditional practices
<ul style="list-style-type: none"> • give examples of technological innovations derived from biological knowledge 	<p>1.4 Biology and technological innovations (2 periods)</p> <ul style="list-style-type: none"> • Human eye versus camera • Birds versus airplanes • Fishes versus submarines 	<p>Students should appreciate how some technologies mimic aspects of biology in what they seek to achieve. Students should discuss:</p> <ul style="list-style-type: none"> • 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 <p>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.</p> <p>Students could research early attempts by people to work underwater under huge bells containing air.</p>

Biology: Grade 7

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none">• identify values developed in learning science	1.5 Values in biology education (2 periods) <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• 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.

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> • 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 	<p>2. Cell biology</p> <p>2.1 Microscope and its use (5 periods)</p> <ul style="list-style-type: none"> • History of the detection of the cell • What is a microscope • Types of microscopes (simple and compound) • Parts of a compound microscope 	<p>Students should appreciate that a microscope is an instrument which magnifies so that we can see objects in much greater detail than with the unaided eye.</p> <p>Students should understand that a hand lens or magnifying glass acts as a simple microscope.</p> <p>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.</p> <p>When drawing specimens, students should draw what they can actually see and not what they think they should be able to see.</p> <p>Students should be made familiar with a compound microscope. They should be able to identify key parts including:</p> <ul style="list-style-type: none"> • Eye lens • Objective lens • Focusing adjustment • Specimen mounting plate and holding clips <p>Students should discuss the function of the different parts of the microscope including:</p> <ul style="list-style-type: none"> • 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 • The focusing adjustment which is used to give a clear image <p>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 $5 \times 10 = 50$.</p> <p>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.</p> <p>In order to broaden the topic students could research such topics as:</p> <ul style="list-style-type: none"> • the invention of the compound microscope • electron microscopes

Biology: Grade 7

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • 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 • examine plant and animal cells under a microscope • draw and label the structures of plant and animal cells seen under a microscope 	<p>2.2 The cell (3 periods)</p> <ul style="list-style-type: none"> • What is a cell? • Structures of plant and animal cells (cell wall, cell membrane, cytoplasm, nucleus, vacuoles, chloroplasts) • Comparing plant and animal cells <p>2.3 Looking at cells (4 periods)</p> <ul style="list-style-type: none"> • Pollen grains and eggs 	<p>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.</p> <p>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.</p> <p>Students should appreciate that there are both similarities and differences between the structures of animal cells and plant cells.</p> <p>Students should identify the similarities of plant cells and animal cells as:</p> <ul style="list-style-type: none"> • Cell membrane • Nucleus • Cytoplasm <p>Students should know that, in addition, plant cells have:</p> <ul style="list-style-type: none"> • Cell wall – made of cellulose • Chloroplasts – to trap sunlight • Large vacuoles <p>Students should discuss the similarities and differences between plant and animal cells.</p> <p>Students should appreciate that:</p> <ul style="list-style-type: none"> • 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 plant cells • Only plant cells contain the green pigment chlorophyll needed for photosynthesis <p>Students should appreciate that they are discussing typical plant cells and typical animal cells but that, within an 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:</p> <ul style="list-style-type: none"> • Root cells do not contain chloroplasts • Root cells have hair-like projections to increase the surface area of the cell <p>Students should be given some general instructions about using a compound microscope. Issues could include:</p> <ul style="list-style-type: none"> • 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 before looking down the microscope and then slowly moving the lens away until the specimen is in focus

Biology: Grade 7

Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> show types, shapes, and sizes of cells using diagrams 	<ul style="list-style-type: none"> Onion cells Cheek cells <p>2.4 Cell type, shape and size (1 period)</p>	<ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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 <i>Elodea</i>, 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 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 <i>Elodea</i> 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. 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.

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> • 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 	<p>3. Human biology and health 3.1 The muscular and skeletal system (10 periods)</p> <ul style="list-style-type: none"> • Axial and appendicular skeleton • Structures and functions of the skeleton • Types of bones (long, short, flat irregular) • Types of joints <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - Physical exercise - Proper diet 	<p>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.</p> <p>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.</p> <p>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).</p> <p>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 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.</p> <p>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.</p>

Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> 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 	<p>3.2 Human dentition (5 periods)</p> <ul style="list-style-type: none"> Types of human teeth Functions of each type of teeth Dental formula 	<p>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 (<i>cutting</i>), the canine the premolar and the molar (<i>grinding</i>). This could be taught using models of human teeth which could easily be constructed by the students themselves.</p> <p>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 upper mouth. Therefore, The human dental formula is: 2.1.2.3</p> <p style="text-align: center;">2.1.2.3</p> <p>Let the students compare this formula with that of other mammals. For example the dental formula of cats is: 3.1.3.1</p> <p style="text-align: center;">3.1.2.1</p> <p>The differences between the two dental formulas could initiate a very interesting group discussion through which students learn why such differences occur among mammals.</p>

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.

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> • 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 • state the general characteristics of flowering plants 	<p>4. Plants</p> <p>4.1 Diversity of plants (3 periods)</p> <ul style="list-style-type: none"> • How diverse are plants (in size, type, and distribution) • Classifying plants into flowering and non-flowering • Non –flowering plants <p>4.2 Flowering plants (22 periods)</p> <ul style="list-style-type: none"> • General characteristics • Root, stem and leaf (internal and external characteristics) 	<p>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:</p> <ul style="list-style-type: none"> • Their size • The colour of their flowers • The places where they are found <p>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:</p> <ul style="list-style-type: none"> • Flowering plants • Non-flowering plants <p>Ask students to identify different types of plants that do not have flowers. From their suggestions focus on:</p> <ul style="list-style-type: none"> • Mosses; Ferns; Gymnosperms <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • Root, Stem, Leaf, Flower <p>Students should be able to state the internal and external characteristics of each of these organs, and identify and label important parts on diagrams.</p>

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<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Monocotyledons and dicotyledons (examples and comparison) 	<p>Students should know the functions of each of the organs in a plant including:</p> <p>Root:</p> <ul style="list-style-type: none"> • 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 <p>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.</p> <p>Stem:</p> <ul style="list-style-type: none"> • 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 <p>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.</p> <p>Leaves:</p> <ul style="list-style-type: none"> • Carry out photosynthesis to make food • Excretion of carbon dioxide from respiration • Loss of water <p>Students should carefully examine the underside of a leaf and identify stoma from which water is lost using a hand lens or microscope.</p> <p>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</p> <p>Flower:</p> <ul style="list-style-type: none"> • Sexual reproduction <p>Students should dissect a flower, and draw and label the parts including</p> <ul style="list-style-type: none"> • Petals, Anthers, Filaments, Style, Stigma, Ovary, Nectaries, Calyx <p>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.</p> <p>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.</p> <p>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.</p>
<ul style="list-style-type: none"> • classify flowering plants into monocotyledons and dicotyledons • distinguish between monocotyledons and dicotyledons • give examples of monocotyledons and dicotyledons 		

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Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Reproduction in flowering plants <ul style="list-style-type: none"> -vegetative propagation -sexual reproduction (flower structure, pollination, fertilization) -dissecting the pistil -observing pollen grains 	<p>Students should use the differences they have identified to try and identify other examples of monocotyledons and dicotyledons which grow in their locality.</p> <p>Students should appreciate that flowering plants are able to reproduce both by asexual or vegetative reproduction, and by sexual production.</p> <p>Students should examine a number of examples of vegetative reproduction in plants. These could include examples of natural propagation such as:</p> <ul style="list-style-type: none"> • Rhizome – canna lily • Bulb – onion • Corm – Colocasia • Sucker – banana • Runner – Desmodium <p>and examples of artificial propagation such as:</p> <ul style="list-style-type: none"> • Stem cuttings – Hibiscus • Grafting – fruit trees • Layering – Bougainvillea <p>Students could take stem cuttings of <i>Hibiscus</i> or <i>Geranium</i> and get them to root in soil or in water.</p> <p>Students could research the use of rooting compounds and rooting hormones in rooting cuttings.</p> <p>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.</p> <p>Students should appreciate the functions of the different parts of the flower:</p> <ul style="list-style-type: none"> • 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 <p>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.</p> <p>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.</p> <p>Students should discuss how pollination might occur. What agents could transfer pollen? Focus them on the idea of wind and animals (insects and birds)</p> <p>Students could discuss the features of flowers that are wind pollinated. These could include:</p>

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Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Seeds and fruits (formation, structure, function) 	<ul style="list-style-type: none"> • Light single pollen grains • Dull-coloured petals • Petals fully open exposing the anthers and stigma • Lack of smell / nectar <p>Students could discuss the features of flowers that are animal pollinated. These could include:</p> <ul style="list-style-type: none"> • 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 <p>Students could be given examples of local flowers to examine and, from their knowledge, to deduce whether the flower is wind or animal pollinated.</p> <p>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.</p> <p>Students should appreciate that pollen is the male sex organ of the plant. As a result of pollination:</p> <ul style="list-style-type: none"> • 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 <p>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.</p> <p>Students should examine a soaked bean or some other large dichotomous seed. They should identify the micropyle before removing the testa.</p> <p>The student should draw and label a large dichotomous seed to show parts including:</p> <ul style="list-style-type: none"> • Testa, Micropyle, Cotyledons <p>Students should discuss the function of each part of the seed including:</p> <ul style="list-style-type: none"> • 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.

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<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
		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.

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> • 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 • define metamorphosis as a change of form of an animal involving several distinct stages • explain complete and incomplete metamorphosis 	<p>5. Animals</p> <p>5.1 Diversity of animals (2 periods)</p> <ul style="list-style-type: none"> • How diverse are animals? (in size, type, and distribution) • Why are insects the most diverse group of animals? <p>5.2 Life histories of some insects (4 periods)</p> <ul style="list-style-type: none"> • What is metamorphosis? • Complete and incomplete metamorphosis 	<p>Ask students to name some different animals which live in Ethiopia. Make a list of these on the board.</p> <p>Point out to students that animals show differences in a number of ways including:</p> <ul style="list-style-type: none"> • 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 <p>Students should discuss why insects are the most diverse group of animals. This could include:</p> <ul style="list-style-type: none"> • 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 <p>Students should appreciate that a fundamental difference between some insects and other animals is that as these insects grow, their bodies completely change their form. This process is called metamorphosis.</p> <p>Students should appreciate that metamorphosis may be said to be incomplete or complete.</p> <ul style="list-style-type: none"> • 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

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Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> • give examples of insects that reproduce by complete and incomplete metamorphosis • 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 	<p>5.3 Some economically important insects (6 periods)</p> <ul style="list-style-type: none"> • Tsetse flies • vectors of diseases • methods of control • Dark moth (army worm) • how it affects crops • methods of control • Maize borer moth • how it affects maize • methods of control 	<p>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 or incomplete.</p> <p>Students should examine an egg, a nymph and adult cockroach and decide whether this metamorphosis is complete or incomplete.</p> <p>Students could research other examples of complete and incomplete metamorphosis.</p> <p>Students could be given specimens of other insect in different stages and asked to determine the nature of the metamorphosis e.g. the locust.</p> <p>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.</p> <p>Students should appreciate that the tsetse fly is a harmful pest that affects both cattle and people.</p> <p>Students should understand the term vector as a carrier of disease and should know that:</p> <ul style="list-style-type: none"> • 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 <p>Students should discuss suitable methods of controlling the tsetse fly. These should include:</p> <ul style="list-style-type: none"> • 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 <p>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.</p>

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<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • explain the characteristics specific to social insects • give examples of social insects • explain the roles of queen, drones and workers in bees 	<p>5.4 Social insects (11 periods)</p> <ul style="list-style-type: none"> • Characteristics specific to social insects • Honey bees and bee keeping -queen, drone and workers 	<p>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.</p> <p>Students should identify examples of social insects. These should include:</p> <ul style="list-style-type: none"> • Termites • Honey bees <p>Students should discuss the advantages to the insects of living in a large social group.</p> <p>Students should appreciate that honey bees are a social insect which are beneficial to people. They live in a hive in which there are three castes:</p> <ul style="list-style-type: none"> • Queen – lays eggs • Drones – mates with the queen • Workers – gather nectar, build honeycomb, protect the hive <p>Students should appreciate that it is possible to harvest some of the honey made by bees but leaving the colony of bees sufficient for its needs.</p> <p>Students should examine both a traditional and a modern beehive and discuss the advantages and disadvantages of each.</p>
<ul style="list-style-type: none"> • explain methods of bee keeping and management of beehive • demonstrate the techniques of harvesting honey • compare a modern beehive with a traditional one 	<ul style="list-style-type: none"> -methods of beekeeping -management of beehive -techniques of harvesting honey -importance of bee keeping -products of bee keeping 	<p>Students should discuss how a beehive should be managed and how the honey is harvested.</p> <p>A bee keeper could be invited to come and talk to students about bee keeping and demonstrate some of the techniques used.</p> <p>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:</p> <ul style="list-style-type: none"> • Honey • Beeswax • Pollen • Queen jelly <p>Students should discuss how bees are able to communicate with each other through various dances, to indicate the source of food.</p> <p>Students should make a model of a beehive.</p> <p>Students should discuss how the ability of honeybees to live together in a hive increases the chances of their survival.</p>
<ul style="list-style-type: none"> • construct a model of modern beehive • appreciate the behaviour of social insects 	<ul style="list-style-type: none"> • Constructing a model beehive 	

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<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none">• express an interest to investigate more about social insects		<p>Students could research into how the life of solitary wood bees differs to that of the honeybee.</p> <p>Students could research into the life of another social insect such as the termite and make comparisons with the honeybee.</p>

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

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

Students below minimum requirement level

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

Unit 6: Environment (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.

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> • 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 	<p>6. Environment</p> <p>6.1 Habitats (3 periods)</p> <ul style="list-style-type: none"> • What is a habitat • Aquatic and terrestrial habitats • Population and community 	<p>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.</p> <p>Ask students to identify some habitats. Group their suggestions under two main headings, terrestrial and aquatic.</p> <p>Ask students if they can add to each list so they have a range of each type of habitat e.g.</p> <ul style="list-style-type: none"> • Terrestrial – farmland, park, savannah, rain forest, desert etc. • Aquatic – ditch, pond, stream, river, lake, rock pool, ocean etc. <p>Students should identify different terrestrial and aquatic habitats in the area around where they live.</p> <p>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.</p> <p>Similarly, within a habitat, there are likely to be populations of different species. A group of populations within a habitat is called a community.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 <p>Students should carry out similar exercises looking at different habitats.</p>

Biology: Grade 7

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • 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 	<p>6.2 Studying a habitat (8 periods)</p> <ul style="list-style-type: none"> • Observing habitats in our surroundings • Using quadrats 	<p>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.</p> <p>Students should write a brief report on their findings. This should have such details as:</p> <ul style="list-style-type: none"> • 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 <p>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.</p> <p>Ask students how this could be done more simply and use the discussion to introduce the idea of sampling.</p> <p>Students should understand that sampling can often give us an overall picture of what is present.</p> <p>Discuss with students how they could go about surveying a habitat. Allow them sufficient time to develop their ideas before introducing the idea of quadrats.</p> <p>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:</p> <ul style="list-style-type: none"> • 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 <p>Students should use a quadrat to sample the organisms in a larger area. This should involve:</p> <ul style="list-style-type: none"> • experimenting with obtaining random samples • using results to make estimates for the whole habitat • commenting on how reliable the estimates will be <p>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.</p> <p>Students should discuss different techniques that could be used to collect animals within a habitat. These could include:</p> <ul style="list-style-type: none"> • pitfall trap • pooter
<ul style="list-style-type: none"> • demonstrate methods of collecting and preserving plant and animal specimens 	<ul style="list-style-type: none"> • Collecting and preserving plant and animal specimens 	

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<ul style="list-style-type: none"> • collect plant and animal specimens • preserve plant and animal specimens <ul style="list-style-type: none"> • describe food chain with a practical example <ul style="list-style-type: none"> • construct a simple food chain by observing food relationship of organisms in their surrounding 	<p>6.3 Food relationships (5 periods)</p> <ul style="list-style-type: none"> • Food chain and food web 	<ul style="list-style-type: none"> • sweep net • butterfly net <p>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.</p> <p>Students should use a variety of techniques to obtain animal specimens.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p style="text-align: center;">leaf → caterpillar → bird</p> <p>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:</p> <ul style="list-style-type: none"> • A food chain always starts with a plant • The plant is eaten by a herbivore • The herbivore is eaten by a carnivore <p>Build on this simple understanding of food chains and introduce some nomenclature. This could include the following information:</p> <ul style="list-style-type: none"> • A food chain always starts with a green plant • Green plants manufacture their own food and are therefore called producers • 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

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Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Trophic levels • Pyramid of numbers • Pyramid of energy 	<p>Students should now be able to write the general pattern for a food chain: Producer → Primary consumer → Secondary consumer</p> <p>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</p> <p>Students should write food chains that contain tertiary consumers.</p> <p>Students should be given food chains and asked to identify the producer and the different consumers.</p> <p>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.</p> <p>Students should combine the information from related food chains to produce a food web.</p> <p>Students should be given a food web and use it to write a series of food chains.</p> <p>Students should use the information gained from their study of a habitat to write a food web.</p> <p>Introduce students to the idea of trophic levels where:</p> <ul style="list-style-type: none"> • First trophic level – producers • Second trophic level – primary consumers • Third trophic level – secondary consumers • Fourth trophic level – tertiary consumers <p>Students should apply the idea of trophic levels to food chains and food webs.</p> <p>Students should discuss the number of organisms at each level in a food chain. For example: leaf → caterpillar → bird</p> <p>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.</p> <p>Students should draw pyramids of numbers representing food chains and food webs and mark the trophic levels on the pyramid.</p> <p>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.</p> <p>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.</p> <p>Students should draw pyramids of numbers using the information they gained from their study of a habitat.</p>

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 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.

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.