

Federal Democratic Republic of Ethiopia
Ministry of Education

Biology Syllabus, Grades 9 and 10

2009

Table of Contents

Introduction	iv
Allotment of Periods	ix
Biology Grade 9	
General Objectives of Grade 9 Biology	2
Unit 1: Biology and Technology	4
Unit 2: Cell Biology	5
Unit 3: Human Biology and Health.....	8
Unit 4: Micro-organisms and diseases	14
Unit 5: Classification.....	18
Unit 6: Environment.....	22
Biology Grade 10	
General Objectives of Grade 10 Biology	26
Unit 1: Biotechnology	28
Unit 2: Heredity.....	30
Unit 3: Human Biology and Health.....	33
Unit 4: Food making and growth in plants	39
Unit 5: Conservation of natural resources	43

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. Biology has special relevance to students as individuals, to the society and to the growth and development of Ethiopia at large. It is true that many of the contemporary issues and problems in the society are essentially biological in nature. Nutrition, health, drug abuse, agriculture, pollution, rapid population growth, environmental depletion and conservation are some examples. If these problems are to be dealt with realistically, an understanding of biological knowledge is required. The recent advances in biotechnology and genetic engineering that have significant influences on people's life also indicate the role of biology as everybody's science everyday.

The Biology syllabus for grades 9 and 10 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	<u>1. Constructing biological knowledge</u> The learner will know and be able to interpret and apply biological, technological and environmental knowledge.
Skills	<u>2. Biological investigation</u> 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	<u>3. Biology, Society and Environment</u> 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 Based Education. This education strategy supports teaching and learning in different environments.

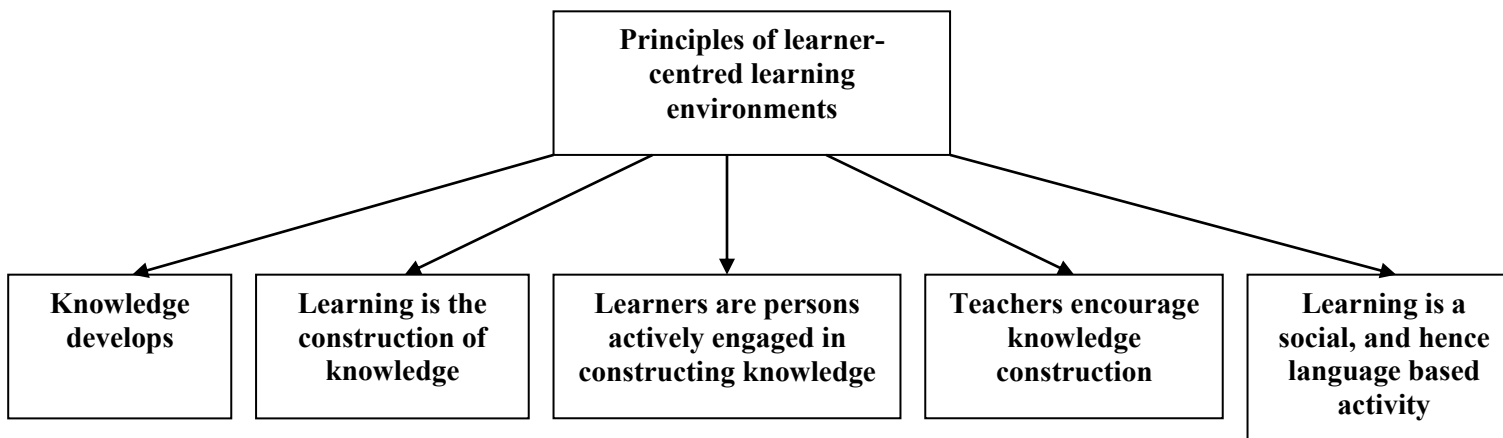
Constructivism emphasizes on two important dimensions:

- 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-centred process. The learner-centred 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-centred learning are summarized in the following diagram.



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 new curriculum framework for Ethiopian schools 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 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.

The curriculum framework has allotted three periods per week for grades 9 and 10 biology. This is for schools that work on the shift system with 30 periods per week. For the schools that work full day with 35 periods per week biology is given four periods per week. 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.

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 flow chart 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 pre-planned, 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

This document of grades 9 and 10 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:

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 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.

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 - Tagel Gashaw (Afar)
 - Terefe Leta (Oromia)
 - Teshome Habte (SNNPR)
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**Allotment of Periods
For Units and Sub-units of Biology
Grades 9 and 10**

<i>Grade</i>	<i>Unit</i>	<i>Sub-unit</i>	<i>Number of Periods</i>	
			<i>Sub-unit</i>	<i>Total</i>
9	Unit 1: Biology and Technology	1.1 Renowned Ethiopian biologists	1	3
		1.2 Some Ethiopian institutions that are involved in biological research	2	
	Unit 2: Cell Biology	2.1 The microscope	4	17
		2.2 The Cell	6	
		2.3 The cell and its environment	7	
Unit 3: Human Biology and Health	3.1 Food and nutrition	7	37	
	3.2 The digestive system	7		
	3.3 Respiratory system	9		
	3.4 Cellular respiration (basic principles)	5		
	3.5 The circulatory system	9		
Unit 4: Micro-organisms and Diseases	4.1 Micro-organisms	6	17	
	4.2 Diseases	6		
	4.3 HIV and AIDS	5		
Unit 5: Classification	5.1 Principles of classification	5	13	
	5.2 The five kingdoms	8		
	Unit 6: Environment	6.1 Ecosystem	3	15
		6.2 Food relationships	4	
		6.3 Recycling in nature	3	
		6.4 Adaptations	3	
		6.5 Tree growing project	2	
10	Unit 1: Biotechnology	1.1 What is biotechnology?	3	6
		1.2 New applications of biotechnology	3	
	Unit 2: Heredity	2.1 Mitosis and meiosis	4	16
		2.2 Mendelian inheritance	6	

Biology: Grades 9 and 10

<i>Grade</i>	<i>Unit</i>	<i>Sub-unit</i>	<i>Number of Periods</i>	
			<i>Sub-unit</i>	<i>Total</i>
		2.3 Chromosomes and genes	2	
		2.4 Heredity and breeding	4	
	Unit 3: Human Biology and Health	3.1 The nervous system	9	44
		3.2 Sense organs	11	
		3.3 The endocrine glands	9	
		3.4 Reproductive health	5	
		3.5 Homeostasis	10	
	Unit 4: Food making and growth in plants	4.1 The leaf	2	22
		4.2 Photosynthesis	8	
		4.3 Transport	6	
		4.4 Response in plants	6	
	Unit 5: Conservation of natural resources	5.1 Definition of terms	1	14
		5.2 Conservation of biodiversity	2	
		5.3 Vegetation	4	
		5.4 Wildlife	4	
		5.5 Air	3	

Biology Syllabus, Grade 10

General Objectives of Grade 10 Biology

1. To develop understanding and acquire knowledge of:

- biotechnology and its significance and it has been in use traditionally and is in use at present
- mitosis and meiosis and their stages
- works of Mendel, the principle of inheritance, chromosome and its structure, and DNA and its components
- the methods, importance and examples of breeding
- parts of the nervous system and the brain and how the brain is protected, types of neurons, and their structures and functions, nerve impulse and synapse and the role of neurotransmitters and types of reflex actions
- the structures and functions of the human eye, image formation and accommodation and the causes and corrective measures of common eye defects
- the structure and function of the human ear and how balance is maintained by the inner ear
- the taste areas of the tongue, the smelling organ and the structure of the skin
- exocrine and endocrine glands, the menstrual cycle and the associated changes and the causes and treatments of goitre and diabetes mellitus
- birth control methods and how each method works and female genital mutilation as a harmful traditional practice
- the symptoms, incubation period and treatment of HIV/AIDS and how it affects immunity
- homeostasis, poikilotherms and homoiotherms, and the physiological and behavioural methods of temperature regulation in homoiotherms
- the functions of the structures of kidney, the liver, and the skin and their role in regulation
- the internal structures of leaves and their functions
- the importance of CO₂, light and chlorophyll for photosynthesis and the significance of photosynthesis in agriculture
- the processes of germination in dicots and monocots
- plant hormones and their functions, the mechanism of action of auxins, and how removal of apical dominance and sunlight influence plant growth
- the different types of tropisms in plants and their processes
- natural resources, renewable and non-renewable resources, conservation and biodiversity
- the uses of vegetation and wildlife and the impacts of humans on them, some endemic vegetation and wildlife species of Ethiopia, methods of conservation of vegetation and wildlife and how Ethiopian vegetation was affected in history
- the national parks of Ethiopia and some of the common species of wild life that exist in each national park
- the causes and effects of air pollution, and the causes and methods of prevention of global warming

2. To develop skills and abilities of:

- demonstrating the principle of inheritance using examples and colored beads
- demonstrating simple reflex actions
- conducting an experiment to prove that the actual taste of food is a mixture of taste and smell
- locating the position and function of endocrine glands
- demonstrating life skills that help them prevent HIV
- using the microscope to study internal structures of leaves
- demonstrating the process of germination and how sunlight affects plant growth

- demonstrating the importance of CO₂, light and chlorophyll for photosynthesis with simple experiments
- scientific enquiry: observing, classifying, comparing, making models, communicating, measuring, asking questions, drawing conclusions, applying concepts, interpreting photos and illustrations and relating cause and effect

3. To develop the habit and attitude of:

- intellectual curiosity, co-operation, reasoning, openness, honesty, love, tolerance, respect and freedom
- willingness to conform to a responsible behaviour that helps live HIV free life

Unit 1: Biotechnology (6 periods)

Unit Outcomes: Students will be able to

- define biotechnology and discuss its significance
- explain how biotechnology has been in use traditionally and is in use at present.

<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 biotechnology as the use of micro-organisms for industrial production • discuss the significance of biotechnology • explain how biotechnology has been in use traditionally <ul style="list-style-type: none"> • identify areas where biotechnology is applied at present 	<p>1. Biotechnology</p> <p>1.1 What is biotechnology (3 periods)</p> <ul style="list-style-type: none"> • Meaning of biotechnology • Significance of biotechnology • Traditional applications: fermented foods and beverages (brewing, wine making, bread making, manufacturing, cheese and yoghurt making) <p>1.2 New applications of biotechnology (3 periods)</p> <ul style="list-style-type: none"> • Agriculture • Food • Medicine • Energy 	<ul style="list-style-type: none"> • Use text that describes biotechnology including definitions and examples and traditional Ethiopian fermented foods and beverages • Demonstration of fermenting dough or tella to students in the class or project on preparing bread, yoghurt, or cheese. With these the micro-organisms responsible for the processes could be discussed • If possible arrange a visit to a nearby brewery or beverage or food industry <ul style="list-style-type: none"> • Use text and pictures that describe modern applications; companies might supply materials • Summarize in a table as follows <table border="1" data-bbox="953 1084 1822 1250"> <thead> <tr> <th data-bbox="953 1084 1304 1122">Area of biotechnology</th> <th data-bbox="1304 1084 1822 1122">Examples</th> </tr> </thead> <tbody> <tr> <td data-bbox="953 1122 1304 1154">Agriculture</td> <td data-bbox="1304 1122 1822 1154"></td> </tr> <tr> <td data-bbox="953 1154 1304 1187">Food</td> <td data-bbox="1304 1154 1822 1187"></td> </tr> <tr> <td data-bbox="953 1187 1304 1219">Medicine</td> <td data-bbox="1304 1187 1822 1219"></td> </tr> <tr> <td data-bbox="953 1219 1304 1250">Energy</td> <td data-bbox="1304 1219 1822 1250"></td> </tr> </tbody> </table>	Area of biotechnology	Examples	Agriculture		Food		Medicine		Energy	
Area of biotechnology	Examples											
Agriculture												
Food												
Medicine												
Energy												

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.

A student working at the minimum requirement level will be able to: define biotechnology and discuss its significance; and explain how biotechnology has been in use traditionally and is in use at present.

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.

Unit 2: Heredity (16 periods)

Unit Outcomes: Students will be able to:

- define mitosis and meiosis and describe their stages
- explain the works of Mendel, relate it to the principle of inheritance, illustrate and demonstrate the principle of inheritance using examples and colored beads
- define chromosome and describe its structure
- define DNA and describe its components
- describe the methods, importance and examples of breeding.

Competencies	Contents	Suggested activities																																								
<p><i>Students will be able to</i></p> <ul style="list-style-type: none"> • define mitosis as division of somatic cells • describe the stages of mitosis • define meiosis as division of sex cells • describe the stages of meiosis • compare mitosis and meiosis • explain the works of Mendel on garden peas • relate Mendel’s work to the principle of inheritance • illustrate Mendelian inheritance • demonstrate the principle of inheritance using beads 	<p>2. Heredity</p> <p>2.1 Mitosis and Meiosis (4 periods)</p> <ul style="list-style-type: none"> • The cell cycle • Mitosis • Meiosis <ul style="list-style-type: none"> – First and second meiotic divisions – Spermatogenesis – Oogenesis <p>2.2 Mendelian inheritance (6 periods)</p> <ul style="list-style-type: none"> • Mendel and the garden pea • Mendel’s experimental designs • F₁ and F₂ generations • The test cross • Dominant and recessive traits 	<ul style="list-style-type: none"> • Use text and picture material (drawings and photos) • Make sure that students understand the key concepts that mitosis divides cells into two identical cells; meiosis divides a diploid cell into a haploid cell; and that sperm cells and egg cells are formed by meiosis • Use picture and text materials that illustrate experiments of Mendel • Make sure that students understand the key concepts that heredity is determined by discrete conserved “factors”; not all genes show dominance; and genotypes can be determined by test crosses • Provide crossing schemes resulting in defined relations of phenotypes • Students solve problems on examples reflecting dominant-recessive type with one trait; and recombination of genes • Let the students conduct a data collecting activity on tongue rolling from grade 10 students. The data of students of all sections could be presented in a table as follows: <table border="1"> <thead> <tr> <th rowspan="2">Section</th> <th rowspan="2">Total Number</th> <th colspan="2">Rollers</th> <th colspan="2">Non-Rollers</th> </tr> <tr> <th>Number</th> <th>%</th> <th>Number</th> <th>%</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Section	Total Number	Rollers		Non-Rollers		Number	%	Number	%	1						2						3						4						5					
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<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • define chromosome as structures in a cell consisting of genes and genetic material • define DNA as the genetic material contained in the nucleus • define genes as a unit of hereditary material located in the chromosome • describe the structure of chromosomes • describe the components of DNA • describe the methods of breeding • explain the importance of breeding for the society • give examples for breeding from their own experience 	<p>2.3 Chromosomes and genes (2 periods)</p> <ul style="list-style-type: none"> • Chromosome structure and number • Genes • DNA components and structure <p>2.4 Heredity and breeding (4 periods)</p> <ul style="list-style-type: none"> • Principles of breeding farm animals and crops <ul style="list-style-type: none"> – Breeding by selection – Breeding by combination of traits (using Mendel laws) – Advantages of breeding for the benefit of the society • Examples for breeding 	<p>Once the data is completed for all sections of grade 10 students, let them analyze it and suggest a) the dominant and recessive alleles; and b) the possible rule for the inheritance of character.</p> <ul style="list-style-type: none"> • Make sure that students understand the key concepts that hereditary information passes through chromosomes; genes are located on chromosomes; and chromosomes are DNA-protein complexes • Draw and name parts of the DNA • Students sort chromosomes to produce karyogram from a photograph of unordered chromosomes • Use text, pictures and diagrams on different breeding methods (selection and combination of traits,). This could be a case study • Group work and brainstorming: Let students list out why breeding is used in farming and animal production • Group work: Learners list examples of breeding from their own experience

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.

A student working at the minimum requirement level will be able to: define mitosis and meiosis and describe their stages; explain the works of Mendel, relate it to the principle of inheritance, illustrate and demonstrate the principle of inheritance using examples and colored beads; define

chromosome and describe its structure; and define DNA and describe its components.

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.

Unit 3: Human Biology and Health (44 periods)

Unit Outcomes: Students will be able to

- name parts of the nervous system and the brain, and explain how the brain is protected
- list the types of neurons, and indicate their structures and functions
- explain nerve impulse and synapse and the role of neurotransmitters
- define reflex action, state its two types, give examples for and compare each type and demonstrate simple reflex actions
- show the structures of the human eye, state their functions, describe image formation and accommodation and explain the causes and corrective measures of common eye defects
- describe the structure and function of the human ear and explain how balance is maintained by the inner ear
- name the taste areas of the tongue and conduct an experiment to prove that the actual taste of food is a mixture of taste and smell and draw and label the smelling organ and the structure of the skin
- define glands, distinguish between exocrine and endocrine glands, locate the position and function of endocrine glands and describe the menstrual cycle and the associated changes
- state the causes and treatments of goiter and diabetes mellitus
- list birth control methods and explain how each method works and describe female genital mutilation as a harmful traditional practice
- describe the symptoms, incubation period and treatment of HIV/AIDS, how it affects immunity and demonstrate life skills that help them prevent HIV
- define homeostasis, poikilotherms and homoiotherms, compare them and explain the physiological behavioral methods of temperature regulation in homoiotherms
- state the functions of the structures of kidney, the liver, and the skin and explain their role in regulation.

<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"> • name parts of the nervous system • explain how the brain is protected • compare functions of fore, mid, and hind brain • list the three types of neurons • indicate the structures of neurons • explain the functions of structures of neurons 	<p>3. Human Biology and Health</p> <p>3.1 The nervous system <i>(9 period)</i></p> <ul style="list-style-type: none"> • Parts of the nervous system • Parts of the brain • Types and functions of neurons • The nerve impulse • Neurotransmitters and synapses • Neuromuscular junction • Reflexes (reflex action) 	<ul style="list-style-type: none"> • Give overview: Sense organ → afferent neurons → Central nervous system → efferent neurons → muscles • Use diagrams models and text on the nervous system including the central nervous system, the peripheral nervous system, sympathetic and parasympathetic • Use text and picture of a brain. Learners draw and label major parts of the brain • Make sure that students understand the key concepts that a nervous system is made up of neurons and communicate by synapse; a nervous system collects and distributes information; all cells maintain an electrical potential across their plasma membranes; a nerve impulse is an action potential that propagates itself along an axon; and a myelinated nerve can carry impulse rapidly • Demonstrate different types of reflexes such as knee jerk, eye reflex (iris and light), and blinking of an eye • Use picture and text materials on the structure of a nerve cell and let students summarize in

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • explain nerve impulse • explain synapses and neurotransmitters • define reflex action as a sudden, automatic and uncontrolled response of parts of the body or the whole body to external stimuli • give examples of reflex action • explain reflex arc • state the two types of reflexes • compare the two types of reflexes • demonstrate simple reflex actions • Explain the harmful effects of drug abuse • Give examples of drugs abused in the in locality • Express willingness to conform to a drug free lifestyle • label the structures of the human eye • state the functions of the structure of the eye • show the structures of the eye using sheep/cow eye • describe accommodation • describe image formation • determine the blind spot 	<p style="text-align: center;">and reflex arc)</p> <ul style="list-style-type: none"> • Drug abuse <p>3.2 Sense organs (11 periods)</p> <ul style="list-style-type: none"> • The eye <ul style="list-style-type: none"> – Structure – function – Accommodation – image formation – eye defects and corrections 	<p>a table the parts and functions of a neuron</p> <ul style="list-style-type: none"> • Draw and label the spinal cord showing its nerve connection <ul style="list-style-type: none"> • Use posters, leaflets and booklets on drug abuse. You can find these materials at healthy institutions. • Let the students assess, in groups, the types of drugs abused in their locality and report to the class. Encourage they to forward recommendations on how to overcome the problem of drug abuse • Let they practice life skills, through role play, on how to lead a dny free life style. <ul style="list-style-type: none"> • Make sure that students understand the key concepts that receptors respond to changes in the environment; chemo-receptors are basic and widely distributed; mechanoreceptors respond to tension and pressure; many mechanoreceptors employ hair cells; thermo-receptors detect heat; photo-pigments absorb light; and the eye focuses light on the retina • Use text and picture material or model on the eye • Dissection of sheep/cow eye • Demonstration of the blind spot • Use text and diagrams to demonstrate short- and long-sightedness and corrective measures • Experiments on 3-dimensional viewing (stereoscopic vision) and on accommodation

Competencies	Contents	Suggested activities						
<p>with a simple activity</p> <ul style="list-style-type: none"> list common eye defects in humans explain causes of common eye defects in humans explain corrective measures of common eye defects in humans label the structures of the human ear describe the functions of the structures of the ear explain how balance is maintained by the inner ear name the taste areas of the tongue conduct an experiment to prove that the actual taste of food is a mixture of taste and smell draw and label the smelling organ draw and label the structure of the skin <ul style="list-style-type: none"> define glands as structures that produce hormones or other secretions distinguish between exocrine and endocrine glands 	<ul style="list-style-type: none"> The ear <ul style="list-style-type: none"> Structure Function (hearing and balancing) Other sense organs <ul style="list-style-type: none"> Tongue Nose Skin <p>3.3 The endocrine glands (9 periods)</p> <ul style="list-style-type: none"> Definition of glands Deference between exocrine and endocrine glands Thyroid, parathyroid, 	<ul style="list-style-type: none"> Experiment that demonstrates the sound as movement of air waves Use text and picture material or model on the ear Demonstration of ear damage by loud noises Description of the way the ear transmits sound to the inner ear Use text and picture material on the tongue Use cotton buds to apply sweet, sour, bitter and salty liquids on the different areas of the tongue and identify the specific areas of the tastes Use text and picture material or model of the nose Draw smelling organ, allocate the sensory cells and label the different parts How the relation between smelling and testing. . Taste different foods with closed and open nose one at a time and account for the difference in taste Use text and picture material of the skin Draw sense receptors of the skin and label the different parts <ul style="list-style-type: none"> Use diagram of a human body showing endocrine glands and a text describing the function of these glands Students develop in groups a table as follows: <table border="1" data-bbox="974 1321 1856 1450"> <thead> <tr> <th data-bbox="974 1321 1236 1354">Name of the gland</th> <th data-bbox="1243 1321 1484 1354">Hormone produced</th> <th data-bbox="1491 1321 1856 1354">Function of the hormone</th> </tr> </thead> <tbody> <tr> <td data-bbox="974 1359 1236 1450"></td> <td data-bbox="1243 1359 1484 1450"></td> <td data-bbox="1491 1359 1856 1450"></td> </tr> </tbody> </table> 	Name of the gland	Hormone produced	Function of the hormone			
Name of the gland	Hormone produced	Function of the hormone						

Competencies	Contents	Suggested activities								
<ul style="list-style-type: none"> • locate the position of endocrine glands • describe the function of each endocrine gland • state the cause of goiter • state the treatment of goiter • state the cause of diabetes mellitus • state the treatment of diabetes mellitus • describe the menstrual cycle and the associated changes • list birth control methods • explain how each birth control method works • describe female genital mutilation as a harmful traditional practice • mention common symptoms of AIDS • describe the incubation period of HIV • explain how AIDS is currently treated • demonstrate life skills that help them prevent HIV 	<p style="text-align: center;">adrenal, pancreas, gonads, pituitary</p> <ul style="list-style-type: none"> • Goiter (causes and treatment) • Diabetes mellitus (causes and treatment) • Hormones and the menstruation cycle 3.4 Reproductive health (5 periods) • Birth control methods • Harmful Traditional Practices (FGM) • HIV and AIDS <ul style="list-style-type: none"> – symptoms – incubation period – treatment – life skills to prevent HIV and AIDS 	<ul style="list-style-type: none"> • Case study on goiter; learners discuss the case study in groups emphasizing on the cause and treatment of goiter; do they know somebody who has goiter? • Use diagram and text on Langerhans cells in the pancreas and on regulation model between insulin and glucagon • Case study of a young person that suffers from diabetes mellitus: Students write a paragraph describing the situation of the person, emphasizing on insulin injections and a strict nutrition schedule • Provide a diagram showing the hormones that rise and fall during the menstruation cycle • Provide a text that describes physical changes during the menstrual cycle in the body including swings of mood • Show actual samples (if possible) of all usual birth control techniques. You can also show them pictures • Let students prepare a table as follows: <table border="1" data-bbox="974 878 1877 1040" style="margin: 10px auto;"> <thead> <tr> <th style="width: 25%;">Birth control technique</th> <th style="width: 25%;">How it works</th> <th style="width: 25%;">Level of security</th> <th style="width: 25%;">Side effects</th> </tr> </thead> <tbody> <tr> <td style="height: 40px;"></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> • Case study on female genital mutilation. It is recommended to integrate an article from a newspaper. If not available, materials from UN or other similar agencies are available • Use causes and effects tree on FGM • Let the students write an observation report on harmful practices in their locality that are related to FGM • Case study of a person living with HIV/AIDS from infection until AIDS symptoms; the case study should show, which behaviours are safe, which are not; the text should also deal with a combination therapy that reduces the symptoms of AIDS, but does not heal. The role of family members and community has to be included • Students role-play the situation of the HIV infected person reflecting living positively with HIV and AIDS • Let them practice certain life skills such as assertiveness, decision making, problem solving, critical thinking, and conflict resolution through role plays and other methods 	Birth control technique	How it works	Level of security	Side effects				
Birth control technique	How it works	Level of security	Side effects							

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • define homeostasis as maintenance of constant internal environment • explain the significance of homeostasis • define poikilotherms as organisms whose body temperature is governed by the external temperature • define homoiotherms as organisms with constant body temperature • compare poikilotherms and homoiotherms • explain the physiological methods of temperature regulation in homoiotherms • explain the behavioral methods of temperature regulation in homoiotherms • label the structures of kidney • state the functions of the structures of kidney • show the structures of kidney on a diagram or model • explain how the kidney regulates water and ionic balance • tell how the skin helps in water and salt balance • explain the role of the liver in regulation 	<p>3.5 Homeostasis (10 periods)</p> <ul style="list-style-type: none"> • What is homeostasis • Significance of homeostasis • Temperature regulation – Poikilotherms and homoiotherms – Physiological and behavioral methods of temperature regulation – Factors affecting heat loss • The kidney <ul style="list-style-type: none"> – Structures – functions • Water balance and ionic control • The liver 	<ul style="list-style-type: none"> • Use text and diagrams that give information on the function of kidneys and the liver • Students dissect a kidney and draw and label the structures in their exercise books. Let them also draw the nephron and its structures by copying from other books and indicate their functions • Use information on the health of kidneys: Which are the main kidney diseases and how can they be prevented • Students discuss in groups about the functions of the liver and summarize their findings • A visit to the nearest hospital or clinic to get information on liver diseases and how to protect themselves against them. Let the students write an essay about their experiences on the field trip • Let the students conduct experiment on the temperature decrease during the evaporation of fluids and draw conclusions related to sweating • E.g. use a cotton ball with a thermometer and add some fluid (best is alcohol, but water is also possible), students capture data in a table and develop a graph) • Students apply some water on their skin and describe their observations

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.

A student working at the minimum requirement level will be able to: name parts of the nervous system and the brain, and explain how the brain is protected; list the types of neurons, and indicate their structures and functions; explain nerve impulse and synapse and the role of neurotransmitters; define reflex action, state its two types, give examples for and compare each type and demonstrate simple reflex actions; show the structures of the human eye, state their functions, describe image formation and accommodation and explain the causes and corrective measures of common eye defects; describe the structure and function of the human ear and explain how balance is maintained by the inner ear; name the taste areas of the tongue and conduct an experiment to prove that the actual taste of food is a mixture of taste and smell and draw and label the smelling organ and the structure of the skin; define glands, distinguish between exocrine and endocrine glands, locate the position and function of

endocrine glands and describe the menstrual cycle and the associated changes; state the causes and treatments of goiter and diabetes mellitus list birth control methods and explain how each method works and describe female genital mutilation as a harmful traditional practice; describe the symptoms, incubation period and treatment of HIV/AIDS, how it affects immunity and demonstrate life skills that help them prevent HIV; define homeostasis, poikilotherms and homoiotherms, compare them and explain the physiological behavioral methods of temperature regulation in homoiotherms; state the functions of the structures of kidney, the liver, and the skin and explain their role in regulation.

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.

Unit 4: Food making and growth in plants (22 periods)

Unit Outcomes: Students will be able to

- label the internal structures of leaves and explain their functions
- use the microscope to study internal structures of leaves
- state the importance of CO₂, light and chlorophyll for photosynthesis and demonstrate their importance with simple experiments
- explain the significance of photosynthesis in agriculture
- describe the mechanism of movement of water, organic materials and minerals in plants
- demonstrate the processes of germination in dicots and monocots
- list plant hormones, state their functions and outline the mechanism of action of auxins
- explain how removal of apical dominance and sunlight influence plant growth
- name the different types of tropisms and explain their processes.

<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"> • label the internal structures of leaves • explain the functions of the internal structures of leaves • use the microscope to study internal structures of leaves • state the importance of light for photosynthesis • state the importance of chlorophyll for photosynthesis • demonstrate the importance of CO₂, chlorophyll and light for photosynthesis with simple experiments 	<p>4. Food making and growth in plants</p> <p>4.1 The Leaf (2 periods)</p> <ul style="list-style-type: none"> • Leaf structure • Observing stomata <p>4.2 Photosynthesis (8 periods)</p> <ul style="list-style-type: none"> • Mechanism of photosynthesis <ul style="list-style-type: none"> – Requirements of photosynthesis – Phases of photosynthesis – Formation of other organic compounds – Storage of starch 	<ul style="list-style-type: none"> • Let students hold a leaf against light and draw the features of a leaf. They can also make a leaf print by pressing a leaf specimen with a bottle rolled against a white sheet of paper • Use microscope to study structures of leaves; alternatively a film sequence could be shown on leave structures; students draw microscopic leaf structures and label them • Make sure that students understand the key concepts that photosynthesis occurs in chloroplasts; molecules absorb light through activation of their electrons; chlorophylls are the major pigments used in photosynthesis; photosynthesis has light dependent and light independent phases; production of ATP and reducing agents occur during the light-dependent phase; and CO₂ is reduced to glucose during the light independent phase. • Use text and diagram on the production, transport and storage of carbohydrates. Students could translate the text and diagram into a table • Compare two plants, one kept in the dark, the other one in the light. Students write a proper report including the method, observation and conclusion • Let the students understand photosynthesis as: Carbon dioxide and water are transformed in the presence of Chlorophyll and light to glucose (students are not yet familiar with organic chemistry)

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • state that it is through photosynthesis that the ultimate source of energy is tapped and converted to chemical energy available to life • appreciate that a great deal of food manufacture takes place by photosynthesis in water bodies • assert that humans should strive to make use of photosynthesis that takes place in water bodies • explain how photosynthesis helps to balance the concentration of O₂ and CO₂ • explain how deforestation may lead to CO₂ build up in the atmosphere and finally to global warming 	<ul style="list-style-type: none"> • Significance of photosynthesis in agriculture <ul style="list-style-type: none"> – Photosynthesis as the basis for the world's food supply – Photosynthesis in water bodies – Photosynthesis and the atmosphere (Global warming) 	<ul style="list-style-type: none"> • Let the students conduct small group discussions and come out with their own points on the significance of photosynthesis and let them present it to the class • Use video films on this issue (if available) • You do not need to get into the details of global warming because it will be treated very well in unit 6. Here, it is enough that you show students how it could simply be related to photosynthesis. That is, removing photosynthetic organisms from our environment is interfering in one of the natural processes of utilizing CO₂ and hence assisting CO₂ build up in the atmosphere which leads to global warming
<ul style="list-style-type: none"> • explain water uptake by roots • explain the mechanism of water movement in plants • describe transpiration and the factors affecting it • discuss the implications of transpiration in agriculture 	<p>4.3 Transport (6 periods)</p> <ul style="list-style-type: none"> • Transport of water and organic molecules • Uptake of mineral salts 	<ul style="list-style-type: none"> • Demonstrate the following experiments and let the students conduct some of the experiments in groups: <ul style="list-style-type: none"> – Show the movement of water in Geranium plant (or any other plant with very soft herbaceous stem) using coloured fluid – Demonstrate transpiration using potometer – Show that transpiration occurs through the leaves using leafy shoot and leafless shoots enclosed in bell jars – Prove that transport of organic materials is through the phloem by the ringing experiment

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • explain the mechanism of uptake of mineral salts through roots • describe the movement of organic materials in the phloem • demonstrate the processes of germination in dicots and monocots • list plant hormones • state the functions of plant hormones • outline the mechanism of action of auxins • explain the effect of removing apical dominance on plant growth • demonstrate how sunlight influences plant growth • name the different types of tropisms in plants • explain the processes of tropism 	<p>4.4 Response in plants (6 periods)</p> <ul style="list-style-type: none"> • Plant growth and development <ul style="list-style-type: none"> – Germination – Plant hormones • The action of auxins <ul style="list-style-type: none"> – Auxin concentration – Apical dominance • Effect of sunlight on plant growth • Tropism 	<ul style="list-style-type: none"> • Outline in detail, with the aid of specimens or diagrams (photographs), the process of germination in selected plants. Let them germinate seeds themselves and compare their results with the outlines presented to them • Use charts or. Demonstrate or let the students perform simple experiments to find out: i) How auxin operates to coordinate plant growth and development; and ii) The role of the shoot of the plant in plant growth and development • The effect of pruning (removing apical dominance) could be observed by a prolonged follow up of a pruned plant • Let the students perform simple experiments, in groups or individually, to show how light affects the growth of plants • Experimental demonstrations to show phototropism and geotropism

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.

A student working at the minimum requirement level will be able to: label the internal structures of leaves and explain their functions; use the microscope to study internal structures of leaves; state the importance of CO₂, light and chlorophyll for photosynthesis and demonstrate their importance with simple experiments; explain the significance of photosynthesis in agriculture; demonstrate the processes of germination in dicots and monocots; list plant hormones, state their functions and outline

the mechanism of action of auxins; explain how removal of apical dominance and sunlight influence plant growth; name the different types of tropisms and explain their processes.

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Unit 5: Conservation of natural resources (14 periods)

Unit Outcomes: Students will be able to

- classify natural resources and define the terms natural resource, renewable resource, non-renewable resource, conservation and biodiversity
- state the uses of vegetation and wildlife and the impacts of humans on them, list some endemic vegetation and wildlife species of Ethiopia, discuss methods of conservation of vegetation and wildlife and narrate how Ethiopian vegetation was affected in history
- list the national parks of Ethiopia and mention some of the common species of wild life that exist in each national park
- explain the causes and effects of air pollution
- define global warming and state the causes and methods of prevention of global warming.

<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 natural resource as anything natural that is useful • classify natural resources into renewable and non-renewable resources • define renewable resources as mainly living things and their products that can be used, re-used and replaced • define non-renewable resources as those that are not living and can not be replaced • define conservation as the protection and preservation of our natural environment 	<p>5. Conservation of natural resources</p> <p>5.1 Definition of terms <i>(1 period)</i></p> <ul style="list-style-type: none"> • Natural resources • Renewable resources • Non renewable resources • Conservation 	<ul style="list-style-type: none"> • Use pictorial examples of natural resources, renewable resources, and non-renewable resources • Brainstorm and develop in groups concept maps on natural resources. The concept maps are put on the walls in the classroom and discussed

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • define biodiversity as wealth of species in a given place • Explain the importance of conserving biodiversity • Summarize the general methods of conserving biodiversity. • state the uses of vegetation • describe the impacts of humans on vegetations • list some endemic vegetation species of Ethiopia • discuss methods of conservation of vegetation • narrate how Ethiopian vegetation was affected in history • state the uses of wildlife • describe the impacts of humans on wildlife • list some endemic wildlife species of Ethiopia • discuss methods of conservation of wildlife • list the national parks of 	<p>5.2 Conservation and biodiversity (2 periods)</p> <ul style="list-style-type: none"> • Why conserve biodiversity • How to conserve biodiversity <p>5.3 Vegetation (4 periods)</p> <ul style="list-style-type: none"> • Use • Human effects • Endemic species • Conservation • National parks <p>5.4 Wildlife (4 periods)</p> <ul style="list-style-type: none"> • Use • Human effects • Endemic species • Conservation • National parks 	<ul style="list-style-type: none"> • When dealing with this topic just give general ideas of why and how to conserve biodiversity. Do not get in to details that require more they two periods. Let the students summarize the why and how of biodiversity conservation throughle group discussion • Field visits to national parks, relevant museums, organizations dealing with wildlife and the conservation of plants and animals • Use relevant magazines or newspapers to for current information • Encourage learners to visit libraries • Learners develop posters or other means to present their findings • The content of these two topics could be combined with the former one by doing field visits to <ul style="list-style-type: none"> – Museums – Libraries – National parks – Wildlife conservation organizations • Students present their findings on: <ul style="list-style-type: none"> – Impact of humans on vegetation and wildlife – Endemic species – Methods used in Ethiopia to conserve wildlife and vegetation – Historical events on the Ethiopian vegetation • Students brainstorm on how they could contribute to the conservation of Ethiopian wildlife and vegetation

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<p>Ethiopia</p> <ul style="list-style-type: none"> • mention some of the common species of wild life that exist in each national park • explain the causes of air pollution • explain the effects of air pollution • define global warming as the increase in the amount of carbon(IV) oxide in the atmosphere trapping heat and increasing the atmospheric temperature • state the causes of global warming • explain the methods of prevention of global arming 	<p>5.5 Air (3 periods)</p> <ul style="list-style-type: none"> • Causes and effects of air pollution • Global warming • Ozone depletion 	<ul style="list-style-type: none"> • Use available video films on air pollution, global warming and ozone depletion • Students develop in groups a causes and effects tree on <ul style="list-style-type: none"> – air pollution, – ozone depletion and – global warming

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.

A student working at the minimum requirement level will be able to: classify natural resources and define the terms natural resource, renewable resource, non-renewable resource, conservation and biodiversity; state the uses of vegetation and wildlife and the impacts of humans on them, list some endemic vegetation and wildlife species of Ethiopia, discuss methods of conservation of vegetation and wildlife and narrate how Ethiopian vegetation was affected in history; list the national parks of Ethiopia and

mention some of the common species of wild life that exist in each national park; explain the causes and effects of air pollution; define global warming and state the causes and methods of prevention of global warming

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