

Biology Syllabus, Grade 9

General Objectives of Grade 9 Biology

1. To develop understanding and acquire knowledge of:

- the contributions of some renowned Ethiopian biologists and the activities of some institutions involved in biological research in Ethiopia
- the functions of the different types of microscopes, magnification and resolution, the different resolutions and dimensions of light and electron microscope and techniques of using a microscope and the purpose of staining cells
- types, shapes, and sizes of cells, the cell theory and the structures and functions of cells and the differences between animal cells and plant cells
- the permeability of the cell membrane, the processes of diffusion and osmosis and how plant cells become flaccid and plasmolysis and turgor pressure
- the six classes of food, their sources, functions and deficiency diseases of each class, nutrition and the importance of balanced diet
- the functions of the structures of the digestive system, enzymes and their role in the process of digestion and the processes of digestion and absorption
- oral hygiene and the cares that should be taken when buying and using canned, packed and bottled foods and the importance of keeping food hygiene for health
- the functions of human breathing structures, the composition of inhaled and exhaled air, the mechanism of breathing and gas exchange and the factors that affect breathing
- methods of keeping hygiene of breathing and the effects of smoking on health and family economy
- the composition and the functions of blood and its components and the three types of blood vessels and their functions
- the structures of the heart, their functions and the process of circulation
- the four blood groups, their compatibility and the causes and prevention of anaemia and hypertension
- micro-organisms, their uses and harms, the methods of controlling, growing and staining micro-organisms, and the importance of vaccines and how they are produced
- the causes, symptoms, transmission and prevention of some common diseases including STDs in Ethiopia
- the proper handling of medicines, the risks of self prescribed medicines, the role of traditional medicines in the treatment and cure of diseases
- the local, national and global distribution of HIV and AIDS, its impacts in the society and
- the structures and functions of the lymphatic system and how HIV affects immunity and why VCT services are important
- the need for classification, species, the system of binomial nomenclature, and how organisms are given scientific names, write scientific names properly and give examples of scientific names
- the characteristic features of kingdoms monera, protista, fungi, plants and animals
- the habitat, nutrition, reproduction and importance of most representative organisms of kingdoms monera, protista, fungi, plants and animals
- biotic and abiotic components of the ecosystem, food chain, food web, pyramid of biomass and pyramid of energy, the carbon and nitrogen cycles, and plant and animal adaptations

2. To develop skills and abilities of:

- using a microscope and demonstrating simple staining methods of micro-organisms
- conducting simple tests for starch, protein and fats
- compose simple examples of balanced breakfast, lunch and dinner
- conducting a simple experiment to prove that digestion begins in the mouth
- examining lung and heart structures using fresh or preserved specimens
- demonstrating the presence of CO₂, water vapour and heat in exhaled air

- demonstrating the steps followed by artificial respiration
- counting their own heartbeats using their fingers
- using information on medicine packs properly
- demonstrating assertiveness, decision making and problem solving skills as life skills that help to prevent AIDS
- writing scientific names properly
- classifying some common plants and animals including humans based on the classification groups
- planting and growing trees
- 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:

- willingness to give care and support to PLWHA
- willingness to participate in VCT services
- participating in community tree planting and growing activities
- intellectual curiosity, co-operation, reasoning, openness, honesty, love, tolerance, respect and freedom

Unit 1: Biology and Technology (3 periods)

Unit Outcomes: Students will be able to:

- name and explain the contributions of some renowned Ethiopian biologists
- mention and explain the activities of some institutions involved in biological research in Ethiopia.

<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 one renowned Ethiopian biologist • explain the contributions of the renowned Ethiopian biologist • mention some institutions involved in biological research in Ethiopia • explain the activities of some institutions involved in biological research in Ethiopia 	<p>1. Biology and Technology</p> <p>1.1 Renowned Ethiopian biologists (1 period)</p> <ul style="list-style-type: none"> • Biography and contribution of Dr. Aklilu Lemma <p>1.2 Some Ethiopian institutions that are involved in biological research (2 period)</p> <ul style="list-style-type: none"> • Institutions involved in biological research in Ethiopia (major activities and contributions of AHRI, ALIPB, IBDC, ENHRI, IAR, AAU Biology Dept. and other universities 	<ul style="list-style-type: none"> • Use materials (books, magazines, newspapers, journals, leaflets) on Ethiopian biologists regarding biography and their contribution to biology; groups of learners will elaborate on each biologist and present it to the class • It must be stressed that there are a lot of Ethiopian biologists in universities and research institutions that are engaged in research activities and that are very well known internationally. • Let the students analyze and report the contribution of Ethiopia biologists in relation to science and technology. • Use materials on research institutions. The particular institutions might have information material available. Develop at the blackboard a table: <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Institution</th> <th>Focus of research</th> </tr> </thead> <tbody> <tr> <td>AHRI ALIPB IBDC ENHR IAR AAU Biology Dept. Other Universities</td> <td></td> </tr> </tbody> </table>	Institution	Focus of research	AHRI ALIPB IBDC ENHR IAR AAU Biology Dept. Other Universities	
Institution	Focus of research					
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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 and explain the contributions of some renowned Ethiopian biologists and mention and explain the activities of some institutions involved in biological research in Ethiopia

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: Cell Biology (17 periods)

Unit Outcomes: Students will be able to:

- name types and state the functions of the different types of microscopes
- distinguish between magnification and resolution and compare the different resolutions and dimensions of light and electron microscope
- explain techniques of using and use a microscope and explain the purpose of staining cells
- show types, shapes, and sizes of cells using diagrams and state the cell theory
- list the structures and describe the functions of the structures of cells and compare animal cells with plant cells
- describe the permeability of the cell membrane and the processes of diffusion and osmosis
- show how plant cells become flaccid and explain plasmolysis and turgor pressure.

<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 types of microscopes • state the functions of the different types of microscopes • distinguish between magnification and resolution of a microscope • compare the different resolutions and dimensions of light and electron microscope • explain basic techniques of using a microscope • use the microscope to study cells • explain the purpose of staining cells • show types, shapes, and sizes of cells using diagrams 	<p>2. Cell Biology</p> <p>2.1 The microscope (4 Periods)</p> <ul style="list-style-type: none"> • Light and electron microscopes • Resolution and magnification • Using the microscope (Mounting, staining and observing) <p>2.2 The Cell (6 periods)</p> <ul style="list-style-type: none"> • Type, shape and size • The cell theory 	<ul style="list-style-type: none"> • Prepare a table and show the principles of light and electron microscopes • Develop table on the blackboard listing the structures that can be detected with both light and electron microscopes <table border="1" data-bbox="936 760 1856 943"> <thead> <tr> <th data-bbox="936 760 1339 808">Light microscope</th> <th data-bbox="1339 760 1856 808">Electron microscope</th> </tr> </thead> <tbody> <tr> <td data-bbox="936 808 1339 943"> <ul style="list-style-type: none"> • Nucleus • Chloroplasts • ... </td> <td data-bbox="1339 808 1856 943"> <ul style="list-style-type: none"> • Mitochondria • Nucleolus • </td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Using a microscope: this depends on the availability different options are listed • Use a microscope, or • Demonstration of a microscope by the teacher, or • Invite a laboratory technician to the classroom to demonstrate a microscope • Do a field visit to a nearby hospital or health centre and get an introduction to how and why a microscope is used there • Use charts, diagrams and micrographs that show different types of cells (nerve cells, hair cells, muscle cells etc.) • Develop table on blackboard reflecting the parts of the cell and their function as follows: 	Light microscope	Electron microscope	<ul style="list-style-type: none"> • Nucleus • Chloroplasts • ... 	<ul style="list-style-type: none"> • Mitochondria • Nucleolus •
Light microscope	Electron microscope					
<ul style="list-style-type: none"> • Nucleus • Chloroplasts • ... 	<ul style="list-style-type: none"> • Mitochondria • Nucleolus • 					

Competencies	Contents	Suggested activities								
<ul style="list-style-type: none"> • state the cell theory • list the structures of cells • describe the functions of the structures of cells • compare animal cells with plant cells <ul style="list-style-type: none"> • describe the permeability of the cell membrane • describe the processes of diffusion and osmosis • show that plant cells become flaccid when they lose water and turgid when they absorb water • explain plasmolysis and turgor pressure 	<ul style="list-style-type: none"> • Structures and functions • Comparing plant and animal cells <p>2.3 The cell and its environment (7 periods)</p> <ul style="list-style-type: none"> • Diffusion and osmosis • Plasmolysis and turgor pressure (isotonic, hypertonic and hypotonic conditions) 	<table border="1" data-bbox="936 337 1787 472"> <thead> <tr> <th>Part of the cell</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>Chloroplasts</td> <td>Photosynthesis</td> </tr> <tr> <td>Nucleus</td> <td>Controls the activities of the cell</td> </tr> <tr> <td>...</td> <td>...</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Develop a table on the differences between a plant and an animal cell <ul style="list-style-type: none"> • Help students to understand the concept of concentration first. This is very important to understand the process of osmosis where movement of molecules is dictated by concentration of molecules. Experiments on osmosis • Onion epidermis cells: Behaviour observed under the microscope by adding high concentrations of KCl solution (Optional) • Behaviour of egg yolk in salt water and distilled water • Demonstrate the process of osmosis using thistle funnel, osmometer, potato cups and drawings • Demonstrate the process of diffusion using any coloured diffusible substance such as potassium permanganate (KMnO₄) or copper sulphate (CuSO₄) in water • Use diagrams to illustrate plasmolysis and turgor pressure • Demonstrate the loss or gain of water using potato cylinders and different concentrations of solutions in which they are immersed 	Part of the cell	Function	Chloroplasts	Photosynthesis	Nucleus	Controls the activities of the cell
Part of the cell	Function									
Chloroplasts	Photosynthesis									
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...	...									

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 types and state the functions of the different types of microscopes; distinguish between magnification and resolution and compare the different resolutions and dimensions of light and electron microscope; explain techniques of using and use a microscope and explain the purpose of staining cells; show types, shapes, and sizes of cells using diagrams and state the cell theory; list the structures and describe the functions of the

Structures of cells and compare animal cells with plant cells; describe the permeability of the cell membrane and the processes of diffusion and osmosis; and show how plant cells become flaccid and explain plasmolysis and turgor pressure.

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Unit 3: Human Biology and Health (37 periods)

Unit Outcomes: Students will be able to:

- define food, list the six classes of food, tell the sources, functions and deficiency diseases of each class and conduct simple tests for starch, protein, fats and vitamin C
- define nutrition and balanced diet, explain the importance of balanced diet and compose simple examples of balanced breakfast, lunch and dinner
- describe the functions of the structures of the digestive system, label the structures on a given diagram, define enzymes and describe the role of enzymes in the process of digestion
- describe the processes of digestion and absorption and conduct a simple experiment to prove that digestion begins in the mouth
- demonstrate oral hygiene and the cares that should be taken when buying and using canned, packed and bottled foods and explain the importance of keeping food hygiene for health
- identify and describe the functions of human breathing structures and examine lung structures using lung specimen
- demonstrate the presence of CO₂, water vapour and heat in exhaled air and compare the composition of inhaled and exhaled air
- explain the mechanism of breathing and gas exchange and the factors that affect breathing
- list methods of keeping hygiene of breathing and explain the effects of smoking on health and family economy
- describe and demonstrate the steps followed by artificial respiration
- list the composition and state the functions of blood and its components and list the three types of blood vessels and explain their functions
- indicate the structures of the heart on a model or diagram, explain their functions, examine a mammalian heart using fresh or preserved specimens, count their own heartbeats using their fingers and diagram the process of circulation
- name the four blood groups, indicate their compatibility and explain the causes and prevention of anaemia and hypertension.

<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 food as the source of nutrients and energy for the body • list the six classes of food • tell the sources of the six classes of food • conduct simple tests for starch, protein, fats and vitamin C 	<p>3. Human Biology and Health</p> <p>3.1 Food and nutrition (7 periods)</p> <ul style="list-style-type: none"> • What is food? • Classes of food (carbohydrates, proteins, fats and oils, vitamins, minerals, and water) • Food tests (starch, protein, fats, and vitamin C) 	<ul style="list-style-type: none"> • Students could make a comparison between the human body and a machine and establish that the role of food is in providing the body with nutrients, and also with energy like a fuel is the source of energy for a machine. • Students should be able to identify the six components in food and discuss important sources of each food component. Let them discuss on the common mistake of considering sunlight as Vitamin D and the role of sunlight in this regard. • Students should test a number of different foods for the presence of starch using iodide solution. A characteristic blue-black colour is obtained if starch is present. • Students should test a number of different foods for the presence of protein using 5% sodium hydroxide solution followed by 1% copper(II) sulphate solution. A characteristic purple or violet colour is obtained if protein is present. • Students should test a number of different foods for the presence of lipids. This can be done in two ways. A simple test is to squeeze the food between filter paper and then leave the filter paper to dry. Squeezing will remove water from the food, which will evaporate

Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> • define nutrition as obtaining food in order to carry out life processes • define balanced diet as a diet that is made up of the four food groups • explain the importance of balanced diet • compose simple examples of balanced breakfast, lunch and dinner • diagram of the human digestive system • name the various parts of the digestive system 	<ul style="list-style-type: none"> • What is nutrition? • What is balanced diet? • Importance of balanced diet • Simple examples of balanced breakfast, lunch and dinner 3.2 The digestive system (7 periods) • Organs of the digestive system 	<p>from the filter paper, and any lipids, which will result in a translucent stain which will remain after any water has evaporated. An alternate test is to shake the food with a small amount of propanol in a test tube. The propanol, into which lipids have dissolved, is then poured into an equal volume of water and shaken. If lipids are present the mixture will be milky due to the formation of an emulsion.</p> <ul style="list-style-type: none"> • Students could extend their work on food tests by testing for the presence of simple sugars using Benedict’s reagent and vitamin C using DCPIP • Students should understand that nutrition is the taking in (in animals) or manufacture (in green plants) of food in order to be able to carry out life processes • Students should understand that a balanced diet is one in which a person obtains all the components of food in the correct proportions and quantities necessary for them to remain healthy. • Students should appreciate that an unbalanced diet in which insufficient of one or more components of food leads to the deficiency diseases discussed in the previous section. • Students should appreciate that an unbalanced diet in which too much of one or more components of food may lead to conditions like obesity in which the body stores excessive amounts of carbohydrates, lipids and proteins as fat under the skin and in other parts of the body. • Students should discuss the components of a balanced diet and suggest a combination of meals during a day that will overall provide a balanced diet. For example: <ul style="list-style-type: none"> • Breakfast – bread and ground nut or chickpeas with tea or milk • Lunch – Key wot (meat sauce) with orange or banana • Dinner – Shiro wot (pea flour sauce) with fresh green pepper • Students should write a week’s menu of a balanced diet. • Students could be given examples of un-balanced diets and asked to: <ul style="list-style-type: none"> • Explain why the diet is unbalanced • Describe the problems this would cause for the person • Suggest how the diet should be modified • Use diagram models and text material on digestive system. Activity: <ul style="list-style-type: none"> • Students develop a sequence of the alimentary canal (Mouth → Stomach → Small intestine → L. Intestine → Anus) • Students develop table showing parts of the digestive system and their function as follows:

Competencies	Contents	Suggested activities																
<ul style="list-style-type: none"> • describe the functions of <ul style="list-style-type: none"> • the structures of the digestive system describe the processes of digestion in the mouth, stomach and small intestine • describe the role of enzymes in the process of digestion • conduct a simple experiment to prove that digestion begins in the mouth • describe the process of absorption • reason the importance of keeping oral hygiene • explain methods of keeping oral hygiene • demonstrate the cares that should be taken when buying and using canned, packed and bottled foods • identify human breathing structures 	<ul style="list-style-type: none"> • The process of digestion • Absorption and assimilation • Keeping the digestive system healthy <ul style="list-style-type: none"> - Oral hygiene (keeping tooth clean) - Care with canned, bottled and packed foods 3.3 Respiratory system (9 periods) • Breathing system 	<table border="1" data-bbox="997 272 1803 406" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Organ</th> <th>Food digested</th> <th>Enzymes</th> <th>End product</th> </tr> </thead> <tbody> <tr> <td>Mouth</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Stomach</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Small intestine</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Demonstrate peristalsis using plastic tube • Students should be aware that saliva contains an enzyme that converts starch into sugars. In order to prove that digestion begins in the mouth students should carry out an experiment in which they mix solutions of amylase (used in preference to saliva) and 2% starch solution, both at 37 °C. Small samples of the mixture should be removed every 30 seconds, placed on white tile and tested with iodine solution. As the starch is digested the intensity of the blue-black colour obtained with iodine will become less. Finally the remaining solution can be tested with Benedict’s solution to show that a reducing sugar has been produced. This test should also be carried out on the original 2% starch solution as a control. • Let students appreciate the fact that ingested food may not be considered to be strictly in the body. It is only after absorption that food is combined into the body • Students write a small essay on the importance and methods of keeping oral hygiene • Students should be able to name some foods which can be bought in cans, bottles or other packets. They should appreciate that these are methods of preserving foods. Students should discuss precautions that must be taken when using such foods. These could include: <ul style="list-style-type: none"> • Checking that the ‘best before’ date stamped on the food has not been exceeded • Ensuring that the can, bottle or packet has not been damaged in any way which would allow the food to be in contact with potentially harmful microbes in the air • Once the container has been opened, using all of the contents or storing any remaining contents in a refrigerator or under conditions suitable to prevent the food from going off • Checking for any bulging in the shape of the can which indicates microbial growth in the canned food. • Allow students to discuss on the need for berating. 	Organ	Food digested	Enzymes	End product	Mouth				Stomach				Small intestine			
Organ	Food digested	Enzymes	End product															
Mouth																		
Stomach																		
Small intestine																		

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • describe the functions of breathing structures • examine lung structures using lung specimen • demonstrate the presence of CO₂, water vapour and heat in exhaled air • compare the composition of inhaled and exhaled air • explain the mechanism of breathing using a lung model • explain the mechanism of gas exchange • list the factors that affect breathing • explain how breathing is affected by the factors • explain the effects of smoking on health and family economy • list methods of keeping hygiene of breathing • describe the steps followed by artificial respiration • demonstrate the steps followed by artificial respiration • explain cellular respiration • describe the formation of ATP 	<p>– Breathing structures.</p> <ul style="list-style-type: none"> • Dissection of lung (sheep or cow) • Mechanism of breathing and gas exchange • Comparison of inhaled and exhaled air • Detection of CO₂, water vapour and heat in exhaled air • Factors affecting breathing • Breathing and health • Effects of smoking • Hygiene of breathing • Artificial respiration <p>3.4 Cellular respiration (basic principles) 5 periods</p> <ul style="list-style-type: none"> • Fuels and energy • ATP formation 	<ul style="list-style-type: none"> • Use diagram or model of lung to teach about the breathing structures • Demonstrate the parts of the lung by dissecting sheep/cow lung • Demonstrate the breathing mechanism using a lung model of balloons and straw • Experiment: Breathing through Ca(OH)₂ solution to detect carbon dioxide • Experiment: Breath against cold glass (e.g. window) to detect water vapour • Students brainstorm in groups on the effects of smoking and develop a concept map. Using the mind map students write a short essay on the effects of smoking • Demonstrate the tar of a cigarette smoke using a simple experiment (a smoking machine) • Provide text and pictures on giving breath to an accident victim as a first aid measure (artificial respiration). Explain the need for artificial respiration, the different situations which cause breathing to stop and the different methods of restoring breathing and demonstrate artificial respiration. The first steps of artificial respiration could be demonstrated on the students themselves. But the final step, i.e., the ‘mouth to mouth’ step should be shown using model. Let the students practice each step in small groups. They must practice the final step using models only. • Let students compare the use of fuels in machines and engines with the use of food in the human body as both are used for energy • Use text material and model to show that:

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<ul style="list-style-type: none"> • describe the importance of ATP to the body • compare aerobic respiration with anaerobic respiration • explain how oxygen and nutrients are transported • indicate the structures of the heart on a model or diagram • explain the functions of the structures of the heart • examine a mammalian heart using fresh or preserved specimens • measure their own heartbeats using their fingers • list the three types of blood vessels • explain the functions of the blood vessels • name the components of blood • tell the functions of the components of blood • list the blood groups • indicate the compatibility of the four blood groups • explain the causes and prevention of anaemia and hypertension 	<ul style="list-style-type: none"> • The release of energy (aerobic and anaerobic) <ul style="list-style-type: none"> ▪ Anaerobic respiration in plants and animals 3.5 The circulatory system <i>(9 periods)</i> • The need for transport system • The heart and blood vessels • Pulse rate and blood pressure • Blood circulation • Blood components • Blood groups and transfusion • Anaemia and hypertension 	<ul style="list-style-type: none"> – We take up high energy food stuff and oxygen – We release water and carbon dioxide – The cellular respiration produces ATP, which is the “energy currency“ in organisms. – Energy uptake and release is reflected by $ADP + P_i \rightarrow ATP$ • Use materials and text on the human circulatory system • Heart specimen from cow/sheep could be dissected or a heart model or chart could be used to study the structures • Students measure the pulse and blood pressure before and after physical activity • Let students illustrate double circulation using a flow diagram • Leave animal blood for about 10 minutes so that the blood cells get separated from the blood serum. • Provide pictures on the various components of blood. Activity: Students will write a summary on the components of blood • Students could also prepare in groups a chart or table showing blood compatibility

Assessment

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A student working at the minimum requirement level will be able to: define food, list the six classes of food, tell the sources, functions and deficiency diseases of each class and conduct simple tests for starch, protein and fats; define nutrition and balanced diet, explain the importance of balanced diet and compose simple examples of balanced breakfast, lunch and dinner; describe the functions of the structures of the digestive system, label the structures on a given diagram, define enzymes and describe the role of enzymes in the process of digestion; describe the processes of digestion and absorption and conduct a simple experiment to prove that digestion begins in the mouth; demonstrate oral hygiene and the cares that should be taken when buying and using canned, packed and bottled foods and explain the importance of keeping food hygiene for health; identify and describe the functions of human breathing structures and examine lung structures using lung specimen; demonstrate the presence of CO₂, water vapour and heat in exhaled air and compare the composition of inhaled and exhaled air; explain

the mechanism of breathing and gas exchange and the factors that affect breathing; list methods of keeping hygiene of breathing and explain the effects of smoking on health and family economy; describe and demonstrate the steps followed by artificial respiration; list the composition and state the functions of blood and its components and list the three types of blood vessels and explain their functions ; indicate the structures of the heart on a model or diagram, explain their functions, examine a mammalian heart using fresh or preserved specimens, count their own heartbeats using their fingers and diagram the process of circulation; name the four blood groups, indicate their compatibility and explain the causes and prevention of anaemia and hypertension.

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.

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Unit 4: Micro-organisms and diseases (17 periods)

Unit Outcomes: Students will be able to:

- define micro-organisms and explain their uses and harms
- describe the importance of vaccines and how they are produced
- explain the methods of controlling, growing and staining micro-organisms and demonstrate simple staining methods
- explain the causes, symptoms, transmission and prevention of some common diseases including STDs in Ethiopia
- explain the proper handling of medicines, the risks of self prescribed medicines, use information on medicine packs properly, and explain the role of traditional medicines in the treatment and cure of diseases
- show the local, national and global distribution of HIV and AIDS, explain its impacts in the society and express willingness to give care and support to PLWHA
- describe the structures and functions of the lymphatic system and how HIV affects immunity
- indicate why VCT services are important and express willingness to participate in such services
- demonstrate assertiveness, decision making and problem solving skills as life skills that help to prevent AIDS.

<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 micro-organism as an organism that can only be seen with the aid of a microscope • explain the uses and harms of micro-organisms • describe the importance of vaccines • describe how vaccines are produced • describe the methods used to control micro-organisms • explain the methods of growing micro-organisms • show simple staining 	<p>4. Micro-organisms and diseases</p> <p>4.1 Micro-organisms (6 periods)</p> <ul style="list-style-type: none"> • Uses and harms • Vaccine development • Microbial techniques 	<ul style="list-style-type: none"> • History of discovering micro-organisms: Provide a text with an example on researchers who discovered micro-organisms and what effect this had on people • Grow bacteria and fungi in Petri dishes on Agar (from normal air, inside and outside of buildings; other locations may be considered). Bacteria could also be grown by simply touching the surface of agar in plate with fingers even after washing with soap and water. This allows students to appreciate the presence of bacteria even on fingers that are washed very well. • Do a brainstorming activity on uses of micro-organisms and develop a concept map on diseases caused by micro-organisms and on vaccines • Provide text and chart on the principles of producing vaccines. Let the students write a paragraph about the principles of vaccine production summarizing the text and picture • Microscopic techniques: Practical work with the microscope on preparation of a slide and staining

<i>Competencies</i>	<i>Contents</i>	<i>Suggested activities</i>
<p>methods of micro-organisms</p> <ul style="list-style-type: none"> • explain the causes, symptoms, transmission and prevention of tapeworm, tuberculosis, malaria, and diarrhoea • explain the causes, symptoms, transmission and prevention of syphilis, gonorrhoea and chancroid • explain how medicines should be handled properly • state the risks of depending on and taking self prescribed medicines • use information on medicine packs and leaflets properly • appreciate the role of traditional medicines 	<p>4.2 Diseases (6 periods)</p> <ul style="list-style-type: none"> • Some common human diseases in Ethiopia (causes, symptoms, transmission, prevention and control) <ul style="list-style-type: none"> – Tapeworm – Tuberculosis – Malaria – Diarrhoea • STDs <ul style="list-style-type: none"> – Syphilis, gonorrhoea and chancroid • Treatment and cure against diseases <ul style="list-style-type: none"> – Proper handling and care with medicines – information on medicine packs and leaflets – role of traditional medicines 	<ul style="list-style-type: none"> • Field visit to the nearest hospital or health centre write a report on diseases based on the field visit • Use materials with text and pictures/diagrams to show the transmission of diseases • Let students discuss the proper handling and use of medicines such as keeping medicines out of reach of children, keeping them cool if necessary, only taking the prescribed dosage, disposing expired medicines etc... • Students could be made to gather information about medicines from containers or the leaflets that are provides with medicine box. You can also display a collection of medicine leaflets and boxes so that students analyze the information found on them and present a report to the class • Let students name some traditional medicines and state for what diseases they are used. They could discuss how they could evaluate whether a traditional medicine is as effective as a modern medicine in treating a particular disease

Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> • show the local, national and global distribution of HIV and Aids using graphs and maps. • explain the impacts of HIV and AIDS in the society • demonstrate methods of giving care and support for PLWHA • express willingness to give care and support to PLWHA • describe the structures and functions of the lymphatic system • explain how HIV affects the immune system • explain the importance of VCT services • express willingness to voluntarily participate in VCT services • show willingness to conform to responsible sexual behaviour • demonstrate assertiveness, decision making, and problem solving skills as life skills that help them to prevent HIV 	<p>4.3 HIV and AIDS (5 periods)</p> <ul style="list-style-type: none"> • HIV/AIDS in Ethiopia • Stigma and discrimination • Care and support to PLWHA • HIV Immunity and lymphatic system • VCT (voluntary counselling and testing) • Responsible sexual behaviour • Life skills to prevent HIV/AIDS 	<ul style="list-style-type: none"> • Provide students with current data on the prevalence of HIV and AIDS in their locality, in Ethiopia and in the world. Pose questions on the data which will require them to interpret maps graphs and data tables. • Charts on the prevalence of HIV worldwide and in Ethiopia are available at UNAIDS in printed form and on the Internet electronically. • Let the students find out if there are governmental or non governmental institutions in their locality that work on giving care and support to PLWHA. A visit could be arranged to such institutions. A guest speaker from the institutions could also be invited to the class to discuss with students. Students should be trained in safer ways of giving care and support to PLWHA. • Use graphic materials on how the immune system fights a foreign body • Role-play the action of the immune system on foreign bodies • Role play the impact on the immune system when T-helper cells are attacked by HIV • Knowledge, skills and attitudes on VCT, responsible sexual behaviour and life skills to prevent HIV infections can be gained by various activities • Games (AIDS and ladders) • Role plays • Activities on cause and effect (to comprehend the bigger picture) • Riddles and crossword puzzles

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 micro-organisms and explain their uses and harms; describe the importance of vaccines and how they are produced; explain the methods of controlling, growing and staining micro-organisms and demonstrate simple staining methods; explain the causes, symptoms, transmission and prevention of some common diseases including STDs in Ethiopia; explain the proper handling of medicines, the risks of self prescribed medicines, use information on medicine packs properly, and explain the role of traditional medicines in the treatment and cure of diseases; show the local, national and global distribution of HIV and AIDS, explain its impacts in the society and

express willingness to give care and support to PLWHA; describe the structures and functions of the lymphatic system and how HIV affects immunity; indicate why VCT services are important and express willingness to participate in such services; demonstrate assertiveness, decision making and problem solving skills as life skills that help to prevent AIDS.

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.

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Unit 5: Classification (13 periods)

Unit Outcomes: Students will be able to:

- state the need for classification
- define species, describe the system of binomial nomenclature, explain how organisms are given scientific names, write scientific names properly and give examples of scientific names
- classify some common plants and animals including humans based on the classification groups.
- list the characteristic features of kingdoms monera, protista, fungi, plants and animals
- describe the habitat, nutrition, reproduction and importance of most representative organisms of kingdoms monera, protista, fungi, plants and animals.

<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"> • state the need for classification • define species as a group of individuals able to breed successfully with one another • describe the system of binomial nomenclature developed by Linnaeus • explain how organisms are given scientific names • write scientific names properly • give examples of scientific names • classify some common plants and animals including humans based on the classification groups 	<p>5. Classification</p> <p>5.1 Principles of classification (5 periods)</p> <ul style="list-style-type: none"> • History of taxonomy • The species concept • Binominal nomenclature • Levels of classification (Kingdom, phylum, class, order, family, genus, species) 	<ul style="list-style-type: none"> • Use text available regarding the history of classification. • Discussion on the species concept • Text on examples: Same species with different names, but only one exact Latin name • Discuss what binomial nomenclature is and on how it is written and used. So state the functions of using the binomial nomenclature. • Let students practice writing and using the binomial nomenclature by giving as many examples as possible. • Classification of some common animals like cat, dog, or grasshopper and plants like the Rose, or teff etc. and the classification of humans should be given so that students will be familiarized with each category of classification.

Competencies	Contents	Suggested activities																																				
<ul style="list-style-type: none"> • list the characteristic features of kingdoms monera, protista and fungi • give examples of kingdoms, monera, protista and fungi • list the characteristic features for each division of kingdom plantae • give examples for each division of kingdom plantae • classify angiosperms into monocots and dicots 	<p>5.2 The five kingdoms (8 periods)</p> <ul style="list-style-type: none"> • Kingdom Monera • Kingdom Protista • Kingdom Fungi <p>(General characteristics of each kingdom and properties of the most representative organisms from each kingdom)</p> <ul style="list-style-type: none"> • Kingdom Plantae 	<ul style="list-style-type: none"> • Discuss that some textbooks present three kingdom system of classification. However, stress that most biologists now accept the five kingdom system as the most logical and appropriate for classifying organisms • Develop a table that simplifies the three kingdoms as follows: <table border="1" data-bbox="926 472 1556 610" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Kingdom</th> <th>Characteristics</th> <th>Examples</th> </tr> </thead> <tbody> <tr> <td>Monera</td> <td></td> <td></td> </tr> <tr> <td>Protista</td> <td></td> <td></td> </tr> <tr> <td>Fungi</td> <td></td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Students could be made to examine monerans and protists under a microscope. This could also be done as a project work • You can grow <u>Rhizopus</u> on moist bread for demonstration. Students also can collect some lichens beforehand which will be used during this lesson. • Develop a table that simplifies the plant kingdom as follows: <table border="1" data-bbox="926 808 1556 1070" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3">The Plant Kingdom</th> </tr> <tr> <th>Division</th> <th>Characteristics</th> <th>Examples</th> </tr> </thead> <tbody> <tr> <td>Bryophyta</td> <td></td> <td></td> </tr> <tr> <td>Pteridophyta</td> <td></td> <td></td> </tr> <tr> <td>Gymnoispermae</td> <td></td> <td></td> </tr> <tr> <td>Angiospermae</td> <td></td> <td></td> </tr> <tr> <td>– monocots</td> <td></td> <td></td> </tr> <tr> <td>– dicots</td> <td></td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Students can collect mosses and liverworts from moist areas near their home and examine them during this lesson. • The teacher can plan a field visit to observe species of conifers and other gymnosperms in their area. • Students can collect angiosperm specimens and group them as monocots and dicots by studying the floral parts, leaf venation and the types of seeds they have. 	Kingdom	Characteristics	Examples	Monera			Protista			Fungi			The Plant Kingdom			Division	Characteristics	Examples	Bryophyta			Pteridophyta			Gymnoispermae			Angiospermae			– monocots			– dicots		
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Competencies	Contents	Suggested activities																																																
<ul style="list-style-type: none"> list the characteristic features for each phylum of kingdom animalia give examples for each phylum of kingdom animalia group animals into vertebrates and invertebrates classify vertebrates into five classes 	<ul style="list-style-type: none"> Kingdom Animalia 	<ul style="list-style-type: none"> Develop a table that simplifies the animal kingdom as follows: <table border="1" data-bbox="926 334 1556 850" style="margin-left: 40px;"> <thead> <tr> <th colspan="3" style="text-align: center;">The Animal Kingdom</th> </tr> <tr> <th style="width: 33%;">Phyllum</th> <th style="width: 33%;">Characteristics</th> <th style="width: 33%;">Examples</th> </tr> </thead> <tbody> <tr> <td>Porifera</td> <td></td> <td></td> </tr> <tr> <td>Coelentrata</td> <td></td> <td></td> </tr> <tr> <td>Platyhelminthes</td> <td></td> <td></td> </tr> <tr> <td>Nemathelminthes</td> <td></td> <td></td> </tr> <tr> <td>Mollusca</td> <td></td> <td></td> </tr> <tr> <td>Annelida</td> <td></td> <td></td> </tr> <tr> <td>Arthropoda</td> <td></td> <td></td> </tr> <tr> <td>Echinodermata</td> <td></td> <td></td> </tr> <tr> <td>Chordata</td> <td></td> <td></td> </tr> <tr> <td> – fishes</td> <td></td> <td></td> </tr> <tr> <td> – amphibian</td> <td></td> <td></td> </tr> <tr> <td> – reptiles</td> <td></td> <td></td> </tr> <tr> <td> – birds</td> <td></td> <td></td> </tr> <tr> <td> – mammals</td> <td></td> <td></td> </tr> </tbody> </table> Preserved or live animal specimens could be used for studying the structures of some members of the animal kingdom. A sample of moist soil or water from the bottom of a pond can be used to find free living nematodes and to observe them. Observation of a sample of pond water under a microscope would help to show crustaceans. Observation of a specimen of an adult grasshopper or cockroach will help to study the external structure of insects in detail. Students can collect millipedes from under rocks, leaves or fallen and decaying trees to observe their structure and behaviour. You can use preserve fish specimen such as tilapia to help students examine its external structures and its teeth and gills. 	The Animal Kingdom			Phyllum	Characteristics	Examples	Porifera			Coelentrata			Platyhelminthes			Nemathelminthes			Mollusca			Annelida			Arthropoda			Echinodermata			Chordata			– fishes			– amphibian			– reptiles			– birds			– mammals		
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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: state the need for classification; define species, describe the system of binomial nomenclature, explain how organisms are given scientific names, write scientific names properly and give examples of scientific names; classify some common plants and animals including humans based on the classification groups; list the characteristic features of kingdoms monera,

protista, fungi, plants and animals; describe the habitat, nutrition, reproduction and importance of most representative organisms of kingdoms monera, protista, fungi, plants and animals

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Unit 6: Environment (15 periods)

Unit Outcomes: Students will be able to:

- explain biotic and abiotic components of the ecosystem
- explain food chain, food web, pyramid of biomass and pyramid of energy using diagrams
- describe and illustrate the carbon and nitrogen cycles
- describe plant and animal adaptations using examples
- explain the importance, of trees, plant and grow trees, and voluntarily participate in community tree planting and growing activities.

<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"> • explain the abiotic components of an ecosystem • explain the biotic components of an ecosystem • explain food chain using diagrams • explain food web using diagrams • explain pyramid of biomass using diagrams • explain pyramid of energy using diagrams • describe the carbon cycle • illustrate the carbon cycle • describe the nitrogen cycle • illustrate the nitrogen cycle 	<p>6. Environment</p> <p>6.1 Ecosystem (3 periods)</p> <ul style="list-style-type: none"> • Physical components • Biological components <p>6.2 Food relationships (4 periods)</p> <ul style="list-style-type: none"> • Phototrophs, chemotrophs and heterotrophs • Food chain and food web • Pyramids of biomass and energy <p>6.3 Recycling in nature (3 periods)</p> <ul style="list-style-type: none"> • The carbon cycle • The nitrogen cycle 	<ul style="list-style-type: none"> • Develop a mindmap on abiotic and biotic components of the ecosystem • Students select a habitat and discuss in groups their experiences on what various animals feed on. From this they develop a food chain and a food web • Use text and picture that illustrates food chains and food webs • Use text and picture that illustrates the pyramids and biomass • Illustrate compounds in which carbon and nitrogen exist • Use charts for carbon and nitrogen cycle • Include the energy conversion for the carbon cycle. Global warming and ozone depletion also are very important issues that should be discussed together with the carbon cycle.

Competencies	Contents	Suggested activities
<ul style="list-style-type: none"> • describe plant adaptations with examples • describe animal adaptations with examples • explain the importance of planting and growing trees • plant and grow trees • express willingness to voluntarily participate in community tree planting and growing activities 	<p>6.4 Adaptations (3 periods)</p> <ul style="list-style-type: none"> • The need for adaptation • Plant adaptations • Animal adaptations <p>6.5 Tree Planting and growing project (2 periods)</p> <ul style="list-style-type: none"> • Importance • Activity: planting and growing trees 	<ul style="list-style-type: none"> • Use text and pictures that illustrates plant and animal adaptations • Let students give examples for adaptations • Field visits to relevant museums, wildlife organizations after which students work in groups to document their findings • Video films that show adaptations of plants and animals • You may use the period allotted for tree growing for explaining the importance of tree planting and growing and at the same time for an actual tree planting activity inside the school compound or the school vicinity. Another option is to use the period for explanation and discussion and to arrange another schedule out of classroom time for planting and growing trees. • Encourage students plan and implement further tree planting and growing activities in their locality • It should be emphasized that planting trees could not be a sufficient and successful undertaking by itself unless a mechanism of following up as the trees grow is created. Let the students suggest as many possible ways or approaches as they can on how to follow up trees as they grow. • Students could document their activities on posters, local newspapers and media and other appropriate documentations

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: explain biotic and abiotic components of the ecosystem; explain food chain, food web, pyramid of biomass and pyramid of energy using diagrams; describe and illustrate the carbon and nitrogen cycles; describe plant and animal adaptations using examples; explain the importance, plant and grow trees and voluntarily participate in community tree planting and growing activities.

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