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ADDIS ABABA CITY ADMINISTRATION EDUCATION BUREAU

Guidelines for selecting Biology contents for Grades 9-11

Addis Ababa Education Bureau

November, 2020

GRADE 9 BIOLOGY SELECTED CONTENTS /TOPICS TO BE REVIEW AND PERIOD ALLOTMENT

	Unit	**Content/sub-content**	No of periods	Rationale (for selection of the content)	Description (knowledge, skill and attitude) and suggested methodology
1	**3**	3.5 The circulatory system • The need for transport system • The heart and blood vessels • Blood circulation • Blood components • Blood groups and transfusion	2	- It is basic and a prerequisite concept for the next grade level(grade 10) - The concept helps learners to understand one of the human organ systems.	At the end of these lessons learners will be able to : ❖ 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 ❖ list the three types of blood vessels ❖ explain the functions of the blood vessels ❖ name the components of blood ❖ explain 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 Suggested teaching methodology ✓ Brain storming ✓ Presentation accompanied by demonstration using real mammalian heart, diagram, model, animated videos etc…
2	4	4.1 Micro-organisms • Uses and harms • Microbial techniques		• The microorganisms are of paramount significance for the live world and man in the spheres of health, industry,	At the end of these lessons learners will be able to : ❖ define micro-organism as an organism that can only be seen with the aid of a microscope

		4.2 Diseases • Some common human diseases in Ethiopia (causes, symptoms, transmission, prevention and control) • Tapeworm • Tuberculosis • Malaria • Diarrhoea • STDs • Syphilis,gonorrhoea and • chancroid	3	biotechnology and life cycles in nature. • They help learners to have knowhow about the spread and prevention method of communicable and non-communicable diseases within the community. • They are also positively influence the health behavior of the learners	❖ explain the uses and harms of micro-organisms ❖ describe the methods used to control micro-organisms ❖ explain the methods of growing micro-organisms ❖ show simple staining methods of micro-organisms ❖ 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 **Suggested teaching methodology** ✓ Brainstorming activity on uses of micro-organisms. ✓ Conducting experiments or Practical work(laboratory activities) accompanied by discussion ✓ Jigsaw small cooperative groups about diseases caused by microorganisms
3	5	5.1 Principles of classification 5.2 The five kingdoms	3	• The topics equip the learners with the prerequisite knowledge, skills and attitude on **taxonomy.** Since biology is the study of life and living things, understanding the principles of classification is the fundamental basis of all fields of biology. • This is because the classification system is a very useful tool for understanding the phylogenic relationships between different groups of animals. It provides	By the end of the lessons learners will be able to: ❖ 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

				information to identify beneficiary animal species and thus help in the selection of economically important animal s.	❖ 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 ❖ 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 **Suggested teaching methodology** ✓ presentation using different simplified tables and real objects ✓ pair discussion ✓ gap lecture

Total Periods 8

GRADE 10 BIOLOGY SELECTED CONTENTS /TOPICS TO BE REVIEW AND PERIOD ALLOTMENT

	Unit	**Content/sub-content**	No of periods	Rationale (for selection of the content)	Description (knowledge, skill and attitude) and suggested methodology
1.	3	**Human Biology and health** **3.4 Reproductive health** Birth control methods **3.5 Homeostasis** Temperature control in homeotherms Homeostasis and the kidney Kidney structure and their function The liver and homeostasis	1 2	This topic is selected because of links to their day to day life's that serve as life skill. Our body can be infected in different cause's .now a day; many people have been infected by kidney disease and liver. Therefore the topics will make a general overview for the students that how animals adapt in extreme conditions. Maintain their body health; students should understand about the kidney, liver structure, and its function. This lesson also will convey to the next grade 11 on the application that factor of temperature on enzyme activity. .	At the end of this lesson students will be able to; ❖ Explain some birth control methods which providing for preventing unwanted conception and family planning. ❖ Use birth control methods throughout their life ❖ compare poikilotherms and homeotherms ❖ Explain the behavioral methods of temperature regulation in homeotherms and poikilotherms. ❖ Label the structures of the kidney and each function. Suggested teaching methodology to achieve the competency of these topics; ✓ Gap lecture method and ✓ Demonstration ✓ Poster Presentations
2.	4	**4.1 The leaf** **4.2 Photosynthesis**	1 1	Human beings are so dependent on photosynthetic organisms because they don't prepare their own food and need a sufficient amount of O_2 to carry out respiration. Students have knowhow about the process of photosynthesis in grade 6, 8; This lesson serves as the pre-	The process of photosynthesis takes place on leaf due to the presence of green pigment/chlorophyll/ on it. After this lesson students will be able to; Draw the structure of the leaf that able plants leaf to adapt for photosynthesis and appreciate it. State the importance of light, chlorophyll, water, and carbon dioxide for photosynthesis and

				request knowledge to the next Grade 11 for UNIT 5/Energy transformation/, Grade 12 Ecology nutrient recycling-carbon cycle.	Explain how the ultimate source of energy /ATP /is tapped and converted to chemical energy available to life Distinguish between light dependence and light independence Discus on Physiological methods of temperature regulation in homoiotherms. Suggested teaching methodology ✓ Brainstorming , ✓ Pair discussion, ✓ Flipped Classroom/materials are studied by the students at home and, then, worked on in the classroom ✓ Jigsaw, use diagram, table, chart etc.
		4.3 Transport and Response in plants	1	The purpose of inclusion of this topic that students have learned about the transport systems in plants in grade 8 unit -2 -plant tissue, / / in grade 9 Osmosis and Diffusion, so they have a background about it. Learning about the mechanism	Plants uptake minerals through their roots and transport by Xylem and phloem tissue. By the end of this lesson students will be able to; ❖ Explain the function of xylem and phloem. ❖ Show that transpiration occurs through the leaves using leafy shoot and leafless

				of adaptations of plants that found in the difficult environment makes as pre-request knowledge to next grade 11 Unit 5 C_3, C4, and CAM plants.	shoots enclosed in bell jars Suggested teaching methodology ; ✓ Brainstorming ✓ Think-pair-share ✓ Discussing/Cooperative Learning/
3	**5**	**Conservation of natural resources** 1.2 Conservation biodiversity. (page 185) 1.3 Vegetation 1.4 Wildlife 1.5 Air	**2**	This topic has selected based on the criteria to provide as the pre-request knowledge of grade 12 biological knowledge/Unit two-Ecology to farther learning / and it is a worldwide issue in case of global warming. They have a background about this topic in Grade 5,6,/Unit 1-air as substance/	Many natural resources are becoming lost due to poor management of natural resources. Contamination of the natural environment by harmful substances as a result of human activities cause for pollution and losing biodiversity.so after the accomplishment of these topics students will be able to; Explain the importance of conserving biodiversity ❖ List some of the endemic vegetation species in Ethiopia ❖ State the uses of wildlife. ❖ List at least five endemic wildlife species of Ethiopia. ❖ explain the methods of prevention of global warming ❖ Explain the causes and effects of air pollution. ❖ State the cause of global warming. Suggested teaching methodology ✓ Think-Pair-Share , ✓ Brain storming, ✓ A concept map, pair Teaching

Total Periods 8

GRADE 11 BIOLOGY SELECTED CONTENTS /TOPICS TO BE REVIEW AND PERIOD ALLOTMENT

No	unit	Content/sub-content	No of periods	Rationale (for selection of the content)	Description (knowledge, skill and attitude) and suggested methodology
1	3	3.2 Functions of enzymes • Enzymes as a catalyst to lower activation of energy • The lock-and-key model • The induced -fit model • Why do some enzymes need cofactors?	1	This topic is selected based on the criteria that students have prior knowledge on the structure of proteins (tertiary structure) and their role in digestion. Again the applications of the topics also directly related to gene expression or control in Grade 12 protein synthesis.	Chemical reactions that take place in the cells are termed as metabolism. Most chemical reaction cannot take place spontaneously hence cells employ a biological catalyst called enzymes to facilitate the rate of chemical reaction. Enzymes are globular proteins that catalyze the chemical reaction in the cells. Generally gene (genotype) determines or control trait (phenotype) by controlling chemical reaction mediated by enzymes. Here is the central dogma of molecular biology DNA → RNA → Enzyme → chemical reaction The key concepts that enzymes work by lowering energy barriers; Thus the students will be able ❖ explain how enzymes lower activation energy ❖ the mechanism of enzyme action ❖ appreciate the role of enzymes in controlling our metabolic activities Methodology ✓ brain storming ✓ Presentation ✓ Discussion ✓ Demonstration
		3.3. Factors affecting the functions of enzymes	2		The rate of an enzyme-catalyzed reaction is affected by the concentration of substrate, and of the enzyme that works on it. In addition, any

		• Temperature • PH • Concentration of substrate • the presence of inhibitors (reversible and irreversible inhibitors) • Competitive inhibitors • Non-competitive inhibitors • How do inhibitors control enzyme activity in living cells			chemical or physical factor that alters the enzyme's three-dimensional shape—such as temperature, pH, salt concentration, and the binding of specific regulatory molecules—can affect the enzyme's ability to catalyze the reaction. Thus the students will be able to ❖ Explain factors that affect enzyme activity. ❖ Investigate the destruction of an enzyme by heat. ❖ Show how temperature, pH, substrate concentration and enzyme concentration affect enzyme activity ❖ Explain allosteric regulation and the feedback control mechanism of enzyme activity. Methodology ✓ Presentation ✓ Discussion ✓ Demonstration
	4	Cell biology 4.1. Why most cells are so microscopic? • The significance of surface area to volume ratio	1	Cells are said to be the functional and structural unit of life. Cells vary in size and shape depending up on their unique function. Students are familiarized with this concept in the previous grade level e.g Grade 7,8,9 and also serve as a prerequisites for microbiology (microorganisms) and genetics in Grade 12	Here emphasis should be given that most cells are so small that they cannot be seen with our necked eye. Two factors must be considered in explaining this reason a. The concept of surface area to volume ratio the smaller the size the bigger the surface area to volume ratio and vice versa b. The second reason is related with the controlling power of the nucleus. That is the smaller the size of the cell the higher power of the nucleus to control the activities. Thus at the end students will be able ❖ Describe cell theory and investigate the size, structure and shape of cells. ❖ State the basic functions of cells.

					❖ Appreciate that all life on Earth originates from cells. Methodology ✓ Presentation ✓ Discussion ✓ Demonstration
		4.2.Types of cells • The evolutionary advancement of eukaryotic over prokaryotic cells • endosymbiont theory	1	The rationale for inclusion of this topic is that students have background information on the structure and functions of cell e.g. Grade 9 biology. This topic is also a basic concept to understand bacterial cell, their structure, metabolism and economic importance, in grade 12 and also serve as a prerequisite knowledge for the understanding of micro biology and evolution of life in grade 12.	The key concepts that: the two major types of cell are prokaryotic and eukaryotic; and that a eukaryotic cell is compartmentalized by its nucleus and membranous organelles. This implies that there is division of labour among the different parts of a single cell. Thus students will be able to ❖ explain the difference between prokaryotic and eukaryotic cells ❖ Appreciate how science try to investigate the origin of Eukaryotic cells from prokaryotic cells Methodology ✓ Think-pair-share ✓ Presentation ✓ Discussion
		4.3 Parts of the cell and their functions • What is the importance of the cell membrane? • What is the plasma membrane like? • The Davson–Danielli model and fluid mosaic model • Active process ✓ Active transport ✓ Endocytosis ✓ Phagocytosis ✓ Pinocytosis ✓ Receptor-mediated	3	The reason for choosing this topic is that cells cannot live in isolation. In order to survive cells have a way or a mechanism for material exchange with its environment. Materials e.g food and oxygen must get into the cells and waste products of metabolism such as carbon dioxide should be removed from cells. This is an extension of grade 9 biology on topics of diffusion and osmosis. The application of this lesson or topic goes to grade 12 how HIV can get into our body or affect the white	Membranes allow some molecules to diffuse freely while they inhibit the passage of others; proteins transport some substances across the cell membrane through facilitated diffusion; and that some molecules are actively transported against concentration gradient. At the end of this topic students will be able to; ❖ explain the mechanisms of substance transport across a cell membrane ❖ to describe she composition and the arrangement of lipids and proteins in the membrane, ❖ compare the Daveson-Daniel and the fluid

		endocytosis ✓ Exocytosis		blood cells	mosaic models ❖ show the arrangement of the phospholipids and proteins in the fluid mosaic model Suggested Methodology ✓ Presentation ✓ Discussion ✓ Demonstration
	5	5.1 Respiration • What is the ATP molecule like and its role in cell metabolism • How is ATP adapted to its role as an energy transfer molecule in cells? • How ATP is produced in the cell • Glycolysis, krebs cycle and electron transport chain • Anaerobic respiration • What substances can be used as energy sources?	2	This topic is selected because the topic has already defined in lower grades as one characteristic features of living organisms , understanding that almost all life activities is energy dependent and also related with our daily life.e.g Baking bread or injera ,Breathing. This topic is also basic in the understanding of carbon cycle in Grade 12 ecology.	After completing this topic students will be able to; ❖ Describe the structure of ATP and its role in cellular metabolism ❖ Explain how ATP is adapted to its role as an energy transfer molecule within a cell. ❖ Describe how ATP is produced in a cell. ❖ Locate where the different processes of cellular respiration occur in the cell. ❖ Explain the role of electron donors and acceptors. ❖ Draw and label the structure of a mitochondrion. ❖ Explain the processes of alcoholic fermentation and lactate production. ❖ Appreciate the importance of lactate production during running and other sports. Methodology ✓ Presentation ✓ Discussion ✓ Demonstration
		5.2. How do plants harness light energy in photosynthesis? • Photosynthesis and photo phosphorylation • Correlation of structure and function .How chloroplast is	2	This topic is selected because a. Students have a prior knowledge on how green plant can manufacture their own food in the previous grades e.g Grades 6,8 & 10	Living organisms depend on the availability of food for their survival. This food comes either directly or indirectly from plants by the process of photosynthesis. key concepts that: photosynthesis in eukaryotes occurs in chloroplasts; molecules absorb light through

		adapted for photosynthesis • What is the structure of a photosystem? Photosystem I &Photosystem II • Process involved during light dependent and light independent reactions of photosynthesis • Factors affecting rate of photosynthesis • Photorespiration • C3 and C4 pathways of photosynthesis		b. It is directly related to the life of all students that the food they eat comes directly or indirectly from plants c. It is an important topic to explain how energy flow (food chain) in an ecosystem and recycling in nature e.g. Carbon cycle –global warming in grade 12.	activation of their electrons; chlorophylls are the major pigments used in photosynthesis; two photosystems cooperate in plant photosynthesis; cyclic photophosphorylation creates only ATP; non-cyclic photophosphorylation creates NADH; CO_2 is reduced to organic compounds in the Calvin cycle; and that some plants use an alternative pathway for CO_2 fixation. Thus students will be able ❖ Locate where light-dependent and independent processes occur in the chloroplast. ❖ Name the products of the light-dependent and independent processes. ❖ Describe the factors that affect the rate of photosynthesis and explain why they affect the rate ❖ Appreciate the importance of C4 plant in Ethiopia. ❖ Describe the CAM photosynthetic pathway and explain why this brings added benefits to plants living in desert conditions. ❖ Describe how glucose is synthesize in the light in dependent reactions of photosynthesis ❖ Describe the factors that affect the rate of photosynthesis and explain why they affect the rate ❖ Explain photorespiration and how it is related to higher temperatures. ❖ Distinguish between C3 and C4 plants and give at least three examples of each ❖ Appreciate the importance of C4 plants in Ethiopia. ❖ Describe the CAM photosynthetic pathway

					and explain why this brings added benefits to plants living in desert conditions

Total Periods 12