Federal Democratic Republic of Ethiopia
Ministry of Education

Minimum Learning Competencies

Biology, Grades 9 to 12

2009

Biology Grades 9 and 10 Minimum Learning Competencies

Area of Competency	*Grade 9*	*Grade 10*
Biology and Technology	• Name some Ethiopian biologists with internationally recognized contributions and explain their works • Mention some institutions in Ethiopia that are involved in biological research and explain their activities	• Define biotechnology and discuss the significance of biology • Discuss the processes where biotechnology has been in use since ancient times • Identify and discuss the important areas of biotechnological application at present time
Cell Biology	• Define microorganisms and explain their useful and harmful effects of some microorganisms • Describe the importance of vaccines and how they are produced • Describe microbiological techniques used to control, grow, and staining of microorganisms • Explain the distribution, impacts and prevention of HIV and AIDS in Ethiopia • Demonstrate methods of giving care and protection for PLWHA • Describe the structures and functions of the lymphatic system and explain how HIV affects it • Explain the importance of VCT services and express willingness to voluntarily participate in this service • Show willingness to conform to responsible sexual behavior • Demonstrate life skills that help them to prevent HIV • List the types of microscopes, state their functions and explain the techniques of using microscopes • Distinguish between magnification and resolution of a microscope • Use the microscope to study cells and explain the purpose of staining specimens • List the structures of cells and describe their functions and compare animal and plant cells • Describe the permeability of the cell membrane and the processes of diffusion and osmosis • Show that plant cells become flaccid when they lose water and become turgid when they absorb water	• Define heredity and compare mitosis and meiosis using sketch diagram • Describe the works of Gregor Mendel on garden peas and relate his experiment to the principle of inheritance • Demonstrate the principle of inheritance using beads • Define chromosome, DNA and genes • Describe the structure of chromosome and list the components of DNA • Describe the methods, importance and examples of breeding farm animals and crops

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	• Explain plasmolysis and turgor pressure • Explain passive and active transport across cell membranes	
Human Biology and Health	• Define the terms food and nutrition, list the six classes of food and tell their sources, functions and deficiency diseases • List vitamins and tell their sources, functions and deficiency diseases • Conduct simple food tests for starch, protein and fats • Explain the importance of balanced diet • Compare their body height and weight with the standards given in a table of height/weight ratios and suggest what they should do to match the standards • Analyze the traditional eating habits of their locality and suggest improvements • Label the diagram of the structures of the human • digestive system and describe the functions of each structure • Define enzymes and describe their role in the process of digestion • Describe the processes of digestion in the mouth, stomach and small intestine • Prove that starch digestion begins in the mouth by conducting a simple experiment using saliva and bread • Describe the process of absorption of digested food • Discuss constipation , care with canned, bottled and packed foods, and food hygiene as issues of digestive health • Identify the human breathing structures on a diagram or model and describe their functions • Examine the structures of the lung using lung specimen of sheep or cow • Explain the mechanism of breathing and gas exchange using a lung model • Demonstrate the presence of CO_2, water vapor and heat in exhaled air	• Mention the two parts of the nervous system and explain the structures and functions of the human nervous system • List the three types of neurons , indicate their structures and tell their functions • Describe nerve impulse and synapse • Describe an action potential and the passage of nerve impulse along a neuron with examples • Describe a synapse and how an action potential crosses it • Describe neurotransmitters with examples • Explain how the brain is protected and compare the fore, mid, and hind brain • Describe the reflex arc, mention the structures involved and compare simple and conditioned reflexes • Demonstrate at least two examples of reflex actions such as knee jerk and eye blinking • Indicate the structures of the human eye, ear, skin, tongue and nose using diagrams or models and describe their functions and methods of caring for them • Dissect sheep or cow eye and identify the structures • Demonstrate the blind spot • Apply sugar, salt, vinegar and rhamnus to the tongue and investigate where each of the four flavors are detected on the tongue • Define substance abuse, explain its effects, its status in Ethiopia, and the possible preventive measures • Compare exocrine and endocrine glands • Describe the structures and functions of thyroid, parathyroid, adrenal, pancreas, gonads, and pituitary glands, list their hormones and the functions of each hormone • Describe goiter and diabetes mellitus, their causes and treatment • Explain the menstrual cycle and the associated changes • List and explain the different birth control methods • Describe female genital mutilation as a harmful traditional

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	• Compare the composition of inhaled and exhaled air, list the factors that affect breathing and explain how they affect it • Explain the effects of cigarette smoking, inhaling gaya, suret and shisha on health and on the economy of the family • List the methods maintaining the hygiene of breathing • Describe the steps followed during artificial respiration and demonstrate these steps • Explain cellular respiration and describe the formation of ATP and its importance to the body • Compare aerobic and anaerobic respiration • Explain the importance of blood, list its composition and tell the functions of each component • List the three types of blood vessels and explain their functions • Indicate the structures of the heart on a diagram/model and explain their functions • Examine a mammalian heart using fresh or preserved specimens from cows or sheep • Count their own heart beat using their fingers • Diagram the process of circulation • Name the four blood groups and indicate their compatibility • Discuss anemia and hypertension as important problems of the circulatory system and the cares that should be taken to control them • Define the terms HIV and AIDS and explain hoe HIV is transmitted through blood and how this could be prevented • Identify WBC as cells that HIV attacks primarily • Demonstrate assertiveness, decision making and problem solving skills as life skills that help to prevent HIV and AIDS	practice • Practice life skills that help them to prevent HIV and AIDS • Define homeostasis and explain how it allows an organism to survive in a wide range of environmental conditions • Define the terms poikilotherm and homeotherm and compare them • Explain the physiological and behavioral methods of temperature regulation in homeotherms • Identify the structures of the human kidney, tell their functions, and describe the contribution of the skin in maintaining salt and water balance • Describe the regulatory functions of the liver

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Plants	• List the characteristic features of kingdoms monera, protista, and fungi and give examples for each • Explain the common characteristics of the plant kingdom • Name the six divisions of plants, describe the common characteristics of each division and name representative plants in each division	• Identify the internal structures of leaves and their functions • Explain the importance of CO_2, water, light and chlorophyll for photosynthesis • Explain how plants convert CO_2 and water into carbohydrate by describing the light and dark reactions • List the various food storage organs in plants with examples • Explain the significance of photosynthesis • Demonstrate the importance of CO_2, light and chlorophyll for photosynthesis using simple experiments • Explain the significance of photosynthesis in agriculture • Explain the mechanism of water transport in plants and name the structure involved in the process • Describe transpiration, the factors affecting it, and its implications for agriculture • Demonstrate water transport in plants using simple experiment • Describe the mechanisms of uptake of mineral salts through roots and movement of organic materials in the phloem • 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
Animals	• Define taxonomy and explain the need for classification • Tell the history of taxonomy by mentioning the works of Aristotle and Linnaeus • Define species and give examples of species • Describe the system of binomial nomenclature, give examples of scientific names of organisms and write these names correctly by following the rules of writing scientific names	

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	• Write the hierarchy of classification groups in a descending order with examples from plants and animals • Name the five kingdoms in the modern system of classification • Define diversity and indicate diversity of animals with examples • List common characteristics of kingdom animalia and identify the distinguishing characteristics of each phylum • Describe phylum helminthes, annelids, mollusks and arthropods with examples • Describe the characteristics of vertebrates and distinguish among its classes	
Environment	• Explain the physical (abiotic) and biological (biotic) components of an ecosystem • Describe and illustrate carbon and nitrogen cycles • Explain food chain, food web, pyramids of biomass and energy using diagrams • Describe plant and animal adaptations with examples • Describe the methods of estimating populations and the factors that limit their growth • Explain the effects of unchecked human population growth on food and environment and the methods of controlling it • Explain the importance of growing trees and participate in a growing project	• Define the term natural resource, list and categorize them as renewable and non-renewable • Define biodiversity and explain its aesthetic, economic and ecological significance • List at least four uses of vegetation to man and discuss the effects of human activity on natural vegetation • Discuss how Ethiopian vegetation was affected in history • Name some of the endemic species of plants in Ethiopia • Define conservation, discuss different methods of conserving vegetation with special attention to endemic species • List the uses of wildlife, the effects of human on them and their status in Ethiopia • List at least five endemic animals in Ethiopia • Describe the conservation of wildlife and the uses of national parks of Ethiopia • List at least five national parks of Ethiopia • Describe the causes and effects of air pollution • Discuss the consequences of global warming (greenhouse effect) and ozone depletion

Biology Grades 11 and 12 Minimum Learning Competencies

Area of Competency	*Grade 11*	*Area of Competency*	*Grade 12*
The Science of Biology	• Define science and List the steps in scientific methodology • Demonstrate scientific methods in solving problems • Classify tools used in biology as laboratory and field equipments • Reflect on the scientific methodology in the learning process • Conduct a library research and gather information to explain the relevance and promises of biological science • Explain the role of biology as a science in the fight against HIV and AIDS • Express willingness to participate in community undertakings against HIV and AIDS • Demonstrate life skills that lead to responsible sexual behavior	**Microorganisms**	• Describe the structure, show the shape of and classify bacteria and explain their role in every ecosystem • Compare infectious disease with functional disease and state the germ theory • Explain how bacteria produce diseases and the role of reservoir hosts in disease transmission • Give examples of industrial processes that use bacteria and indicate how bacteria are used in these processes • Define cloning and illustrate its processes • Describe the structure of a virus, draw and label it, diagram its different forms, give examples of RNA and DNA viruses and compare viruses with free living cells • Compare the lytic and lysogenic cycles of viral reproduction • Draw and label the structure of HIV, explain how it affects the immune system, explain its life cycle, and state its social and economic impacts • Explain how antiretroviral drugs inhibit enzymes of the life cycle of HIV • Demonstrate life skills that lead to responsible sexual behaviour
Biochemical molecules	• Group biochemical molecules as inorganic and organic • Explain the property and importance of water for life • List and describe the organic molecules in living things • Identify biologically important compounds by conducting food tests • Appreciate the way how biological molecules are obtained from different foods	**Ecology**	• Define and describe primary and secondary successions • Appreciate the natural process by which a bare land turns out to be productive area by succession • Describe the water, carbon, nitrogen, phosphorus and sulfur cycles and explain the importance of recycling in nature • Define biomes, list the major land and marine biomes of the biosphere, mention the general features of each biome and state their characteristic fauna and flora

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	• Show the structures and functions of biological molecules using chemical formulae and examples		• Demonstrate love and respect to fauna and flora and their biomes • Define biodiversity, explain its significance and the threats to it, explain its status in Ethiopia and describe the principles of conservation of biodiversity • Reflect a concern towards conservation of biodiversity and appreciate the importance of plant diversity for animal diversity and vice versa • Grow trees in a given area show willingness to participate in further tree growing activities in their locality • demonstrate the influence of natality and mortality on population size and interpret a population growth rate curve • explain the impacts of rapid population growth on development and state the measures that should be taken to control it
Enzymes	• Define enzymes and explain the properties of enzymes • Explain how enzymes are named and classified • Investigate the destruction of an enzyme by heat • Conduct an experiment to show the specificity of an enzyme • Appreciate the importance of enzymes in industries and local products • Explain how enzymes lower activation energy • Explain the mechanism of enzyme action • Discuss the action of apo- and co-enzymes • Classify enzymes according to their structure • Give examples of vitamins and minerals in food that act as co-factors • Explain factors that affect enzyme activity • Explain allosteric regulation and feedback control mechanism of enzyme activity • Show how temperature, pH, substrate conc.	**Genetics**	• Work out different types of gametes from a given dihybrid organism • Use the Punnet square to determine genetic crosses • Determine genotypes and phenotypes formed in a genetic cross • Explain the different types of dominance • Appreciate the significance of artificial crossbreeding and inbreeding to obtain required varieties • Describe different stages of meiotic division and appreciate that the cells formed by meiosis are gametes • Compare the biological importance of meiosis in relation to growth and reproduction • Describe the significance of meiosis in bringing variation through crossing over and independent assortment • Explain why fruit flies are considered ideal for genetic experiments • Explain Sex determination, sex linkage, sex limited

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	And enzyme conc. affect enzymatic activity • Appreciate the role of enzymes in controlling our metabolic activities		and sex influenced traits • Describe inheritance of blood type and Rh factor • Describe the molecular structure of a chromosome • Describe the four types of nucleotides that build up the DNA molecule • Construct a model of DNA showing the base pair between complementary nucleotides and describe DNA replication • Explain the process and site of transcription and translation • Define mutation, describe the different types of mutations, explain the causes of induced mutations, state the spontaneity of a mutation, and explain the impact of mutations
Cell biology	• Describe the cell theory and investigate the size, structure and shape of cells • List different parts of the cell and explain their function and discuss the importance of a cell membrane • Describe the composition and the arrangement of lipids and proteins in the membrane • Compare the Daveson-Daniel and the fluid mosaic model • Construct and show the arrangement of the phospholipids and proteins in the fluid mosaic model • State and explain the mechanisms of substance transport across a cell membrane • Conduct an experiment to show movement of solvent through semi-permeable membrane • Demonstrate osmosis at a semi-permeable membrane • explain that the size of a cell changes by osmosis because of in and outflow of water • Explain the difference between prokaryotic and eukaryotic organisms	**Evolution**	• Define evolution and describe Oparin's and Stanley Miller's experiments on the origin of life • Explain Lamark's and Darwin's theories of evolution and compare these two theories • Explain how fossils are formed and how they are used for dating • Explain how Paleontology, Comparative anatomy, Embryology, Biochemistry, and Plant and animal breeding support the theory of evolution and give examples for each • Define speciation and explain how isolating mechanisms cause speciation • Distinguish between convergent and divergent evolution and give examples for each • define natural selection, state and describe its types and give examples for each type • explain the biological evolution of humans by constructing an evolutionary tree and explain the importance of Lucy *(A. afarensis)* in the study of human evolution • discuss the controversies regarding human races

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Energy transformation	• Describe the structure of ATP and its role in cellular metabolism • Understand the role of electron donors and acceptors • Draw the structure of a mitochondrion and label it • Locate where the different processes of cellular respiration occur in the cell • Explain the process of alcoholic fermentation and lactate production • Appreciate the importance of lactate production during running and other sports • Draw, label and describe a chloroplast • Locate where light dependent and independent processes occur in the chloroplast • Distinguish between C3 and C4 plants and give at least three examples for each • Explain photorespiration • Name the products of the light independent and dependent process • Appreciate the importance of C4 plants in Ethiopia • Separate photosynthetic pigments chromatographically	**Behavior**	• Define behavior and describe its types • Explain the characteristics of innate behavior with examples and list and explain types of innate behavior • Describe reflex in humans, instinct behavior in animals and biological clocks in animals as types of innate behavior • Explain the characteristics and types of learned behavior with examples and explain advantages of innate behavior over learned behavior • Explain how animals learn through habituation, classical conditioning , operant conditioning, imprinting, insight learning and latent learning • Describe patterns of behavior that include courtship, territorial and social behavior and illustrate each pattern with examples