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MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY



BIOLOGY SYLLABUS FOR ORDINARY SECONDARY EDUCATION
FORM I-IV
2023

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Abbreviations and Acronyms

ICT	Information Computer Technology
TIE	Tanzania Institute of Education
TSL	Tanzanian Sign Language

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1.0 Introduction

Biology is a compulsory subject for form I-IV students in General Education pathway who choose to join one of the following streams: the Science, Agriculture, Food and human nutrition, Sports and ICT at Ordinary Secondary Education. However it is an elective subject for students who join other streams. The purpose of learning Biology is to help students to understand the living organisms including human being and how they function, evolve and interact with the environment. It also builds student's strong understanding of Biological concepts, principles, skills and its applications in solving real-world problems. Moreover serves as a bridge to enable students appreciate the values of resources present in Tanzania and to develop the ability to create works for self-employment.

This syllabus is designed to guide the teaching and learning of Biology for Ordinary Secondary Education, Form I-IV in the United Republic of Tanzania. The syllabus interprets the competences indicated in the 2023 Ordinary Secondary Education Curriculum. It provides information that will enable teachers to plan teaching and learning process effectively. It also provides teaching and learning opportunities that guide teachers to apply different methods and strategies to promote student's Biological literacy, ICT skills and develop 21st century skills which include critical thinking, creativity, communication, collaboration and problem solving.

2.0 Main Objectives of Education in Tanzania

The main objectives of education in Tanzania are to enable every Tanzanian to:

- (a) Develop and improve his or her personality so that he or she values himself or herself and develops self-confidence;
- (b) Respect the culture, traditions and customs of Tanzania; cultural differences; dignity; human rights; attitudes and inclusive actions;
- (c) Advance knowledge and apply science and technology, creativity, critical thinking, innovation, cooperation, communication and positive attitudes for his or her own development and the sustainable development of the nation and the world at large;

- (d) Understand and protect national values, including dignity, patriotism, integrity, unity, transparency, honesty, accountability and the national language;
- (e) Develop life and work-related skills to increase efficiency in everyday life;
- (f) Develop a habit of loving and valuing work to increase productivity and efficiency in production and service provision;
- (g) Identify and consider cross-cutting issues, including the health and well-being of the society, gender equality, as well as the management and sustainable conservation of the environment; and
- (h) Develop national and international cooperation, peace and justice per the Constitution of the United Republic of Tanzania and international conventions.

3.0 Objectives of Ordinary Secondary Education

The objectives of Ordinary Secondary Education - General Education are to:

- (a) Strengthen, broaden and develop a deeper understanding of the knowledge, skills and attitudes developed at the Primary Education level;
- (b) Safeguard customs and traditions, national unity, national values, democracy, respect for human and civil rights, duties and responsibilities associated with such rights;
- (c) Develop self-confidence and the ability to learn in various fields, including science and technology as well as theoretical and technical knowledge;
- (d) Improve communication using Tanzanian Sign Language (TSL), tactile communication, Kiswahili and English. The student should be encouraged to develop competence in at least one other foreign language, depending on the school situation;

- (e) Strengthen accountability for cross-cutting social issues, including health, security, gender equality and sustainable environmental conservation;
- (f) Develop competence and various skills which will enable the student to employ himself or herself, to be employed and to manage his or her life by exploiting his or her environment well; and
- (g) Develop readiness to continue to advanced secondary and tertiary education.

4.0 General Competences for Ordinary Secondary Education

The general competences for Ordinary Secondary Education are to:

- (a) Use the knowledge and skills acquired in Primary Education stage to strengthen and expand academic understanding;
- (b) Value citizenship and national customs;
- (c) Demonstrate confidence in learning various professions, including Science and Technology, theoretical and technical knowledge;
- (d) Use language skills, including Tanzanian Sign Language (TSL), Kiswahili, English language, and at least one other foreign language to communicate;
- (e) Use knowledge of cross-cutting issues to manage their environment around them; and
- (f) Use knowledge and skills to enable a student to be self-employed, employable, manage life, and conserve the environment

5.0 Main and Specific Competences

The main and specific competences to be developed are presented in Table 1.

Table 1: *Main and Specific Competences for Form I-IV*

Main competences	Specific competences
1. Demonstrate mastery of the concepts, principles and processes of Biology	1.1 Describe the physiological, anatomical and ecological processes of living organisms
2. Communicating using scientific biological terminologies	2.1 Demonstrate mastery of scientific biological terminologies
3. Conduct biological investigations	3.1 Demonstrate mastery of basic skills for conducting biological investigations 3.2 Prepare and present results of biological investigations 3.3 Carry out a biological project work using biological principles

6.0 Roles of Teachers, Students and Parents in Teaching and Learning

A good relationship between a teacher, student and parent or guardian is fundamental in ensuring successful learning. This section outlines the roles of each participant in facilitating effective teaching and learning of Biology.

6.1 The teacher

The teacher is expected to:

- (a) Help the student to learn and acquire the intended competences in Biology;
- (b) Use teaching and learning approaches that will allow students with different needs and abilities to:
 - i. develops the competencies needed in the 21st century.
 - ii. actively participate in the teaching and learning process.

- (c) Use student centred instructional strategies that make the student a centre of learning which allow them to think, reflect and search for information from various sources;
- (d) Create a friendly teaching and learning environment;
- (e) Prepare and improvise teaching and learning resources;
- (f) Conduct formative assessment regularly by using tools and methods which assess theory and practice;
- (g) Treat all the students equally irrespective of their differences;
- (h) Protect the student while at school;
- (i) Keep track of the student's daily progress;
- (j) Identify individual student's needs and provide the right intervention;
- (k) Involve parents/guardians and the society at large in the student's learning process; and
- (l) Integrate cross-cutting issues and ICT in the teaching and learning process;

6.2 The student

The student is expected to:

- (a) Develop the intended competences by participating actively in various learning activities inside and outside the classroom;
- (b) Participate in the search for knowledge from various sources, including textbooks, reference books and other publications in online libraries.

6.3 The parent

The parent/guardian is expected to:

- (a) Monitor the child's academic progress in school;
- (b) Where possible, provide the child with the needed academic support;
- (c) Provide the child with a safe and friendly home environment which is conducive for learning;
- (d) Keep track of the child progress in behaviour;
- (e) Provide the child with any necessary materials required in the learning process;and
- (f) Instil in the child a sense of commitment and positive value towards education and work

7.0 Teaching and Learning Methods

The teaching and learning methods are instrumental in developing student's competences. This syllabus suggests teaching and learning methods for each activity which includes but not limited to discussions, presentations, field visits, practical work, research, scientific experiments, and project works. However, a teacher is advised to plan and use other appropriate methods based on the environment or context. All the teaching and learning methods should be integrated with the everyday lives of students.

8.0 Teaching and Learning Resources

The process of teaching and learning requires different resources, In that regard, both the teacher and students should work together to collect or improvise alternative resources available in the school and home environment when needed. The teacher and students are expected to constantly seek for information from various sources to effectively facilitate teaching and learning process. The list of the approved textbooks and reference books shall be provided by TIE.

9.0 Assessment

Assessment is important in teaching and learning of Biology subject. It is divided into formative and summative assessments. Formative assessment informs both the teacher and students on the progress of teaching and learning, and in making decisions on improving the teaching and learning process. Teachers are, therefore, expected to apply a wide range of formative assessment

methods which include but not limited to discussions, presentations, oral questions, brainstorming, experiments, observations, practical and projects.

Summative assessment, on the other hand, will focus on determining student’s achievement of learning. Teachers are expected to use a variety of summative assessments including mid-term tests, terminal, mock examinations and projects. The scores obtained from these assessments will be used as Continuous Assessment (CA). Therefore, the continuous assessments shall contribute 30% and the National Form IV Examination shall be 70% of the student’s final achievement, as indicated in Table 2.

Table 2: *Contribution of Continuous Assessment and National Examination in the final score*

Assessment measures	Weight (%)
Standard VI National Assessment	7.5
Form II National Assessment	7.5
Form III Annual Examination	5
Form III Project	5
Form IV Mock Examination	5
Form IV National Examination	70
Total	100

10.0 Number of Periods

The Biology Syllabus for Ordinary Secondary Education provides estimates of the time that will be spent in teaching and learning, in consideration of the complexity of the specific competences and the learning activities. Therefore while form 1 and II will have three periods of 40 minutes each per week, form III and IV have four periods of 40 minutes each per week.

11.0 Teaching and Learning Contents

The contents of this syllabus are presented in matrix form with seven columns which include main competence, specific competence, learning activities, suggested teaching and learning methods, assessment criteria, suggested resources, and number of period as presented in the Table 3 – 6.

Form I

Table 3: Detailed Contents for Form I

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1. Demonstrate mastery of the concepts, principles and processes of Biology	1.1 Describe the physiological, anatomical and ecological processes of living organisms	(a) Explain the basic concepts of Biology (<i>meaning, branches, basic terminologies, importance and its relationship with other disciplines</i>)	<p>Group discussion: Guide students in manageable groups to discuss meaning of biology, basic biological terminologies and branches of biology</p> <p>Brainstorming: Guide students to brainstorm on importance of biology in our life</p> <p>Jigsaw: Guide students in manageable groups, to explain the relationship of Biology with other disciplines through jigsaw</p>	The basic concept of Biology are clearly explained	Charts, relevant text, and online resources on basic concept of biology	27

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Describe a cell (<i>meaning, types, structures and functions</i>)	<p>Group Discussion: Guide students in manageable groups to discuss concept of cell</p> <p>Simulation: Guide students to explain cell structures and cell differentiation through simulation</p> <p>Experimentation: Guide students to prepare microscope slides of a plant and animal cell</p>	The concept of cell is described clearly	Cells charts/ models, light/ electronic microscope, slide covers, microscope slides, and cells online resources	
		(c) Describe nutrition in plants (<i>photosynthesis, leaf structure and mineral requirements</i>)	<p>Field visit: Guide students to collect different plant leaves around the school compound to observe and explain the external structure of leaves</p> <p>Group Discussion: Guide students in manageable groups to discuss the</p>	Nutrition in plants is described clearly	Relevant equipment and apparatus, heat sources, water, relevant chemicals and reagents, leaves, pond weeds, nutrition in plants models/ charts, and nutrition in	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			<p>concept of nutrition in plants, internal structure of a leaf and how photosynthesis occurs in the leaf</p> <p>Guest speaker: Invite guest speaker (Agricultural extension officer) to share with students on mineral requirements in plants</p>		plants online resources	
2. Communicating using scientific biological terminologies	2.1 Demonstrate mastery of scientific biological terminologies	(a) Explain the concept and systems of classification (<i>meaning, importance of classification, rules of scientific naming of organisms,</i>	<p>Field visit: Guide students to collect various living things around the school compound and group all the items according to their similarities</p> <p>Brainstorming: Guide students to brainstorm on the concept of</p>	Concept and systems of classification explained clearly	Variety of living organisms, classification charts, and classification online resources	28

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		<i>artificial and natural classification systems)</i>	<p>classification</p> <p>Group Discussion: Guide students in manageable groups to discuss systems of classification and scientific rules of naming organisms</p> <p>Project: Guide students to assign scientific names to organisms and label trees around their school environment</p>			

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Describe the major groups of organisms: (<i>Monera</i> , <i>Protista</i> , <i>Fungi</i> , <i>Plantae</i> , <i>Animalia</i> and <i>Viruses</i>)	<p>Field trip: Guide students in groups to collect various living organisms around the school compound which are representatives of the major groups of organisms and classify them</p> <p>Group Discussion: Guide students in manageable groups, to identify the major groups of organisms and viruses, discuss their features and economic importance</p> <p>Gallery walk: Guide students to explore the economic importance of major groups of living</p>	The major groups of organisms and viruses are described clearly	Variety of living organisms, preserved specimens, charts on major groups of organisms, and classification online resources	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			organisms and viruses through gallery walk			
3. Conduct biological investigations	3.1 Demonstrate mastery of basic skills for conducting biological investigations	(a) Describe the basic skills for conducting biological experiments (<i>observation, measurement and experimentation</i>)	<p>Group discussion: Guide students to visit biology laboratory to identify common apparatus and equipment used in biological experiments</p> <p>Experimentation: Guide students to perform activities that involve observation, measurement and experimentation</p>	Basic skills for conducting biological experiments are correctly described	Basic skills for conducting biological experiments online resources, colorful pictures, perfume, hot water, preserved specimen, live plants and animals specimens, thermometer, weighing scales, rulers, boxes, stones, variety of equipment and apparatus used in conducting biological experiments	40

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Carry out microscopic observation of a cell	<p>Group discussion: Guide students in manageable groups to explore procedures that are required to observe a cell under a microscope</p> <p>Laboratory practical: Guide students to observe cells of living things under microscope</p>	Microscopic observation of a cells carried out correctly	Light/ electronic microscope, slide covers, microscope slide, online resources on microscopic observation of a cell and relevant apparati	
		(c) Carry out investigations related to photosynthesis (<i>conditions necessary for photosynthesis</i>)	Experimentation: Guide students to carry out investigations on the conditions necessary for photosynthesis	Investigations related to photosynthesis are carried out correctly	Variety of equipment and apparati, live plant specimens, relevant chemicals, reagents and photosynthesis online resources	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	3.2 Prepare and present results of biological investigations	(a) Prepare and present a report on cell and photosynthesis investigations	<p>Group discussion: Guide students in groups to discuss the steps in preparation of biological investigation report</p> <p>Project: Guide students to prepare a report using the steps in preparation of a biological investigation report</p> <p>Presentation: Guide students to present a biological investigation report</p>	Investigation report on cell and photosynthesis is prepared and presented correctly	Relevant text on steps for scientific investigations and report writing, online resources on report writing	10

Form II

Table 4: *Detailed Contents for Form II*

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of the concepts, principles and processes of Biology	1.1 Describe the physiological, anatomical and ecological processes of living organisms	(a) Describe nutrition in human and ruminants (<i>nutrients, digestive system and processes</i>)	<p>Brainstorming: Guide students to brainstorm on the concept of nutrition in human and ruminants</p> <p>Jigsaw: Guide students to explore nutrients, nutritional deficiency and disorders through jigsaw</p> <p>ICT-Based learning: Guide student to explain the digestive system, digestion processes in human and ruminants through simulation</p> <p>Group discussion: Guide students in manageable groups to discuss diseases and disorders of human digestive system</p>	Nutrition in human and ruminants is described clearly	Models/charts of human and ruminant digestive system, dissected mammal specimen displaying digestive system, variety of food samples and charts of variety of food nutrients	64

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Describe the mechanism of transportation of materials in flowering plants <i>(vascular system, absorption and movement of water and mineral salts and transpiration)</i>	<p>Brainstorming: Guide students to brainstorm on the concept of transportation of materials in flowering plants</p> <p>Group discussion: Guide students in manageable groups to discuss vascular system</p> <p>ICT based learning: Guide students to explain absorption and movement of water and mineral salts in plants and transpiration process through simulation</p> <p>Question and answers: Guide students to explain factors affecting rate of transpiration through questions and answers</p>	Mechanism of transportation of materials in flowering plants is described clearly	Relevant equipment and apparatus, stain, potted plants, germinated seeds, charts on transportation of materials in plants, ringed plant, and Transportation of materials in plants online resources	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Describe the mechanism of transportation of materials in the human body (<i>the mammalian heart, blood vessels, blood, blood circulation</i>)	<p>Brainstorming: Guide students to brainstorm on the concept of transportation of materials in human body</p> <p>Field trip: Guide students to visit nearby health facility to learn about blood cells, blood groups, blood pressure and blood transfusion</p> <p>ICT-Based learning: Guide students to explain the structure of the heart and blood circulation in human through simulation</p> <p>Group discussion: Guide students in manageable groups to discuss the importance of blood circulation, diseases and disorders of the human circulatory system</p>	The mechanism of transportation of materials in the human body are described clearly	Mammalian heart models/ charts/ photographs, blood circulatory system online resources and dissected mammal displaying the heart and major blood vessels, diseases and disorders of human circulatory system charts	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d) Describe the mechanisms of gaseous exchange and respiration in mammals (<i>gaseous exchange in mammals, aerobic and anaerobic respiration</i>)	<p>Brainstorm: Guide students to brainstorm the concept of gaseous exchange and respiration in mammals</p> <p>Group discussion: Guide students in manageable groups to discuss on gaseous exchange in mammals, factors affecting the rate of gaseous exchange and respiration in mammals</p> <p>Guest speaker: Invite guest speaker to share with students on various infections and diseases of respiratory system</p> <p>Exploration: Guide students to explore how aerobic and anaerobic respiration are applied in their real life</p>	The mechanisms of gaseous exchange and respiration in mammals are described clearly	Models/ photographs/ charts showing structure of the lungs and alveolus in human, online resources on gaseous exchange and respiration in mammals	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(e) Describe the mechanism of gaseous exchange in plants (<i>parts of plants responsible for gaseous exchange and the process</i>)	Questions and answers: Guide students to explain the concept of gaseous exchange in plants through question and answers ICT based learning: Guide students to explain the mechanism of gaseous exchange in plants through simulation	The mechanism of gaseous exchange in plants is described clearly	Plant leaves, photographs showing the structure of stomata, potted plants, charts/pictures of gaseous exchange in plants, and gaseous exchange in plants online resources	
2.0 Conduct biological investigations	2.1 Demonstrate mastery of basic skills for conducting biological investigations	(a) Investigate food nutrients in various food samples	Group discussion: Guide students in manageable groups to explore the scientific procedures required to conduct food test Laboratory practical: Guide students to investigate food nutrients in various food samples	Food nutrients in various food samples are investigated correctly using the scientific procedures	Relevant reagents and chemicals, various food samples, apparatus and source of heat	31

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Investigate processes of transportation of materials in flowering plants	<p>Group discussion: Guide students in manageable groups to discuss processes of transportation of materials in flowering plants</p> <p>Experimentation: Guide students to investigate processes of transportation of materials in flowering plants</p>	Processes of transportation of materials in flowering plants are investigated correctly	Transverse section of living plant tissues, relevant reagents and chemicals, source of heat, potted plant, mounted slides of plant tissues, distilled water, ringed plant, charts on transportation of materials in plants, and online resources on transportation of materials in plants	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Carry out experiments to determine the pulse rate in human	Experimentation: Guide students to carry out experiment to determine pulse rate among themselves	Experiments to determine the pulse rate in human are carried out correctly	Blood pressure machine, smartphone app, digital fitness trackers and exercise machine	
		(d) Investigate aerobic and anaerobic respiration in living organisms	Experimentation: Guide students to investigate aerobic and anaerobic respiration in living organisms through experiment	Aerobic and anaerobic respiration in living organisms are investigated correctly	Charts/ diagrams and models on aerobic and anaerobic respiration of living organisms	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	2.2 Prepare and present results of biological investigations	(a) Prepare and present a report of a biological investigation on (<i>food nutrients in various food samples, transportation of materials in flowering plants, pulse rate in human, aerobic and anaerobic respiration</i>)	Project: Guide students to prepare biological investigation report using scientific steps/ procedures Presentation: Guide students to present a biological investigation report	A biological investigation report is prepared and presented correctly using scientific procedures	Steps / procedures for biological investigations online resources	10

Form III

Table 5: Detailed Contents for Form III

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of the concepts, principles and processes of Biology	1.1 Describe the physiological, anatomical and ecological processes of living organisms	(a) Describe coordination in plants (<i>tropic, responses</i>) and animals (<i>nervous coordination in human, structure of neurones, sense organs and endocrine system</i>)	<p>Brainstorm: Guide students to brainstorm on the concept of coordination in plants and animals</p> <p>Jigsaw: Guide students to discuss types of tropic responses in plants through jigsaw</p> <p>Group discussion: Guide students in manageable groups to discuss nervous coordination in human, structure of neurons, sense organs and endocrine system in human</p>	Coordination in plants and animals described clearly	Models/ pictures of sense organs, young plants, charts showing plants tropic responses, models/ charts/pictures showing structure of neurones and online resources on plants and animals coordination	80

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Describe the mechanism of excretion in the human body (<i>systems: organs, products</i>)	<p>Brainstorming: Guide students to brainstorm on the concept of excretion in human</p> <p>Group discussion: Guide students in manageable groups to discuss excretory organs, products and urinary system</p> <p>ICT based learning: Guide students to explain common complications and disorders of human excretory system through simulation/ video</p>	The mechanism of excretion in human body is described clearly	Models/ charts/ pictures of human urinary system, picture of mammalian kidney, online resources on human excretion and charts illustrating disorders of human excretory system	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Describe the mechanism of regulation in the human body (<i>temperature regulation, blood sugar regulation and osmoregulation</i>)	<p>Question and answers: Guide students to explain the concept of regulation in human body through questions and answers</p> <p>Group discussion: Guide students in manageable groups to discuss temperature regulation, blood sugar regulation and osmoregulation</p> <p>ICT based learning: Guide students to demonstrate mechanisms of temperature regulation by using digital simulation or videos</p>	The mechanism of regulation in the human body is described clearly	Charts on temperature and blood sugar regulation and online resources of temperature regulation, blood sugar regulation and osmoregulation	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
2.0 Conduct biological investigations	2.1 Demonstrate mastery of basic skills for conducting biological investigations	(a) Investigate the process of nervous coordination (<i>reflex arc and knee jerk</i>)	<p>Group discussion: Guide students in manageable groups to discuss the processes involved during reflex arc and knee jerk</p> <p>ICT based learning: Guide students to demonstrate the process of nervous coordination by using a digital simulations or videos</p> <p>Experimentation: Guide students to demonstrate a simple experiment on the human nervous coordination that involves knee jerk</p>	The process of nervous coordination is investigated correctly	Sharp objects, hot objects, animal toys models (snake, scorpion), live small animals specimens and nervous coordination online resources	40

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Investigate tropic responses in plants	<p>Project : Organize students in groups to perform experiment to investigate tropic responses in plants</p> <p>Gallery walk: Guide students in manageable groups to prepare drawings of various tropic responses in plants and share through gallery walk</p>	Tropic responses in plants are investigated correctly	Variety of plants Seedlings, pots, seeds, soil, water, boxes and online resources/ charts on tropic responses in plants	
	2.2 Carry out a biological project work using biological principles	(a) Develop and carry out a simple research project in Biology	<p>Group discussion: Guide students to discuss the principles of carrying out a biological research project</p> <p>Experiment: Guide students to carry out a biological research project using the required principles</p>	A biological research project work is developed and carried out correctly	Text/online resources on principles of biological projects	20

Form IV

Table 6: Detailed Contents for Form IV

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Demonstrate mastery of the concepts, principles and processes of Biology	1.1 Describe the physiological, anatomical and ecological processes of living organisms	(a) Describe reproduction in plants (<i>concept of reproduction in plants, asexual and sexual reproduction, pollination and fertilization</i>)	Brainstorming: Guide students to brainstorm on the concept of reproduction in plants Group discussion: Guide students in manageable groups to discuss on the asexual and sexual reproduction, pollination and fertilization in plants Jigsaw: Guide students to discuss factors affecting seed germination through jigsaw	Reproduction in plants is described clearly	Reproduction in plants online resources, potted plants, hibiscus flowers and flower pots	86

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Describe reproduction in humans (<i>sexual reproduction in human, fertilization, pregnancy and child birth</i>)	<p>Question and answers: Guide students to explain the concept of reproduction in humans through question and answers:</p> <p>ICT based learning: Guide students to explore mechanism of meiosis through digital simulation</p> <p>Group discussion: Guide students in manageable groups to discuss sexual reproduction, fertilization, pregnancy and child birth in human</p> <p>Guest speaker: Invite guest speaker to share with students on family planning and contraception and disorders of reproductive system</p>	Reproduction in humans is described clearly	Charts/ models of human reproduction system, online resources of reproduction in human, charts/models of meiosis stages and charts of family planning methods	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Describe the mechanisms of growth in mammals and flowering plants <i>(concept of growth, mitosis and growth, growth and developmental stages in human and seed germination)</i>	Brainstorm: Guide students to brainstorm on the concept of growth in flowering plants and mammals ICT based learning: Guide students to explain stages of mitosis, growth and developmental stages in human through digital simulation Group discussion: Guide students in manageable group to discuss growth process in plants and factors affecting growth in plants and animals Project : Guide students in manageable groups to carry out an experiments on growth in plants and small mammals	The mechanisms of growth in flowering plants and mammals are described clearly	Photographs/ charts on growth in flowering plants, growth in plants online resources	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(d) Explore the basic tenets of genetics (<i>genetic materials, principles of inheritance, monohybrid, Mendelian and non-Mendelian inheritance; variation</i>)	<p>Brainstorming: Guide students to brainstorm on the concept of genetics</p> <p>Group discussion: Guide students in manageable groups to discuss genetic materials, principles of inheritance and variation</p> <p>ICT based learning; Guide students to demonstrate Mendelian laws of inheritance and non-Mendelian through simulation</p> <p>Problem solving: Guide students to apply principles of genetics to solve genetic problems</p>	The basic tenets of genetics are explored clearly	Charts/ models photographs on basic tenets of genetics and online resources on basic tenets of genetics	

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
2.0 Conduct biological investigations	2.1 Demonstrate mastery of basic skills for conducting biological investigations	(a) Carry out investigation related to reproduction in flowering plants (<i>flower structure and embryo</i>)	Practical work: Guide students to make longitudinal and cross-sections of flower to identify reproductive structures and the embryo ICT based learning: Guide students to investigate the reproductive structure of flowering plants through digital simulation	Investigation related to reproduction in flowering plants performed correctly	Hibiscus flowers, razor blade, forceps, reproduction in plants online resources	18
		(b) Investigate growth in flowering plants (<i>hypogeal and epigeal germination</i>)	Experimentation: Guide students in manageable groups to set up a simple experiment on the investigation of epigeal and hypogeal germination	Growth in flowering plants is investigated correctly	Seeds, pots, water, soil and charts/ pictures on growth in plants	18

Main competence	Specific competence	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
	2.2 Carry out a biological project work using biological principles	(a) Complete and submit a report for the research project started in Form Three	Project activity: Guide students to prepare and submit report of a research project	Research project report are completed and timely submitted	Relevant text on biology research project and online resources on research projects	18

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