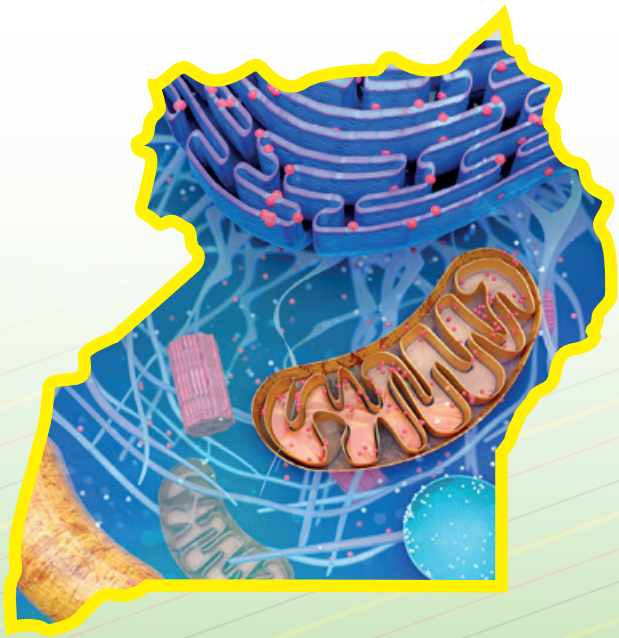
THE REPUBLIC OF UGANDA
Ministry of Education and Sports

ADVANCED SECONDARY CURRICULUM



BIOLOGY
ASSESSMENT GUIDELINES

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

2026

ADVANCED SECONDARY
CURRICULUM

BIOLOGY
ASSESSMENT GUIDELINES

2026

A product of the National Curriculum Development Centre for the Ministry of Education and Sports with support from the Government of Uganda

National Curriculum Development Centre
P.O. Box 7002,
Kampala- Uganda
www.ncdc.co.ug

ISBN: 978-9913-06-110-0

Contents

ACKNOWLEDGEMENTS

The National Curriculum Development Centre (NCDC) is indebted to the Government of Uganda for financing the development of these Assessment Guidelines to support the implementation of the Advanced Secondary Curriculum.

Our gratitude goes to the Ministry of Education and Sports for overseeing the development process, the Curriculum Task Force of the Ministry of Education and Sports for the guidance and timely decisions whenever necessary, and members of the public who made helpful contributions towards shaping these Guidelines.

NCDC is also grateful to UNEB, Members of Parliament, schools, universities, and other tertiary institutions, the writing panels, critical reviewers, and professional bodies for their contribution towards the design and development of these Assessment Guidelines. To all those who worked behind the scenes to finalise the production of these Guidelines, your efforts are invaluable.

NCDC takes responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for effectively addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through P. O Box 7002, Kampala, or Email: admin@ncdc.go.ug or on the Website: www.ncdc.go.ug

Dr Bernadette Nambi Karuhanga
Director
National Curriculum Development Centre

1. Introduction

This assessment guidelines document has been developed as a companion to the Assessment Framework for Advanced Secondary Curriculum and should be read and applied in conjunction with it. The Framework provides the overarching principles, standards, and requirements for assessment across all subjects, while this guideline contextualises those provisions to the specific demands and practices of Biology as a subject.

The assessment of Biology will be guided by four assessment objectives drawn from the four assessment constructs. The assessment of items will be set at the level of the construct, allowing learners to integrate knowledge, skills, and values drawn from the topics within a construct to address a societal challenge or problem. The end-of-cycle assessment of Biology will be administered by the Uganda National Examinations Board (UNEB). Assessment of Biology at the school level will be formative and summative.

1.1 Assessment Objectives

Assessment objectives for Biology focus on the learner's ability to:

AO1: Evaluate the significance of the interactions that sustain life and energy production by analysing the structure of cells and tissues, the roles of biomolecules (water, lipids, proteins, and nucleic acids), and the processes of ATP production, cell division, and protein synthesis, to apply these biological principles to challenges in genetic technologies and health improvement.

AO2: Evaluate plant structure and physiology by analysing structural adaptations and photosynthetic pathways in C_3 and C_4, environmental influences on photosynthesis, plant adaptations (to water availability), growth, photoperiodism, and the hormonal control of growth, to promote sustainable agricultural practices that improve crop yield and food security.

AO3: Evaluate the structure and physiology of animal sensory organs and systems (circulatory, nervous, immune, and homeostatic) by analysing blood circulation, gas transport, immunity (vaccination and allergies), neural transmission, sensory perception, homeostatic control, and the role of

adaptive behaviours in survival, to make informed health decisions and promote animal welfare

AO4: Evaluate the principles of genetics, evolutionary mechanisms, and ecological interactions by analysing Mendelian and non-Mendelian genetics, species evolution, speciation, resistance, extinction, population dynamics, ecosystem balance, and carbon emissions, to create sustainable strategies for managing invasive species, enhancing food security, and mitigating climate change.

1.2 Linkage Between Assessment Objectives, Constructs, and Syllabus

The table below illustrates the relationship between the assessment objectives, constructs, and topics in the syllabus that contribute to each construct.

Table 1:

Table showing the relationship between assessment objectives, constructs, and the topics in the syllabus

Assessment Objective	Construct	Construct Description	Topics in the Syllabus
AO1	Cellular Organisation, Respiration, and Molecular Analysis	Investigating the structure of cells, tissues, and levels of organisation, the roles of biomolecules (water, lipids, proteins, and nucleic acids), and processes of ATP production, cell division, protein synthesis, and genetic manipulation, by analysing how they interact to sustain life, and then ethically applying biological principles in genetic technologies and health improvement.	Topic 1. Cell Biology Topic 4. Respiration Topic 7. Inheritance and Evolution
AO2	Plant physiology and adaptation	Evaluating plant structure and physiology by analysing structural adaptations and photosynthetic pathway differences in C_3 and C_4, plant adaptations (to water availability), environmental influence on photosynthesis, growth, photoperiodism, and the	Topic 2. Nutrition in plants Topic 6. Co-ordination Topic 8. Growth in Plants and

		hormonal control of growth, to promote sustainable agricultural practices that improve crop yield and food security.	Development in Insects
AO3	Analysis of animal systems and behaviours in adapting to environmental changes for health, survival, and welfare	Evaluating the structure and physiology of animal sensory organs and systems (circulatory, nervous, immune, and homeostatic) by analysing blood circulation, gas transport, immunity (vaccination and allergies), neural transmission, sensory perception, homeostatic control, and how adaptive behaviours support survival to make informed health decisions and promote animal welfare	Topic 3. Transport in Humans Topic 5. Homeostasis Topic 6. Coordination
AO4	Genetic, evolutionary, and ecological dynamics	Evaluating inheritance patterns, evolutionary mechanisms, and ecological interactions by analysing Mendelian and non-Mendelian genetics, species evolution, speciation, resistance, extinction, population dynamics, ecosystem balance, and carbon emissions, to inform sustainable strategies for managing invasive species, promoting food security, and mitigating climate change.	Topic 7. Inheritance and Evolution Topic 8. Growth in Plants and Development in Insects Topic 9. Ecology

2. Table of Constructs

The table below details the constructs for Biology, including the competencies and learning outcomes, the expected learner abilities, and the evidence the assessor should look for in the learner's work to determine mastery of the intended learning outcomes (Indicators of Mastery).

Construct	**Learning Outcomes** The learner should be able to:	**Abilities**	**Indicators of Mastery** The learner:	**LEVEL OF COMPLEXITY**
Cellular Organisation, Respiration, and Molecular Analysis Investigating the structure of cells	1) (a): Operate a light microscope to observe plant and animal tissues under magnification. (s, gs)	a. use a light microscope.	i) focuses a light microscope. ii) prepares and mounts temporary slides iii) estimates cell size. iv) calculates linear magnification.	Medium

and tissues, the roles of biomolecules (water, lipids, proteins, and nucleic acids), and processes of ATP production, cell division, and protein synthesis, by analysing how these components interact to	1) (b) Analyse the ultrastructure of animal/plant cells, bacterial cells, and plasma membrane to distinguish prokaryotic/eukaryotic characteristics.	a) analyse the ultrastructure of animal, plant bacterial cells. b) use a light microscope to analyse the structures of cells. c) distinguish between eukaryotic cells and prokaryotic cells.	i) identifies parts of the animal, plant cells, and bacterial cells observed in an electron microscope. ii) identifies functions of parts of the plant, animal, and bacterial cells observed in the electron microscope iii) relates the structure of parts of the cells observed in the electron microscope to their functions iv) explains the differences between eukaryotic cells and prokaryotic cells.	High

sustain life and energy production, to apply biological principles in genetic technologies and health improvement	1) (d) Analyse the structures of plant (parenchyma, collenchyma, sclerenchyma, xylem, and phloem) and animal (epithelial, cardiac, areolar, fibrous, and skeletal) tissues to assess their roles in physiological processes, disease diagnosis, and levels of organisation. (u, s, v/a, gs).	a) analyse the features of healthy tissues and diseased tissues. b) relate the structure and location of tissues to their roles. c) use a microscope to study tissues.	i) Describes the structure of tissues. ii) identifies types and locations of tissues in plants and animals. iii) analyses how the structure and location of tissues relate to their functions. iv) compares healthy tissues with diseased tissues. v) extracts plant and animal tissues for scientific investigations.	High

	1(a): Analyse the properties and functions of chemical compounds (water, lipids, and proteins, including enzymes from mammals) in a cell, focusing on their roles in maintaining cellular structure and metabolic processes in living organisms. (s, gs) (Thermal properties of water not required.)	a) relate properties of water, lipids, and proteins to cellular structure. b) relate properties of water, lipids, and proteins to metabolic processes. c) plan and carry out investigations on the properties of water, lipids, proteins, and enzymes. d) compare the suitability of properties of water, lipids, proteins, and enzymes in	i) identifies properties of water, lipids, and proteins. ii) identifies roles of water, lipids, and proteins in cellular structure and metabolic processes. iii) explains how the properties of water, lipids, and proteins relate to their roles in cellular structure and metabolic processes. iv) generates clear aims, hypotheses, and procedures for scientific investigations on properties of chemical compounds. v) identifies and uses appropriate apparatus during scientific investigations vi) obtains experimental data and presents it in an orderly form. vii) analyses data and provides appropriate recommendations.	High

		performing metabolic processes and in cellular structures.	viii) extracts enzymes from the animal digestive system.	
	4(a): Examine the relationship between the structure of the mitochondrion and the stages of cellular respiration in living organisms. (u, s)	a) describe mitochondrial structure. b) relate the structure of the mitochondrion to its functions and stages of cellular respiration.	i) relates the stages of cellular respiration to the structure of the mitochondrion. ii) describes ATP production stages. iii) describes the energy release from ATP.	Medium
	4)(b) Analyse the biochemical processes leading to ATP production in living organisms, and how these processes are	a) analyse ATP production in living organisms. b) assess the alternative respiratory substrates in living organisms and the	i) identifies the common respiratory poisons. ii) explains how physical activities and respiratory poisons affect ATP production. iii) explains weight loss during starvation.	High

	affected by physical activities and respiratory poisons (cyanide). (u, s, gs, v/a). (Details of biochemistry are not required)	implications of using them. c) relate physical activities and respiratory poisons to ATP production.		
	7(a): Analyse the structural and functional significance of nucleic acids in meiosis and mitosis, their role in cellular functions, and how mutations in nucleotide sequences can contribute to disease (cancer). (u, s, gs, v/a)	a) analyse the properties of DNA and RNA. b) analyse the relationship between DNA and protein structure. c) describe the processes of protein synthesis, DNA	i) describes the structure and components of DNA and RNA. ii) compares the events of mitosis and meiosis. iii) explains the role of nucleic acids in mitosis and meiosis. iv) relates to DNA replication to protein synthesis. v) explains how mutations alter protein function and cause uncontrolled cell division.	High

		replication, and Cell division. d) explain how mutation contributes to disease. e) explain risk factors, prevention methods, and management of cancer. f) plan and carry out a scientific investigation on the behaviour of chromosomes during cell division.	vi) explains how risk factors contribute to cancer development through DNA mutation and uncontrolled cell division. vii) describes methods for cancer prevention. viii) explains common cancer management strategies. ix) generates clear aims, hypotheses, and procedures for scientific investigations of chromosome behaviours. x) identifies and uses appropriate apparatus during scientific investigations. xi) analyses data and provides appropriate recommendations. xii) identifies regions of mitosis in onion roots. xiii) identifies the different stages of mitosis.	

			xiv) describes the features of the cell at the different stages of mitosis. xv) uses a light microscope to observe stages of mitosis in a growing plant.	
	7(b): Assess gene technology techniques, their applications in various fields, and the associated ethical implications. (u, s, gs, v/a)	a) contrast genetic engineering techniques. b) explore the ethical implications of genetic engineering. c) assess applications of gene technologies and their environmental implications.	i) describes major gene technology techniques and their real-world application. ii) contrasts gene technology techniques. iii) assesses the different ethical considerations in genetic engineering. iv) recognises the potential risks and environmental impacts of using gene technology.	High

Plant physiology and adaptation Evaluating plant structure and physiology by analysing structural adaptations and photosynthetic pathway differences in C_3 and C_4, plant adaptations (to water availability), environmental influence on photosynthesis, growth, photoperiodism, and the	2(a): Evaluate the relationship between the structure of chloroplast and photosynthesis in C3 and C4 plants. (u, s, gs)	a) relate the structure of a chloroplast in C3 and C4 plants to function. b) compare the photosynthetic pathways of C3 and C4 plants. c) describe glucose, protein, and lipid synthesis pathways. d) plan and carry out a scientific investigation on photosynthetic efficiency in C3 and C4 plants.	i) identifies the structural components of a chloroplast ii) explains the function of chloroplast structures in photosynthesis. iii) analyses how structural differences in chloroplasts affect photosynthetic efficiency. iv) distinguishes the photosynthetic pathways in C3 and C4 plants. v) explains the process of glucose, protein, and lipid synthesis. vi) assesses the advantages and limitations of photosynthesis in C3 and C4 plants. vii) generates clear aims, hypotheses, and procedures for scientific investigations on photosynthetic efficiency in C3 and C4 plants.	High

hormonal control of growth, to promote sustainable agricultural practices that improve crop yield and food security.,			viii) identifies and uses appropriate apparatus during scientific investigations. ix) obtains experimental data and presents it in an orderly form. x) analyses data and provides appropriate recommendations.	
	2(b): Assess the influence of environmental factors on the photosynthetic efficiency of plants to optimise photosynthetic rates and crop yields. (u, s, gs, v/a)	a) analyse the distribution and abundance of C3 and C4 plants at different altitudes, temperatures, and oxygen levels. b) relate the influence of environmental factors on photosynthetic	i) assesses the advantages and limitations of photosynthesis in C3 and C4 plants. ii) identifies the environmental factors that affect the rate of photosynthesis, hence crop yields. iii) analyses the effect of environmental factors on the rate of photosynthesis. iv) explains the concept of limiting factors and compensation points v) observes the structure of guard cells using a microscope.	High

		efficiency to crop yields. c) use a light microscope to study the structure of guard cells. d) plan and carry out a scientific investigation on the effect of environmental factors on photosynthetic efficiency.	vi) generates clear aims, hypotheses, and procedures for scientific investigations on the behaviour of guard cells and the effect of environmental factors on photosynthetic efficiency. vii) identifies and uses appropriate apparatus during scientific investigations. viii) obtains experimental data and presents it in an orderly form. ix) analyses data and provides appropriate recommendations.	
	5(b): Examine the adaptations and management of different plant categories (xerophytes, mesophytes, hydrophytes) based	a) analyse the distribution and abundance of different plant categories in relation to water availability in	i) examines the adaptations of plants to different levels of water availability in the environment. ii) describes and carries out management strategies of plants with different water needs.	High

	on their osmoregulatory abilities and the application of excretory plant products in everyday life. (u, s, gs, v/a)	various environments. b) evaluate management strategies of the different plant types with different water needs (xerophytes, mesophytes, and hydrophytes). c) analyse the application of plant excretory products in everyday life. d) plan and investigate stomatal distribution in xerophytes,	iii) identifies plant excretory products and their uses in everyday life. iv) generates clear aims, hypotheses, and procedures for scientific investigations of stomatal distribution. v) identifies and uses appropriate apparatus during scientific investigations.	

		mesophytes, and hydrophytes.		
	6(a): Examine the role of plant hormones in tropisms, photoperiodism, and the application of these processes in agricultural practices. (u, s, gs, v/a)	a) analyse the effects of plant hormones on tropisms and photoperiodism b) assess the use of plant hormones in agricultural practices to optimise crop yield. c) plan and carry out scientific investigation on the role of plant hormones on plant growth, tropisms, photoperiodism, and applications	i) applies hormones to improve crop yields (SBA). ii) generates clear aims, hypotheses, and procedures for scientific investigations on the effects of hormones, the different excretory products in plants, and stomatal behaviour in varying amounts of water. iii) identifies and uses appropriate apparatus during scientific investigations. iv) obtains experimental data and presents it in an orderly form. v) analyses data and provides appropriate recommendations.	High

		of plant hormones.		
	8(a): Analyse the pre- and post-germination stages during the growth and development of plants in relation to their significance in crop production. (u, s, gs, v/a)	a) analyse the concept of seed dormancy and seed banks. b) analyse physical changes in meristems at different stages of growth and development. c) compare the significance of primary and secondary growth. d) analyse strategies of enhancing germination, growth, and	i) explains the meaning of and factors that lead to seed dormancy. ii) justifies the need for seed banks. iii) investigates cell size and appearance in the different regions of a young dicotyledonous root and shoot by microscopic examination. iv) describes the processes of primary and secondary growth in plants. v) explains the importance of primary and secondary growth in plants. vi) develops strategies for how farmers can enhance germination, growth, and development in plants.	High

		development in plants. e) examine factors that affect the measurement of growth. f) plan and carry out scientific investigations on rates and patterns of growth.	vii) generates clear aims, hypotheses, and procedures for scientific investigations on measurements of growth. viii) identifies and uses appropriate apparatus during scientific investigations. ix) analyses data and provides appropriate recommendations.	
Analyses animal systems and behaviours in adapting to environmental changes for health, survival, and welfare. Evaluating the structure and	3 (a) Assess the role of the human heart in blood circulation and the role of haemoglobin in the transportation of gases in blood under various physiological conditions. (u, s, gs, v/a)	a) describe how oxygen and carbon dioxide are transported in the body. b) analyse the physiological factors that affect the amount and transportation	i) describes the structure and reaction of haemoglobin with oxygen and carbon dioxide ii) explains the behaviour of oxygen dissociation curves under various physiological conditions iii) explains the importance of the Bohr effect.	High

physiology of animal sensory organs and systems (circulatory, nervous, immune, and homeostatic) by analysing blood circulation, gas transport, immunity (vaccination and allergies), neural transmission, sensory perception, homeostatic control, and how adaptive behaviours support survival to make		of oxygen and carbon dioxide in the body. c) explain the role of the brain, sinoatrial node, and atrioventricular node during the regulation of the heartbeat.	iv) explains the causes, effects, and management of carbon monoxide poisoning. v) describes different mechanisms of carbon dioxide transportation in the body. vi) explains the circulatory differences between athletes and non-athletes and low and high-land dwellers vii) relates the structure of the heart to myogenic action and heartbeat rate. viii) explains the role of the brain in heartbeat. ix) relates physiological conditions of the body to the heartbeat rate.	
	3 (b) Analyse the role of antibodies in vaccination and allergic reactions in	a) explain the different types of immunity.	i) describes the structure of an antibody.	High

informed health decisions and promote animal welfare	relation to human body immunity. (u, s, gs, v/a)	b) analyse the action of antibodies in vaccination and the allergic reactions. c) explain the effects of the Rhesus factor on compatibility (e.g., pregnancy, blood transfusion).	ii) describes how antibodies are produced in response to vaccines. iii) relates the role of antibodies in immunity and vaccination in disease prevention in communities. iv) explains how antibodies are involved in allergic reactions. v) differentiates between immune responses in vaccination and allergic reactions. vi) describes how rh incompatibility can cause newborn haemolytic disease. vii) explains how the rhesus blood groups affect blood transfusion. viii) explains the functioning of rapid test kits.	
	5(a): Analyse the homeostatic control	a) analyse the working of an	i) identifies the key components of a homeostatic control system.	High

	system, focusing on the role of negative feedback mechanisms in maintaining internal stability. (u, s, gs)	efficient homeostatic systems (e.g. glucose, temperature, respiratory gases). b) explain the significance of maintaining a stable internal environment. c) analyse the role of the hypothalamus and the skin in temperature regulation in endotherms. d) examine the characteristics and behaviour of endotherms	ii) explains how negative feedback works to maintain internal stability. iii) examines the responses and adaptations of endotherms to temperature changes. (SBA) iv) describes the roles of the hypothalamus, thermo receptors, and effectors in temperature regulation. v) explains the role of the hypothalamus and the pituitary gland in the secretion of ADH and the conditions that affect its production. vi) explains how ADH controls water reabsorption in the kidney nephrons to ensure water balance in the body.	

		surviving in different temperature conditions. e) explain the control of ADH production and the role of ADH in water balance in endotherms.		
	6(b): Analyse impulse transmission in relation to the structure of a neurone, a chemical synapse, and the factors that influence neural activity in response to environmental stimuli. (u, gs, v/a)	a) analyse events during resting potential, action potential, hyperpolarisation, and synaptic transmission. b) relate neuron structure, magnitude, and frequency of stimulation to	i) identifies the types and properties of neurone. ii) relates the structure of neurone to its functioning. iii) analyses how potential differences are achieved during polarised, depolarised, and hyperpolarised states of the neurone. iv) explains impulse transmission across the synapse.	High

		impulse transmission. c) analyse the effects of warm-ups and ice-cold first aid on impulse transmission. d) assess how environmental stimuli affect impulse transmission. e) explain the functioning of local anaesthetics.	v) explains how different factors affect the speed of impulse transmission. vi) explains the significance of warm-ups and ice cold first aid in impulse transmission. vii) identifies the examples of local anaesthetics. viii) explains how local anaesthetics work.	
	6(c): Examine the properties and functions of sensory receptors, the role of the retina in visual perception, and the	a) analyse the properties and functions of different types of	i) identifies types of receptors and stimuli. ii) explains the properties of sensory receptors.	High

	ear's organs of balance in relation to their response to environmental stimuli. (u, s, gs, v/a)	sensory receptors. b) explain the role of the retina in visual perception c) analyse how the ear maintains balance during motion and in a still position.	iii) describes stimulus perception by sensory receptors. iv) relates the structure of the retina to visual perception. v) relates the structure and distribution of photoreceptors on the retina to visual perception. vi) describes the structure of the organ of balance in the ear. vii) analyses how balance is maintained during stationary and movement positions by the ear.	
	6(d): Examine adaptive animal significance of diverse animal behaviour in promoting survival and reproductive success. (u, s, gs, v/a)	a. identify types of animal behaviour. b. relate animal behaviours to survival and reproductive success.	i) classifies different animal behaviours. ii) analyses the role of innate behaviours in survival and reproduction. iii) explains how each learned behaviour contributes to the	High

			survival and reproduction of organisms. iv) manages animals based on their behavioural patterns.	
Genetic, evolutionary, and ecological dynamics Evaluating inheritance patterns, evolutionary mechanisms, and ecological interactions by analysing Mendelian and non-Mendelian genetics, species evolution, speciation, resistance, extinction,	7(c): Apply Mendelian principles to predict inheritance patterns and utilise mathematical models to analyse allele frequencies and genotype distributions within populations. (u, s)	a) apply Mendelian laws of inheritance. b) analyse allele frequencies and genotype distributions within populations. c) analyse the factors that affect genetic equilibrium. d) plan and carry out a scientific investigation on Mendelian	i) explains Mendel's laws of inheritance. ii) identifies genotype and phenotype ratios from monohybrid and dihybrid crosses. iii) uses Punnett squares and probability to predict outcomes of crosses. iv) calculates allele and genotype frequencies in populations using the Hardy-Weinberg equation. v) describes how allele frequencies relate to genotype distributions. vi) explains factors that affect genetic equilibrium.	High

population dynamics, ecosystem balance, and carbon emissions, to inform sustainable strategies for managing invasive species, promoting food security, and mitigating climate change.		inheritance (SBA).	vii) generates clear aims, hypotheses, and procedures for scientific investigations on Mendelian inheritance. viii) identifies and uses appropriate apparatus during scientific investigations. ix) analyses data and provides appropriate recommendations.	
	7(d): Examine different forms of allele interactions (autosomal linkage, multiple alleles, codominance, and incomplete dominance), including their examples and influence on phenotypic expression. (u, s, gs)	a) examine different forms of allele interactions. b) distinguish Mendelian from non-Mendelian inheritance. c) analyse observed vs. expected genetic ratios.	i) distinguishes types of allele interactions, including codominance, incomplete dominance, multiple alleles, and autosomal linkage. ii) identifies examples of each type of allele interaction. iii) uses Punnett squares and pedigree analysis to show how each allele interaction influences phenotypic expression.	High

		d) plan and carry out a scientific investigation on non-Mendelian inheritance (SBA).	iv) differentiates between Mendelian and non-Mendelian inheritance patterns. v) generates clear aims, hypotheses, and procedures for scientific investigations on non-Mendelian inheritance. vi) identifies and uses appropriate apparatus during scientific investigations. vii) analyses data and provides appropriate recommendations.	
	7(e): Analyse evolutionary advancements in key life processes (circulation, reproduction, gaseous exchange, coordination, movement, and excretion), as well as their suitability for	a) compare the advancement in life processes in different organisms. b) plan and carry out investigations on evolutionary advancements.	i) explains how adaptations enhance survival in specific environments. ii) describes evolutionary adaptations in systems across species. iii) carries out dissections to investigate structural and physiological advancements in organisms.	High

	survival across different species. (u, s, gs, v/a)	c) compare the structures of organisms to identify evolutionary advancement.	iv) generates clear aims, hypotheses, and procedures for scientific investigations on structural and physiological advancements in organisms. v) identifies and uses appropriate apparatus during scientific investigations. vi) analyses data and provides appropriate recommendations.	
	7(f): Assess speciation and resistance, mechanisms driving them, and factors contributing to extinction events, through comparison of historical and contemporary examples. (u, s, gs, v/a)	a) examine the process of speciation. b) analyse resistance and extinction in organisms. c) analyse impacts of antimicrobial and pesticide resistance and	i) describes allopatric and sympatric speciation. ii) compares different mechanisms of isolation. iii) explains the modern theory of evolution as mechanisms of development of antimicrobial and pesticide resistance. iv) proposes practical solutions to the impacts of antimicrobial and pesticide resistance.	High

		suggest a way forward. d) assess the occurrence of endangered species and extinction.	v) analyses the causes and extent of extinction in earth's history. vi) assesses current threats to biodiversity. vii) suggests strategies to prevent the extinction of endangered species.	
	8(b): Analyse the role of insect growth stages in ecosystems, focusing on their contributions to waste management, food security, and water quality assessment. (u, s)	a) assess the contribution of insects to waste management, food security, and water quality assessment. b) compare water quality in different locations using insect bioindicators.	i) explains the role of the different insect stages in waste management, food security, and water quality assessment. ii) relates insect population density to water quality in different locations. iii) explains how trends and patterns in insect populations affect crop productivity. iv) generates clear aims, hypotheses, and procedures for scientific investigations on water quality assessment.	High

		c) relate the trends and patterns in insect populations to crop productivity. d) plan and carry out investigations on water quality assessment.	v) identifies and uses appropriate apparatus during scientific investigations. vi) analyses data and provides appropriate recommendations.	
	9(a): Analyse population dynamics and the factors affecting them in different ecosystems. (u, s, gs, v/a)	a) relate a population's growth pattern to its features. b) evaluate the factors affecting population dynamics. c) estimate population size using quadrats and capture-	i) identifies the characteristics of a population. ii) explains the different population growth patterns in ecosystems. iii) analyses how different factors affect patterns of population distribution and size. iv) identifies and uses appropriate materials to estimate population size.	High

		recapture techniques.	v) designs coherent procedures to estimate population size. vi) manipulates data to estimate the population size.	
	9(b): Analyse the processes of ecological succession and strategies for effective ecological restoration practices in diverse environments. ()	a) explain ecological succession and ecological restoration practices. b) compare ecological succession. and ecological restoration. c) plan and carry out ecological restoration in the community (SBA).	i) identifies the stages of primary and secondary succession. ii) examines the similarities and differences between primary and secondary succession. iii) explains the role of succession in ecosystems. iv) identifies the characteristics of degraded ecosystems. v) uses different techniques of ecological restoration (SBA). vi) examines the impact of ecological restoration in various communities. vii) identifies differences between ecological succession and ecological restoration.	High

	9(c): Examine the concept of energy flow through ecosystems, its role in maintaining ecosystem stability, and the impact of human activities on energy flow. (u, s)	a) recognise patterns of energy flow in natural and disturbed ecosystems. b) relate changes in energy flow to ecosystem stability. c) assess the impacts of bioaccumulation and biomagnification during energy flow. d) plan and carry out a scientific investigation on nutrient assimilation at	i) identifies the sequence of energy flow in an ecosystem. ii) explains the importance of energy flow in an ecosystem. iii) explains the assimilation of energy during energy flow. iv) explains energy loss during energy flow. v) compares the impacts of bioaccumulation and biomagnification during energy flow. vi) analyses the role of humans and their activities in energy flow. vii) generates clear aims, hypotheses, and procedures for scientific investigations on nutrient assimilation at each trophic level.	High

		each trophic level. e) explain the impact of human activities on energy flow.	viii) identifies and uses appropriate apparatus during scientific investigations. ix) analyses data and provides appropriate recommendations.	
	9(d): Explain the concept of carbon footprint in relation to climate change, including its measurement, as well as the role of carbon sequestration in mitigating climate change. (u, gs, v/a)	a) analyse personal and societal activities to identify those with high carbon footprints. b) relate human activities, carbon emissions, and climate change to carbon sequestration mitigation strategies. c) plan and carry out scientific	i) identifies human activities that lead to increased carbon output. ii) compares the rate of carbon emissions to the extent of climate change. iii) explains the role of vegetation in improving the climate. iv) implements activities that reduce carbon output. v) generates clear aims, hypotheses, and procedures for scientific investigations on the measurement of carbon footprint.	High

		measurement of the carbon footprint.	vi) applies standard emission factors to accurately calculate and report the carbon footprint for a specific, defined entity. vii) identifies and uses appropriate apparatus during scientific investigations. viii) analyses data and provides appropriate recommendations.	
	9(e): Examine the impact of invasive species on native biodiversity, ecosystems, and economies, as well as strategies for their management and control. (u, s, gs, v/a)	a) investigate common local invasive plant or animal species. b) describe how invasive species disrupt ecosystem processes. c) compare the efficiency and consequences of various control	i) examines organisms and identifies characteristics of invasive species. ii) compares the morphological characteristics between native and invasive species. iii) assesses the impact of invasive species on ecosystems, biodiversity, and economies. iv) identifies methods of managing invasive species.	High

		methods on the ecosystem. d) analyse trends in invasive species spread and impact. e) design and carry out management of invasive species. (SBA)	v) explains the considerations made while selecting a control method. vi) compares the impacts of different methods of controlling invasive species (SBA). vii) identifies appropriate materials to use to manage invasive species. viii) develops procedures and safety precautions in managing invasive species. ix) presents data from the management of species and makes recommendations.	
	9(f): Analyse the concept of food security, focusing on its components and sustainable agricultural practices	a) analyse the concept of food security. b) assess the effectiveness of food security	i) explains the meaning of food security using specific local examples. ii) explains the components of food security and their roles in	High

	to address its challenges. (u, s, gs, v/a)	interventions or practices. c) assess government policies/ initiatives in Uganda aimed at promoting food security.	maintaining a stable food supply. iii) describes the different threats to food security. iv) explains different agricultural practices aimed at addressing food insecurity. v) critiques the different government policies/ initiative aimed at promoting food security.	

3. Structure of the Assessment Papers

There will be two assessment papers for Biology at the Advanced Secondary level.

Paper 1 (Theory) will contain two sections, A and B. The items in the paper will be scenario-based. The paper will take 3 hours.

Section A

This will have two compulsory items.

One item will come from construct 1 (**Cellular organisation, respiration, and molecular Analysis**), addressing assessment objective 1, and the other from construct 2 (**Plant physiology and adaptation**), addressing assessment objective 2.

Section B

This will consist of parts I and II. The section will have four test items.

Part I will have two items that come from construct 3 (**Organismal systems and homeostasis**), addressing assessment objective 3.

Part II will have two items from construct 4 (**Genetic, evolutionary, and ecological dynamics),** addressing assessment objective 4.

A learner will respond to one item from each construct (Part).

Paper 2 (Practical) will contain two compulsory items and will take 3 hours. The items in the paper will be scenario-based.

i) Items in this paper will come from any of the four constructs addressing their respective assessment objectives.

ii) One item will require the use of scientific investigations to solve a challenge presented in the scenario.

iii) The second item will require relating structural and behavioural mechanisms to the survival advantage of the organism.

Biology

Paper I (Theory)

November 2026

Time: 3 Hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION

SAMPLE EXAMINATION PAPER

BIOLOGY

PAPER I (THEORY)

Time: 3 Hours

INSTRUCTION TO CANDIDATES

This paper consists of two sections, **A** and **B**. It has six examination items.

Section **A** has two compulsory items.

Section **B** has two Parts, I and II. Answer one item from each part.

Answer four items in all.

SECTION A

Answer all the items in this section.

Item 1(Construct 1)

Victoria Nile is a source of food and income for the communities living along it. However, the community near a textile factory has reported to the district authorities that the fish catches have significantly reduced over the past few months. The authorities requested Dr. Achen, a fisheries biologist from the National Environmental Management Authority (NEMA), to carry out an investigation. She suspected that the cause was pollution from the factory that releases wastes containing heavy metals and cyanide into the lake.

She caged fish at two different sites: a clean control site (no pollution) and a site near the factory outflow. She investigated the effects of the heavy metals on ATP synthesis, the gill, and mitochondrial structures. The data she collected is provided in the table below.

Fish group	**ATP Concentration (µmol/g cell)**	**Thickness of gill squamous cells**	**Number of ribosomes per mitochondrion ($\times 10^6$)**	**Concentration of oxidised NAD** (µmol/g tissue)	**Space between cells gill epithelium**	**Amount of cyanide in river water (mg/L)**	**Amount of lead (Pb) in river water (mg/L)**
Control (no pollution)	9.5	Thin	9.8	7.2	0.5µm	0.01	0.01
Polluted site – factory outflow	2.2	Thick	3.5	1.3	6.0µm	1.00	1.00

Task

Analyse how changes in the fish from the polluted site affect fish catches and propose a sustainable management plan to ensure health of fish in the river.

Item 2 (Construct 2)

Napak district is one of the agricultural areas in Uganda. It is a lowland area with high temperature, shallow soils that have limited organic matter and very low moisture. Farmers grow both native and non-native crops, however, they often get low yields from the non-native crops unlike from the native crops.

The farmers invited Agricultural Extension workers to study the situation and propose strategies to improve the yields. They conducted a study in the district and the data collected on native and non-native crops grown is shown in the table below.

Condition	**Native crops** e.g. Sisal, Aloe vera, wild millet	**Non-native crops grown** e.g. Amaranthus, Avocado trees, Wild peas
The type of leaf anatomy	Kranz anatomy present	Kranz anatomy absent
Distribution of stomata	Many stomata on lower leaf epidermis	Many stomata on upper leaf epidermis
Size of leaf cuticle	Thick	Thin
Number of hairs on the leaf	Numerous	Very few

You are part of the team invited by the Agricultural Extension Officer to help the farmers improve their crop yields.

Task:

Account for the difference in the yields between native and non-native crops grown in the district, and propose strategies to enhance productivity and resilience.

SECTION B

Part I

Answer only one item from this section.

Item 3(Construct 3)

Alex and Chris were among the participants in 400m race during the district sports championship in Soroti district (Altitude 1130m above sea level and temperature 30°C).

Before the race, Alex trained at the Teryet National Grounds in Kapchorwa, a high-altitude facility (2,200 m above sea level and temperature 21°C) while Chris trained at Namboole National Stadium in Wakiso, a low-altitude facility (1,128 m above sea level and temperature 25°C).

Immediately after the race, Chris showed signs of extreme fatigue, collapsed and injured his lower leg.

Chris' coach wondered why Alex did not show signs of extreme fatigue and asked the first aider to investigate since he was suspecting Alex of sports doping. The first-aid team recorded the following measurements in the table below immediately after the race.

Parameter	Alex	Chris
Pulse rate after race (beats/min)	115	155
Blood oxygen saturation (%)	93	85
Breathing rate (breaths/min)	18	28
Stroke volume (ml/beat)	120	100

The first aider has presented to Chris's coach and he is seeking a scientific explanation for the differences between the participants and expert advice on post-race management of Chris.

Task

Explain how the athletes' performance and observed conditions after the race were influenced by differences in training environments and propose strategies for safe management of Chris's condition after the race.

Item 4 (Construct 3)

Brian a re-known fastest sprinter in the region, has recently lost many races. This has caused him to lose self-confidence, become depressed and he also says that he feels unsteady whenever he turns his head quickly. However, he is seen to perform impressive warm-up routines during training whenever his girlfriend is around, an act his coach jokingly calls his "courtship display."

His coach noticed that Brian's reaction time to the start signal is slower than that of his peers and he sometimes staggers and leans forward when walking and running. Brian's coach is worried that he might be having a medical condition affecting his performance and has referred him to a medical doctor who conducted tests and compared his results with reference values typical of healthy sprinters. Brian's laboratory and clinical results are shown in table below.

Parameter	Brian's Result	Normal Reference (trained athletes)
Total synaptic vesicles at the motor end-plate (vesicles per end-plate)	8.0×10^{5}	2.0×10^{6}
Acetylcholine per synaptic vesicle (molecules·vesicle^{-1})	5.0×10^{3}	1.0×10^{4}
Arteriole wall smooth muscle (media thickness) in µm	12	22
Core temperature at the onset of sweating (°C)	39.0	37.2
Whole-body sweat rate at 36 °C ambient	0.2	1.0 L·h^{-1}
Endolymph volume in vestibular apparatus µL (normal range per ear)	60	70–170
Structure of otolith organs	Increased mechanical stiffness	Normal elasticity

Task:

Account for the physiological mechanisms underlying Brian's observed symptoms and behaviours, explain their survival value, and propose strategies to improve his performance.

Part II

Answer only one item from this section

Item 5(Construct 4)

Farmers in Kayunga District use a pesticide to control beetles that destroy the flowers of coffee plants. Over the past five years, the pesticide has become less effective, as the beetle population has continued to increase.

An investigation by the district research team reported the following:

i) The beetle population is large and randomly mating.

ii) 20% of the beetles are homozygous recessive (rr) for a pesticide-resistance allele.

iii) Coffee yields have declined during the same period.

iv) Pollinator populations in the coffee fields have decreased.

v) Bird populations feeding in the fields have increased.

Task

Predict and explain the changes in population of the beetles and birds in relation to their effect on coffee yield, and therefore propose an integrated pest management strategy for the district.

Item 6 (Construct 4)

In western Uganda, communities around Budongo Forest Reserve report increasing native rodent species invasions into crop gardens. The National Forestry Authority (NFA) directed an investigation into the complaints of communities. The investigation showed that the population of native rodent species in the forest declined, while that of non-native rodent species increased. The non-native rodents have stronger limbs, larger incisors, and a higher reproductive rate. The native species, therefore, are outcompeted by the non-native species and end up in crop gardens.

The investigation further showed that deforestation and farming have degraded and fragmented the forest into three isolated patches, each with distinct conditions. Unlike before the formation of the patches, the native rodent species are unable to move throughout the forest, restricting interbreeding within patches only. The breeding experiments between native rodent species from the different patches A, B, and C showed that those from:

i) A cannot mate with those from B at all

ii) B can mate with C, but their offspring are infertile

iii) C and A can mate, but a zygote never forms

Task

Analyse the ecological and evolutionary interactions in the forest to propose a management plan for Budongo Forest that restores the forest, controls the invasive rodents, and conserves native biodiversity while supporting local livelihoods.

Biology

Paper II (Practical)

November 2026

Time: 3 Hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION

SAMPLE EXAMINATION PAPER

BIOLOGY

PAPER II (PRACTICAL)

3 Hours

INSTRUCTIONS TO CANDIDATES

This paper consists of two examination items. Answer all items.

Write all your answers in the spaces provided within this question paper booklet.

Use sharp pencils for drawings. Coloured pencils or crayons should not be used.

For any calculations, show all your workings clearly in the space provided.

Silent, non-programmable scientific calculators may be used.

No extra paper is allowed. Any work written on additional sheets will not be scored.

Item 1

The Kita community members carry out commercial beetroot farming. However, the plants are regularly attacked by worms that destroy the leaves. The farmers use pesticide A to kill the worms, but the plants end up drying. This results in poor yields and financial losses to the farmers, and consequently, they have asked the Ministry of Agriculture for help.

A research team sent by the Ministry of Agriculture discovered that the pesticide is a reducing sugar, polar, and moves across the beetroot cell membranes into the cytoplasm, where it causes cell death after a week. One of the farmers reported that whenever she mixes the pesticide with solution D and sprays, the plants do not dry. The agricultural team wants to recommend mass use of solution D together with the pesticide; however, they do not have scientific justification for its effectiveness.

You have been provided with fresh beetroot, pesticide A, solution D, and a cork borer.

Task.

Design and carry out an investigation on how solution D affects the cell membrane to prevent damage by pesticide A and assess its potential use together with solution D.

Item 2

Many goats in Karama parish would take a long time to fatten, to the dismay of many commercial goat farmers in the area. The farmers requested a team of scientists to carry out an investigation and recommend ways of decreasing the duration the goats required to fatten.

The scientists suspected poor nutrient absorption and low cardiac output. They then formulated an oral solution that would improve the structures of the organs to permit a high nutrient absorption in the ileum and cardiac output. As part of ethical practices, they administered the oral solution to rats in the laboratory for five months to test for its effectiveness. They obtained rats of the same age, sex, and health condition and divided them into two groups. Those of group A were not administered the oral solution, and those of group B were provided with the oral solution.

You have been provided with a freshly killed rat from group A, a light microscope, a dissection kit, an image of the ileum of a 250g rat from group B

observed under medium power of a light microscope, and measurements of the external sizes of its heart chambers.

Chamber	Measurement
Left atrium	25mm
Left ventricle	6.0mm
Right atrium	3.5mm
Right ventricle	4.0mm

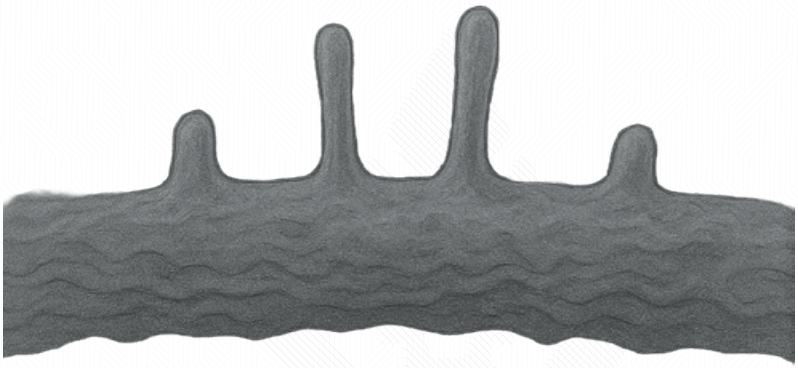


Figure 1: Photomicrograph of the rat ileum villus structure of a rat from group B, viewed under a medium-power objective lens (×10).

You are required to investigate the effect of the oral solution on the histology of the ileum and the relative external sizes of the heart chambers.

Task.

Design and carry out an investigation to evaluate the effectiveness of the oral solution and advise the farmers on whether to adopt the use of the solution or not. Your design should include planning, methods of data collection, data presentation, analysis of results, and recommendations.

Advanced instruction for practical paper: Pesticide A is a glucose solution; solution D is pawpaw juice; beetroots, cork borer, knife, two boiling tubes.

4. Assessment Rubrics

SAMPLE BIOLOGY PAPER 1 (THEORY)

SECTION A

Item 1 (Construct 1)

Basis of evaluation	Score 4	Score 3	Score 2	Score 1
1) Interpretation of task/context Identifies factors affecting the health of this fish, leading to low catches.	Identifies concentration of pollutants (cyanide and lead), concentration of oxidised NAD, number of ribosomes, and structure of squamous epithelium of the gills, which affects ATP production and health of the fish in the river	Correctly identifies most data differences and pollutants with minor omissions.	Identifies some data differences with major omissions.	Mentions limited or no factors affecting fish health in the river

2. Generating and presenting ideas a) Analyses the structures and functions of cells/tissues/organelles/levels of organisation/properties of biomolecules.	Thoroughly explains how structural changes in gill tissue, ATP synthase, and gene mutations disrupt biological function. Demonstrates deep understanding of how these disruptions affect oxygen uptake, energy production, muscle function, and survival across multiple biological levels.	Clearly explains how most structural changes affect cell and organism function. Demonstrates a good understanding of the links between tissue/organelles and organismal performance.	Describes some structural changes with partial explanation of effects on function (e.g., how gill damage affects oxygen uptake). Some cross-level connections are made.	Identifies relevant structures but provides no or vague explanations of their function. A Few or no links across biological levels.

(a) Evaluates the processes in a cell that sustain life (protein synthesis, glycolysis, Krebs cycle, ETS, fermentation, DNA replication, meiosis, mitosis, mutation)	Accurately evaluates how disruptions to ATP synthase and mutations affect energy production (e.g., ETS, oxidative phosphorylation) and cell division. Clearly explains downstream consequences for muscle performance and survival.	Explains how changes in ATP synthase or mutation frequency affect energy production or cell division. Describes most consequences clearly.	Describes one or more relevant processes and partially links them to organismal function or health. Evaluation is limited.	Identifies relevant processes with no connections to function.
Making Informed Judgement Applies concepts of cellular structures, cellular organisations, and processes to improve health	Proposes a well-justified and integrated management plan. Clearly connects specific cellular and physiological disruptions to	Proposes a justified conservation strategy with clear links to organism or ecosystem health. Applies biological understanding to support solutions.	Suggests a relevant plan based on general biological understanding. Links to health or survival are present but underdeveloped.	Recommends a basic or general action with minimal biological explanation. Weak connection to

	ecosystem-level interventions. Addresses pollution, fish health, and food security using cross-level biological reasoning at cellular, tissue, and ecosystem levels.			cellular or organismal processes.

Item 2 (Construct 2)

Basis of Evaluation	Score 4	Score 3	Score 2	Score 1
Interpretation of task/context (a) identifies the anatomical and ecological features of native and non-native plants grown (b) identifies Napak's environmental challenges	Accurately connects the task to biological concepts (like adaptation, photosynthesis type, and water conservation), clearly describes Napak's environmental challenges (high temperature, low moisture, shallow soils), and notes the differences in yield between native and non-native crops.	Links the task to some relevant biological concepts (e.g., C_4 vs C_3 pathway), describes the general environmental conditions, and notes differences in yields between native and non-native crops.	Mentions the environmental conditions that enable native crops perform better, but gives no or limited connection to biological concepts	States that native crops grow better than non-native crops, but gives wrong or no environmental or biological basis

Generating and presenting ideas a) Analysis of Plant Structural Features, Photosynthetic Pathways, and Water Adaptations	Clearly explains how C_4 traits (Kranz anatomy, stomata arrangement, thick cuticle, many hairs) give native plants superior water-use efficiency, heat tolerance, and reduced transpiration over C_3 traits. Shows clear connections from leaf anatomy to physiology to adaptation and then high yield.	Correctly explains most anatomical adaptations and how they favour native crops. Shows the relationships between structure and function well, though with less depth and integration.	Gives some correct explanations (e.g., cuticle reduces water loss), but reasoning lacks depth or completeness. Structure to function links are partially made	Describes some plant features or adaptation strategies with no or limited linkage to C_3 and C_4 traits. Poorly relates structure to function and crop yield.

b) Evaluation of Physiological Processes and Environmental Influences	Integrates the interaction between physiology (photosynthesis pathways, transpiration, water use efficiency) and ecology (adaptation to heat, drought, soil conditions) into a coherent explanation.	Analyses key physiological processes and environmental/ ecological factors and partially explains interactions between them.	Explains physiological processes and the environmental conditions independently, showing minimal interactions between them.	Identifies physiological processes and environmental conditions with no connections between them.
Making Informed Judgement Application of Ethical and Effective Agricultural Strategies for Sustainability	Proposes well-justified, data-driven strategies to improve crop yields in Napak, showing strong scientific reasoning, ethical responsibility, and long-term sustainability.	Develops effective strategies to improve crop yields in Napak, with good scientific grounding and discussion of sustainability and ethical considerations.	Suggests generally appropriate strategies with some scientific explanation and reference to sustainability.	Recommends a basic or generic strategy with minimal justification or vague relevance to sustainability.

Section B

Part I

Item 3 (Construct 3)

Basis of evaluation	Score 4	Score 3	Score 2	Score 1
Interpretation of task/context Identification of aspects of highland acclimatization, responses to a decrease in environmental temperature	Comprehensively identifies all the effects of training at highland (increased pulse rate, breathing rate, stroke volume, and blood oxygen saturation) and responses to a decrease in environmental temperature.	Identifies most effects of training at highland and responses to a decrease in environmental temperature.	Identifies basic effects of training at highland and responses to a decrease in environmental temperature.	Identifies few effects of training at highland or responses to a decrease in environmental temperature.

Generating and presenting ideas (a) Analysis of Organismal Systems and Homeostasis	Insightfully interprets post-race data to evaluate how the circulatory, respiratory, and nervous systems interact to maintain homeostasis. Clearly explains how these systems responded differently across participants and how homeostatic disruption affected recovery.	Clearly analyses how key systems worked together to regulate variables like heart rate and breathing during and after the race. Links physiological differences among participants to variations in homeostatic control.	Describes key physiological responses (e.g., increased heart rate, heavy breathing), with some explanation of how systems responded to exercise. Limited integration across systems.	Lists general changes in data (e.g., high heart rate, faster breathing) with minimal or vague physiological explanation.
(b) Evaluation of Sensory & Behavioural Responses	Thoroughly evaluates participants' behavioural responses (e.g., collapse, fatigue, delayed recovery) and explains their underlying physiological causes. Connects responses to sensory input, adaptation,	Analyses observed behaviours and explains their likely physiological causes. Shows some connection to participant adaptation and performance outcomes.	Describes observed behaviours (e.g., exhaustion, slow movement) and gives partial explanation of physiological responses.	Identifies behaviours with minimal or unclear physiological links.

	performance, and overall welfare.			
Making Informed Judgement Application of Concepts to Health & Performance Issues	Proposes well-justified, ethical, and scientifically accurate interventions for Chris's recovery. Explains the effects of the local anaesthetic on multiple physiological systems and recommends appropriate strategies (e.g., gradual rewarming, hydration, monitoring vitals).	Explains how the anaesthetic likely affected Chris's recovery and suggests mostly ethical, effective strategies to support physiological recovery and safe outcomes.	Describes one or more general effects of the anaesthetic and proposes a basic recovery measure (e.g., rest, fluids), with limited justification.	Suggests a vague or incomplete intervention without explaining the physiological rationale or safety.

Item 4 (Construct 3)

Basis of evaluation	Score 4	Score 3	Score 2	Score 1
Identification of Key Observations and Physiological Effects a) Identifies abnormal parameters in Brian's data.	Accurately identifies all physical, physiological, and psychological factors that affect Brian.	Identifies most factors that affect Brian.	Identifies some factors that affect Brian.	Recognises only one or two factors that affect Brian.
Analyses physiological systems that sustain life (neural transmission, balance, thermoregulation)	Accurately integrates physiological data from neural, vestibular, and thermoregulatory systems to explain the full range of Brian's symptoms. Justifies causal links using specific biological mechanisms and evidence from the case.	Analyses the contribution of each physiological system to Brian's symptoms. Shows some integration across systems and uses case data to support explanations.	Explains abnormalities in each system separately, with limited discussion of how they contribute to Brian's symptoms. May generalise or oversimplify causal links.	Describes basic functions of one or more systems or identifies affected systems with minimal explanation of symptoms.

Evaluates sensory & behavioural responses (innate behaviours)	Thoroughly evaluates Brian's observed innate behaviours (e.g., postural reflexes, startle responses), explains their physiological triggers, and clearly links them to survival and training relevance.	Analyses key behaviours and identifies their physiological basis and adaptive function. May partially explain the survival benefit or training relevance.	Describes behaviours and gives a basic explanation of their function. Provides a general or implied link to survival or adaptation.	Identifies behaviours with little or no explanation of their physiological cause or adaptive significance.
Applies concepts to real-life health & performance issues (improvement strategies)	Proposes accurate, ethical, and context-specific strategies (e.g., vestibular rehabilitation, neuromuscular training, thermoregulation support), each clearly linked to Brian's physiological deficits. Justifies how each strategy improves performance.	Suggests appropriate, mostly ethical strategies with relevant links to Brian's physiological issues. Offers a reasonable explanation of how performance would improve.	Proposes general strategies for performance improvement with limited physiological justification or vague relevance to Brian's case.	Suggests a basic or generic strategy without providing physiological reasoning.

Item 5 (Construct 4)

Basis of evaluation	Score 4	Score 3	Score 2	Score 1
1. Interpretation of Task and Context Identifies the genetic traits/allele type, ecological changes, and recognises changes in pesticide effectiveness.	Accurately identifies all key findings in the data: allele type, population increase, pesticide ineffectiveness, and ecological shifts.	Identifies most findings with minor omissions or slight inaccuracies.	Identifies some findings, such as beetle resistance or population increase, but misses key genetic or ecological details.	Identifies one or two findings or confuses them with unrelated details.
2. Generating and explaining Ideas a) Analyses genetic, evolutionary, and ecological mechanisms/processes (Mendelian & non-Mendelian, speciation	Thoroughly integrates codominance, selection pressure, and ecological feedback to explain the beetle's rapid adaptation. Uses data-driven analysis of allele frequencies to justify a clear and logical prediction of	Accurately explains codominance and selection pressure, and connects these to the rise of resistance in beetles. Uses current trends to predict genotype distribution with reasonable justification.	Describes codominance and selection separately, offering a general prediction of beetle population changes. Reasoning is present but partially developed or	Identifies basic genetic ideas (e.g., inheritance, adaptation), but does not fully explain mechanisms. Prediction is vague or lacks connection to data.

	future genotype distributions.		somewhat generic.	
b) Evaluates the significance, impact/role/causes of genetic, evolutionary, and ecological dynamics	Critically evaluates multiple interacting ecological factors (e.g., pollinators, birds, beetles, climate) and prioritizes causal pathways with short- and long-term ecological consequences. Demonstrates strong systems thinking.	Analyses relevant ecological interactions with mostly clear causal links. Explains how changes in biotic populations affect beetle numbers and maize yield, showing solid ecological reasoning.	Identifies some ecological factors and explains individual effects on beetles or maize. Connections are present but somewhat simplistic or fragmented.	Identifies only one or two ecological factors with no further explanation, or the explanation is scientifically inaccurate. May confuse or overlook key ecological interactions.

3. Making Informed Judgements / Proposing Strategies and Applications a) Suggests integrated pest management strategies b) Justifies strategies using biological principles	Proposes a comprehensive strategy (like chemical rotation, biological control, pollinator enhancement, cultural methods, biopesticides, and varietal improvements) with a biologically sound justification. (linking to natural selection, ecological balance, pollination, and coffee productivity)	Proposes mostly relevant strategies; justification is provided with relevant biological reasoning, but with no full explanation of key principles.	Proposes some relevant strategies, but the justification is basic or partially correct; biological principles are mentioned with no explanation.	Suggests weak strategie**s**, poorly justified; limited reference to biological principles.

Item 6 (Construct 4)

Basis of evaluation	Score 4	Score 3	Score 2	Score 1
Interpretation of task/context Identifies the ecological and evolutionary aspects	Comprehensively identifies all ecological concepts (invasive species, competition, food security, and degradation) and evolutionary concepts (speciation, isolation, and selection pressure).	Identifies most of the ecological concepts (invasive species, competition, food security, and degradation) and evolutionary concepts (speciation, isolation, and selection pressure).	Identifies basic ecological concepts (invasive species, competition, food security, and degradation) and evolutionary concepts (speciation, isolation, and selection pressure).	Identifies one or two ecological concepts or evolutionary concepts

Generating and presenting ideas (a) Analyses genetic, evolutionary, and ecological mechanisms/processes (Mendelian and non-Mendelian inheritance, speciation, succession)	Analyses ecological, evolutionary, and genetic mechanisms of competition, adaptation, reproductive isolation, and speciation, clearly linking them to invasive success, native decline, and ecosystem imbalance.	Explains ecological, evolutionary, and genetic mechanisms linking some of them to invasive success, native decline, and ecosystem imbalance, but with minor gaps.	Describes ecological, evolutionary, and genetic mechanisms, but no linkage to invasive success, native decline, and ecosystem imbalance.	Identifies ecological, evolutionary, and genetic mechanisms, but it is limited or no explanation of the underlying mechanisms.
(b) Evaluates the significance, impact/role/causes of genetic, evolutionary, and ecological dynamics	Evaluates how fragmentation of the forest alters ecological interactions, genetic flow, and selection pressures leading to speciation and crop invasion, giving the effects on	Explains how human activities disrupt ecological and genetic processes, connecting impacts to biodiversity loss	Describes ecological impacts and possible genetic consequences, but the discussion lacks depth or a long-term view.	Identifies ecological effects with limited explanation of underlying genetic or evolutionary mechanisms.

	biodiversity and community welfare.	and community effects.		
Making Informed Judgement Applies principles of inheritance, evolutionary change, ecosystem dynamics, and ecological change to address challenges in genetics, sustainability, and climate change	Uses ecological and genetic justification to propose a realistic Budongo-specific plan that integrates habitat restoration, invasive species control, genetic conservation, and livelihood support, and includes feasibility, risk management, and monitoring indicators.	Proposes a mostly integrated, feasible plan with sound biological justification and monitoring, but lacking some detail on feasibility or risk management.	Suggests a reasonable plan with basic biological justification and limited risk management or monitoring details.	Suggests generic or incomplete actions with minimal justification and no monitoring or risk management considerations.

ASSESSMENT RUBRICS FOR SAMPLE BIOLOGY PAPER II (PRACTICAL)

ITEM 1

Expected Output: Scientific report

Basis of evaluation	Score 4	Score 3	Score 2	Score 1
Planning	Formulates a clear, testable aim; develops a hypothesis linking pawpaw juice to reduced beetroot membrane permeability; identifies all variables (independent, dependent, controlled) and lists all required materials. Planning reflects a deep understanding of the investigation.	States a clear aim and hypothesis; identifies most variables and materials; planning shows good understanding with minor omissions.	States a clear aim; identifies key variables and some materials; planning shows a basic understanding of the investigation.	States a general aim; identifies one or two variables or materials; planning shows limited understanding.

Risks and Mitigations	Identifies all significant risks (handling chemical A, sharp instruments, pigment staining), explains the potential impact of each, and proposes practical, effective mitigation strategies.	Identifies major risks and proposes relevant mitigation strategies; explanation of risk impact may be partial or slightly incomplete.	Identifies some possible risks; proposes general or vague mitigation measures; explanation of impacts is limited.	Mentions at least one risk; mitigation and explanation are minimal or unclear.
Procedure	Designs a detailed, logical, repeatable step-by-step procedure controlling all key variables (disc size, exposure time, temperature); uses all materials correctly; procedure ensures valid and reproducible results.	Designs a coherent procedure controlling the most important variables; uses most materials appropriately; minor omissions in controls or sequencing.	Outlines a workable procedure; controls some variables; uses some materials correctly; procedure shows basic logical flow.	Provides a partial or simple procedure; weak control of variables; sequencing may be inconsistent.

Data Presentation	Records all measurements accurately; presents data systematically in tables and/or graphs with correct titles, labels, and units; includes relevant qualitative observations (e.g., pigment leakage, copper reduction results); presentation supports analysis.	Presents data clearly with minor errors; most units, labels, and titles are correct; includes some qualitative observations.	Records and presents relevant data; some errors or omissions in units, labels, or qualitative observations.	Records partial or inconsistent data; presentation is incomplete or poorly labelled; qualitative observations are limited.
Analysis and Recommendation	Analyses data thoroughly to identify patterns (e.g., reduction of membrane permeability with pawpaw juice); draws valid, evidence-based conclusions; provides strong, justified recommendations on the use of pawpaw juice as an organic pesticide.	Analyses data to identify patterns; draws meaningful conclusions; provides recommendations with partial evidence support.	Identifies patterns; draws basic conclusions; recommendations are incomplete or partially supported.	Identifies minimal patterns; draws weak or unclear conclusions; recommendations are absent or unsupported.

ITEM 2

Basis of evaluation	Score 4	Score 3	Score 2	Score 1
Planning	Clearly states aims, hypothesis, and expected outcome linking the ileum and heart structure to nutrient absorption and cardiac output. Lists all materials, ethical precautions, and logical steps for both investigations.	States clear aims and outlines logical steps with most materials and safety points identified. Relates the investigation to nutrient absorption and circulation.	Gives a general aim or purpose and a partial list of materials or steps; limited link between structures and functions.	Gives vague aim or disorganised plan; omits key steps or materials; unclear relationship to investigation purpose.
Methods of Data Collection / Procedure	Follows a systematic, accurate procedure for both ileum and heart investigations. The sequence is logical and scientifically sound. Includes mitigations of risks.	Procedure generally correct and logical with minor omissions. Includes mitigations of risks.	The procedure is partly correct but lacks detail or misses one key component (either heart or ileum).	Incomplete or partly incorrect method; limited procedural understanding.

Observations / Results / Drawings / Data Presentation	Records accurate, detailed, and well-organized data. Produces a neat, correctly labelled diagram of the ileum (villi, epithelium, goblet cells, layers). Presents heart chamber measurements in a clear table with correct units and magnification.	Observations are clear and factual; diagram well-labelled but slightly less detailed; measurement table mostly correct and includes units.	Some relevant observations: diagram present but missing some key labels or poor proportion; data table incomplete or partially incorrect.	Few relevant observations: rough or incorrect diagram; limited or disorganised data presentation.
Data Analysis / Explanation / Suitability	Provides comprehensive scientific interpretation linking structural features to function (e.g., taller villi → increased absorption; larger LV → higher cardiac output). Correctly relates findings to improved fattening in goats. Uses accurate terminology.	Good interpretation with minor conceptual gaps; links to function are mostly accurate and relevant to goat fattening.	Partial interpretation; some correct relationships, but reasoning is incomplete or lacks scientific depth.	Weak or vague explanation; uses general statements with minimal biological linkage or errors in reasoning.

5. Performance Level Descriptors

Construct	Performance Level	Descriptor
Cellular Organisation, Respiration, and Molecular Analysis Investigating the structure of cells and tissues, the roles of biomolecules (water, lipids, proteins, and nucleic acids), and processes of ATP production, cell division, and protein synthesis, by analysing how these components interact to sustain life and energy production, to apply biological principles in genetic technologies and health improvement	Exceptional	Evaluates how cell and tissue structures, biomolecules, energy systems, and gene expression interact across levels of organisation to sustain life, and applies this knowledge to genetics and health solutions.
	Outstanding	Analyses linkages among cells, tissues, and biomolecules, explaining how organisation and gene expression regulate energy production and biological function.
	Satisfactory	Explains functions of cells, tissues, and biomolecules in ATP production, cell division, and protein synthesis, showing their role in maintaining life.
	Basic	Describes basic structures of cells and tissues and outlines simple processes of energy release and cell division.
	Elementary	Identifies cells or tissues and mentions basic life processes without linking structure, organisation, or gene activity.

Construct	Performance Level	Descriptor
Plant physiology and adaptation Evaluating plant structure and physiology by analysing structural adaptations and photosynthetic pathway differences in C_3 and C_4, plant adaptations (to water availability), environmental influence on photosynthesis, growth, photoperiodism, and the hormonal control of growth, to promote sustainable agricultural practices that improve crop yield and food security.	Exceptional	Evaluates plant structure and physiology, including C_3 and C_4 adaptations, environmental effects on photosynthesis, water-use adaptations, growth, photoperiodism, and hormonal regulation, to inform sustainable practices that improve crop yield and food security.
	Outstanding	Evaluates some plant structures and physiology, adaptations, environmental effects on photosynthesis, growth, photoperiodism, and hormonal regulation, to inform sustainable practices that improve crop yield and food security.
	Satisfactory	Evaluates minimal plant structures and physiology, adaptations, environmental effects on photosynthesis, growth, photoperiodism, and hormonal regulation, to inform minimal sustainable practices that improve crop yield and food security.
	Basic	Explains main features of plant structure, photosynthetic pathways, and environmental effects with partial accuracy and limited application to yield improvement.
	Elementary	Identifies a few plant structures or processes with major inaccuracies and no clear linkage to photosynthesis or yield.

Construct	Performance Level	Descriptor
Analyses animal systems and behaviours in adapting to environmental changes for health, survival, and welfare. Evaluating the structure and physiology of animal sensory organs and systems (circulatory, nervous, immune, and homeostatic) by analysing blood circulation, gas transport, immunity (vaccination and allergies), neural transmission, sensory perception, homeostatic control, and how adaptive behaviours support survival to make informed health decisions and promote animal welfare	Exceptional	Evaluates animal sensory organs and systems (circulatory, nervous, immune, and homeostatic) by analysing physiological processes, adaptive behaviours, and their role in survival, to inform health decisions and promote animal welfare.
	Outstanding	Evaluates some animal sensory organs and systems (circulatory, nervous, immune, and homeostatic) by analysing physiological processes, adaptive behaviours, and their role in survival, to inform some health decisions and promote animal welfare.
	Satisfactory	Evaluates limited animal sensory organs and systems (circulatory, nervous, immune, and homeostatic) by analysing physiological processes, adaptive behaviours, and their role in survival, to inform limited health decisions and promote animal welfare.
	Basic	Explains the main features of animal sensory organs and systems, identifies key physiological processes, and recognises some adaptive behaviours, with a partial understanding of their role in health and survival.
	Elementary	Identifies a few sensory organs or physiological processes with limited accuracy, and demonstrates minimal understanding of adaptive behaviours or their relevance to health and welfare.

Construct	Performance Level	Descriptor
Genetic, evolutionary, and ecological dynamics Evaluating inheritance patterns, evolutionary mechanisms, and ecological interactions by analysing Mendelian and non-Mendelian genetics, species evolution, speciation, resistance, extinction, population dynamics, ecosystem balance, and carbon emissions, to inform sustainable strategies for managing invasive species, promoting food security, and mitigating climate change.	Exceptional	Evaluates genetics, evolution, and ecological interactions, integrating all aspects to develop well-justified, fully sustainable strategies addressing invasive species, food security, and climate change.
	Outstanding	Analyses genetics, evolution, and ecology, linking major aspects to develop generally sustainable strategies that address issues related to the management of invasive species, food security, and climate change.
	Satisfactory	Analyses some genetic and ecological factors and suggests moderately sustainable strategies for managing invasive species, food security, and climate change.
	Basic	Shows limited analysis of genetic or ecological factors and proposes weak or incomplete strategies for managing invasive species, food security, or climate change.
	Elementary	Demonstrates minimal understanding of genetic, evolutionary, or ecological concepts and fails to propose strategies for sustainability.

CONTACT US:

National Curriculum Development Centre
Plot M838, Kyambogo.
P.O.Box 7002 Kampala, Uganda
+256-393-112-088
www.ncdc.go.ug

ISBN 978-9913-06-110-0