SUMMARY 2026 BIOLOGY GUIDELINE ADVANCED LEVEL BY TR MUSINGUZI IBRAHIM

1.2 ASSESSMENT OBJECTIVES

The end of Cycle assessment for Biology will be guided by four assessment objectives focusing 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, in order to apply these biological principles to challenges in genetic technologies and health improvement.

TOPICS IN THE SYLLLABUS

- Cell biology
- Respiration
- Inheritance and evolution

This will be for item 1 in theory paper

AO2: Evaluate plant structurre 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.

TOPICS IN THE SYLLLABUS

- Nutrition in plants
- Coordination
- Growth in plants and development in insects

This will be for item 2 in theory paper

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BY TR. MUSINGUZI IBRAHIM O759514302

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

TOPICS IN THE SYLLLABUS

- Transport in in humans
- Homeostasis
- Co ordination

This will be for item 3 and item 4 in theory paper

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.

TOPICS IN THE SYLLLABUS

- Inheritance and evolution
- Growth in plants and development in insects
- ecology

This will be for item 5 and item 6 in theory paper

NOTE

Items in paper 2 (practical) will come from any of the four constructs addressing their respective assessment objectives.

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STRUCTURE OF THE EXAMINATION PAPERS

There will be two examination 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,
  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 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)

This will contain two compulsory items, and the paper will take 3 hours.
The items in the paper will be scenario-based.

- Items in this paper will come from any of the four constructs addressing their respective assessment objectives.
- One item will require the use of scientific investigations to solve a challenge presented in the scenario.
- The second item will require relating structural and behavioural mechanisms to the survival advantage of the organism.

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BIOLOGY PAPER I (THEORY)

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 have 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 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 the gill and mitochondrial structures and ATP synthesis. The data she collected is provided in table 1.

Table 1

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**	**A**
Control (no pollution)	9.5	Thin	9.8	7.2	0.5µm	0.0
Polluted site – factory outflow	2.2	Thick	3.5	1.3	6.0µm	1.0

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You are tasked with analysing her findings and proposing a course of action.

Task

Analyse how cellular and tissue changes in the fish from the polluted site affect respiration and result in reduced fish catches to propose and justify a sustainable management plan to ensure health of organisms 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 table 2.

Table 2

Condition	**Native plants**	**Non-native crops grown**
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 analyse the data and propose strategies to the farmers on how to improve their crop yields.

Task:

(a) 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.

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SECTION B

Part I

Answer only one item from this section.

Item 3(Construct 3)

During the District Multi-Sport Championship in Soroti district (Altitude 1130m above sea level and temperature 30°C), Alex and Chris, were among the participants in 400m race

Athlete profiles and pre-competition factors:

- **Alex (400m Sprint):** Trained at the Teryet National grounds in Kapchorwa, a high-altitude facility (2,200 m above sea level and temperature 21°C).
- **Chris (400m Sprint)**: Trained at Namboole National Stadium in Wakiso, a low-altitude facility (1,128 m above sea level).

Immediately after the events, 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 table 3 immediately after each event.

Table 3

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, explain the thermoregulatory adjustment in Alex's body on reaching Soroti 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. Worried that he might be

having a medical condition affecting his performance, Brian's coach 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 4.

Table 4

Parameter	**Brian's Result**	**Normal Reference (trai**
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 elasti

On receiving the test results from Brian, the coach could not understand them. You have been tasked with interpreting the results for the coach.

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. However, over the past five years, the pesticide has become less effective, as the beetle population has continued to increase.

Findings from an investigation conducted by the district research team show that 20% of the beetles possess a recessive pesticide-resistance allele leading to a decline in coffee yields and pollinator population , while bird populations feeding in the fields increased.

You have been tasked to analyse these findings and help the district officials on how to manage pests.

Tasks

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(a) Analyse the increase in pesticide-resistant beetles and predict the population of those with pesticide resistant allele, evaluate the effects of changing pollinator and bird populations on coffee yields, and propose a biologically justified, 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:

- A can not mate with those from B at all
- B can mate with C, but their offspring are infertile
- C and A can mate but a zygote never forms

Tasks

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.

SAMPLE 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.

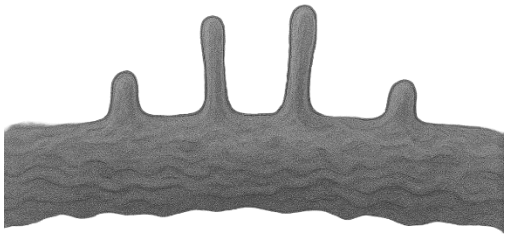
Item 2

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, health condition and divided them into two groups. Those of group A were not administered with 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 B, a light microscope, a dissection kit, an image of the ileum of a 250g rat from group A 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 A, 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, and analysis of results and recommendation.

I REGRET FOR ANY MISTAKE

Summarised by teacher musinguzi ibrahim

0759514302

Struggle continues 2026

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