

PRE-REGISTRATION EXAMINATIONS 2026

Student's Name:.....

Signature.....

Random No.						Personal No.		

BIOLOGY
PAPER 1
(Theory)
3 Hours



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BIOLOGY

Paper 1

(Theory)

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INSTRUCTIONS 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 **FOUR ITEMS**: Answer **one ITEM**.*

*Answers to section **A** must be written in the spaces provided while answers to **Section B** must be written in the answer booklet(s) provided.*

*Answer **FOUR** items in all.*

*Any additional item(s) answered will **not** be scored*

SECTION B

Part I

Attempt one item from this section

ITEM 3

At a secondary school in Mbale (Altitude 1,200 m), students participated in a tree-planting exercise near a busy roadside. After several hours, four students showed unusual signs.

- Musa felt dizzy and had a headache.
- Lillian developed itchy eyes and sneezing.
- Tom reacted slowly when called and staggered slightly.
- Aisha complained of blurred vision in dim light.

The health club recorded the following:

Parameter	Musa	Lillian	Tom	Aisha	Normal
Blood oxygen saturation (%)	82	96	88	95	95–100
Carboxyhaemoglobin (%)	18	1	10	1	<2
Heart rate (beats/min)	120	90	110	85	70–100
Reaction time (s)	0.32	0.19	0.30	0.18	0.18
Tear secretion	Normal	High	Normal	Normal	Normal
Rod cell response (retina test)	Normal	Normal	Normal	Low	Normal

Later it was discovered that traffic had been heavy and some students had not eaten or drunk water all morning.

TASK

- (a) Using the data, explain how carbon monoxide exposure, dehydration, allergic reactions, and sensory receptor function affected the students' oxygen transport, heart activity, nervous coordination, and vision.
- (b) Suggest practical strategies to prevent such conditions during outdoor school activities.

ITEM 4

During a school mountain hiking trip to the slopes of Mount Elgon (elevation 3000 m), students participated in a survival challenge. The weather was cold (10 °C), and the air was thin.

Two students, Musa and Joel, showed unusual responses:

- Musa complained of headache and dizziness. His lips appeared slightly blue.
- Joel fainted briefly near a charcoal stove used for cooking inside a tent.
- Both had increased breathing rates.
- Later that night, some students developed itchy rashes after eating packed groundnuts.
- One student, Aisha, had recently received a tetanus booster vaccine.
- Rapid malaria test kits were used on two febrile students and were negative.

The teacher recorded the following:

Parameter	Musa	Joel
Breathing rate (breaths/min)	30	28
Pulse rate (beats/min)	120	130
Blood oxygen saturation (%)	82	78
Carboxyhaemoglobin level (%)	2	25
Core body temperature (°C)	35.5	36.8
Urine output	Low	Normal

The school nurse suspected problems related to oxygen transport, temperature regulation, immunity, and nerve function.

TASK

- Analyse the physiological causes of Musa's and Joel's symptoms by linking oxygen dissociation, haemoglobin function, carbon monoxide effects, nervous and hormonal control of heart rate, hypothalamic temperature regulation, histamine action, vaccination, and rapid test kit mechanisms.
- Propose biologically justified preventive and management strategies for future mountain hikes.

PART II

Attempt one item from this section

ITEM 6

In the bean-growing regions of eastern Uganda, farmers are battling an outbreak of black bean aphids (*Aphis fabae*). A researcher from Makerere University found that the aphids exist in two main strains: one that is resistant to a common pyrethroid pesticide, and one that is susceptible. The resistance is controlled by a dominant allele (R). The aphids also vary in their colour: some are shiny black, while others are dull brown. The colour is controlled by a separate gene (B for black, dominant over b for brown). The researcher performed a cross between a true-breeding resistant, black aphid and a true-breeding susceptible, brown aphid. The F1 generation were all resistant and black. However, when these F1 males were crossed with susceptible, brown females (a test cross), the offspring were not in a 1:1:1:1 ratio. The 500 offspring produced were:

- Resistant, Black: 205
- Resistant, Brown: 45
- Susceptible, Black: 48
- Susceptible, Brown: 202

The researcher also noted that ladybird beetles (a natural predator of aphids) prefer to eat the brown aphids, as they are more visible against the green bean leaves.

Task: Analyse the genetic data from the test cross to explain the inheritance pattern of the resistance and colour genes, predict how the interaction between pesticide use and predator preference will affect the allele and phenotype frequencies in the aphid population over time, and propose an integrated pest management strategy for farmers that combines chemical and biological controls sustainably.

ITEM 7

In the rice-growing region of Jinja District, farmers have noticed that brown planthoppers are causing reduced yields despite pesticide application. Observations include:

- Some planthoppers carry alleles for pesticide resistance showing incomplete dominance.
- Resistant allele frequency increased from 10% to 55% over four years.
- Paddy fields with high bird populations report fewer planthoppers, while frog populations have declined.
- Waterlogged fields favour planthopper nymph survival, increasing over the wet season.
- Some planters practice crop rotation; others leave paddies fallow.

Task: Analyse the genetic, ecological, and population factors contributing to the increase in pesticide-resistant planthoppers and propose a sustainable, biologically informed pest management strategy for Jinja rice fields.

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SELF-STUDY A-LEVEL BIOLOGY COMPETENCY-BASED TEXT-BOOK

NOTES: SCENARIO ITEMS: EXAM PAPERS



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END

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