Student's Name:.....

Signature.....

Random No.						Personal No.		

BIOLOGY
PAPER 1
(Theory)
3 Hours

BIOCLASS HUB

RESOURCE MOCK SET ONE 2026
BIOLOGY
3 HOURS

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* **two ITEMS**.
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*

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SECTION A
This section is compulsory

ITEM 1

In Kampala, a fast-growing poultry processing plant supplies chicken to major markets. Recently, consumers reported meat that spoils quickly, has a sour smell, and causes stomach illness.

Veterinary officers observed:

- Birds show rapid breathing and weak muscle coordination before slaughter
- Meat tissue appears soft with excessive water loss
- Microscopy of muscle cells shows swollen mitochondria and disrupted membranes
- Lab tests detected traces of cyanide-like compounds from contaminated feed
- Genetic screening revealed increased mutations in genes controlling cell division

The factory uses enzyme-based tenderizers and stores meat in warm conditions during transport.

Table: Cellular and Biochemical Observations

Parameter	Normal chicken	Affected chicken
Oxygen consumption (mg O_2/g/min)	7.8	3.5
ATP production (%)	100	40
Enzyme activity (protease %)	85	30
Mutation rate in DNA (%)	2	18
Muscle water content (%)	60	78
Mitochondrial integrity (%)	95	50

Task

(a) Explain how disruption of mitochondrial structure, enzyme inhibition, and DNA mutations affect respiration, protein synthesis, membrane function, and tissue structure leading to poor meat quality.

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(b) Propose practical measures that could restore safe poultry production and protect consumer health based on the observed findings.

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ITEM 2

Farmers in Moroto District reported that their sorghum crops initially grow well but later show leaf curling, reduced height, and low grain production. The region experiences high temperatures, low rainfall, and strong sunlight.

Field observations showed:

- Leaves are narrow with thick cuticles
- Stomata remain closed during the day
- Plants produce high levels of abscisic acid (ABA)
- Some wild grasses nearby show Kranz anatomy
- Farmers plant mainly C3 crops

Table: Plant Responses Under Field Conditions

Parameter	Sorghum crop	Wild grasses
Photosynthetic rate (%)	45	85
Stomatal opening (%)	30	70
ABA levels	High	Moderate
Water loss (%)	25	10
Growth rate (%)	50	80

Task

(a) Explain how stomatal behaviour, photosynthetic pathways, and chloroplast processes affect plant performance under water stress.

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(b) Suggest changes in crop selection and field practices that could improve productivity in this environment.

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SECTION B
PART I
Attempt one item from this section

ITEM 3

In Kampala City, several charcoal vendors working in enclosed stalls have reported headaches, dizziness, blurred vision, and occasional fainting during busy trading hours. One vendor collapsed while serving customers.

Health officers observed:

- Poor ventilation in stalls
- Burning charcoal throughout the day
- Reduced alertness and slow reaction to visual signals
- Rapid breathing but low oxygen saturation

A small investigation was conducted:

Parameter	Vendor A	Vendor B	Normal Range
Blood oxygen saturation (%)	82	85	95–100
Carboxyhaemoglobin (%)	18	15	0–2
Heart rate (beats/min)	120	110	60–80
Breathing rate (breaths/min)	30	28	12–20
Reaction time to light (s)	0.35	0.32	0.20
Body temperature (°C)	37.8	37.5	36.5–37.2

Further observations:

- Vendors complained of dry mouth and passed little urine
- Some showed red eyes and mild swelling
- Rapid test kits for infection were negative

Task

(a) Use the data to explain how carbon monoxide exposure affected oxygen transport, nervous coordination, heart activity, and behaviour of the vendors.

(b) Suggest measures that could reduce the health risks and improve physiological stability of the vendors.

ITEM 4

During a football tournament in Mbarara, injured players were treated with local anaesthetics to reduce pain and continue playing. However, several players later showed poor coordination, delayed responses to visual and auditory signals, and difficulty tracking fast-moving objects such as the ball.

Medical officers observed that the affected players:

- Had reduced sensitivity to light and difficulty focusing on moving objects
- Responded slowly to visual stimuli
- Showed poor spatial awareness and judgement
- Had delayed overall response to environmental changes

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Data collected:

Parameter	Player A	Normal
Reaction time to visual stimulus (s)	0.30	0.18
Synaptic transmission rate	Low	Normal
Visual acuity (clarity of vision)	Reduced	Normal
Retina response efficiency	Low	High
Balance test (seconds stable)	8	25
Heart rate during activity (beats/min)	95	120

Further findings:

- Reduced transmission of impulses from photoreceptors in the retina
- Temporary blockage of sodium ion channels in neurone membranes
- Reduced efficiency of synaptic transmission in visual pathways
- Evidence of impaired synaptic convergence in retinal and brain circuits
- No structural damage to the eye was detected

Task

(a) Explain how local anaesthetics disrupt coordination by affecting retinal function, transmission of impulses along neurones, synaptic transmission, synaptic convergence, and processing in the central nervous system.

(b) Suggest safe ways to manage recovery while maintaining effective visual coordination and nervous system function.

PART II
Attempt one item from this section

ITEM 5

In the Busoga region, cassava farmers report severe crop losses due to a rapid increase in whiteflies over the past 6 years, despite continuous pesticide use.
Field observations indicate that resistance to pesticide is controlled by a gene with two alleles:
R = resistance (dominant)
r = susceptibility (recessive)
Whiteflies with RR and Rr genotypes survive spraying, while rr individuals are eliminated.
Further findings show:

- Initial frequency of susceptible whiteflies (rr) was 64% before pesticide use
- After several years, the susceptible population reduced to 16%
- Farmers repeatedly use the same pesticide
- Natural predators such as ladybirds have declined
- Cassava fields are fragmented due to land subdivision
- Warmer temperatures have increased breeding cycles

Assuming the population was initially in Hardy–Weinberg equilibrium, the increase in resistant whiteflies has led to reduced cassava yields, increased prices, and seasonal food shortages.

Task. Using the information provided, determine the initial and current allele frequencies of resistance, explain how inheritance, natural selection, and ecological changes have increased whitefly populations, and propose sustainable strategies to restore cassava production and food security.

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ITEM 6

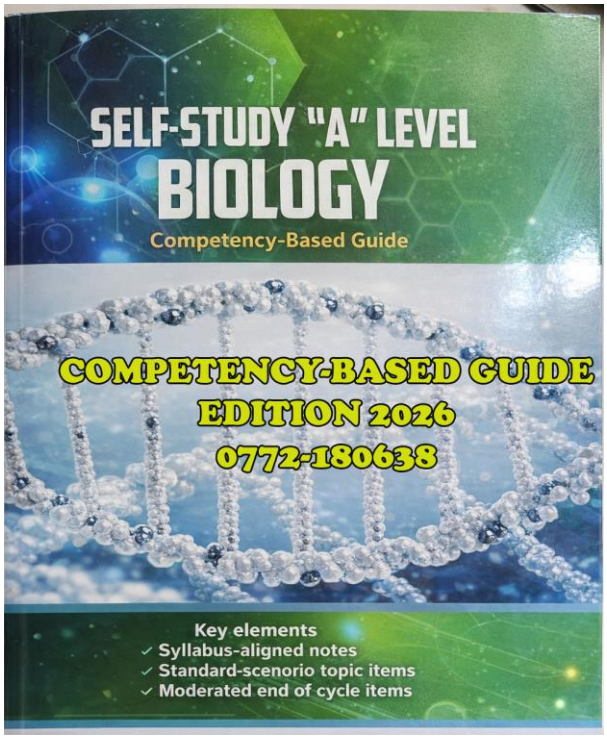
In Bushenyi District, banana plantations are declining due to increasing weevil infestation, while farmers also report accumulation of toxic pesticide residues in soils and nearby water sources, raising concerns about contamination along the food chain.

Field observations show:

- Weevils possess genes controlling pesticide resistance and high reproductive rate.
- A breeding experiment was carried out by crossing homozygous resistant, fast-reproducing weevils (RRFF) with susceptible, slow-reproducing weevils (rrff), and the F_2 generation showed a ratio close to 3:1 for resistance.
- Farmers practice monoculture farming, reducing genetic diversity
- Continuous pesticide use has led to toxin accumulation in soil organisms, which are eaten by birds and other predators
- Soil fertility has reduced, and organic waste has increased breeding sites.
- Some banana varieties show better tolerance to weevil damage.

As a result, banana yields and farmer income have declined, while toxin levels appear to increase along the food chain, affecting birds and other organisms.

Task. Evaluate how genetic inheritance, population dynamics, ecological interactions, and toxin accumulation along food chains contribute to weevil infestation and banana decline and propose sustainable management strategies.



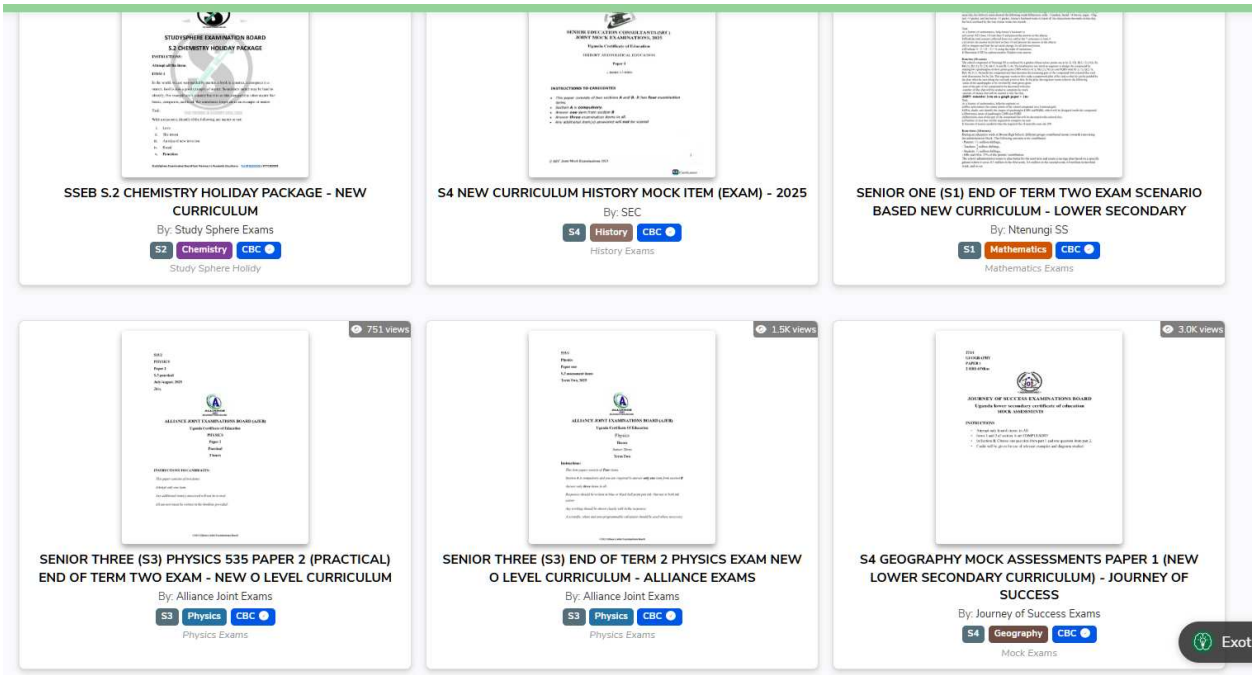
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