553/1
BIOLOGY
Paper 1
20242 ½
HOURS

YAAKA EXAMINATIONS

Uganda Certificate of Education

INSTRUCTIONS TO CANDIDATES

This paper consists of **seven** *examination items. It has two sections;* **A** *and* **B**.*Section* **A** *has* **three** *compulsory items.*
Section **B** *has two Parts;* **I** *and* **II**. *Answer* **one** *item from each part.Answer* ***five*** *items in all.*
Any additional item(s) answered will not be scored.

FOR EXAMINER'S USE ONLY			
SECTION	**ITEM**	**SCORE(S)**	**EXAMINER'S SIGNATURE**
A	1		
	2		
	3		
B	4		
	5		
	6		
	7		
TOTAL			

Section A (Compulsory Questions)

Item 1

Mr. Wanyama, a seasoned farmer in Eastern Uganda, prepared his land meticulously for the planting season. With great care, he selected a new variety of maize seeds touted for their high yield and disease resistance. However, as the weeks passed, he noticed a worrying trend—many of the maize plants were stunted, their leaves turning yellow. Despite using fertilizers and watering diligently, the plants failed to thrive, and the expected lush green fields were replaced with struggling crops. Mr. Wanyama's dream of a bountiful harvest now seemed distant. He wondered, what went wrong?

Task:

(a). Identify the nutrient deficiency likely affecting Mr. Wanyama's maize plants.

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(b). Explain how this deficiency disrupts essential processes in the plant.

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(c). Suggest methods to improve plant nutrition in future growing seasons.

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Item 2

Kipsang, a renowned long-distance runner, had spent months training at high altitudes, pushing his body to adapt to the thin air. On the day of the big race, he was in high spirits. After a heavy breakfast filled with carbohydrates, he warmed up, feeling energized and ready. The race was grueling, but Kipsang's training paid off—he was in the lead. However, as he neared the finish line, his muscles began to cramp, and he could barely breathe. Still, he pushed through, crossing the line in first place. Despite his victory, the intense cramps and breathlessness lingered.

Task:

(a). What caused his body to struggle in those final moments?

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(b). Explain how high-altitude training improved Kipsang's performance.

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(c). Describe how the body uses carbohydrates during intense exercise.

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(d). Suggest strategies Kipsang could use to prevent muscle cramps in future races.

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Item 3

Masendi Market was bustling with activity. Vendors sold fresh produce and meat, with stalls overflowing into a nearby swamp. As weeks passed, the market's hygiene began to decline. Rubbish littered the ground, and the swamp's water, once clear, became polluted. Soon, health workers reported a spike in diarrhea, cholera, and malaria cases among the vendors and their customers. Amid the chaos, local leaders realized that the market's expansion into the swamp and poor waste management had caused an environmental and public health crisis.

Task:

(a). Assess the environmental impacts of the market's expansion into the swamp.

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(b). Suggest immediate actions to mitigate the health risks and restore environmental balance.

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Section B

Part 1

Item 4

John, a bright ten-year-old, was returning from school when a tragic accident occurred. He was rushed to the hospital, where doctors determined he needed an urgent blood transfusion. As John lay unconscious, his family anxiously gathered. His blood type was B, but none of his family members had the same blood type—his mother was type A, his sister AB, and his younger brother O. With time running out, the doctors had to decide quickly. Would anyone be able to help John in his time of need?

Task:

(a). Identify which family member can safely donate blood to John.

(b). Explain why blood compatibility is critical in transfusions.

Item 5

After the birth of their child, Sarah and David were devastated to learn that their baby had sickle cell anemia, a condition neither of them fully understood. David was overwhelmed with guilt and anger, blaming Sarah for their child's suffering. Unsure of what to do, they sought advice, desperate to understand how this could happen and what they could do to care for their child. Their story reflects the struggles of many families faced with the impact of inherited disorders.

Task:

(a). Explain how sickle cell anemia is inherited and why neither parent is to blame.

(b). Suggest ways the couple can manage the condition and support their child.

Part 2

Item 6

During a biology class, students examined blood samples under a microscope. One sample had cells that looked different—elongated and oddly shaped. The teacher explained that these were sickle cells, and a student asked how such abnormalities could affect a person's health. Through this engaging lesson, students learned about the impact of genetic mutations on cellular function and human health.

Task:

(a). Identify the condition associated with the abnormal cells observed.

(b). Discuss how these cell abnormalities can affect overall health.

Item 7

A once-thriving savanna faced severe drought, leading to dwindling waterholes and the migration of herbivores. Predators struggled to find prey, and the entire food web was strained. Conservationists stepped in, implementing measures to restore the savanna's balance and ensure the survival of its diverse species.

Task

(a). Explain how drought impacts food webs in savanna ecosystems.

(b). Discuss the importance of water sources in maintaining savanna biodiversity.

(c). Propose strategies to mitigate the effects of drought on savanna ecosystems.

END

MARKING GUIDE TO THE ABOVE TASKS

Item 1: Mr. Wanyama's Maize Plants

(a). Nutrient Deficiency Likely Affecting the Maize Plants

The most likely nutrient deficiency affecting Mr. Wanyama's maize plants is Nitrogen deficiency. Nitrogen is essential for chlorophyll production, and its deficiency often leads to yellowing leaves (chlorosis), stunted growth, and poor plant development.

(b). Disruption of Essential Processes

Nitrogen deficiency disrupts several essential processes in plants, including chlorophyll production, which is crucial for photosynthesis. Without sufficient nitrogen, plants cannot synthesize proteins and enzymes effectively, leading to reduced photosynthesis rates, poor energy production, and inhibited growth. This ultimately results in stunted plants and low yields.

(c). Methods to Improve Plant Nutrition

To improve plant nutrition, Mr. Wanyama can:

- Use Nitrogen-Rich Fertilizers: Apply fertilizers rich in nitrogen, such as urea or ammonium nitrate, to the soil.
- Incorporate Organic Matter: Adding compost or manure enriches the soil with organic nitrogen, improving plant nutrition.
- Crop Rotation: Rotate crops with legumes (e.g., beans) that fix nitrogen in the soil, enhancing soil fertility for subsequent crops.
- Soil Testing: Regularly test the soil to monitor nutrient levels and adjust fertilizer applications accordingly.

Item 2: Kipsang's Race Performance

(a). Cause of Kipsang's Struggles

Kipsang's body struggled in the final moments due to muscle cramps and breathlessness, which were likely caused by lactic acid buildup resulting from anaerobic respiration during intense exercise. As the muscles work harder, they require more oxygen than the body can supply, leading to anaerobic respiration and the accumulation of lactic acid, causing cramps.

(b). Effect of High-Altitude Training

High-altitude training improves performance by stimulating the production of more red blood cells, which enhances oxygen-carrying capacity. This adaptation increases endurance and stamina, making athletes more efficient at utilizing oxygen during intense exercise.

(c). Carbohydrate Use During Intense Exercise

During intense exercise, the body breaks down carbohydrates into glucose, which is converted into ATP (adenosine triphosphate), the primary energy currency of cells. Carbohydrates are the preferred energy source because they provide quick energy through glycolysis and aerobic respiration, crucial during high-intensity efforts.

(d). Strategies to Prevent Muscle Cramps

Kipsang can prevent muscle cramps by:

- Hydration: Ensure adequate fluid intake before, during, and after races to prevent dehydration, a key factor in cramping.
- Electrolyte Balance: Consume foods or drinks rich in electrolytes (potassium, magnesium, sodium) to maintain muscle function.
- Proper Warm-Up: Engage in thorough warm-ups and stretches to prepare muscles for exertion.
- Gradual Intensity Increase: Gradually increase training intensity to condition muscles and avoid sudden high demands.

Item 3: Environmental and Health Impacts of Market Expansion
(a). Environmental Impacts of Market Expansion into the Swamp

The market's expansion into the swamp has several environmental impacts, including habitat destruction, water pollution from waste, and disruption of the natural ecosystem. These changes degrade water quality, leading to reduced biodiversity and altered ecosystem functions.

(b). Mitigation Measures

Immediate actions to mitigate health risks include:

- Clean-Up Campaigns: Organize community clean-ups to remove waste from the swamp and market area.
- Proper Waste Management: Implement waste segregation and disposal systems to prevent future pollution.
- Health Education: Educate vendors and customers on hygiene practices to reduce the spread of diseases.
- Construct Proper Market Facilities: Build appropriate stalls and drainage systems to contain waste and limit environmental impact.

Section B
Part I
Item 4: Blood Transfusion Case

(a). Family Member Who Can Safely Donate Blood to John:

John can safely receive blood from his younger brother, who has blood type O. Blood type O is a universal donor for all other blood types, making it compatible with John's type B blood.

(b). Importance of Blood Compatibility:

Blood compatibility is critical in transfusions because incompatible blood can cause severe immune reactions. The recipient's body can reject the transfused blood, leading to complications such as hemolysis, kidney failure, or even death.

Item 5: Sickle Cell Anemia Case

(a). Inheritance of Sickle Cell Anemia and Blame:

Sickle cell anemia is inherited when both parents carry the sickle cell trait (HbAS). It is a genetic condition caused by a recessive gene; neither parent is to blame, as they each carry one normal gene and one sickle cell gene.

(b). Managing the Condition and Supporting the Child:

- Regular medical check-ups and vaccinations to prevent infections.
- Pain management techniques and medications for crises.
- Educate the family on recognizing symptoms of complications early.
- Ensure the child stays hydrated and avoids extreme temperatures.

Part II

Item 6: Abnormal Blood Cells in Class Observation

(a). Condition Associated with Abnormal Cells:

The condition observed is Sickle Cell Anemia, where red blood cells become sickle-shaped due to a genetic mutation affecting hemoglobin.

(b). Health Effects of Sickle Cells:

Sickle cells can block blood flow, leading to pain, organ damage, increased risk of infection, and reduced oxygen delivery to tissues. This can cause severe complications, including stroke and acute chest syndrome.

Item 7: Drought in the Savanna Ecosystem

(a). Impact of Drought on Food Webs:

Drought reduces water availability, leading to the decline of primary producers (plants), which disrupts the entire food web. Herbivores migrate or die, affecting predator populations and overall ecosystem stability.

(b). Importance of Water Sources:
Water sources are crucial in maintaining biodiversity, as they support plant growth, provide drinking water for animals, and sustain aquatic ecosystems critical for food chains.

(c). Strategies to Mitigate Drought Effects:

- Implement water conservation practices and artificial waterholes.
- Reforestation to enhance rainfall retention.
- Introduce drought-resistant plant species to stabilize food availability.
- Controlled grazing to prevent overuse of available vegetation.

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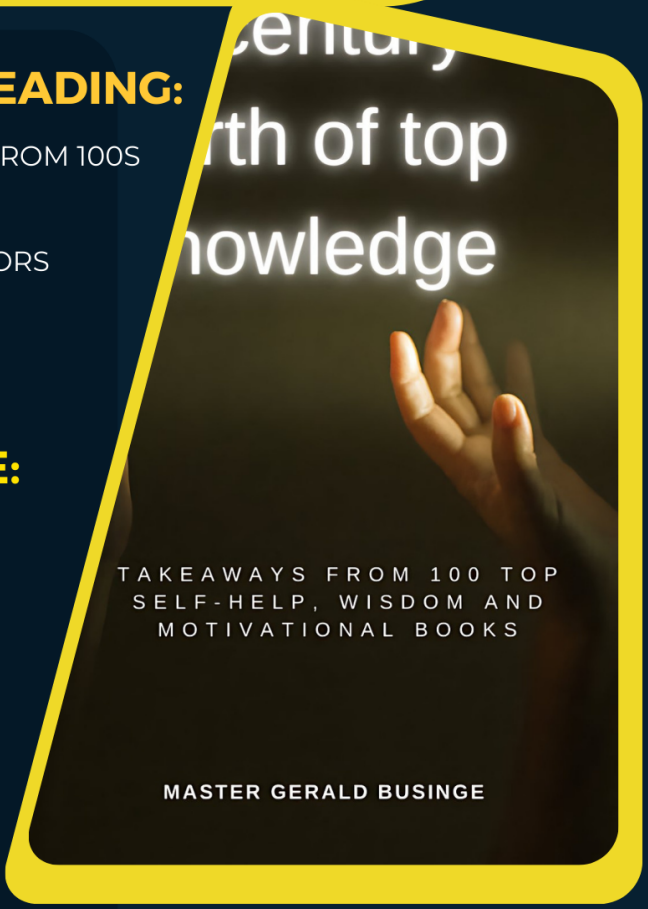

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