EBENEZER CHRISTIAN SS NAMULANDA

COMPETENCE BASED ASSESSMENT 2025

MID-TERM 3 EXAMS 2025

S.5 BIOLOGY 1

TIME : 2 ½ HOURS

NAME …… SIGN……

INSTRUCTIONS

Attempt all items

ITEM 1

During the final seconds of a 400 m sprint, athlete Nia feels her muscles tightening and her speed dropping sharply.

After the race, laboratory results show that:

Blood lactate concentration has tripled compared to pre-race levels.

Muscle ATP levels remain higher than expected despite the low oxygen supply.

Her coach wonders how her cells managed to keep producing energy so quickly under these stressful conditions.

You are part of a student biology team asked to explain what might be happening inside Nia's muscle cells during this sprint.

Task

(a) Describe the metabolic pathway that could still operate effectively when oxygen is scarce, and identify the molecule that acts as its initial substrate. Infer how many ATP molecules are likely to be available per molecule of this substrate in such conditions.

(b) The lab technician notes that pyruvate levels are unusually low while lactate levels are high.

(i) Explain what this pattern suggests about how cells are handling pyruvate and why this adaptation might be necessary

(ii) Discuss how scientific knowledge of glycolysis can be applied ethically to improve performance without compromising integrity

Item 2

Two athletes Angel, who trains at sea level, and Kato, who trains in the highlands run side by side during an international competition held in Nairobi (high altitude).

Despite breathing the same air, Angel quickly tires, while Kato maintains his pace effortlessly.

Later tests reveal that Kato's haemoglobin releases oxygen to his muscles more easily than Angel's under the same partial pressure of oxygen

Task

(a) Identify the type of curve that could explain this difference and describe what it shows about oxygen binding and suggest which athlete's curve is shifted to the right and explain how this helps under low-oxygen conditions

(b) Predict what might happen to Angel's performance if her blood became more acidic during intense exercise and discuss whether using artificial methods to induce such a shift (like "blood doping") is a fair or ethical way to improve performance.

(c) Reflect on why a scientist must remain objective and evidence-driven when comparing physiological adaptations between individuals.

Item 3

During a school marathon, Liam suddenly feels dizzy and light-headed.

At the clinic, his ECG shows irregular spacing between the QRS complexes.

The doctor explains that the problem may not be in his heart muscle, but in the system that initiates and coordinates the heartbeat.

She also notes that stress and caffeine intake might be influencing his heart rhythm.

Task

(a) Describe the two key structures that normally start and coordinate electrical impulses in the heart and State what ensures that the atria contract before the ventricles.

(b) Using reasoning, explain why Liam's ECG pattern might show irregular intervals if one of these control points fails. Discuss how nervous or hormonal signals could further influence his heart rate during stress.

(c) (i) Suggest a physiological response the body might trigger to restore blood pressure when the heart rate drops suddenly

(ii). Liam's friends suggest using energy drinks to boost his heart rate before sports.

Evaluate this idea in terms of scientific understanding and responsible health decisions and reflect on why a biologist or medic should remain honest, calm, and evidence-based when explaining heart rhythm disorders to anxious patients

Item 4

During a routine check-up, three lab slides from different patients show clusters of epithelial cells packed with vesicles.

One slide comes from the pancreas, another from the skin, and another from the stomach lining.

Curiously, all three patients show unusual secretions one produces excess oil, one struggles with digestion, and one has fluctuating blood sugar.

The biologist suspects that the same type of tissue behaves differently in each case

Task

(a) describe what key feature identifies a cell as glandular rather than a typical covering epithelium and explain how the mode of secretion (merocrine, apocrine, or holocrine) could account for the different secretions in the three patients.

(b) If you had to identify which slide belonged to the endocrine gland, explain which clues you would look for under the microscope and why.

(c) A scientist proposes using artificial gland implants to replace damaged secretory cells.

(i) Discuss one ethical concern and one potential benefit of this idea and reflect briefly on how a biologist should respond when data about tissue behavior contradict their initial assumptions.

END

IF U'RE GOING THROUGH HELL, KEEP GOING.