THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

733/1 **BIOLOGY 1**

Time: 3 Hour. **ANSWERS** **Year: 2006**

Instructions

1. This paper has Section A, B and C.
2. Answer **all** questions from Section A and **two (2)** questions from Section B and C each.
3. Section A and B carry 30 marks each and Section C carries 40 marks.
4. Mobile phones are not allowed inside the examination room.
5. Write your Examination Number on every page of your answer booklet.

SECTION A (30 Marks)

Answer all questions from this section.

1. Define homeostasis and give four examples in humans.

Homeostasis is the ability of an organism to maintain a stable internal environment despite changes in external conditions. It ensures that physiological processes operate within optimal ranges.

The regulation of body temperature at around 37°C is an example of homeostasis. When the body overheats, mechanisms like sweating and vasodilation help cool it down.

Control of blood glucose levels is another example. The pancreas secretes insulin to lower glucose and glucagon to raise it, maintaining balance.

Osmoregulation maintains the water and salt balance in the body. The kidneys play a key role by adjusting the amount of water reabsorbed or excreted.

Regulation of blood pH is also part of homeostasis. The body uses buffer systems, breathing rate, and kidney function to maintain pH around 7.4.

2. List four differences between prokaryotic and eukaryotic cells.

Prokaryotic cells lack a true nucleus; their genetic material is free in the cytoplasm, while eukaryotic cells have a membrane-bound nucleus enclosing their DNA.

Prokaryotic cells do not contain membrane-bound organelles like mitochondria or Golgi apparatus, while eukaryotic cells possess such organelles.

Prokaryotes are generally smaller in size, usually 1–10 micrometers, whereas eukaryotic cells are larger, typically 10–100 micrometers.

Prokaryotic cells usually reproduce through binary fission, a simpler process, while eukaryotic cells undergo mitosis or meiosis, which are more complex.

3. State four factors that influence enzyme activity.

Temperature affects enzyme activity. Each enzyme works best at an optimum temperature; too high can denature the enzyme, and too low slows down the reaction.

pH levels influence enzyme structure and function. Each enzyme has an optimal pH range, and deviations can alter its shape and reduce activity.

Substrate concentration impacts the rate of reaction. More substrate increases enzyme activity up to a point, after which the rate plateaus as enzymes become saturated.

The presence of inhibitors, which may be competitive or non-competitive, can reduce enzyme activity by blocking or altering the active site.

4. Outline four components of blood and their functions.

Red blood cells (erythrocytes) carry oxygen from the lungs to tissues using hemoglobin, and also assist in transporting carbon dioxide to the lungs.

White blood cells (leukocytes) defend the body against infection by engulfing pathogens and producing antibodies.

Platelets (thrombocytes) help in blood clotting by clumping at injury sites and releasing chemicals that initiate clot formation.

Plasma is the liquid component that carries nutrients, hormones, waste products, and heat throughout the body.

5. Mention four structural adaptations of plant roots for absorption.

Root hairs increase the surface area for absorption, allowing more water and minerals to enter the root.

Thin walls in root hair cells facilitate the easy passage of water and dissolved substances into the cell.

Large vacuoles in root cells store absorbed water and help maintain osmotic pressure for continuous absorption.

The presence of permeable cell membranes helps selectively absorb useful ions and water from the soil.

6. State four functions of the human liver.

The liver detoxifies harmful substances, such as drugs and alcohol, making them less dangerous for the body.

It produces bile, which aids in the digestion and emulsification of fats in the small intestine.

The liver stores glycogen, a form of glucose, and releases it into the bloodstream as needed to regulate blood sugar levels.

It metabolizes proteins and converts excess amino acids into urea, which is then excreted by the kidneys.

7. List four routes through which water is lost from the body.

Water is lost through urination, where the kidneys filter excess water and waste from the blood.

Sweating eliminates water and salts through the skin, especially during physical activity or hot weather.

Water vapor is lost through exhalation during breathing, particularly in cold or dry environments.

Defecation removes water along with undigested waste from the digestive tract.

8. Give four examples of non-communicable diseases and their causes.

Diabetes is caused by insufficient insulin production or poor cellular response to insulin.

Hypertension (high blood pressure) often results from poor diet, lack of exercise, and genetic factors.

Cancer arises from uncontrolled cell division due to genetic mutations or environmental triggers like radiation.

Asthma is caused by chronic inflammation and sensitivity of the airways, often influenced by allergens and environmental factors.

9. State four advantages of classroom demonstrations in Biology teaching.

Demonstrations make abstract concepts concrete, helping students visualize and understand difficult processes.

They capture student interest and attention, increasing motivation and engagement during the lesson.

Demonstrations provide real-time learning, allowing students to observe biological processes as they happen.

They promote critical thinking and inquiry as students can ask questions and hypothesize about what they observe.

10. Mention four features of an effective learning objective.

A good learning objective is specific, clearly stating what learners should achieve.

It is measurable, meaning that the outcome can be assessed or evaluated.

The objective is achievable and realistic based on the learners' level and lesson duration.

It is time-bound, indicating the period within which the learning goal should be accomplished.

SECTION B (30 Marks)

Answer two questions from this section.

11. Discuss the carbon cycle and its importance to ecosystems.

The carbon cycle refers to the continuous movement of carbon among the atmosphere, biosphere, hydrosphere, and geosphere through processes such as photosynthesis, respiration, decomposition, and combustion.

During photosynthesis, green plants absorb carbon dioxide from the atmosphere and use it to produce glucose. This is the main method through which carbon enters the biological parts of the ecosystem.

When animals feed on plants, they absorb carbon into their bodies. Both animals and plants release carbon dioxide back into the atmosphere through respiration, thereby maintaining atmospheric carbon levels.

Decomposition of dead organisms by bacteria and fungi returns carbon to the soil and atmosphere, ensuring that nutrients are recycled within the ecosystem.

Combustion of fossil fuels and biomass releases stored carbon back into the atmosphere as carbon dioxide. This process has been intensified by human activities, contributing to climate change.

The carbon cycle is vital for regulating Earth's temperature, supporting plant life, and maintaining a balance of carbon dioxide levels in the atmosphere.

12. Describe the human respiratory system and explain gas exchange.

The human respiratory system includes the nasal cavity, trachea, bronchi, bronchioles, lungs, and alveoli. Air enters through the nose, gets filtered, warmed, and passes through the trachea into the bronchi and bronchioles, finally reaching the alveoli.

Alveoli are small air sacs surrounded by capillaries where gas exchange occurs. Their thin walls and large surface area facilitate efficient diffusion of gases.

Oxygen in the alveoli diffuses into the capillaries and binds to hemoglobin in red blood cells. Simultaneously, carbon dioxide from the blood diffuses into the alveoli to be exhaled.

Breathing is controlled by the diaphragm and intercostal muscles. Inhalation occurs when the diaphragm contracts and flattens, creating negative pressure that draws air in. Exhalation occurs when the diaphragm relaxes, pushing air out.

Gas exchange ensures that body cells receive oxygen for cellular respiration and remove carbon dioxide, a waste product. This maintains pH balance and supports energy production in cells.

13. Explain the structure, function, and adaptations of the nephron in kidneys.

The nephron is the functional unit of the kidney, consisting of the Bowman's capsule, glomerulus, proximal tubule, loop of Henle, distal tubule, and collecting duct. Each kidney contains about a million nephrons.

The Bowman's capsule surrounds the glomerulus and is responsible for ultrafiltration of blood under high pressure, allowing water, salts, glucose, and urea to pass into the nephron while retaining blood cells and proteins.

The proximal convoluted tubule reabsorbs most of the filtered water, glucose, and useful ions back into the blood through active and passive transport mechanisms.

The loop of Henle helps in concentrating urine by creating a concentration gradient in the medulla, facilitating reabsorption of water and salts.

The distal convoluted tubule and collecting duct regulate salt and water balance under hormonal control, especially by antidiuretic hormone (ADH) and aldosterone.

Adaptations of the nephron include a large surface area, extensive blood supply, selective permeability, and the presence of microvilli in tubules to increase reabsorption efficiency.

14. Discuss five types of asexual reproduction in plants with examples.

Vegetative propagation involves the growth of new plants from vegetative parts like stems, roots, or leaves. For example, potatoes use underground stems (tubers) to reproduce.

Budding occurs when a new plant grows as an outgrowth from the parent plant. Bryophyllum reproduces through buds that develop on its leaf margins.

Fragmentation happens when a plant breaks into pieces, and each piece develops into a new plant. This is common in algae like Spirogyra.

Spore formation involves producing spores that can grow into new individuals under favorable conditions. Ferns and fungi commonly reproduce this way.

Apomixis is the formation of seeds without fertilization. Some grasses and dandelions reproduce through this method, producing offspring genetically identical to the parent.

SECTION C (40 Marks)

Answer two questions from this section.

15. During a microteaching on transpiration, learners give contrasting explanations. Explain six reflective steps to guide their conceptual clarity.

The first step is to review the teaching approach used during the lesson. As the teacher, I would reflect on whether the explanation of transpiration was clear and aligned with the learners' level of understanding.

Secondly, I would use targeted questioning to assess what the learners understood and where their misconceptions lie. This helps in identifying the exact points of confusion among students.

Next, I would provide an accurate, simplified definition of transpiration and use a step-by-step explanation, preferably with diagrams, to reinforce the correct concept.

I would also involve students in a quick practical activity, such as observing water loss from leaves using cobalt chloride paper or a potometer, to give them experiential understanding.

To consolidate learning, I would encourage students to explain the concept in their own words and compare answers in pairs or groups. This peer discussion often helps correct misconceptions.

Lastly, I would assess their understanding with a short quiz or oral questions and revisit any points that are still unclear, ensuring that all learners leave with the correct understanding.

16. A lab assistant breaks a reagent bottle before a dissection class. Describe six actions you would take to manage safety, maintain lesson flow, and support learners.

The immediate step would be to secure the area by keeping students away from the broken glass and spilled reagent to prevent accidents or exposure.

I would then alert the lab assistant or another staff member to assist in cleaning the spill using proper protective equipment such as gloves and a dustpan, following lab safety protocol.

While the cleanup is underway, I would engage the class in a discussion or brainstorming activity related to the dissection topic to maintain lesson continuity.

I would improvise by using preserved specimens, charts, videos, or models if the actual dissection cannot proceed due to the loss of the reagent.

To turn the incident into a learning opportunity, I would involve learners in a safety talk, reinforcing lab rules and procedures in the context of the current situation.

Finally, I would make arrangements with the lab or administration to replace the reagent and schedule a make-up session if needed to complete the dissection.

17. You observe inconsistent student performance in a quiz on genetics. Propose six steps to diagnose the problem and strengthen understanding.

I would begin by analyzing the quiz results to identify specific questions or topics where most students performed poorly, which helps pinpoint the exact areas of weakness.

Next, I would conduct a class discussion to clarify students' misconceptions and encourage them to express which areas they found difficult and why.

I would review my previous lesson notes and teaching strategies to check if I had covered all critical concepts of genetics adequately and in a student-friendly manner.

After identifying gaps, I would reteach those specific topics using different instructional strategies such as concept mapping, storytelling, or visual aids.

I would provide targeted practice exercises and follow-up quizzes to reinforce understanding and track improvement in individual and class performance.

To support slower learners, I would organize remedial sessions or peer tutoring groups to give them extra help outside normal class time.

18. Electricity fails halfway through practical enzyme demonstration. Outline six adaptive strategies to continue the lesson effectively.

I would first reassure students and remain calm, emphasizing that learning can continue even without electricity, and adapt quickly to maintain student focus.

If alternative light sources like windows or solar lamps are available, I would reposition the class and materials to ensure visibility for all learners.

Instead of using the live demonstration, I would switch to showing pre-printed diagrams or charts explaining enzyme-substrate interaction and experimental setup.

I could use a verbal demonstration by narrating step-by-step what would happen during the experiment and involve students by asking them to predict results and observations.

To maintain engagement, I would involve students in role-playing the process using classroom materials or simulate the enzyme reaction using basic items like starch and iodine.

Lastly, I would assign follow-up work such as writing expected results, drawing conclusions from theoretical data, or preparing a short report to consolidate the lesson despite the disruption.