THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

733/1 **BIOLOGY 1**

Time: 3 Hour. **ANSWERS** **Year: 2012**

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. State four characteristics of living organisms that distinguish them from non-living things.

Living organisms carry out metabolism, which includes all chemical reactions involved in maintaining life. This distinguishes them from non-living things that do not exhibit such biochemical processes.

Another distinguishing feature is growth. Living organisms grow by increasing in size or number of cells, whereas non-living things do not grow in a biological sense.

Living organisms respond to stimuli. They can detect and react to changes in their environment, such as light, temperature, or pressure. Non-living things do not have this responsiveness.

Lastly, reproduction is unique to living organisms. They have the ability to produce offspring either sexually or asexually, ensuring the continuity of their species. Non-living things do not reproduce.

2. Mention four functions of the human skeletal system.

The skeletal system provides structural support for the body. It forms the framework that maintains the body's shape and allows it to stand upright.

It facilitates movement by serving as points of attachment for muscles. When muscles contract, they pull on bones, resulting in motion.

The skeleton also protects internal organs. For example, the skull encloses the brain, and the rib cage shields the heart and lungs.

Additionally, bones are involved in the production of blood cells. The bone marrow within certain bones produces red blood cells, white blood cells, and platelets.

3. Give four reasons why cell division is important to living organisms.

Cell division allows for growth. Multicellular organisms increase in size by producing more cells through mitosis.

It plays a crucial role in tissue repair. Damaged or worn-out cells are replaced through cell division, which maintains tissue health.

Cell division is essential for reproduction. In unicellular organisms, it is the main method of reproduction, while in multicellular organisms, meiosis produces gametes for sexual reproduction.

It also supports development and differentiation. As organisms develop from a single fertilized egg, cell division allows for specialization into various tissue types and organs.

4. Outline four features used to classify vertebrates.

One feature is the presence of a backbone or vertebral column, which supports the body and protects the spinal cord.

Another distinguishing trait is the type of skeleton. Vertebrates possess an internal skeleton made of bone or cartilage.

Vertebrates are classified based on their mode of reproduction, such as laying eggs or giving birth to live young.

They can also be classified by their method of thermoregulation. Some, like mammals and birds, are warm-blooded, while others, like reptiles and amphibians, are cold-blooded.

5. State four laboratory rules that should be observed when handling glassware.

Always inspect glassware before use to ensure it is not cracked or damaged. Using faulty glassware increases the risk of breakage and injury.

Handle glassware with care, using both hands where necessary, and avoid sudden temperature changes to prevent shattering.

Clean glassware thoroughly after use to remove any chemical residues that may be harmful or cause inaccurate future results.

Store glassware in designated places, ensuring they are placed securely and not stacked in a way that may cause toppling or breakage.

6. Briefly explain four factors that affect enzyme activity.

Temperature affects enzyme activity. Each enzyme has an optimum temperature at which it functions best. Extreme temperatures can denature the enzyme.

pH level influences enzyme action. Enzymes have specific pH ranges for optimal activity; deviation from this range reduces their efficiency or denatures them.

Substrate concentration impacts the rate of enzyme activity. An increase in substrate concentration raises the rate of reaction until the enzyme becomes saturated.

The presence of inhibitors can affect enzyme function. Competitive and non-competitive inhibitors reduce enzyme efficiency by blocking the active site or altering its shape.

7. Mention four elements commonly found in biological molecules.

Carbon is a key element found in all organic molecules, forming the backbone of carbohydrates, proteins, lipids, and nucleic acids.

Hydrogen is present in water and most organic compounds, contributing to the structure and energy content of biological molecules.

Oxygen is found in carbohydrates, fats, and proteins, and is essential for aerobic respiration and energy production.

Nitrogen is a crucial component of amino acids and nucleic acids, forming the building blocks of proteins and genetic material.

8. Outline four strategies used to prevent sexually transmitted infections (STIs).

Abstinence from sexual activity is the most effective way to prevent STIs, as it eliminates the risk of exposure.

Using condoms during sexual intercourse provides a barrier that reduces the transmission of infections.

Maintaining mutual monogamy with an uninfected partner reduces the risk of contracting STIs.

Regular medical checkups and early treatment help detect and manage STIs, preventing complications and further transmission.

9. List four teaching aids a teacher can use when teaching reproduction in flowering plants.

A real flower or dissected specimen helps students observe the parts of a flower directly, enhancing understanding of plant reproduction.

A labeled diagram or chart showing the structure of a flower allows for visual reinforcement of theoretical content.

Multimedia presentations or animations can illustrate processes like pollination and fertilization more clearly than static images.

Models of flowers, ovules, and pollen grains allow tactile learners to explore structures and processes involved in reproduction.

10. Mention four characteristics of a well-formulated learning objective.

A good learning objective should be specific, clearly stating what the learner should achieve by the end of the lesson.

It should be measurable, meaning the outcome can be assessed or evaluated through observable behavior or responses.

The objective must be achievable, considering the time, resources, and learner level available for the lesson.

It should be relevant and aligned with the overall curriculum goals, ensuring that it contributes meaningfully to learner development.

SECTION B (30 Marks)

Answer two questions from this section.

11. Explain five roles of the liver in maintaining body homeostasis.

One role of the liver in homeostasis is detoxification. The liver filters and breaks down harmful substances in the blood, such as drugs, alcohol, and metabolic waste products like ammonia. This ensures that the internal environment remains chemically stable and safe for other organs.

The liver also regulates blood glucose levels. It stores excess glucose as glycogen and releases it back into the bloodstream when needed. This buffering of glucose maintains a steady energy supply and prevents dangerous fluctuations in blood sugar.

Another key function is the synthesis of plasma proteins such as albumin and clotting factors. Albumin maintains osmotic pressure, which controls the movement of fluids between blood vessels and body tissues, helping to regulate fluid balance.

The liver is responsible for the metabolism of fats and cholesterol. It converts excess carbohydrates and proteins into fatty acids and manages cholesterol levels in the body. This contributes to energy balance and the maintenance of healthy blood vessels.

Additionally, the liver produces bile, which is necessary for the emulsification and digestion of fats. Bile also facilitates the excretion of bilirubin, a byproduct of red blood cell breakdown, thus contributing to waste removal and digestive efficiency.

12. Describe the structure of a typical plant cell and explain the function of each organelle.

A typical plant cell is enclosed by a rigid cell wall made of cellulose. This wall provides structural support, shape, and protection against mechanical stress and pathogens.

Inside the cell wall is the cell membrane, a semi-permeable barrier that controls the entry and exit of substances, thus regulating the internal environment of the cell.

The cytoplasm is a jelly-like substance that fills the cell and houses the organelles. It facilitates the movement of materials and provides a medium for biochemical reactions.

The nucleus is surrounded by a nuclear membrane and contains the cell's DNA. It controls all cellular activities, including growth, metabolism, and reproduction, by regulating gene expression.

Chloroplasts are unique to plant cells and contain the green pigment chlorophyll. They are the sites of photosynthesis, where light energy is converted into chemical energy stored in glucose.

Mitochondria, also known as the powerhouses of the cell, are responsible for producing ATP through cellular respiration, providing energy for cellular functions.

The large central vacuole maintains turgor pressure, which keeps the cell firm. It also stores nutrients, waste products, and pigments.

Ribosomes, which may float freely or attach to the rough endoplasmic reticulum, are responsible for protein synthesis, playing a vital role in growth and repair.

Lastly, the Golgi apparatus packages and modifies proteins and lipids, preparing them for transport within or outside the cell.

13. Discuss the nitrogen cycle and its importance to living organisms.

The nitrogen cycle is a biogeochemical process through which nitrogen is converted into various chemical forms as it circulates among the atmosphere, soil, and living organisms. It ensures the availability of nitrogen in forms that plants and animals can use.

Nitrogen fixation is the first step, where atmospheric nitrogen (N_2), which is inert and unusable by most organisms, is converted into ammonia (NH_3) by nitrogen-fixing bacteria such as *Rhizobium* or through lightning.

Ammonia is then converted into nitrites (NO_2^-) and nitrates (NO_3^-) through nitrification, carried out by nitrifying bacteria like *Nitrosomonas* and *Nitrobacter*. Nitrates are the most usable form of nitrogen for plants.

Plants absorb nitrates from the soil and use them to synthesize amino acids and proteins. When animals consume plants, they obtain these nitrogen compounds and incorporate them into their own bodies.

When plants and animals die, decomposers such as bacteria and fungi break down the organic matter, releasing ammonia back into the soil through a process called ammonification.

Finally, denitrification occurs when denitrifying bacteria convert nitrates back into nitrogen gas, releasing it into the atmosphere and completing the cycle.

The nitrogen cycle is crucial because nitrogen is a key component of DNA, proteins, and other cellular structures. It maintains soil fertility and supports the productivity of ecosystems.

14. Describe five differences between aerobic and anaerobic respiration and state their importance.

Aerobic respiration occurs in the presence of oxygen, while anaerobic respiration takes place in the absence of oxygen. This is the most fundamental difference between the two types of respiration.

Aerobic respiration produces a large amount of energy, yielding up to 36 ATP molecules per glucose molecule. In contrast, anaerobic respiration generates only 2 ATP molecules, making it less efficient in energy production.

The end products of aerobic respiration are carbon dioxide and water, which are less harmful and easily removed from the body. Anaerobic respiration produces end products like lactic acid in animals or ethanol and carbon dioxide in yeast, which may require additional mechanisms for removal or detoxification.

Aerobic respiration takes place in the mitochondria, as it requires oxygen and complex enzymatic systems. Anaerobic respiration, on the other hand, mainly occurs in the cytoplasm and involves fewer enzyme-controlled steps.

Anaerobic respiration is important in environments where oxygen is scarce, such as in waterlogged soils or during intense muscular activity in animals. Aerobic respiration, however, is the dominant process in most organisms due to its higher energy yield.

Together, both forms of respiration ensure that organisms can adapt to varying environmental conditions and maintain vital metabolic activities.

SECTION C (40 Marks)

Answer two questions from this section.

15. Outline six teaching strategies you would use to enhance participation during a Biology lesson on blood circulation.

One strategy is the use of group discussions. The teacher can divide the class into small groups to discuss the components of the circulatory system, such as the heart, blood vessels, and blood. This encourages learners to share ideas and learn from one another.

The second strategy is questioning. The teacher can ask open-ended questions during and after the lesson to stimulate thinking and involve learners in reasoning about how blood circulates through the body.

A third strategy is the use of models or charts. A teacher can bring or draw a labeled diagram of the heart and blood vessels, which students can use to trace the path of blood. This visual aid promotes better understanding and invites learners to actively interact with the materials.

Role-play is another useful strategy. Learners can be assigned roles as red blood cells, the heart, veins, and arteries to simulate how circulation works. This fun and interactive method helps learners grasp abstract ideas in a memorable way.

Using real-life examples is also effective. The teacher can connect the lesson to everyday experiences, such as how exercise affects heart rate, helping learners relate the topic to their own lives and become more engaged.

Lastly, integrating technology, such as animations or videos showing the heartbeat and blood flow, captures learners' attention and makes the concept more dynamic and easier to understand.

16. Explain six components of a Biology lesson plan and their importance in lesson delivery.

One key component is the topic or subject matter. This indicates what the lesson will cover and ensures the teacher focuses on the intended content without deviating from curriculum requirements.

The second component is the lesson objectives. These are clear statements of what the learners should be able to do by the end of the lesson. They guide the teacher’s instruction and help in evaluating whether learning took place.

Another component is teaching and learning materials. These are the resources the teacher plans to use, such as charts, specimens, or videos. Including them in the plan ensures the teacher is prepared and enhances learner engagement.

Teaching and learning activities are also essential. They detail how the lesson will be conducted — including introductions, development, and conclusion. Well-organized activities help maintain flow and keep learners involved throughout the lesson.

Assessment strategies are another key component. They explain how the teacher will check if learners understood the lesson. This might include oral questions, written work, or practical demonstrations.

Lastly, the time allocation for each section of the lesson ensures that the teacher manages the period effectively, covers all content, and avoids rushing or running out of time.

17. Describe six assessment techniques used by Biology teachers to evaluate student understanding.

One technique is oral questioning. The teacher asks learners questions during or after the lesson to check their understanding. It promotes classroom interaction and gives instant feedback.

Another technique is quizzes and short tests. These help measure individual student knowledge over specific topics and provide a record of academic progress.

Practical assessments are also used. During experiments or demonstrations, the teacher evaluates how students apply concepts and handle scientific equipment, which is crucial in Biology.

Assignments and homework are a fourth technique. They allow learners to extend their learning beyond the classroom and show how well they can apply concepts independently.

Peer assessment can also be used, where students assess each other's work. This builds responsibility and critical thinking while allowing students to learn from one another.

Lastly, project work is a powerful tool. When students carry out investigations or make presentations, the teacher can assess their creativity, problem-solving skills, and understanding of scientific procedures.

18. Discuss six ways in which a teacher can integrate ICT tools in teaching Biology at the secondary level.

One way is by using animations and simulations. These tools can illustrate complex processes like mitosis, osmosis, or respiration in a more visual and engaging manner, making learning more effective.

The second method is incorporating educational videos from platforms such as YouTube. These can supplement textbook explanations and provide real-world examples that enhance comprehension.

A third method is through online quizzes and assessment platforms. Teachers can create digital tests using Google Forms or Kahoot, which provide immediate feedback and make assessment more interactive.

Teachers can also use PowerPoint presentations to organize and present content clearly. This allows for structured delivery of key points with added visual support like diagrams and charts.

Interactive whiteboards or smartboards can be used to manipulate images, label diagrams, or show live internet content during lessons. This makes lessons more dynamic and participatory.

Lastly, using e-learning platforms like Moodle or Google Classroom helps manage assignments, share resources, and communicate with learners beyond class hours, thus extending the learning environment digitally.