THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

733/1 **BIOLOGY 1**

Time: 3 Hours **ANSWERS** **Year: 2015**

Instructions

1. This paper consists of section A, B and C.

2. Answer all questions in section A and two questions from section B and C.

1. Briefly explain the following:

(a) Continuous variation.

(b) Natural selection.

(c) Artificial selection.

(a) Continuous variation:

Continuous variation refers to the range of small, gradual differences in traits within a population, such as human height, influenced by both genetics and environment.

(b) Natural selection:

Natural selection is the process where organisms with traits best suited to their environment, like camouflage in moths, survive and reproduce, passing those traits to offspring.

(c) Artificial selection:

Artificial selection is the human-guided process of breeding organisms for desired traits, such as developing high-yield corn, by selecting specific individuals.

2. Distinguish between the following:

(a) Essential amino acids

(b) α-glucose and β-glucose

(a) Essential amino acids:

Essential amino acids cannot be synthesized by the body and must be obtained from the diet, like lysine, whereas non-essential amino acids, like alanine, can be produced internally.

(b) α-glucose and β-glucose:

α-glucose and β-glucose are isomers differing in the orientation of the hydroxyl group on carbon 1; α-glucose has the OH below the ring plane, used in starch, while β-glucose has it above, found in cellulose, affecting their bonding.

3. Deduce why enzymes are specific and catalyze only single substrates.

Because they use a syllabus in the teaching and learning process.

Enzymes are specific and catalyze only single substrates due to their unique active site structure, which fits a specific substrate like a lock and key, ensuring precise reactions, such as amylase acting only on starch.

This specificity arises from the enzyme's three-dimensional shape, determined by its amino acid sequence, allowing only complementary substrates to bind effectively.

The presence of a syllabus in teaching aids this understanding by providing a structured framework to explain enzyme-substrate interactions, enhancing learning efficiency.

4. State three uses of a syllabus in constructing a Dichotomous identification Key.

A syllabus guides the selection of traits for the key, ensuring relevant biological features, like leaf shape, are included.

It provides a sequence of topics, helping organize the key's steps, such as identifying plant families systematically.

The syllabus supports assessment alignment, ensuring the key tests knowledge outlined in the curriculum, like species classification.

5. List three points to consider when constructing a Dichotomous identification Key.

Ensure clear, mutually exclusive choices at each step, like "leaves simple or compound," to avoid confusion.

Use observable characteristics, such as flower color, that are easily identifiable in the field.

Maintain a logical sequence, progressing from general traits, like stem type, to specific ones, like petal number.

6. Distinguish between the following by giving one relevant example for each:

(a) Natural active immunity and artificial passive immunity.

(b) Natural passive immunity and artificial passive immunity.

(a) Natural active immunity and artificial passive immunity:

Natural active immunity develops from exposure to a pathogen, like recovering from measles, producing antibodies naturally; artificial passive immunity involves injected antibodies, such as immunoglobulin for rabies, providing immediate but temporary protection.

(b) Natural passive immunity and artificial passive immunity:

Natural passive immunity occurs when antibodies pass from mother to baby via breast milk, protecting the infant; artificial passive immunity involves medical administration of antibodies, like tetanus antitoxin, for quick defense.

7. In three points, briefly describe how you can guide Form One students at your school to prepare themselves effectively for a Biology test.

Encourage regular revision, advising students to review topics like cell structure daily to reinforce memory.

Provide practice questions, such as on photosynthesis, to familiarize them with test formats and boost confidence.

Teach time management, suggesting they allocate specific times for each topic, like respiration, during study sessions.

8. Working in a laboratory entail a great care. Briefly explain three precautions to be taken by a teacher in order to make a Biology laboratory a safe place to work in.

The teacher should ensure proper labeling and storage of chemicals, like acids, to prevent misuse or accidental spills.

They must enforce the use of personal protective equipment, such as goggles during dissections, to minimize injury risks.

Regular safety drills should be conducted, teaching evacuation procedures in case of emergencies like chemical fires.

9. State where you can collect the following specimens for laboratory use:

(i) Planktons

(ii) Moulds

(iii) Liverworts.

(i) Planktons:

Planktons can be collected from freshwater bodies like ponds or lakes using a plankton net.

(ii) Moulds:

Moulds can be collected from damp areas, such as bread left in a moist environment or decaying fruit.

(iii) Liverworts:

Liverworts can be collected from moist, shaded forest floors or near streams where they grow naturally.

10. For effective study of Biology, students should have some basic skills. Outline at least three skills that a Biology student needs to develop in the course of studying Biology.

Observation skills are essential, enabling students to note details, like color changes in chemical reactions.

Analytical skills help students interpret data, such as understanding graphs of population growth.

Practical skills, like using a microscope to view cells, allow hands-on application of theoretical knowledge.

11. (a) With the aid of a diagram, describe the mechanism of DNA replication.

(b) Justify the statement that “DNA replication is semi-conservative”.

(a) With the aid of a diagram, describe the mechanism of DNA replication:

(Description since a diagram cannot be drawn: DNA replication begins with the double helix unwinding at the origin, aided by helicase. The enzyme DNA polymerase adds nucleotides to each separated strand, using each as a template. One new strand (leading) is synthesized continuously, while the lagging strand forms Okazaki fragments, later joined by ligase. This produces two identical DNA molecules, each with one original and one new strand.)

(b) Justify the statement that "DNA replication is semi-conservative":

DNA replication is semi-conservative because each new DNA molecule contains one original strand and one newly synthesized strand, as demonstrated by the Meselson-Stahl experiment using nitrogen isotopes, ensuring genetic continuity and fidelity.

12. Signify why classification of fungi and viruses are found to have great challenges compared to other groups of organisms.

Fungi and viruses lack consistent morphological features, as fungi vary widely (e.g., yeasts vs. mushrooms) and viruses lack cellular structure, complicating traditional classification.

Their reproductive methods, like fungal spores or viral host dependency, differ from other organisms, making taxonomic criteria hard to apply.

Evolutionary relationships are unclear, with fungi bridging plants and animals, and viruses potentially evolving from diverse origins, challenging phylogenetic grouping compared to bacteria or animals.

13. (a) Explain the role played by each of the following in the release of energy during aerobic respiration:

(i) Oxygen

(ii) Mitochondria

(iii) Glucose.

(b) Give a summary of electron transport system (Diagram not necessary).

(c) Describe four uses of ATP in a metabolically active cell.

(a) (i) Oxygen:

Oxygen acts as the final electron acceptor in the electron transport chain, enabling ATP production by facilitating the reoxidation of NADH and $FADH_2$.

(ii) Mitochondria:

Mitochondria house the Krebs cycle and electron transport chain, where glucose is oxidized to produce ATP through oxidative phosphorylation.

(iii) Glucose:

Glucose is the primary substrate, broken down in glycolysis and the Krebs cycle, providing electrons and protons for ATP synthesis.

(b) Give a summary of electron transport system:

The electron transport system is a series of protein complexes in the mitochondrial membrane where electrons from NADH and $FADH_2$ are passed along, creating a proton gradient. This gradient drives ATP synthase to produce ATP, with oxygen accepting electrons to form water, completing the process.

(c) Describe four uses of ATP in a metabolically active cell:

ATP powers active transport, moving ions like sodium across membranes against gradients.

It drives muscle contraction, supplying energy for movement via actin-myosin interactions.

ATP supports protein synthesis, providing energy for ribosome assembly of amino acids.

It maintains cellular processes, like maintaining ion gradients for nerve impulse transmission.

14. (a) (i) What is the relationship between the population of herbivores and carnivores between 0 and 3 years?

Between 0 and 3 years, both the herbivore and carnivore populations show a gradual increase. This suggests a balanced ecological relationship where an increase in herbivore population provides sufficient food for carnivores, leading to their population growth as well. The rise in herbivores creates favorable conditions for carnivores to reproduce and thrive.

(ii) Give possible reasons for the decrease in carnivore population between 5th and 10th year and increase of herbivore population between 7th and 10th year.

The decrease in carnivore population between the 5th and 10th year may be due to factors such as insufficient food resulting from an earlier decline in herbivores, diseases, or harsh environmental conditions. As carnivores reduce in number, herbivores face less predation, which allows their population to increase between the 7th and 10th year. Additionally, favorable weather and abundant vegetation could contribute to herbivore population growth during this period.

(iii) Suggest the reasons that may cause decline in herbivore population after the 10th year.

The decline in herbivore population after the 10th year could be due to overgrazing, which leads to food scarcity. Another reason could be the resurgence of carnivores, leading to increased predation. Also, the outbreak of diseases or unfavorable environmental conditions such as drought could contribute to this decline. Competition among herbivores and accumulation of waste in the habitat may also reduce reproductive success and survival rates.

(b) (i) Describe six adaptive features of endoparasites.

Endoparasites possess a thick protective cuticle or tegument that resists the digestive enzymes of the host, ensuring their survival inside the host body.

They exhibit reduced or absent locomotory organs since they live in a stable internal environment where movement is not essential.

Most endoparasites have a highly developed reproductive system capable of producing a large number of eggs to increase the chances of transmission and continuation of the life cycle.

They have adhesive structures such as hooks and suckers that help them attach firmly to the host tissues and prevent expulsion.

Endoparasites have simplified or absent digestive systems, as they absorb pre-digested nutrients directly from the host body fluids.

They often have a complex life cycle involving multiple hosts, which increases the likelihood of successful transmission from one host to another.

(ii) Describe how light, temperature and atmospheric pressure affect distribution of organisms in an ecosystem.

Light influences the distribution of organisms because it is a source of energy for photosynthesis. Plants grow where there is sufficient light, and herbivores follow these plants, followed by carnivores. Areas with low light may support fewer plants and hence fewer organisms.

Temperature affects enzyme activity and metabolic processes in organisms. Most organisms have an optimum temperature range for survival and reproduction. Extremely high or low temperatures may limit their distribution to specific areas where conditions are favorable.

Atmospheric pressure influences respiration and water balance in organisms. At high altitudes, where pressure is low, oxygen availability is reduced, making it difficult for some organisms to survive. This restricts the distribution of organisms to areas with favorable pressure levels.

15. Most students hate studying science subjects. As a biology teacher, explain how your teaching can motivate form one students to like studying Biology subject. (Give six points).

Using practical activities in teaching biology makes the subject more interesting and enjoyable. When students engage in experiments and observe real biological processes, they develop curiosity and a better understanding of the subject.

Incorporating interactive teaching methods such as group discussions, role play, and educational games can make biology lessons more engaging. This encourages active participation and makes learning fun.

Relating biology concepts to real-life experiences helps students understand the relevance of the subject. For example, explaining digestion in terms of the food they eat daily makes the topic more relatable.

Using visual aids such as models, charts, and videos enhances comprehension. Visual learning helps students grasp complex biological concepts more easily, especially those that are difficult to visualize.

Creating a supportive learning environment where students feel free to ask questions and express their opinions increases their interest and confidence in the subject. This motivates them to learn more.

Providing regular feedback and encouragement helps build students' self-esteem. When students realize they are making progress, they develop a positive attitude towards biology and become more motivated to study it.

16. Explain how you can assist students in the following accidents during practical session:

(a) Some pieces of broken test-tubes have entered into a student's eye.

In such a case, the first step is to keep the student calm and avoid rubbing the affected eye. The teacher should immediately rinse the eye with clean running water or sterile saline solution to flush out any glass particles. The eye should be covered with a clean cloth or eye pad, and the student should be taken to a medical facility for further examination and treatment. It is essential to avoid using any tools or fingers to remove the glass pieces.

(b) A student has suffered an electric shock.

When a student suffers an electric shock, the power source should be turned off immediately to prevent further injury. The student should be separated from the source using a non-conductive object such as a wooden stick. After ensuring safety, the teacher should check for breathing and pulse. If the student is unconscious or not breathing, CPR should be administered while waiting for medical help. The student should be taken to a medical center immediately, even if they appear to recover quickly.

17. (a) Biological models are effective for teaching and learning some biology concepts. Justify the statement by giving five points.

Biological models simplify complex concepts by providing tangible representations of biological structures and processes. This makes learning easier for students, especially for abstract concepts such as organ systems.

Models stimulate interest and curiosity in learners. When students see realistic structures, they become more engaged and motivated to learn, enhancing their retention of the content.

Models facilitate active learning by encouraging observation, manipulation, and interaction. This hands-on approach helps students to remember concepts better and promotes practical skills.

They help cater to diverse learning styles. While some students learn best through reading or listening, others benefit more from visual and tactile experiences provided by models.

Models are reusable teaching aids that can be used repeatedly in different classes. This makes them cost-effective and a long-term resource for both teachers and students.

(b) Suppose you have planned to use a "human kidney" model in teaching a sub-topic "excretion in human" to a form three class. Explain how you will effectively use the model during classroom instruction (give five points).

I will begin the lesson by showing the human kidney model to capture the students' attention and introduce the topic. This visual representation will arouse curiosity and create a mental image of what the actual organ looks like.

Next, I will use the model to identify and explain the external parts of the kidney, such as the renal artery, renal vein, and ureter. I will point out each part on the model to enhance visual understanding.

I will then open the model to show the internal structures like the cortex, medulla, and pelvis. I will explain the functions of each part and how they work together in the process of urine formation.

I will demonstrate the flow of blood and waste materials through the nephrons using the model, making it easier for students to follow the sequence of excretion from filtration to urine formation.

After the explanation, I will engage students in a discussion where they identify different parts and explain their roles. This interaction will help reinforce their understanding and allow me to assess their grasp of the topic.

18. (a) In six points explain what would happen if a biology teacher uses a syllabus direct for teaching without preparing a scheme of work.

Without a scheme of work, the teacher may teach topics in an unstructured and disorganized manner. This can lead to confusion and poor coverage of the syllabus.

The teacher may not manage time effectively. Some topics may be rushed while others are given too much time, resulting in imbalance in content delivery.

There may be lack of coherence in lesson progression. Students may find it difficult to link concepts from one lesson to another, which hinders proper understanding.

The teacher may overlook important teaching aids and assessment tools. A scheme of work helps in planning instructional materials and evaluation strategies in advance.

It becomes difficult to track teaching progress. Without a scheme, the teacher may repeat some topics or skip important content unknowingly.

The absence of a scheme of work reduces accountability and professionalism. It becomes hard to evaluate the teacher's performance and ensure effective teaching.

(b) Explain four importance of preparing lesson notes to biology teachers.

Lesson notes help the teacher to plan content systematically. They ensure that all important points are included and covered during the lesson.

They guide the teacher during lesson delivery, helping them to stay focused and organized throughout the teaching process.

Lesson notes enable teachers to manage time effectively by allocating appropriate time to each sub-topic within the lesson.

They serve as a reference material that can be reviewed before teaching or reused in future lessons, thereby saving preparation time and improving consistency.