THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

733/1 BIOLOGY 1

Time: 3 Hours **ANSWERS** **Year: 2011**

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. Outline three importance of studying Biology.

Studying Biology helps individuals understand the structure and function of living organisms, such as how cells work together to sustain life in plants and animals, fostering a deeper appreciation of nature.

It equips students with knowledge to address health issues, enabling them to comprehend diseases like cancer or diabetes and contribute to medical advancements through research and prevention strategies.

Biology provides insights into environmental conservation, teaching about ecosystems and biodiversity, which empowers people to protect endangered species and mitigate climate change effects effectively.

2. Distinguish between the following terms:

(a) Homogametic sex and heterogametic sex.

(b) Genetic engineering and biotechnology.

(a) Homogametic sex and heterogametic sex:

Homogametic sex refers to individuals producing gametes with identical sex chromosomes, such as human females (XX), who produce only X-chromosome-bearing eggs, ensuring consistent genetic contribution to offspring.

Heterogametic sex involves individuals producing gametes with different sex chromosomes, such as human males (XY), who produce both X- and Y-bearing sperm, leading to varied genetic outcomes in offspring based on which sperm fertilizes the egg.

(b) Genetic engineering and biotechnology:

Genetic engineering is a specific technique within biotechnology that involves directly manipulating an organism's DNA, such as inserting a gene for pest resistance into a crop like Bt corn, to achieve desired traits.

Biotechnology is a broader field that uses living organisms or their components to develop products and processes, including genetic engineering, fermentation for yogurt production, and bioremediation, encompassing a wide range of applications beyond DNA manipulation.

3. Briefly analyse three reasons why liverworts and Mosses have sometimes been described as amphibians of plant world.

One reason is their dependence on water for reproduction, as liverworts and mosses require moisture for sperm to swim to the egg, similar to how amphibians rely on water for breeding, earning them the amphibian analogy.

Another reason is their ability to thrive in moist terrestrial environments but struggle in dry conditions, much like amphibians that inhabit both land and water, reflecting their dual ecological niche.

Lastly, their simple structure and lack of vascular tissues limit water and nutrient transport, necessitating damp habitats, akin to amphibians' reliance on wet environments for survival, reinforcing the descriptive term.

4. (a) What is meant by the term "active site" as applied in biochemistry?

(b) What is the difference between enzymes and catalysts in their mode of action?

(a) What is meant by the term "active site" as applied in biochemistry?

The active site is a specific region on an enzyme where the substrate binds and undergoes a chemical reaction, characterized by a unique three-dimensional shape that complements the substrate, such as the site where amylase binds starch to initiate hydrolysis.

(b) What is the difference between enzymes and catalysts in their mode of action?

Enzymes are biological catalysts, typically proteins, that are highly specific to their substrates, like lipase acting only on fats, and function under mild physiological conditions, whereas general catalysts, such as platinum in industrial reactions, are non-specific and often require extreme conditions like high temperatures.

Enzymes are produced by living organisms and can be regulated by the body, such as through inhibition, while catalysts are often inorganic and lack such biological control, highlighting their distinct operational contexts.

Enzymes may undergo temporary conformational changes during catalysis, as seen with induced fit in hexokinase, whereas catalysts remain unchanged throughout the reaction, emphasizing their differing interaction dynamics.

5. (a) Define the term "community".

(b) Evaluate the usefulness of food web rather than food chain in studying ecology.

(a) Define the term "community":

A community in ecology refers to all the interacting populations of different species living together in a specific area, such as the birds, insects, and plants in a forest, where their relationships influence the ecosystem's dynamics.

(b) Evaluate the usefulness of food web rather than food chain in studying ecology:

A food web provides a more comprehensive view of energy flow and species interactions by showing multiple feeding relationships, such as a deer eaten by both a wolf and a mountain lion, unlike a food chain that simplifies it to a linear sequence like grass to deer to wolf.

It highlights the complexity and interdependence of ecosystems, revealing how the loss of one species, like a pollinator, affects multiple trophic levels, which a food chain cannot adequately represent.

Food webs are more realistic for ecological studies, accommodating omnivores and detritivores, such as a bear eating both berries and fish, offering a broader understanding of stability and resilience compared to the limited scope of a food chain.

6. Outline three differences between a Biology teacher's guide and Biology teacher's manual.

One difference is that a Biology teacher's guide provides a broad overview and suggestions for teaching methods, like group activities for photosynthesis, while a teacher's manual offers detailed lesson plans and step-by-step instructions for each topic, such as a specific lab on cell division.

Another difference is that the guide focuses on general educational strategies and resource recommendations, such as using videos for ecology, whereas the manual includes specific assessment tools and answer keys, like a quiz on respiration with solutions.

Lastly, a teacher's guide is less prescriptive, allowing flexibility in implementation, such as adapting lessons on genetics, while a teacher's manual is more structured, providing a rigid schedule and content outline to ensure curriculum adherence.

7. Give six precautions on what is likely to happen in laboratory rules and regulations are not adhered to.

One precaution is the risk of chemical spills if rules are ignored, such as mishandling acids during titration, which could cause burns or damage equipment.

Another is exposure to hazardous fumes if ventilation protocols are neglected, like inhaling formaldehyde during dissections, leading to respiratory issues.

Failure to wear protective gear, such as gloves, increases injury risk, as cuts from glassware during experiments could become infected.

Improper waste disposal, like discarding biological waste in regular bins, can spread pathogens, contaminating the lab environment.

Ignoring equipment maintenance, such as uncalibrated microscopes, may lead to inaccurate observations, compromising research validity.

Lastly, neglecting emergency procedures, like not knowing fire extinguisher locations, can exacerbate incidents, endangering lives during a lab fire.

8. Ten students from Matoeke secondary school sat for a Biology test and their scores were recorded as follows: 50, 30, 34, 44, 80, 60, 70, 74 and 52. Calculate:

(a) Mean

(b) Range

(c) Median

(a) Mean:

To calculate the mean, add all scores: 50 + 30 + 34 + 44 + 80 + 60 + 70 + 74 + 52 = 494. Divide by the number of students (9): 494 ÷ 9 ≈ 54.89. Thus, the mean score is approximately 54.89.

(b) Range:

The range is the difference between the highest and lowest scores. The highest score is 80, and the lowest is 30: 80 - 30 = 50. Therefore, the range is 50.

(c) Median:

To find the median, arrange the scores in ascending order: 30, 34, 44, 50, 52, 60, 70, 74, 80. With 9 scores (odd number), the median is the middle value, which is the 5th score, 52. Thus, the median is 52.

9. List six qualities of a good Biology teacher.

A good Biology teacher possesses strong subject knowledge, understanding complex topics like genetics to explain them clearly to students.

They exhibit effective communication skills, using simple language to teach concepts like photosynthesis, ensuring student comprehension.

Patience is essential, allowing them to guide struggling students through practicals like dissections without frustration.

They are enthusiastic, inspiring interest in topics like ecology through engaging demonstrations.

Organizational skills help them plan lessons and labs, such as preparing materials for osmosis experiments efficiently.

Lastly, they are adaptable, adjusting teaching methods to suit diverse learners, such as using visuals for cell structure.

10. Itemize three applications of Biology in genetic engineering.

One application is the production of genetically modified crops, such as Bt corn, where a gene for pest resistance is inserted to increase yield and reduce pesticide use.

Another is gene therapy, used to treat genetic disorders like cystic fibrosis by correcting defective genes in a patient's cells.

Lastly, Biology in genetic engineering enables the creation of pharmaceuticals, such as insulin produced by genetically modified E. coli, improving diabetes management.

11. Discrimination and stigmatization towards people living with HIV/AIDS play a profound effect on them. Discuss six ways which can be used to support the PLWHA from educational programmes.

One way is providing education on HIV transmission, teaching that it is not spread by casual contact, reducing stigma and supporting PLWHA emotionally.

Another is offering counseling services through schools, helping PLWHA cope with discrimination and build self-esteem.

Including HIV awareness in the curriculum raises empathy, encouraging students to support peers living with HIV/AIDS.

Organizing support groups within educational settings allows PLWHA to share experiences, fostering a sense of community and reducing isolation.

Training teachers to be sensitive and non-discriminatory ensures a supportive classroom environment for PLWHA.

Lastly, integrating anti-stigma campaigns in educational programs promotes acceptance, enhancing PLWHA's social integration and mental health.

12. Write an essay on "global warming" using the following guidelines:

(a) Meaning of "global warming"

(b) Discuss any two ways in which human activities contribute to global warming

(c) Suggest seven measures which can be taken to alleviate the consequences of global warming

(a) Meaning of "global warming":

Global warming refers to the long-term increase in Earth's average surface temperature due to human and natural activities that enhance the greenhouse effect. This phenomenon is primarily driven by the accumulation of greenhouse gases, such as carbon dioxide (CO_2) and methane (CH_4), in the atmosphere, trapping heat and leading to climate changes, rising sea levels, and extreme weather patterns.

(b) Discuss any two ways in which human activities contribute to global warming:

One way is the burning of fossil fuels, such as coal and oil for energy, which releases large amounts of CO_2 into the atmosphere, intensifying the greenhouse effect and raising global temperatures.

Another way is deforestation, where trees are cut down for agriculture or urban development, reducing the planet's capacity to absorb CO_2 through photosynthesis, thus increasing atmospheric greenhouse gas levels.

(c) Suggest seven measures which can be taken to alleviate the consequences of global warming:

One measure is promoting the use of renewable energy sources, like solar and wind power, to reduce reliance on fossil fuels and lower CO_2 emissions.

Another is reforestation, planting trees to absorb CO_2 and restore ecosystems, mitigating temperature rises.

Implementing energy-efficient technologies, such as LED lighting, reduces energy consumption and greenhouse gas output.

Encouraging public transportation and reducing vehicle use decreases emissions from combustion engines.

Enforcing stricter industrial emission regulations limits pollutants from factories, curbing global warming.

Raising awareness through education campaigns informs communities about sustainable practices to combat climate change.

Finally, developing carbon capture and storage technologies can remove CO_2 from the atmosphere, helping to stabilize climate conditions.

13. Describe the stages involved in the conversion of glucose to pyruvate.

The first stage is glycolysis, where glucose, a six-carbon sugar, is phosphorylated using ATP to form glucose-6-phosphate in the cytoplasm.

The second stage involves the cleavage of fructose-1,6-bisphosphate into two three-carbon molecules, glyceraldehyde-3-phosphate, through a series of enzymatic reactions.

The third stage is the oxidation of glyceraldehyde-3-phosphate, producing NADH and ATP, while converting it to 1,3-bisphosphoglycerate.

The fourth stage includes the formation of pyruvate, where 1,3-bisphosphoglycerate is dephosphorylated to 3-phosphoglycerate, and through further steps, yields pyruvate, with a net gain of 2 ATP and 2 NADH per glucose molecule.

14. (a) Give five reasons, why assessment is an important exercise in the process of teaching and learning Biology?

(b) A table of specification is an important guide in test construction. Provide detailed explanation about its meaning, its features and its uses in Biology test construction.

(a) Give five reasons, why assessment is an important exercise in the process of teaching and learning Biology?

Assessment measures student understanding, ensuring they grasp concepts like photosynthesis, which guides further instruction.

It provides feedback to teachers, highlighting areas like cell division where students struggle, allowing for targeted support.

Assessment motivates students, encouraging consistent study of topics like respiration through visible progress.

It aids curriculum evaluation, assessing if the biology syllabus meets learning goals, such as ecosystem knowledge.

Finally, it prepares students for exams, familiarizing them with question types on genetics, boosting confidence.

(b) A table of specification is an important guide in test construction. Provide detailed explanation about its meaning, its features and its uses in Biology test construction:

The meaning of a table of specification is a blueprint that aligns test items with curriculum objectives and cognitive levels, ensuring comprehensive coverage of topics like osmosis.

Its features include a structured layout with columns for sub-topics (e.g., gaseous exchange), rows for cognitive domains (e.g., Knowledge, Analysis), and cells indicating question numbers, reflecting the weight of each area.

Its uses include ensuring content validity, verifying that all biology topics, such as cell structure, are tested proportionally. It guides question distribution, preventing overemphasis on easy topics like plant anatomy. It aids in balancing difficulty, mixing recall and application questions on respiration. Lastly, it supports fairness, ensuring all students are assessed on the same intended learning outcomes.

15. Some Biology teachers argue that it is wastage of time and energy to design and assign practical work to students. Discuss this argument by presenting seven roles and five limitations of practical work.

(a) Discuss this argument by presenting seven roles of practical work:

Practical work reinforces theoretical knowledge, allowing students to observe cell division under a microscope, enhancing understanding.

It develops laboratory skills, teaching proper use of pipettes for titration experiments on enzymes.

It fosters critical thinking, as students analyze data from ecology field studies to draw conclusions.

Practical work increases interest, making topics like dissection engaging through hands-on experience.

It prepares students for careers, providing skills relevant to medical or research fields.

It encourages teamwork, as group experiments on osmosis promote collaboration.

Finally, it provides evidence-based learning, allowing students to verify hypotheses, such as testing plant transpiration rates.

(b) Discuss this argument by presenting five limitations of practical work:

One limitation is the high cost, as equipment like microscopes requires significant investment, straining school budgets.

Another is time consumption, as setting up and conducting dissections can take hours, reducing lecture time.

Safety risks are a concern, with potential injuries from chemicals or glassware during experiments.

Limited resources, such as insufficient specimens for all students, restrict participation in practicals.

Lastly, the need for skilled supervision demands experienced teachers, which may not always be available.

16. (a) Give five features of learner centered biology instruction.

(b) Development of learning objectives and subject matter content are crucial factors to put into consideration when analyzing O-level Biology syllabus. Justify this statement.

(a) Give five features of learner centered biology instruction:

One feature is active student participation, where learners conduct experiments like measuring plant growth, enhancing engagement.

Another is individualized learning, allowing students to explore topics like genetics at their own pace.

It includes collaborative activities, such as group projects on ecosystems, fostering teamwork.

The approach uses real-world applications, connecting lessons on respiration to human health.

Lastly, it incorporates continuous feedback, enabling teachers to adjust teaching based on student needs in cell biology.

(b) Justify this statement:

Development of learning objectives ensures the syllabus targets specific skills, like identifying organelles, aligning with educational goals.

Subject matter content provides the foundation, covering topics like photosynthesis comprehensively for student mastery.

Clear objectives guide assessment, ensuring tests on evolution reflect intended outcomes.

Content relevance keeps the syllabus current, incorporating advances in biotechnology for O-level learners.

Considering both prevents gaps, ensuring a balanced curriculum from cell structure to ecology.

17. Computer aided instructions in teaching and learning is currently accepted globally. Discuss its implementation in teaching and learning of Biology subject in Tanzanian context by analyzing five strength and three weaknesses of this type of instruction.

(a) Discuss its implementation by analyzing five strengths:

One strength is accessibility, as computers in Tanzanian schools allow rural students to access biology simulations on photosynthesis.

Another is interactivity, enabling students to explore 3D cell models, enhancing understanding in resource-limited settings.

It supports individualized learning, letting students review genetics lessons at their pace via e-learning platforms.

Cost-effectiveness over time reduces reliance on physical lab materials, benefiting Tanzanian budgets.

It updates content, providing the latest research on ecology, keeping the curriculum relevant.

(b) Discuss its implementation by analyzing three weaknesses:

One weakness is the high initial cost, as acquiring computers and software may strain Tanzanian school finances.

Another is limited technical skills, as teachers and students may lack training to use biology software effectively.

Lastly, unreliable electricity and internet in rural areas hinder consistent use of computer-aided instruction for topics like respiration.