**THE UNITED REPUBLIC OF TANZANIA**

**NATIONAL EXAMINATIONS COUNCIL OF TANZANIA**

**CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

**071 BIOLOGY 2**

**ALTERNATIVE TO PRACTICAL**

(For Both School and Private Candidates)

**Time: 2:30 Hours** **ANSWERS** **Year: 2008**

**Instructions**

1. This paper consists of sections Five questions. Answer all questions

2. Each question carries ten marks.

1. Study the diagrams below.

(a) (i) Identify specimens represented in figures 1, 2, and 3.

- Figure 1: Spirogyra (filamentous algae)
- Figure 2: Yeast cells (Saccharomyces)
- Figure 3: Bean pod (Legume seed pod)

(ii) Explain how each of the organisms/part of the organism represented by figures 1, 2, and 3 reproduce.

- Figure 1 (Spirogyra) reproduces through fragmentation, where a filament breaks into smaller pieces, each of which grows into a new individual.
- Figure 2 (Yeast) reproduces through budding, where a small outgrowth (bud) forms on the parent cell, enlarges, and eventually detaches as an independent organism.
- Figure 3 (Bean pod) reproduces through seed formation, where mature seeds develop inside the pod and are later dispersed for germination.

(iii) Mention the type of reproduction exhibited by the organisms/part of the organism represented by figures 1, 2, and 3.

- Figure 1: Asexual reproduction (fragmentation)
- Figure 2: Asexual reproduction (budding)
- Figure 3: Sexual reproduction (seed formation following fertilization)

(b) Write down the advantages and disadvantages of the mode of reproduction represented by figure 1.

advantages:
- Rapid multiplication, leading to quick population growth.
- No need for a mate, making reproduction efficient.
- High survival rate as new filaments are genetically identical to the parent.

disadvantages:
- Lack of genetic variation, making the population susceptible to diseases and environmental changes.
- Overgrowth may lead to competition for resources such as nutrients and sunlight.

2. Form two students of Morogoro Secondary School were asked to carry out an experiment by their Biology teacher. The experiment was conducted as follows.

(i) Three test tubes labeled A, B, and C were set as shown in figure 4 below. Each of the three test tubes contained 1 ml saliva and 1 ml water. The three test tubes were heated in a water bath at different temperatures for 30 minutes.

(ii) Another set of three test tubes also labeled A, B, and C each containing 1 ml starch solution was heated for the same duration in a water bath as shown in figure 5 below.

(iii) The contents of the test tubes in the corresponding water bath of figure 4 and figure 5 was mixed and heated further for 30 minutes.

(iv) The contents of each test tube was then tested for starch using iodine solution.

Study the above procedures carefully and then answer the following questions.

(a) What was the aim of the experiment?

- The aim of the experiment was to investigate the effect of temperature on enzyme activity, specifically the activity of amylase in saliva, which breaks down starch into simple sugars.

(b) Why was it necessary to heat the tubes for 30 minutes before mixing their contents?

- Heating the tubes for 30 minutes ensured that the saliva (containing amylase) reached the required temperature for the experiment.
- It also helped determine whether temperature affects the activity of the enzyme by either activating or denaturing it before mixing with starch.

(c) State the colour change you would expect in each test tube after adding iodine solution.

- Test tube A (5°c): blue-black color
- Test tube B (37°c): no color change (remains yellow-brown)
- Test tube C (70°c): blue-black color

(d) Account for the expected observations.

- Test tube A (5°c): The amylase enzyme was inactive at low temperature, so starch was not broken down. The iodine test showed a blue-black color, indicating the presence of starch.
- Test tube B (37°c): Amylase was most active at this temperature, breaking down all the starch into maltose. Since no starch remained, iodine did not change color, confirming complete starch digestion.
- Test tube C (70°c): High temperature denatured the enzyme, making it ineffective. Starch remained undigested, and the iodine solution turned blue-black, confirming the presence of starch.

3. In an ecological study a student caught an organism represented by figure 6 below.

(a) (i) Name the kingdom and phylum to which the organism belongs.

- The organism belongs to the kingdom Animalia because it is a multicellular, heterotrophic organism that relies on other living things for food.

- It belongs to the phylum Arthropoda because it has jointed appendages, an exoskeleton made of chitin, and a segmented body.

(ii) Name the class to which the organism belongs. Give reason(s) for your answer.

- The organism belongs to the class Insecta.
- It has three distinct body segments (head, thorax, and abdomen), which is a key characteristic of insects.
- The presence of a pair of antennae, compound eyes, and six legs further confirms that it is an insect.
- It has specialized mouthparts, such as a proboscis, which is used for feeding.

(iii) Suggest its feeding habits.

- The organism is a parasite because it feeds on the blood of its host. It has a specialized mouthpart called a proboscis, which is adapted for piercing the skin and sucking blood.

(iv) Suggest its mode of locomotion.

- The organism moves by jumping using its powerful hind legs, which are well-adapted for leaping long distances. It can also crawl using its legs.

(b) Suggest how the organism is adapted to its habitat.

- It has a strong proboscis, which enables it to pierce the skin of its host and suck blood efficiently.
- Its hind legs are well-adapted for jumping, allowing it to move quickly between hosts or escape predators.
- The organism has claws that help it cling to the fur or skin of its host, preventing it from being easily dislodged.
- Its flattened body allows it to move easily through the hair or feathers of its host, making it difficult to detect or remove.

4. A Form Four student was interested in investigating the osmosis phenomenon and decided to set up the experiment as shown in figure 7 below.

(a) Which solution has a higher concentration of free water molecules?

- Solution A has a higher concentration of free water molecules because it has a lower solute concentration. Water molecules are more abundant where solute concentration is lower.

(b) Which solution has a high solute concentration?

- Solution B has a high solute concentration because it contains more dissolved solute particles, which reduce the number of free water molecules available for movement.

(c) In which direction will osmosis occur?

- Osmosis will occur from Solution A to Solution B. Water molecules will move from the region of high water potential (Solution A) to the region of low water potential (Solution B) through the semi-permeable membrane.

(d) What does the semi-permeable membrane correspond to within an animal cell?

- The semi-permeable membrane corresponds to the **cell membrane** in an animal cell. The cell membrane regulates the movement of water and solutes into and out of the cell, allowing osmosis to occur.

(e) (i) What is osmosis?

- Osmosis is the movement of water molecules from a region of high water potential (low solute concentration) to a region of low water potential (high solute concentration) across a semi-permeable membrane.

(ii) Name five processes in living things that depend on osmosis.

- Absorption of water by root hairs in plants: Root hair cells absorb water from the soil through osmosis, allowing plants to maintain hydration.
- Movement of water across cell membranes in animal cells: Cells regulate their water content by osmosis, preventing dehydration or bursting due to excessive water intake.
- Rehydration of dehydrated cells: When organisms lose water, osmosis helps restore normal hydration levels by allowing water to enter cells.
- Regulation of water balance in kidneys: The kidneys use osmosis to control the concentration of urine, allowing the body to retain or eliminate water as needed.
- Movement of water in and out of red blood cells: Red blood cells maintain their shape and function through osmosis, ensuring proper fluid balance in the bloodstream.

5. The diagram in figure 8 shows the setup of an experiment to investigate a certain physiological process in a plant. Study the apparatus setup and then answer the questions that follow.

(a) (i) Which gas is collected in the test tube?

- The gas collected in the test tube is oxygen.

(ii) Where does it come from?

- The gas comes from the water plant, which releases oxygen as a byproduct of photosynthesis.

(iii) During which process is this gas produced?

- The gas is produced during photosynthesis, where plants convert carbon dioxide and water into glucose and oxygen using sunlight.

(iv) Write conditions necessary for the process to take place.

- Presence of light: Photosynthesis requires light energy to convert carbon dioxide and water into glucose and oxygen.
- Availability of water: Water molecules are split during the light-dependent reactions of photosynthesis, producing oxygen.
- Presence of carbon dioxide: Carbon dioxide is one of the raw materials used in photosynthesis to produce glucose.
- Presence of chlorophyll: Chlorophyll is the green pigment in plants that absorbs light energy needed for photosynthesis.

(v) Suggest a test for this gas and expected results.

- The gas can be tested using a glowing splint. When the glowing splint is inserted into the test tube containing the collected gas, it will relight, confirming the presence of oxygen.

(b) What will happen if the apparatus is kept in a dark place?

- If the apparatus is kept in a dark place, photosynthesis will not occur because light is required for the process. As a result, no oxygen will be produced, and no gas will be collected in the test tube.

(c) What was the aim of the experiment?

- The aim of the experiment was to demonstrate that oxygen is produced during photosynthesis in aquatic plants.

(d) There was a mistake in assembling the apparatus. With a reason, point out that mistake.

- The mistake is that the funnel should be inverted properly. If the funnel is not positioned correctly, the oxygen gas produced may not be efficiently directed into the test tube for collection.

(e) Why is water held up in the test tube without running onto the funnel?

- Water is held up in the test tube due to capillary action and air pressure. The pressure difference prevents water from flowing freely into the funnel.