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: 2007**

Instructions

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

2. Each question carries ten marks.

1. In a practical lesson, a candidate has been provided with a sweet potato and a ginger

(a) Explain how the candidate should prepare these organs for investigation of stored food and suggest the experiment(s) he/she would carry out and his/her observations.

- The candidate should cut small samples from both the sweet potato and ginger and place them in separate test tubes.
- To test for starch, the candidate should add a few drops of iodine solution to each sample and observe any color change.
- To test for reducing sugars, the candidate should add Benedict's solution to a sample, heat it in a water bath, and observe the color change.

expected observations:
- If starch is present, iodine solution will turn blue-black.
- If reducing sugars are present, Benedict's solution will turn green, yellow, or brick red depending on the concentration of sugar.

(b) Record the information as shown in the table below.

Test For	Procedure	Observation	Inference
Starch	Add iodine solution	Blue-black color in sweet potato, no color change in ginger	Sweet potato contains starch, ginger does not
Reducing sugars	Add Benedict's solution and heat	Color change from blue to brick red in ginger, no color change in sweet potato	Ginger contains reducing sugars, sweet potato does not

(c) (i) State the nature of the stored food substances identified in each storage organ.

- The sweet potato stores carbohydrates in the form of starch.
- The ginger stores carbohydrates in the form of reducing sugars.

(ii) Name the plant part from which each storage organ develops.

- The sweet potato develops from the root.
- The ginger develops from the stem (rhizome).

2. A class of twelve groups of students carried out a survey of uncultivated land measuring 20 × 15 meters, with twelve 5 × 5 m quadrats labeled A - L. Each group counted the number of black ants, grasshoppers, spiders, and beetles in each quadrat as shown in the table below.

Animals	Number of animals in each quadrat
Black ants	30 5 6 7 26 10 4 2 7 11 30 20

Red ants	25 8 3 10 7 6 4 41 6 15 3 20
Grasshoppers	5 2 4 3 5 2 3 6 1 5 12 5
Spiders	0 1 2 2 0 1 3 4 2 1 0 1
Beetles	0 2 0 2 1 0 0 2 0 0 1 1

(a) Calculate the

(i) area of the land surveyed.

- The total area surveyed is given by multiplying the length and width of the land:
  20 m × 15 m = 300 square meters

(ii) density of grasshopper population in the whole plot.

- Total number of grasshoppers counted = 5 + 2 + 4 + 3 + 5 + 2 + 3 + 6 + 1 + 5 + 12 + 5 = 53
- Area of the plot = 300 square meters
- Density = total number of grasshoppers / total area surveyed
  Density = 53 / 300 = 0.18 grasshoppers per square meter

(b) Which group of animals is most abundant/plentiful?

- Black ants are the most abundant, as their total count across all quadrats is the highest.

(c) Calculate the density of the most abundant group of animals.

- Total number of black ants counted = 30 + 5 + 6 + 7 + 26 + 10 + 4 + 2 + 7 + 11 + 30 + 20 = 158
- Density = total number of black ants / total area surveyed
  Density = 158 / 300 = 0.53 black ants per square meter

(d) Give three reasons to explain why the population density of the area studied will have changed after six months.

- Changes in environmental conditions, such as temperature and rainfall, may affect the survival and reproduction of animals.
- Predation may increase or decrease certain populations, leading to shifts in animal density.
- Availability of food resources may influence reproduction rates, with abundant food leading to population growth and scarce food leading to a decline.

3. Carefully observe the organisms represented by diagrams A, B, C, and D shown below.

(a) (i) Identify the organisms represented by diagrams A, B, C, and D by their common names.

- A: Tree seedling
- B: Crustacean (possibly a shrimp or prawn)
- C: Planarian (flatworm)
- D: Hydra

(ii) Name the kingdom to which each of the organisms in (a)(i) above belongs.

- A: Plantae
- B: Animalia
- C: Animalia
- D: Animalia

(iii) Which two features have you used to group each organism represented by diagrams B and D in their respective kingdom?

- B: Possesses jointed appendages and an exoskeleton, which are characteristic features of arthropods.
- D: Has tentacles and a simple body structure, which are characteristic features of cnidarians.

(b) Name the mode of reproduction and movement for the organism represented by diagram D.

- Mode of reproduction: Asexual reproduction through budding, where a small new individual develops on the parent and detaches when fully developed.
- Mode of movement: Uses tentacles and body contractions to move by gliding or somersaulting.

(c) (i) Where does the organism in diagram A live?

- The organism in diagram A (tree seedling) lives in terrestrial environments, particularly in soil where it germinates and grows into a mature plant.

(ii) What is the economic importance of the organism in diagram C?

- The organism in diagram C (planarian) is important in scientific research for studies on regeneration, as it has the ability to regrow body parts.
- Some flatworms help in controlling pest populations by feeding on small invertebrates.
- However, some flatworms are parasitic and may cause diseases in humans and livestock, leading to economic losses.

4. The diagram below shows an experiment set up for a biological investigation. The potted plant was kept in darkness for 48 hours before the experiment. It was then kept in sunlight for several hours. Observe the setup and answer the questions.

(a) Suggest the purpose of the

(i) caustic soda/potash.

- Caustic soda or caustic potash is used to absorb carbon dioxide from the air inside the setup. This ensures that no carbon dioxide is available for photosynthesis in the enclosed environment.

(ii) soda lime.

- Soda lime is also used to remove carbon dioxide from the air. It is commonly used in experiments to investigate whether carbon dioxide is necessary for photosynthesis.

(iii) polythene (plastic) bag.

- The polythene bag is used to isolate part of the plant from the external atmosphere. This helps in creating a controlled environment where carbon dioxide removal can be tested effectively.

(b) Why was the potted plant kept in darkness?

- The plant was kept in darkness for 48 hours to destarch the leaves. This ensures that any starch previously stored in the leaves is used up so that any starch detected later must have been produced during the experiment.

(c) (i) What will be observed if iodine solution is added to leaves M and N after their chlorophyll is removed?

- Leaf M, which was exposed to normal air, will turn blue-black when iodine is added, indicating the presence of starch, meaning photosynthesis occurred.
- Leaf N, which was in an environment without carbon dioxide, will remain brown when iodine is added, indicating that no starch was produced due to the absence of carbon dioxide.

(ii) Which of the leaves M and N served as a control experiment?

- Leaf N served as the control because it was placed in an environment without carbon dioxide. This setup helped determine whether carbon dioxide is necessary for photosynthesis.

(d) (i) Name the biological process investigated in the experiment.

- The biological process being investigated is photosynthesis, specifically whether carbon dioxide is necessary for starch formation.

(ii) Suggest the aim of the experiment.

- The aim of the experiment is to determine whether carbon dioxide is required for photosynthesis to occur in plants.

(iii) State the importance of the experiment.

- The experiment demonstrates the role of carbon dioxide in photosynthesis, which helps in understanding plant growth and the importance of maintaining atmospheric carbon dioxide levels.
- It also confirms that plants produce their own food through photosynthesis using sunlight, water, and carbon dioxide.
- The findings support agricultural practices, such as increasing crop yield by ensuring plants receive adequate carbon dioxide.

5. In an experiment to find the composition of blood, 5 cm^3 of fresh blood from a rabbit was centrifuged and the result was as shown below.

(a) (i) Label A and B.

- A: Plasma
- B: Blood cells (Red blood cells and white blood cells)

(ii) Identify four substances present in A.

- Water: It makes up the majority of plasma and serves as a medium for transporting nutrients and waste.
- Proteins: Includes albumin, fibrinogen, and globulins, which play roles in maintaining osmotic balance and immune function.
- Glucose: Provides energy to cells through cellular respiration.
- Hormones: Regulate various physiological processes such as metabolism and growth.

(iii) Identify three substances present in B and state the function(s) of each substance.

- Red blood cells: Contain hemoglobin, which transports oxygen from the lungs to tissues and removes carbon dioxide.
- White blood cells: Help in fighting infections by attacking pathogens and producing antibodies.
- Platelets: Play a crucial role in blood clotting, preventing excessive bleeding from injuries.

(b) Name the substance that is

(i) most plentiful in B.

- Red blood cells are the most plentiful because they are responsible for transporting oxygen throughout the body and are found in the highest quantity in blood.

(ii) least plentiful in B.

- White blood cells are the least plentiful because they are only produced in response to infections or immune responses. Their numbers fluctuate depending on the body's condition.

(c) Arrange in increasing order the substances present in B.

- White blood cells --> Platelets ---> Red blood cells.
- White blood cells are the least abundant, followed by platelets, while red blood cells are the most abundant in the blood.