THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

733/2A **BIOLOGY 2A**

Time: 3 Hour. **ANSWERS** **Year: 2003**

Instructions

1. This paper has three papers.
2. Answer **all** questions.
3. Question **1** contains 30 marks while question 2 and 3 have 10 marks each.
4. Mobile phones are not allowed inside the examination room.
5. Write your Examination Number on every page of your answer booklet.

1. Dissect the provided specimen Z (a male or female grasshopper) in the usual way to expose the digestive and reproductive systems. Then, respond to the following:

(a) Draw a well labelled diagram of dissected specimen Z showing six parts of the digestive system and two reproductive parts.

Answer:
Drawing is expected to be done by candidate on paper. However, a typical labelled diagram should show the following digestive parts: crop, gizzard, midgut, hindgut, rectum, and anus. Reproductive parts may include testes/ovaries and seminal vesicles/spermatheca depending on the sex.

(b) Identify three major parts of the alimentary canal visible in specimen Z.

- The crop is one major part of the alimentary canal. It serves as a temporary storage site for ingested food before it moves into the gizzard.
- The gizzard is another main component. It is muscular and helps grind food, especially since the grasshopper lacks chewing teeth for fine grinding.
- The midgut is where digestion and absorption take place. It contains digestive enzymes that break down food and allows nutrients to be absorbed into the body.

(c) State the observable differences in reproductive system between male and female grasshopper.

- In males, testes are visible as paired whitish structures along the dorsal side of the abdomen, and a pair of vas deferens may also be seen leading toward the genital pore.
- Females have ovaries made up of multiple tubular structures known as ovarioles, which appear as yellowish or cream-colored bunches. These are more branched and distinct compared to testes.
- The female also has an ovipositor, a hard, pointed structure at the posterior end used to lay eggs, which is absent in males. In contrast, the male may show claspers at the end of the abdomen used during mating.

2. You are provided with specimen X1 and X2 and instructed to carry out the following experiment:

(i) Cut specimen X1 into two halves using a scalpel.
(ii) Add 2 drops of iodine to one half and observe after 5 minutes.
(iii) To the second half, add 3 drops of Benedict's solution, heat gently and observe.
(iv) Peel specimen X2 and rub it on a brown paper sheet, then heat it under flame and observe.

Questions:

(a) What colour change was observed when iodine was added to specimen X1?

A blue-black colour appeared on the surface of specimen X1 after iodine was added. This colour change indicates the presence of starch in the specimen.

(b) Identify the food substances present in specimen X1.

Starch and reducing sugars were present in specimen X1. The blue-black colour from iodine confirms starch, while the Benedict's test, which turned from blue to orange upon heating, indicates reducing sugars such as glucose.

(c) What was the chemical basis for the colour change observed with iodine?

The iodine molecules interact with the coiled structure of amylose (a component of starch), forming a starch-iodine complex. This results in a visible blue-black coloration, which is a characteristic indicator for starch presence.

(d) Name the enzymes responsible for digesting the food substances identified in X1 and their end products.

The enzyme amylase digests starch into maltose, and further into glucose by maltase. The reducing sugar identified (glucose) is a direct end product of carbohydrate digestion.

(e) Mention four roles of the identified food substance in X1 in plant metabolism.

- Starch serves as the main storage form of carbohydrates in plants, which can later be converted to glucose for energy.
- It provides a reserve energy source during periods of low photosynthesis, such as at night.
- Starch contributes to osmotic balance by preventing the excessive accumulation of soluble sugars in cells.
- It supports growth and development by supplying glucose needed in respiration and biosynthesis of other organic molecules.

(f) State two adaptive functions of the food substance in specimen X2 to desert animals.

- The lipid or oil present in specimen X2 helps store metabolic energy in a compact form, which is critical for animals in arid regions where food is scarce.

- Lipids also serve as a source of metabolic water when oxidized during respiration, thus helping desert animals survive with minimal external water intake.

3. You are given specimens F (Chameleon), G (Lizard), H (Frog), and I (Tortoise). Observe them and answer:

(a) Mention five observable features that differentiate specimen F and H.

- The chameleon (F) has a rough scaly skin while the frog (H) has smooth and moist skin.
- Chameleon has claws and digits adapted for grasping branches, whereas the frog has webbed feet suited for swimming and jumping.
- Eyes in a chameleon move independently and are large with conical lids, while frog's eyes are more fixed and project outward.
- The chameleon breathes using lungs only, while the frog uses both lungs and skin for respiration.
- Chameleons are adapted for arboreal life (tree-living) with a prehensile tail, while frogs live in or near water with strong hind limbs for leaping.

(b) Identify three shared features between specimens G and I.

- Both lizard (G) and tortoise (I) have dry, scaly skin which is a feature of reptiles.
- They both lay shelled eggs on land, characteristic of reptiles' reproduction.
- They are ectothermic (cold-blooded), meaning their body temperature depends on the environment.

(c) Draw specimen G and label five observable features.

Drawing should be done practically. The labelled features to include are: head, eye, forelimb, hindlimb, tail.