THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

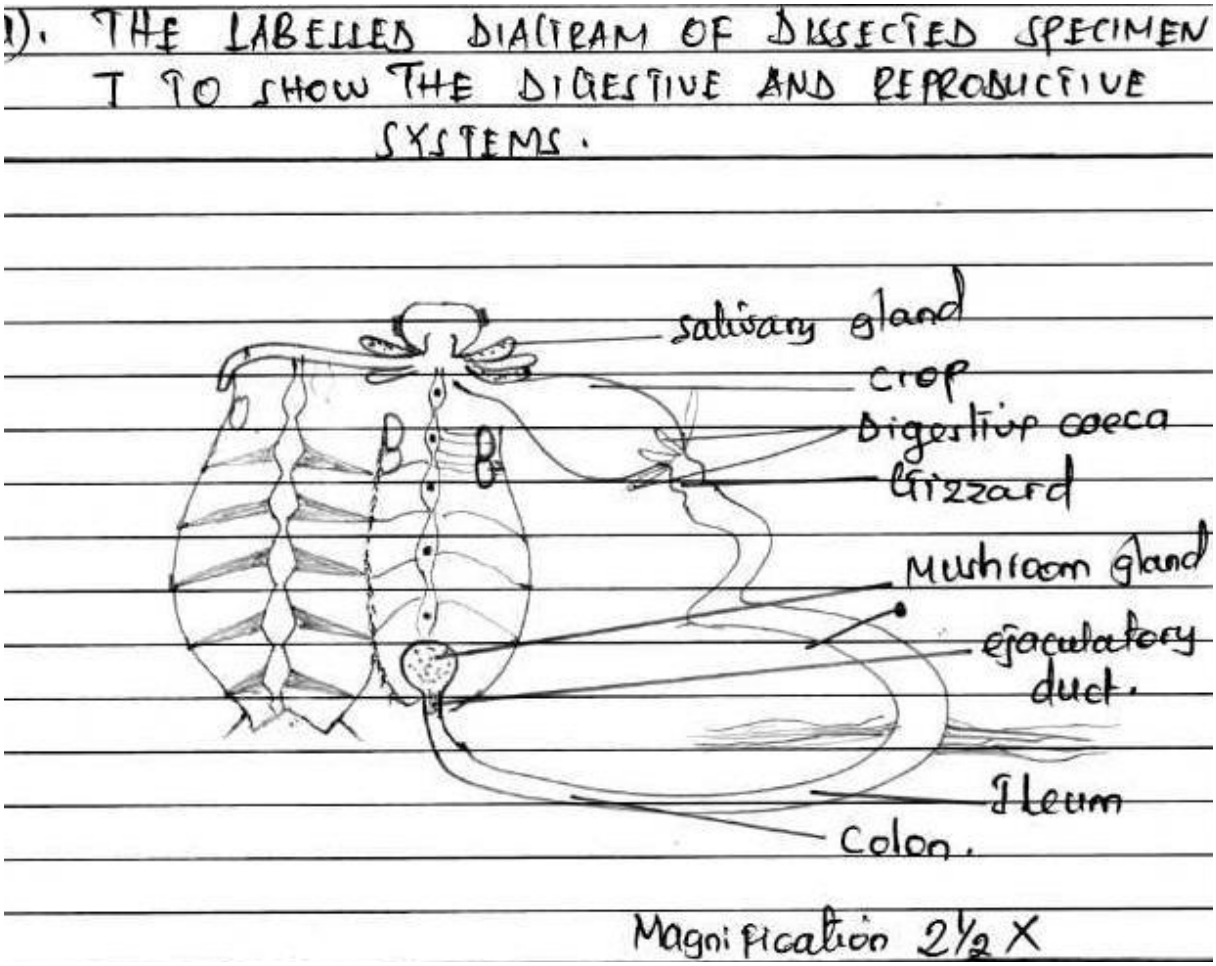
733/2A **BIOLOGY 2A**

Time: 3 Hour. **ANSWERS** **Year: 2007**

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 specimen T (cockroach male or female) to expose the reproductive and excretory systems.
(a) (i) Draw a well-labelled diagram showing two parts of the reproductive system and two of the excretory system.



(ii) Label the position of the heart and crop on the diagram.

In the actual diagram (to be drawn by the candidate), two reproductive parts such as testes and vas deferens (in males) or ovaries and oviducts (in females) must be shown. Two excretory structures should include Malpighian tubules and the rectum. Additionally, the heart should be shown as a long dorsal tube above the digestive system, and the crop should be positioned in the foregut region of the digestive tract.

(b) (i) State one function of each reproductive and excretory part drawn.

The testes produce sperm cells while the vas deferens transports sperm to the exterior. In females, the ovaries produce ova and the oviducts transport them. The Malpighian tubules filter nitrogenous waste from the hemolymph and the rectum helps reabsorb water and expel fecal waste.

(ii) Describe how waste is removed from the body of specimen T.

In cockroaches, waste is removed by the Malpighian tubules which absorb nitrogenous waste from the surrounding hemolymph. These wastes are passed into the hindgut, particularly the rectum, where water is reabsorbed and uric acid is excreted with feces through the anus.

(c) (i) Identify the sex of specimen T.

(ii) Give three justifications based on observable features.

If the cockroach has long, slender anal styles and symmetrical cerci, it is a male. Males also have smaller abdomens and visible genitalia at the tip. Females lack anal styles, have broader abdomens, and a visible ovipositor used for laying eggs.

2. You are given solutions V and W.

(a) (i) Carry out food tests using iodine, Benedict's, Biuret, and ethanol solutions.

(ii) Complete the following table:

Food Test	Procedure	Observation	Inference
Starch (Iodine)	Add iodine solution to sample	Blue-black colour forms	Starch is present
Reducing sugar (Benedict's)	Add Benedict's solution then heat in a water bath	Brick-red precipitate forms	Reducing sugar present
Protein (Biuret)	Add Biuret reagent (NaOH + $CuSO_4$) to solution	Purple/violet colour appears	Protein is present
Lipids (Ethanol)	Mix with ethanol then add water	Cloudy white emulsion forms	Lipid/fat is present

(b) (i) Name the enzyme that digests the substance found in solution V.

If solution V contains starch, the enzyme is amylase. It breaks down starch into maltose, and later maltase converts it into glucose.

(ii) State the final product of digestion and where it is absorbed.

The final product of starch digestion is glucose, which is absorbed into the bloodstream in the small intestine through the villi lining.

(c) (i) What is the importance of each food substance to a growing child?

Starch provides energy needed for growth and movement. Proteins are essential for body building and repair of tissues. Lipids supply concentrated energy and help in the formation of cell membranes. Reducing sugars like glucose provide quick energy, especially for brain activity.

(ii) Explain how temperature affects the biochemical test for reducing sugar.

The Benedict's test for reducing sugars requires heat. Low temperature may result in no visible colour change, while optimal heating allows reduction reactions to occur, forming brick-red precipitate. Overheating may denature the solution or give false results.

3. Observe specimens X (Spider), Y (Bee), and Z (Butterfly).
(a) (i) List three observable similarities between Y and Z.
Specimens Y and Z both have three body parts: head, thorax, and abdomen. They have two pairs of wings and three pairs of jointed legs. Both possess compound eyes and antennae.

(ii) List two features that distinguish X from both Y and Z.
Specimen X (Spider) has two body parts (cephalothorax and abdomen) and four pairs of legs. It lacks wings and antennae, unlike specimens Y and Z.

(b) (i) Explain three reasons why Y is classified in class Insecta.
Specimen Y (Bee) has a body divided into three main parts: head, thorax, and abdomen. It possesses three pairs of legs and compound eyes. It also has one or two pairs of wings and one pair of antennae.

(ii) Describe two benefits of Y to crop production.
Bees help in pollination by transferring pollen from one flower to another, which enhances fertilization and fruit production. They also contribute to honey production, which has economic and nutritional value.

(c) (i) Draw specimen Z and label five external structures.
(ii) How do these structures assist in survival?
In the actual diagram, key structures should include antennae, compound eyes, forewings, hindwings, and legs.
Antennae help in sensing chemicals and vibrations. Compound eyes allow wide-angle vision. Wings enable flight for movement and escape from predators. Legs aid in walking, feeding, and gripping surfaces.