THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

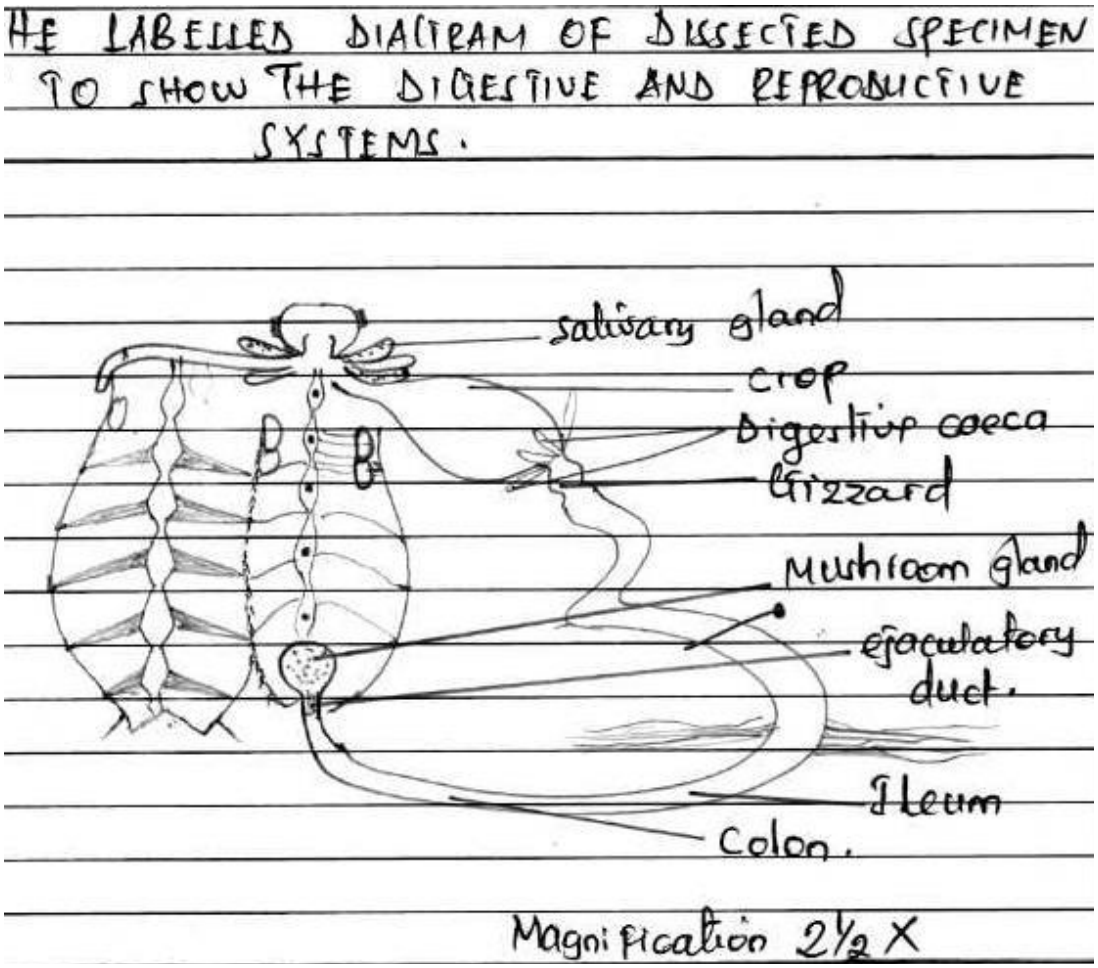
733/2A **BIOLOGY 2A**

Time: 3 Hour. **ANSWERS** **Year: 2008**

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



(a) (ii) Indicate with arrows the direction of movement in the excretory system.
In the diagram, arrows should point from the Malpighian tubules toward the gut (specifically the hindgut), indicating the movement of nitrogenous wastes into the gut for excretion.

(b) (i) State the function of each reproductive part drawn in (a)(i).
The ovary is responsible for the production of ova (eggs) in females. In males, the testes produce sperm. These are the primary sex organs involved in gamete production.

The vas deferens in males transports sperm from the testes to the ejaculatory duct. In females, the oviduct transports eggs from the ovaries toward the genital chamber for laying.

(b) (ii) Compare the reproductive system of specimen R to that of a mammal using two points.
Unlike cockroaches, mammals possess internal fertilization and complex reproductive organs like the uterus, which is not present in insects. Mammals also have external reproductive openings that are separate from the digestive tract, whereas in cockroaches, some structures share common exits.

(c) (i) Identify the sex of specimen R.
The sex of the cockroach can be identified as male.

(c) (ii) Give three observable features that support your answer.
Males have a narrow abdomen that is pointed and symmetrical. They also possess styli — short, unsegmented appendages found on the 9th abdominal segment — which are absent in females. Furthermore, males often have longer wings that fully cover the abdomen, while females have shorter wings that may not reach the end of the abdomen.

2. You are provided with solutions S and T.
(a) (i) Perform appropriate food tests using iodine, Benedict's, and Biuret solutions.
This task should be performed practically. Iodine tests for starch (blue-black), Benedict's for reducing sugars (brick red), and Biuret for proteins (purple/violet).

(a) (ii) Record your procedures, observations, and inferences in a table format.

Food Test	Procedure	Observation	Inference
Starch	Add iodine to solution S	Solution turned blue-black	Starch is present
Reducing Sugar	Add Benedict's to solution T, then heat	Solution turned brick red	Reducing sugar is present
Protein	Add Biuret solution to solution T	Solution turned violet	Protein is present

(b) (i) Name the enzymes that digest each food substance identified.
Amylase is responsible for breaking down starch into maltose. Maltase then breaks down maltose into glucose. Proteins are broken down by protease enzymes like pepsin and trypsin. Reducing sugars are simple and may not need further digestion.

(b) (ii) State the organ where each enzyme functions best.
Amylase functions in the mouth and small intestine. Pepsin functions in the stomach, while trypsin acts in the small intestine. Maltase works on the villi surface of the small intestine.

(b) (iii) Write the final product for each digestion.
Starch is digested to glucose. Proteins are digested to amino acids. Reducing sugars are already in absorbable form like glucose.

(c) (i) Why is heat needed during Benedict's test?
Heating provides the energy necessary to drive the redox reaction in Benedict's test. This causes the

copper (II) sulfate to be reduced to copper (I) oxide, leading to the color change that indicates the presence of reducing sugars.

(c) (ii) What would be the result if a protein sample is tested using iodine?
If a protein sample is tested using iodine, there would be no color change. The solution would remain brownish-yellow, as iodine does not react with proteins.

3. Observe specimens X (Tilapia scale), Y (Bean seedling), and Z (Cactus plant).
(a) (i) State two observable features used to place specimen Z into its kingdom.
Specimen Z has green parts for photosynthesis, indicating it's an autotroph. It also has a cell wall made of cellulose, typical of members in the Plantae kingdom.

(a) (ii) Give three morphological adaptations that enable Z to survive in dry regions.
Cactus plants have succulent stems that store water. They possess spines instead of leaves to reduce transpiration. Their roots are shallow but widespread to absorb minimal rainfall quickly.

(b) (i) Name the organism from which specimen X was taken.
Specimen X was taken from a Tilapia fish.

(b) (ii) State two roles played by the scale to that organism.
Fish scales protect the fish's body from mechanical injury and infections. They also reduce friction during swimming, enhancing movement efficiency.

(b) (iii) How do fish scales differ from reptile scales?
Fish scales are dermal in origin and typically smooth, thin, and overlapping. Reptile scales are epidermal and made of keratin, often rougher and dry.

(c) (i) Which features are used to classify specimen Y into dicotyledonous plants?
The bean seedling has broad leaves with net-like veins. It exhibits a taproot system, and its seeds split into two cotyledons.

(c) (ii) What are the economic benefits of specimen Y?
Bean plants are a source of protein-rich food. They improve soil fertility through nitrogen fixation. Additionally, they serve as cash crops for small-scale farmers.