THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

733/2A **BIOLOGY 2A**

Time: 3 Hour. **ANSWERS** **Year: 2006**

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 F (cockroach) to reveal its internal reproductive and excretory systems.
(a) (i) Draw a well-labelled diagram of the internal parts exposed.

(ii) Use arrows to show the flow of reproductive products and excretory materials.
In the diagram, show the reproductive parts such as testes or ovaries and vas deferens or oviducts. Also, include excretory structures such as malpighian tubules and rectum. Arrows should indicate sperm or eggs moving through ducts and nitrogenous wastes flowing from the malpighian tubules to the rectum for excretion.

(b) (i) State the role of the reproductive system in insects.
The reproductive system produces and transports gametes for fertilization. In males, it produces sperm and facilitates their transfer to the female. In females, it produces eggs and provides a pathway for laying fertilized eggs.

(ii) Explain how the malpighian tubules function.
Malpighian tubules extract nitrogenous waste like uric acid from the hemolymph and transport it to the hindgut, where it mixes with feces and is excreted. This helps conserve water in terrestrial insects.

(c) (i) Determine the sex of specimen F.
The sex of specimen F can be determined by checking the posterior end. Males have claspers at the abdomen tip, while females have an ovipositor.

(ii) Justify with three observations.
If claspers are present and the abdomen is narrow and pointed, it is a male. If there is an ovipositor and broader abdomen, it is a female. Also, males usually have symmetrical cerci while females may have a more segmented terminal structure.

2. You are provided with solution L suspected to contain proteins and starch.
(a) (i) Carry out food tests and record results as follows:

Food Test	Procedure	Observation	Inference
Starch	Add iodine solution to solution L	Blue-black coloration	Starch is present
Protein	Add Biuret reagent (NaOH + $CuSO_4$) to solution L	Purple/violet colour	Protein is present
Reducing Sugar	Add Benedict's solution and heat	No colour change	Reducing sugar absent
Lipid	Add ethanol and water (emulsion test)	No cloudy emulsion	Lipids absent

(b) (i) State the enzyme used to break down starch and its end product.
The enzyme is amylase. It breaks down starch into maltose, which is further digested into glucose.

(ii) What organ secretes the enzyme for protein digestion?

The stomach secretes pepsinogen, which becomes active as pepsin to digest proteins.

(iii) Why are proteins essential in the human body?
Proteins are essential for building and repairing tissues, forming enzymes and hormones, and maintaining muscle mass. They also aid in immune defense.

(c) (i) Why should the solution be kept warm during Benedict's test?
Heating is required to activate the reaction between reducing sugars and Benedict's reagent, which only occurs at elevated temperatures.

(ii) What is the role of water in a Biuret test?
Water acts as a medium to dissolve both the test solution and reagents, ensuring proper interaction between copper ions and peptide bonds in proteins.

3. Observe specimens G (Beetle), H (Grasshopper), and J (Dragonfly).

(a) (i) Mention five observable features common in all three.
All have segmented bodies divided into head, thorax, and abdomen. They possess three pairs of jointed legs. They have one pair of antennae. All have compound eyes. Their bodies are covered with an exoskeleton made of chitin.

(ii) What are two distinct features of specimen J?
Specimen J has two pairs of transparent wings that do not fold over the body. It also has an elongated abdomen and large eyes that occupy most of the head.

(b) (i) Explain how specimen H adapts to jumping.
Specimen H has long, muscular hind legs with large femurs adapted for jumping. The joints are strong and flexible, providing the thrust needed to leap forward.

(ii) State two economic values of specimen G.
Beetles can act as pollinators for certain plants. Some beetle species also help decompose organic material, improving soil fertility.

(c) Draw specimen J and label five external parts.
The drawing should include the head, compound eyes, antennae, thorax, wings, legs, and abdomen. These structures assist in flight, feeding, sensory detection, and locomotion.