THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

733/2A **BIOLOGY 2A**

Time: 3 Hour. **ANSWERS** **Year: 2000**

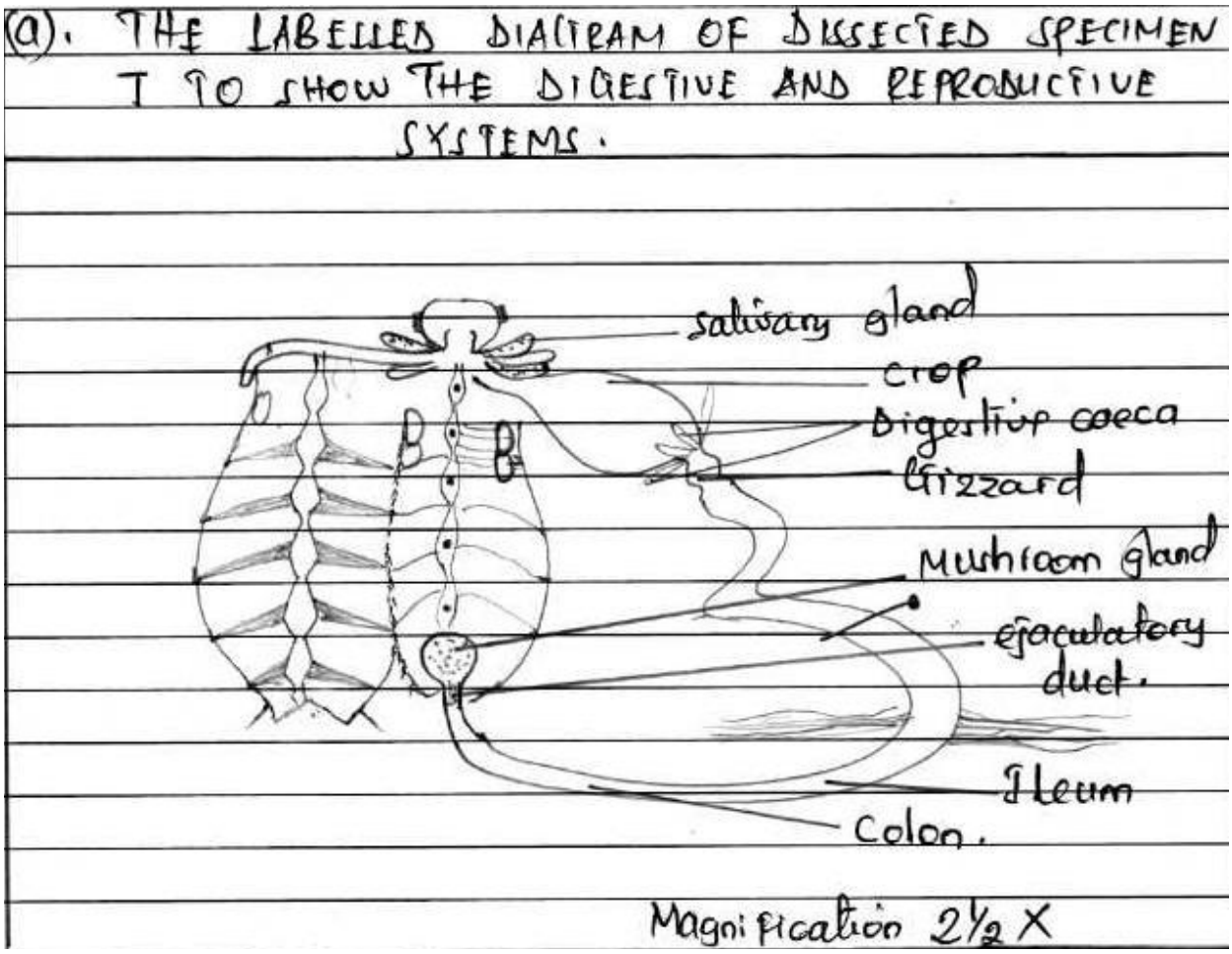
Instructions

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 Q (a male or female cockroach) in the usual way to expose both the digestive and excretory systems. Then answer the following:

(a) Draw a well-labelled diagram of dissected specimen Q showing three parts of the digestive system and three parts of the excretory system.

(This should be drawn practically. For digestive system: oesophagus, crop, and gizzard can be labelled. For excretory system: Malpighian tubules, rectum, and anus should be shown.)



(b) State the function of each labelled part of the excretory system.

The Malpighian tubules remove nitrogenous waste from the haemolymph and convert it into uric acid, which is less toxic and helps conserve water.

The rectum reabsorbs water and salts from the waste before excretion, making the excretory product more solid and suitable for water conservation.

The anus is the final opening through which solid waste and uric acid are excreted out of the body.

(c) Determine the sex of specimen Q. Give three observable features to support your answer.

If the specimen is male, it will have a narrow abdomen that ends in a pair of short anal styles which are absent in females.

Males also have symmetrical cerci (sensory appendages) and their last abdominal segments are less broad compared to those of the female.

In females, the abdomen is wider and ends in an ovipositor, a structure used for laying eggs. This is absent in males.

2. You are provided with solution F and G. Perform the following:

(a) Use appropriate reagents to test for food substances in solutions F and G. Record your results in the table below:

Food Tested	*Procedure*	*Observation*	*Inference*
Starch	Add iodine solution	Blue-black colour	Starch present
Reducing sugar	Add Benedict's solution and heat	Brick-red precipitate	Reducing sugar present
Protein	Add Biuret reagent	Purple colour	Protein present
Lipid	Rub on brown paper dry gently	Permanent translucent spot	Lipid present

(b) List three roles of the food substance(s) found in solution F and G in the human body.

Starch is a major source of energy. It is broken down into glucose which fuels metabolic processes and supports physical activity.

Reducing sugars like glucose provide quick-release energy and are essential for brain function and muscular activity.

Proteins support growth and tissue repair, enzyme formation, immune response, and act as structural components in the body.

Lipids provide a dense energy reserve, support insulation, protect organs, and help in the absorption of fat-soluble vitamins.

(c) (i) State the enzyme responsible for digestion of the food substance identified in solution G in the ileum.

Lipase is the enzyme responsible for the digestion of lipids in the ileum.

(ii) What is the end product of digestion by the enzyme stated in (c)(i)?

The end products of lipid digestion by lipase are fatty acids and glycerol, which are then absorbed into the intestinal villi.

3. You are provided with specimen H (Liver). Carry out the procedures below and answer the questions:

(a) Cut specimen H into small pieces.
(b) Mix with sand in a mortar and grind thoroughly.
(c) Divide into two test tubes: Test Tube M and Test Tube N.
(d) Add 2 ml of hydrogen peroxide into both tubes.
(e) Boil the contents in Test Tube N before adding hydrogen peroxide.
(f) Use a glowing splint to test the gas evolved.

(a) What was the aim of this experiment?

The aim was to show the presence and action of catalase enzyme in liver tissue and demonstrate the effect of heat on enzyme activity.

(b) Which test tube served as the control?

Test tube N served as the control because its contents were boiled, which inactivates the enzyme and allows comparison with the unboiled sample.

(c) What changes were observed in each test tube? Give reasons.

In Test Tube M, rapid bubbling occurred when hydrogen peroxide was added. This was due to the active catalase breaking down H_2O_2 into water and oxygen.

In Test Tube N, no bubbling was observed because boiling denatured the catalase enzyme, rendering it inactive.

(d) Identify the substance in specimen H responsible for the observed change.

The enzyme catalase is responsible for the rapid breakdown of hydrogen peroxide observed in the unboiled test tube.

(e) Write the chemical equation of the reaction.

$2H_2O_2 \rightarrow 2H_2O + O_2$

(f) Name the gas evolved and explain how it was identified.

The gas evolved was oxygen. It was confirmed by inserting a glowing splint into the test tube, which relit in the presence of oxygen.

(g) Give two deductions that can be made from this experiment.

Living tissues such as liver contain catalase which decomposes hydrogen peroxide. Enzyme activity is sensitive to heat and is lost when the enzyme is denatured by boiling.