THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

033/2 **BIOLOGY 2**

ALTERNATIVE TO PRACTICAL

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: January, 1999**

Instructions

1. This paper consists of sections Five questions. Answer all questions

2. Each question carries ten marks.

1. A substance X was mixed with an enzyme and incubated at 37°C for 10 minutes. The products were then boiled with dilute acid (e.g., HCl), then neutralized with NaOH solution until alkaline. It was boiled with Benedict's solution and heated. A red precipitate was formed.

a) What is X? Give reasons.

X is a carbohydrate, specifically a non-reducing sugar such as sucrose. The reason is that it did not initially react with Benedict's solution, indicating it was not a reducing sugar. However, after hydrolysis with acid and subsequent neutralization, it gave a positive result with Benedict's solution, forming a red precipitate, which indicates the presence of reducing sugars like glucose and fructose.

b) Outline the possible chemical changes that took place.

- X (a non-reducing sugar) was hydrolyzed by the enzyme into simpler sugars.
- The hydrolyzed solution was treated with HCl, breaking down any remaining non-reducing sugars into reducing sugars.
- The solution was neutralized with NaOH to make it suitable for Benedict's test.
- The Benedict's test confirmed the presence of reducing sugars by forming a red precipitate.

c) Why was the temperature kept at 37°C?

The temperature was kept at 37°C because it is the optimum temperature for enzyme activity, ensuring efficient hydrolysis of the non-reducing sugar.

d) What is the role of HCl in this experiment?

HCl helps to hydrolyze non-reducing sugars into reducing sugars by breaking glycosidic bonds in disaccharides such as sucrose.

e) Why was neutralization necessary before the addition of Benedict's solution?

Neutralization was necessary because Benedict's solution only works in an alkaline medium. The addition of NaOH neutralized the acidic hydrolysate, making it suitable for Benedict's test.

2. Two leafy shoots taken from different plant species A and B, which occupy different habitats, were each weighed and hung in an oven, which was regulated to a temperature of 50°C. The shoots were reweighed at 20-minute intervals. The results were tabulated as shown below.

Time in minutes	Mass in gms of leafy shoot of species A	Mass in gms of leafy shoot of species B
0	100.0	100.0
20	70.0	89.1
40	40.0	80.0

60	24.0	78.0
80	19.50	74.0
100	19.0	72.0
120	19.0	71.0

i) Using graph paper, plot graphs of mass against time for species A and B using a common axis.

ii) Calculate the percentage mass decrease of each after the end of the experiment.

For species A:
Initial mass = 100.0 g
Final mass = 19.0 g
Percentage mass decrease = ((100.0 - 19.0) / 100.0) × 100 = 81.0 percent

For species B:
Initial mass = 100.0 g
Final mass = 71.0 g
Percentage mass decrease = ((100.0 - 71.0) / 100.0) × 100 = 29.0 percent

iii) Explain the cause of mass change in the two leafy shoots.

The mass loss in both species is due to water loss through transpiration.
- Species A shows a higher rate of water loss, likely due to having more stomata, thinner leaves, or less cuticular wax, making it more susceptible to dehydration.
- Species B retains more water, possibly due to adaptations such as a thick cuticle, fewer stomata, or sunken stomata, reducing transpiration.

iv) Which of the two plant species can survive in semi-arid regions? Give reasons to support your answer.

Species B can survive in semi-arid regions because:
- It has a lower rate of water loss, as indicated by its gradual mass decrease.
- It may have adaptations such as thick cuticles, sunken stomata, or reduced leaf surface area, which minimize water loss.
- Its ability to retain moisture for longer periods makes it more suited to dry environments.

3. Figures 1 to 4 are mouthparts of different animals. In the table below, write the modification of each mouth and the feeding habits shown by each, as shown by the example of figure 0015.

Fig	Shape of mouth	Feeding habit

0015	Thick, tough, sharp, and curved	For cracking nuts in order to get seeds
1	Long, coiled proboscis	Sucking nectar from flowers (e.g., butterfly)
2	Sharp, hooked beak	Tearing flesh from prey (e.g., eagle)
3	Short, pointed beak	Pecking seeds and small insects (e.g., finch)
4	Strong mandibles with cutting edges	Chewing and cutting plant material (e.g., grasshopper)

4. Study the organisms represented by figures 5, 6, and 7.
a) Provide common names for the organisms represented by figures 5 - 7.
- Figure 5: Earthworm
- Figure 6: Caterpillar (Larva of a butterfly or moth)
- Figure 7: Nematode (Roundworm)

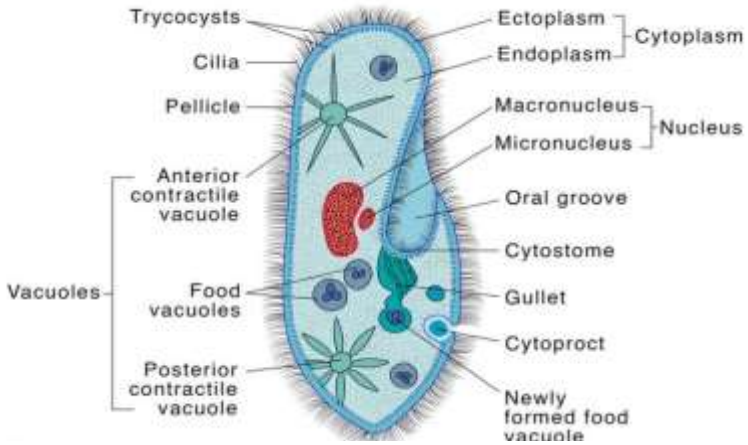
b) Give the phyla and class to which the organisms represented by the figures belong.
- Earthworm (Figure 5): Phylum Annelida, Class Clitellata
- Caterpillar (Figure 6): Phylum Arthropoda, Class Insecta
- Nematode (Figure 7): Phylum Nematoda, Class Secernentea

c) Label parts a - e.
- a: Segmented body
- b: Clitellum (thickened glandular section of the earthworm's body)
- c: Prolegs (fleshy, stubby structures for movement in the caterpillar)
- d: True legs (jointed legs in caterpillars)
- e: Spiracles (openings for respiration)

d) What features are observable in figure 6 which are seen in adult stages of the organism?
- The segmented body, which remains in the adult insect
- Spiracles for respiration, which continue functioning in the adult stage
- Jointed legs that develop into the insect's primary walking and grasping legs

e) Which features are present in the habitat of figure 6?
- The caterpillar's habitat contains vegetation for feeding
- The presence of leaves for shelter and camouflage
- Moist environments that support larval development before metamorphosis

5. a) Draw a diagram to show the structure of Paramecium and label structures used for:



b) Figures 8 - 10 represent plant structures.

i) What plant part do these figures represent?

The figures represent different types of leaves.

ii) Differentiate figures 9 and 10 by their types.

- Figure 9: Simple leaf (has a single undivided blade)
- Figure 10: Compound leaf (divided into multiple leaflets)

iii) Mention the functions of structure 8.

- Photosynthesis: Captures sunlight to produce food through photosynthesis.
- Transpiration: Facilitates the loss of water vapor through stomata.
- Gaseous exchange: Allows oxygen and carbon dioxide to diffuse in and out of the leaf.
- Storage: Some leaves store food and water in specialized plants.