THE UNINTED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION AND CULTURE

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

133/1 **BIOLOGY 1**

Time: 2:30 Hours **ANSWERS** **Year: 1993.**

Instructios:

1. this paper consists of eleven questions
2. answer all questions in section A, and three questions in section B.
3. the marks allocation is indicated at the beginning of each section.

1. (a) (i) Identify the two cell organelles.

Diagram A: Mitochondrion
Diagram B: Chloroplast

(ii) Name the structures numbered 1–8.

1. Outer membrane
2. Inner membrane
3. Cristae
4. Matrix
5. Outer membrane
6. Inner membrane
7. Stroma
8. Thylakoids

(b) Without using diagrams, outline the processes taking place in the structures labeled 3 and 8.

Structure 3 (Cristae):
The cristae in the mitochondrion are the sites of the electron transport chain and oxidative phosphorylation. These processes produce ATP by transferring electrons from NADH and $FADH_2$ to oxygen, coupled with the movement of protons across the inner membrane to generate a proton gradient.

Structure 8 (Thylakoids):
Thylakoids in the chloroplast are the sites of the light-dependent reactions of photosynthesis. Chlorophyll absorbs light energy, leading to the production of ATP and NADPH through photophosphorylation. Water is split, releasing oxygen as a byproduct.

(c) Explain briefly how organelles 1 and 2 are adapted to the functions they perform.

Mitochondrion:
- The double membrane structure provides compartments for different reactions.
- The inner membrane has cristae, increasing the surface area for the electron transport chain.
- The matrix contains enzymes for the citric acid cycle.

Chloroplast:
- The double membrane encloses the stroma, which contains enzymes for the Calvin cycle.
- Thylakoids stacked into grana increase the surface area for light absorption.
- Chlorophyll and other pigments capture light energy for photosynthesis.

2. (a) Explain the role of each of the reagents in step 3.
In step 3, the reagent used was Millon's reagent.

- Millon's reagent is used to test for the presence of proteins. It reacts with tyrosine, an amino acid found in proteins, to produce a reddish-brown coloration. This confirms the presence of proteins in the sample.

(b) Why was it necessary to carry out the procedure for steps 1 and 2 before step 3?
Steps 1 and 2 were necessary to prepare the sample properly for testing:
- Step 1 involved boiling the sample to denature proteins and make them more accessible for the reaction with Millon's reagent.
- Step 2 involved cooling the sample, preventing decomposition or further denaturation that could interfere with the test in step 3.
(d) Using only the information in your table, construct a simple dichotomous key which could be used to separate the six insects.

Dichotomous Key for Identifying the Six Insects

1. (a) Insect has wings ..... Go to 2
   (b) Insect does not have wings ..... Go to 4

2. (a) Insect has two pairs of wings ..... Go to 3
   (b) Insect has one pair of wings ..... Insect X

3. (a) Wings are membranous ..... Insect Y
   (b) Wings are not membranous ..... Insect Z

4. (a) Body has three pairs of legs ..... Insect W
   (b) Body has more than three pairs of legs ..... Go to 5

5. (a) Body is segmented ..... Insect A
   (b) Body is not segmented ..... Insect B

4. (a) (i) Name the class to which specimen S_3 belongs.

The class to which specimen S_3 belongs can be determined based on its observable features. For example, if it is an insect with segmented bodies, three pairs of legs, and antennae, it belongs to the class Insecta.

(ii) What observable features enable specimen S_3 to inhabit terrestrial environments?

- Presence of a chitinous exoskeleton that reduces water loss.
- Spiracles and tracheal systems for efficient gaseous exchange on land.

- Jointed legs for locomotion on varied terrestrial surfaces.
- Ability to conserve water through excretion of uric acid instead of ammonia.

(iii) Make a large labeled drawing of specimen S_3.

Create a detailed diagram showing the key features of the specimen, such as the head, thorax, abdomen, antennae, compound eyes, legs, and wings (if present). Ensure proper labeling of all parts.

(b) (i) Provide the common and scientific names of specimen S_4.

The common name and scientific name of specimen S_4 depend on its observed characteristics. For example, if it is a grasshopper, the names would be:
Common name: Grasshopper
Scientific name: Caelifera

(ii) Name the class and phylum to which specimen S_4 belongs.

Class: Insecta
Phylum: Arthropoda

(iii) Name one other class of the phylum to which specimen S_4 belongs and say how the members of this class differ from those in the class from which S_4 was taken.

Another class: Arachnida
Differences:
- Arachnids have two body segments (cephalothorax and abdomen), while insects have three (head, thorax, abdomen).
- Arachnids have four pairs of legs, while insects have three pairs of legs.
- Arachnids lack antennae, while insects possess one pair of antennae.

5. Cut transverse sections (T.S.) of specimen S_5. Select the best section and stain it with phloroglucinol. Mount the section on a microscope slide and observe it under a microscope.

(a) Make a low power drawing (tissue map) of the section. Label the different layers.

(b) (i) Name the tissues which have stained in phloroglucinol.
(ii) What functions do these tissues perform in the plant represented by S_5?
(iii) What features enable the structures which have taken up the stain perform the functions you have mentioned in b(ii)?

(a) Make a low-power drawing (tissue map) of the section. Label the different layers.

A low-power drawing should depict the key layers of the transverse section, such as the epidermis, cortex, vascular bundles, and pith. Ensure clear and precise labeling of each structure.

(b) (i) Name the tissues which have stained in phloroglucinol.

The tissues that stain with phloroglucinol are lignified tissues, such as xylem and sclerenchyma.

(ii) What functions do these tissues perform in the plant represented by S_5?
- Xylem: Conducts water and dissolved minerals from the roots to other parts of the plant and provides mechanical support.
- Sclerenchyma: Provides strength and rigidity to the plant.

(iii) What features enable the structures which have taken up the stain perform the functions you have mentioned in b(ii)?

- Xylem: Thick lignified walls for support and prevention of collapse under water pressure, and hollow lumens for efficient water conduction.
- Sclerenchyma: Lignified cell walls provide tensile strength and durability, enabling structural support.