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: 2000.**

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) Point out two similarities and two differences between an animal cell and a plant cell.

Similarities:
(i) Both animal and plant cells are eukaryotic, meaning they have a true nucleus and membrane-bound organelles.
(ii) Both cells have a plasma membrane, cytoplasm, mitochondria, and other organelles responsible for cellular functions.

Differences:
(i) Plant cells have a rigid cell wall made of cellulose, while animal cells lack a cell wall.
(ii) Plant cells contain chloroplasts for photosynthesis, while animal cells do not.

(b) Outline the functions of a nucleus.

(i) The nucleus controls all cellular activities, including growth, metabolism, and reproduction.
(ii) It contains genetic material (DNA) that provides instructions for protein synthesis.
(iii) The nucleus regulates cell division and differentiation.
(iv) It facilitates the production of ribosomes in the nucleolus.

2. (a) Identify stages A, B, C, D, E, and F.
A - Egg
B - Nymph
C - Adult cockroach
D - Egg
E - Larva
F - Pupa
(b) Giving reasons, identify the types of metamorphosis exhibited in each life history or cycle above and state any two examples of insects undergoing each type of metamorphosis.

(i) Figure 1a exhibits incomplete metamorphosis because the life cycle involves three stages: egg, nymph, and adult, without a pupal stage. Examples include cockroaches and grasshoppers.
(ii) Figure 1b exhibits complete metamorphosis because the life cycle involves four stages: egg, larva, pupa, and adult. Examples include butterflies and beetles.

3. (a) Can water enter xylem vessels by osmosis? Give reasons to support your answer.

No, water cannot enter xylem vessels by osmosis. Osmosis involves the movement of water across a semi-permeable membrane, and xylem vessels lack such membranes. Instead, water enters the xylem through apoplastic or symplastic pathways, driven by root pressure and capillary action.

(b) Name three forces which are believed to cause the flow of water through xylem. Are these forces active or passive?

(i) Root pressure: Active
(ii) Capillary action: Passive
(iii) Transpirational pull: Passive

4. (a) Mention four roles of carbohydrates in the plant body.

(i) Provide energy through respiration.
(ii) Serve as structural components (e.g., cellulose in cell walls).
(iii) Act as storage molecules (e.g., starch).
(iv) Play a role in cell signaling and recognition.

(b) Explain what you understand by the term disaccharides and name any two examples.

Disaccharides are carbohydrates formed by the condensation of two monosaccharides, linked by a glycosidic bond. Examples include sucrose and lactose.

5. (a) State the roles of:

(i) Bowman's capsule: Filtration of blood to form glomerular filtrate.
(ii) Proximal convoluted tubule: Reabsorption of nutrients, salts, and water from the filtrate.
(iii) Loop of Henle: Concentrates urine by reabsorbing water and salts.
(iv) Distal convoluted tubule: Regulates ion balance and pH by reabsorbing salts and secreting hydrogen ions.
(v) Collecting duct: Collects urine and facilitates its final concentration by reabsorbing water.

(b) Name the plant hormones that:

(i) Initiate root development: Auxins.
(ii) Ripen orange rapidly: Ethylene.
(iii) Induce cell division: Cytokinins.

6. (a) Distinguish between sex determination and sex linkage.

Sex determination refers to the biological process by which an organism's sex is established, often through specific chromosomes (e.g., XX for females and XY for males in humans).
Sex linkage refers to genes located on sex chromosomes that are inherited differently in males and females, such as hemophilia and color blindness.

(b) Define the following terms:

(i) Chromosomal mutation: A permanent change in the structure or number of chromosomes, affecting genetic information.

(ii) Co-dominance: A genetic condition where both alleles in a heterozygote are fully expressed, such as in AB blood type.
(iii) Polygenic inheritance: The inheritance of traits controlled by multiple genes, resulting in continuous variation, such as height and skin color in humans.

9. (a) (i) What was the aim of the experiment?

The aim of the experiment was to investigate the factors necessary for seed germination, such as the presence of water, warmth, and oxygen.

(ii) What was the purpose of including pyrogallic acid and caustic soda in conical flask B?

The purpose of including pyrogallic acid and caustic soda in conical flask B was to absorb oxygen and create an anaerobic environment to demonstrate the importance of oxygen for seed germination.

(iii) show how the seeds in flask C will appear at the end of the experiment.
- A conical flask labeled C with moistened cotton wool and germinated seeds.
- The seeds should have small shoots and roots emerging, indicating successful germination in the presence of water, warmth, and oxygen.

(b) What could be the possible reasons for failure of viable seeds to germinate when they are sown under optimum conditions for germination?
(i) Dormancy: Some seeds may be dormant and require specific treatments (e.g., scarification or stratification) to break dormancy and begin germination.
(ii) Poor seed quality: Seeds that are old, damaged, or infected by pathogens may fail to germinate despite being viable.
(iii) Presence of inhibitors: Some seeds contain chemical inhibitors that prevent germination until certain environmental conditions are met.
(iv) Genetic defects: Genetic mutations or abnormalities in the seed may prevent successful germination.
(v) Contamination: The presence of contaminants in the soil or environment, such as harmful chemicals or microorganisms, may inhibit germination.

10. (a) (i) Giving reasons, explain what happens to the breathing rate and heartbeat in the men shown in the photograph.

The breathing rate and heartbeat of the men increase because their muscles require more oxygen and energy during intense physical activity. The increased breathing rate enhances oxygen intake, while the faster heartbeat ensures efficient distribution of oxygen and nutrients to the muscles and the removal of carbon dioxide and other waste products.

(ii) Explain briefly why the muscles of these men are going to experience anaerobic respiration.

During intense physical activity, the oxygen supply to the muscles may become insufficient to meet the high energy demand. As a result, the muscles switch to anaerobic respiration, where glucose is broken down without oxygen, producing energy and lactic acid as a byproduct.

(b) How does anaerobic respiration differ from aerobic respiration?

Anaerobic respiration:
- Occurs in the absence of oxygen.
- Produces less energy (ATP) per glucose molecule.
- Produces lactic acid (in animals) or ethanol and carbon dioxide (in plants and microorganisms) as byproducts.

Aerobic respiration:
- Requires oxygen.
- Produces more energy (ATP) per glucose molecule.
- Produces carbon dioxide and water as byproducts.

11. (a) The term "growth" when applied to bacteria differs from how it is applied to higher plants and animals. Briefly show this difference.

In bacteria, growth refers to an increase in population size through binary fission, where one bacterial cell divides into two identical cells. In higher plants and animals, growth refers to an increase in size and mass of an individual organism, involving cell division (mitosis), differentiation, and elongation.

(b) Distinguish between the meaning of excretion and secretion.

Excretion is the process of removing metabolic waste products, such as carbon dioxide and urea, from the body. These substances are harmful and must be eliminated.

Secretion is the process of producing and releasing useful substances, such as enzymes, hormones, and mucus, that play specific roles in the body's physiological processes.

12. (a) Define "speciation."

Speciation is the evolutionary process by which new species arise from existing ones due to genetic isolation, natural selection, and other mechanisms over time.

(b) How does adaptive radiation and genetic variation bring about speciation?

Adaptive radiation: When a single ancestral species diversifies into multiple species, each adapted to different environments or ecological niches, speciation occurs. For example, Darwin's finches evolved distinct beak shapes to exploit different food sources.

Genetic variation: Variations in the genetic makeup of populations, driven by mutations, gene flow, and recombination, create differences among individuals. Over time, these differences, coupled with reproductive isolation, lead to the formation of new species.