THE UNINTED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION AND CULTURE

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

133/2 **BIOLOGY 2**

Time: 2:30 Hours **ANSWERS** **Year: 1995**

Instructions:

1. this paper consists of six questions
2. answer five questions
3. Each question carries twenty marks.

1. (a) How are the foreign cells adapted for their functions
i. Erythrocyte
- Adaptation: Erythrocytes (red blood cells) are biconcave in shape, increasing surface area for oxygen transport. They lack a nucleus, providing more space for hemoglobin.

ii. Neutrophil
- Adaptation: Neutrophils have a lobed nucleus, allowing flexibility to move through blood vessels. They contain lysosomes with enzymes to digest pathogens.

(b) i. Vessel element
- Adaptation: Vessel elements are elongated cells with perforated end walls, forming continuous tubes for efficient water transport. They are lignified for structural support.

ii. Sieve-tube element
- Adaptation: Sieve-tube elements have reduced organelles to facilitate the flow of sap and are connected by sieve plates for transport in the phloem.

2. (a) i. What is a taxon?
A taxon is a group of organisms classified together based on shared characteristics, such as genus, family, or species.

ii. Explain why organisms in a lower taxon have more features in common than organisms in a higher taxon.
Organisms in a lower taxon (e.g., species) share more specific traits due to their closer evolutionary relationship. In contrast, higher taxa (e.g., kingdom) include diverse organisms with fewer shared traits.

iii. Name the six classes of the phylum Chordata and give one distinguishing characteristic of each.
- Pisces: Possess gills for breathing.
- Amphibia: Undergo metamorphosis and can live in water and on land.
- Reptilia: Have scales and lay eggs with leathery shells.
- Aves: Have feathers and beaks.
- Mammalia: Have mammary glands for milk production.
- Agnatha: Jawless fish with cartilaginous skeletons.

3. The diagram below represents the gut parasite of a man
(a) i. Name the genus and phylum to which it belongs.
- Genus: Taenia
- Phylum: Platyhelminthes

ii. Give the names of the structures labelled A to D.
- A: Scolex
- B: Suckers
- C: Proglottids
- D: Hooks

iii. Briefly explain how structures A and B adapt the organism to its mode of life.
- Scolex (A): Allows attachment to the host's intestinal wall.
- Suckers (B): Help the parasite remain fixed and resist being dislodged.

iv. How does the organism harm its host?
- Causes malnutrition by absorbing nutrients from the host's intestine.
- Produces toxic waste that can harm the host's health.

4. (a) The diagram below is an abbreviated representation of sum of the processes of a photosynthesis.
i. Identify compound X.
Compound X is NADPH.

ii. State in which part of the chloroplast the process represented by step 4 occurs.
Step 4 occurs in the stroma of the chloroplast.

(b) What is the fate of PGA? Illustrate your answer by means of a simplified labelled diagram.
PGA (phosphoglyceric acid) is converted into glucose through the Calvin cycle using ATP and NADPH. Excess glucose is stored as starch.

5. (a) i. What is the significance of pollination to plants?
Pollination enables sexual reproduction, leading to the production of seeds for propagation.

ii. Describe three natural mechanisms preventing self-pollination and favouring cross-pollination in flowering plants.
- Dichogamy: Male and female reproductive parts mature at different times.
- Self-incompatibility: Pollen from the same plant is unable to fertilize the ovule.
- Physical separation: Male and female organs are located on different flowers or plants.

(b) State what do you understand by each of the followings
i. Menstrual cycle
The menstrual cycle is a monthly series of changes in the female reproductive system, involving the preparation of the uterus for pregnancy and the shedding of the uterine lining if fertilization does not occur.

ii. Gametogenesis
Gametogenesis is the process of formation of gametes (sperm in males and ova in females) through meiosis in reproductive organs.

6. The diagram below represents a transverse section of cochlea to show the organ of corti
(a) Name the structures labelled A to E.
- A: Tectorial membrane
- B: Basilar membrane
- C: Hair cells

- D: Spiral ganglion
- E: Cochlear duct

(b) Briefly explain the part played by the organ of Corti in hearing.
The organ of Corti contains hair cells that are stimulated by vibrations in the basilar membrane. These hair cells convert mechanical vibrations into electrical impulses, which are transmitted to the brain via the auditory nerve for sound perception.

7. (a) Explain the fate of pyruvic acid during anaerobic respiration in the tissues of an animal that usually respires aerobically.
i. In animals, pyruvic acid is converted into lactic acid during anaerobic respiration.
ii. This occurs when oxygen supply is insufficient, such as during intense exercise.
iii. The process regenerates NAD+, which is required for glycolysis to continue producing ATP.
iv. Accumulation of lactic acid can cause muscle fatigue and is later transported to the liver for conversion back to glucose or glycogen when oxygen becomes available.

(b) What is the physiological reason for shivering?
i. Shivering is an involuntary contraction of muscles that generates heat as a response to cold.
ii. It helps maintain body temperature by increasing metabolic activity.
iii. The process is controlled by the hypothalamus in response to signals from temperature receptors in the skin.

8. Color blindness is an autosomal recessive defect. Refer to the following key and study the pedigree of a family affected by color blindness.

(a) Make a continuation of the pedigree to show the expected distribution of the gene for color blindness among F2 offspring, assuming 3 and 5 marry individuals with normal X chromosomes.
[For this part, draw a continuation of the pedigree showing the inheritance pattern based on the parents' genotypes.]

(b) What are the chances that a carrier grandchild (F2) will have a color-blind son if she marries:
i. A normal man
- A carrier (XcX) has a 50% chance of passing the defective X chromosome to her son. Therefore, the chance of a color-blind son is 50%.

ii. A color-blind man
- A carrier (XcX) and a color-blind man (XcY) have a 50% chance of having a color-blind son.

9. (a) Name one example of each of the following in relation to enzymes:
i. Co-factor: Magnesium ions (for DNA polymerase).
ii. Co-enzyme: NAD+ (nicotinamide adenine dinucleotide).
iii. Inhibitor: Cyanide (inhibits cytochrome oxidase).

10. (a) State why vitamin D deficiency results in deformed bones.
i. Vitamin D is essential for calcium absorption in the intestines.
ii. A deficiency leads to insufficient calcium levels in the body, weakening bones and causing deformities such as rickets in children and osteomalacia in adults.

(b) How do ploughing and good drainage increase soil fertility?
i. Ploughing aerates the soil, promoting root growth and the activity of beneficial microorganisms.
ii. Good drainage prevents waterlogging, which can lead to anaerobic conditions harmful to plant roots and beneficial soil organisms.

11. (a) Distinguish between ecological succession and climax community.

i. Ecological succession
Ecological succession is the gradual process by which ecosystems change and develop over time, involving the replacement of one community by another until a stable ecosystem is established.

ii. Climax community
A climax community is the final, stable community that results from ecological succession, where the ecosystem remains relatively unchanged unless disturbed by external factors.

(b) Distinguish between ecological niche and trophic level.

i. Ecological niche
An ecological niche refers to the role or position of an organism in its environment, including its habitat, interactions with other species, and its contribution to the ecosystem.

ii. Trophic level
A trophic level represents the position of an organism in a food chain, based on its feeding relationships, such as producers, primary consumers, secondary consumers, or tertiary consumers.

12. (a) Briefly interpret the two curves.

i. Curve a
This represents a human population with high infant mortality and low survivorship in early and middle life, followed by a sharp decline in old age. It suggests poor living conditions, lack of healthcare, and high mortality rates.

ii. Curve b
This represents a human population with high survivorship throughout most of life and a sharp decline in survivorship at old age. It indicates better living conditions, access to healthcare, and lower mortality rates.

(b) Suggest possible causes for the difference in survivorship of the human population in the two countries.

i. Healthcare
Country b likely has better healthcare systems, vaccinations, and access to medical facilities, leading to higher survivorship compared to country a.

ii. Nutrition
Improved nutrition in country b supports better growth and immunity, reducing infant mortality and increasing life expectancy.

iii. Sanitation and hygiene
Better sanitation and clean water availability in country b reduce the prevalence of diseases.

iv. Education
Education in country b may lead to better health awareness and adoption of healthy practices.

v. Socioeconomic factors
Higher income levels and improved living standards in country b contribute to better overall survivorship compared to country a.