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: 2002**

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) What is Binomial Nomenclature?
Binomial Nomenclature is a system of naming organisms scientifically, consisting of two names: the genus name (capitalized) and the species name (in lowercase), both written in italics or underlined.

1(b) Give any three rules followed in naming organisms scientifically.
i. The genus name is written first and is capitalized.
ii. The species name is written second and is in lowercase.
iii. The name must be italicized if typed or underlined if handwritten.

2(a)(i) Identify structures A, B, C, D, and E.
A: Pileus (cap)
B: Gills
C: Annulus (ring)
D: Stipe (stem)
E: Mycelium

2(a)(ii) Name the kingdom, phylum, and genus to which the organism in figure 1 belongs.
Kingdom: Fungi
Phylum: Basidiomycota
Genus: Agaricus

2(b) State any two ways in which the kingdom to which the organism in figure 1 belongs is of economic importance.
i. Fungi are used in food production, such as in the fermentation process to make bread, beer, and wine.
ii. Fungi decompose organic material, recycling nutrients in the ecosystem.

3(a) State any two differences between non-cyclic and cyclic photophosphorylation.
i. Non-cyclic photophosphorylation involves both photosystem I and photosystem II, while cyclic photophosphorylation involves only photosystem I.
ii. Non-cyclic photophosphorylation produces ATP, NADPH, and oxygen, whereas cyclic photophosphorylation produces only ATP.

3(b)(i) What are the two types of products of the Brunner's glands of the small intestine?
i. Mucus
ii. Alkaline secretions

3(b)(ii) State the roles of the products in (i) above.
i. Mucus protects the intestinal lining by providing a barrier against digestive enzymes and acid.
ii. Alkaline secretions neutralize the acidic chyme entering the small intestine from the stomach, creating an optimal pH for enzyme activity.

4(a) Name the parts labeled A, B, C, D, and E.
A: Alveoli
B: Bronchioles
C: Bronchus
D: Pulmonary artery
E: Pulmonary vein

4(b) Explain two ways by which the structures labeled A are able to perform their functions efficiently.
i. Alveoli have thin walls (one cell thick) to facilitate rapid gas exchange.
ii. Alveoli are surrounded by a dense network of capillaries to maintain a concentration gradient for oxygen and carbon dioxide exchange.
5(a) Give a brief explanation of how the loop of Henle operates as a "counter-current multiplier system."
The loop of Henle creates a concentration gradient in the medulla. The descending limb is permeable to water but not solutes, allowing water to leave the filtrate. The ascending limb is impermeable to water but actively transports sodium and chloride ions into the medulla, maintaining the gradient essential for water reabsorption in the collecting duct.

5(b) What would happen if our kidneys stopped working?
If kidneys stopped working, waste products and toxins would accumulate in the body, leading to uremia. Fluid imbalance would cause swelling, high blood pressure, and potentially fatal complications.

6(a) Give two differences between the X and Y chromosomes of humans.
i. The X chromosome is larger and contains more genes than the Y chromosome.
ii. The X chromosome is present in both males and females, while the Y chromosome is found only in males.

6(b) Why are there more colorblind individuals than hemophiliacs in the population when the alleles for both defects are inherited in the same fashion, that is, sex-linked?
Colorblindness is more common because the gene for color vision is on the X chromosome and is recessive. Males have only one X chromosome, so a single defective allele causes the condition. Hemophilia, though also X-linked, is less frequent due to a lower mutation rate of the responsible gene.

7(a) Define convergent evolution.
Convergent evolution is the process by which unrelated organisms independently evolve similar traits to adapt to similar environments or ecological niches.

7(b)(i) What were Lamarck's ideas on this theory?
Lamarck proposed that organisms could acquire traits during their lifetime through use or disuse of organs and that these acquired traits could be passed to their offspring.
7(b)(ii) How are these ideas explained by modern ideas?
Modern genetics refutes Lamarck's theory, showing that acquired traits cannot be inherited because they do not alter an organism's DNA. Instead, evolution occurs through natural selection acting on genetic variations.

8(a)(i) How many trophic levels are shown in this food web? Name them and give one example of an organism for each trophic level.

There are four trophic levels in this food web:

- Producers. Aquatic plants
- Primary consumers. Small crustaceans, insect larvae, tadpoles
- Secondary consumers. Water beetles, frogs, roach
- Tertiary consumers. Perch, pike, man

8(a)(ii) Name one animal in this food web which feeds at three trophic levels.
Frogs feed at three trophic levels, consuming insect larvae (primary consumers), water beetles (secondary consumers), and small crustaceans (primary consumers).

8(a)(iii) Write down the longest food chain shown in the food web.
Aquatic plants -> Small crustaceans -> Water beetles -> Perch -> Pike -> Man

8(b)(i) Write short notes on density-dependent factors.
Density-dependent factors are factors whose effects on population size or growth vary with population density. Examples include competition for resources, predation, disease, and parasitism. These factors tend to regulate population size by increasing mortality or decreasing reproduction as density rises.

8(b)(ii) Write short notes on interspecific competition.
Interspecific competition is the interaction between individuals of different species competing for the same limited resources, such as food, space, or light. This competition can affect species distribution and abundance, leading to the exclusion of one species or the coexistence of both through niche differentiation.

9(a) Name the parts labeled A, B, C, D, E, F, G, and H.
A: Mitochondrion
B: Rough endoplasmic reticulum
C: Golgi apparatus
D: Secretory vesicle
E: Nucleus
F: Nuclear pore
G: Plasma membrane
H: Exocytosis (site of enzyme release)

9(b) Briefly explain how organelles A, C, D, and H are involved in the synthesis and secretion of the inactive enzyme.
- A (Mitochondrion): Provides the energy (ATP) required for the synthesis and secretion processes.
- C (Golgi apparatus): Modifies, packages, and sorts the enzymes into secretory vesicles.
- D (Secretory vesicle): Transports the inactive enzymes to the plasma membrane for release.
- H (Exocytosis): Releases the enzymes into the extracellular space.

10(a)(i) Classify receptors into five categories on the basis of the stimuli they respond to.
- Mechanoreceptors: Respond to mechanical pressure or distortion.
- Thermoreceptors: Respond to changes in temperature.
- Chemoreceptors: Respond to chemical stimuli.
- Photoreceptors: Respond to light.
- Nociceptors: Respond to pain or harmful stimuli.

10(a)(ii) Name the stimulus in each case.
- Mechanoreceptors: Pressure or vibration
- Thermoreceptors: Heat or cold
- Chemoreceptors: Chemicals such as oxygen, carbon dioxide, or glucose
- Photoreceptors: Light
- Nociceptors: Pain or damage

10(b) Tabulate four differences between rods and cones.

Feature	**Rods**	**Cones**
Sensitivity	More sensitive to dim light	M ore sensitive to bright light
Color detection	Cannot detect color	Detect color (RGB pigments)
Location	Found in peripheral retina	Found in central retina (fovea)
Visual acuity	Low visual acuity	High visual acuity

11(a) Describe three ways of obtaining gaseous oxygen in terrestrial flowering plants.
- Through stomata on leaves during gas exchange.
- Through lenticels on stems for gaseous exchange.
- By diffusion through the root hairs during respiration.

11(b) Briefly explain why the oxidation of fats liberates more than double the energy of the same quantity of carbohydrate.
Fats contain more hydrogen atoms per molecule, which provide more electrons for the electron transport chain during respiration. This results in greater ATP production compared to carbohydrates.

12(a)(i) What process is responsible for maintaining a lower concentration of sodium inside the cell?
Active transport through the sodium-potassium pump.
12(a)(ii) Explain your answer in 12(a)(i) above.
The sodium-potassium pump uses ATP to transport three sodium ions out of the cell and two potassium ions into the cell against their concentration gradients, maintaining the ionic balance.

12(b) What do you understand by the term guttation?
Guttation is the process by which water droplets are exuded from the tips or edges of leaves of plants, usually during the night, due to root pressure.

13(a)(i) What type of growth does this curve show?
This curve shows discontinuous growth, characterized by periods of rapid increase in mass followed by plateaus.

13(a)(ii) Explain the cause for such type of growth curve.
The discontinuous growth curve is caused by the molting process (ecdysis) in arthropods. During molting, the exoskeleton is shed, and the organism rapidly grows in size before the new exoskeleton hardens, resulting in the step-like pattern.

13(b)(i) Giving one example, explain what is meant by allometric growth.
Allometric growth refers to the disproportionate growth of different parts of an organism's body relative to its overall size. For example, in humans, the head grows at a slower rate than the limbs during development.

13(b)(ii) Giving one example, explain what is meant by isometric growth.
Isometric growth refers to the equal growth of all parts of an organism's body, maintaining the same proportions. For example, in fish, the body grows uniformly without significant changes in relative proportions.

14(a) Explain an unfertilized ovule of a flowering plant the following parts:
(i) Micropyle
(ii) Nucellus
(iii) Integuments
(iv) Embryo sac
(v) Polar nuclei
(vi) Female nucleus

An unfertilized ovule of a flowering plant contains several key structures essential for reproduction.

i. Micropyle. A small opening in the integuments of the ovule, located at the apex, through which the pollen tube enters during fertilization.

ii. Nucellus. The central tissue within the ovule that encloses the embryo sac, providing nourishment to the developing gametophyte.

iii. Integuments. Protective layers surrounding the nucellus; they develop into the seed coat after fertilization.

iv. Embryo sac. The female gametophyte located within the nucellus, containing the egg cell and other associated cells necessary for fertilization.

v. Polar nuclei. Two nuclei situated in the central cell of the embryo sac; they fuse with a sperm cell during fertilization to form the triploid endosperm.

vi. Female nucleus (egg cell). The haploid cell within the embryo sac that, upon fertilization with a male sperm cell, develops into the zygote, eventually forming the embryo.

14(b)(i) With reference to a maize plant, describe double fertilization.
Double fertilization is a unique process in flowering plants like maize. One sperm nucleus fuses with the egg cell to form a diploid zygote (embryo), while the second sperm nucleus fuses with the two polar nuclei in the central cell of the embryo sac, forming a triploid endosperm.

14(b)(ii) Explain the importance of double fertilization.
Double fertilization ensures efficient use of resources. The zygote develops into the embryo, and the triploid endosperm provides nourishment to the developing embryo and seedling. This adaptation contributes to the reproductive success of flowering plants.