THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

133/1 **BIOLOGY 1**

(For Both School and Private Candidates)

Time : 2:30 Hours **ANSWERS** **Year : 2005**

Instructions

1. This paper consists of ***fifteen (15)*** questions in sections A and B.
2. Answer ***all*** questions in section A and ***two*** questions from section B.
3. Communication devices and any unauthorised materials are **not** allowed in the examination room.
4. Write your **Examination Number** on every page of your answer booklet(s).

1. (a) Define a cell.

A cell is the basic structural, functional, and biological unit of life, capable of carrying out all essential processes of living organisms.

(b) **State four (4) structural differences between animal cell and plant cell.**

A plant cell has a cellulose cell wall, while an animal cell has only a plasma membrane.

Plant cells contain chloroplasts for photosynthesis, while animal cells lack chloroplasts.

Plant cells usually have a large central vacuole, while animal cells have small vacuoles or none.

Centrioles are present in animal cells but absent in most plant cells.

2. The diagram shows how organisms may be separated into five kingdoms.

(a) (i) Name Kingdoms B and C.

Kingdom B: Plantae.

Kingdom C: Animalia.

(ii) Two characteristics other than chloroplasts that distinguish Kingdom B from Kingdom C:

Cells in Kingdom B have cell walls made of cellulose, while those in Kingdom C lack cell walls.

Kingdom B cells store food as starch, while Kingdom C cells store food as glycogen.

(b) **Which of the Kingdoms A, B, C, D and E represent Fungi?**

Kingdom D represents Fungi.

3. Make a list of six similarities (including biochemical ones) between photosynthesis and aerobic respiration.

Both involve electron transport chains.

Both use ATP as an energy carrier.

Both involve redox reactions.

Both take place in specialized organelles (chloroplasts for photosynthesis, mitochondria for respiration).

Both depend on enzymes for catalysis.

Both produce energy-rich molecules essential for life processes.

4. (a) What do you understand by the term "respiratory quotient" (RQ) of a respiratory substrate?

RQ is the ratio of the volume of carbon dioxide produced to the volume of oxygen consumed during respiration of a substrate.

(b) Calculate the respiratory quotient of fat (tripalmitin).

Equation: $2C_{51}H_{98}O_6 + 145O_2 \rightarrow 102CO_2 + 98H_2O$

RQ = CO_2 produced / O_2 consumed = $102 \div 145 \approx 0.7$

(c) If one glucose yields about 2830 kJ and one ATP molecule = 33 kJ, efficiency with glycolysis and Krebs cycle:

Energy in 38 ATP = $38 \times 33 = 1254$ kJ.

Efficiency = $(1254 \div 2830) \times 100 \approx 44.3\%$.

5. The diagram shows a transverse section of cochlea.

(a) **Label structures A, B, C, D.**

A: Scala vestibuli

B: Organ of Corti

C: Cochlear nerve

D: Scala tympani

(b) **Role of the organ of Corti in hearing.**

It contains hair cells that convert sound vibrations into electrical impulses, which are transmitted via the auditory nerve to the brain.

6. (a) Explain briefly how the morula is formed from the zygote.

The zygote undergoes repeated mitotic divisions (cleavage) to form a solid ball of cells called the morula.

(b) What do you understand by "the formation of morula from the zygote is radial and indeterminate"?

Radial cleavage means cells divide parallel or perpendicular to the axis of the embryo, forming symmetrical arrangement.

Indeterminate cleavage means each cell retains the potential to develop into a complete organism if separated.

7. Using relevant illustrations, explain the differences between limited and unlimited growth.

Limited growth occurs when organisms grow up to a certain size and stop (e.g. humans).

Unlimited growth occurs when organisms continue growing throughout life (e.g. many plants and fish).

8. (a) Distinguish between sex-limited and sex-linked traits.

Sex-linked traits are controlled by genes located on sex chromosomes (e.g. haemophilia).

Sex-limited traits are expressed in one sex only, though the genes are present in both sexes (e.g. milk production in cows).

(b) Define:

(i) Chromosomal mutation – change in structure/number of chromosomes.

(ii) Codominance – condition where both alleles of a gene are expressed equally in heterozygotes.

(iii) Polygenic inheritance – inheritance controlled by many genes producing continuous variation.

9. (a) Law of use and disuse.

Proposed by Lamarck: organs develop when used frequently and diminish when not used.

(b) Convergent evolution.**

Process where unrelated organisms evolve similar traits due to adapting to similar environments.

10. Food web of organisms P–T.

Explain the effects of sudden removal of R.

If R is removed, organisms P and S that depend on R will decrease due to lack of food.

This leads to an increase in organisms Q and T, as their predation decreases.

Imbalance in the ecosystem will occur, causing instability in population sizes.

11. (a) Give two (2) events of meiosis which account for the differences in genetic materials in the four daughter cells produced by the process.

Crossing over during prophase I, where homologous chromosomes exchange genetic material, produces new combinations of alleles.

Independent assortment during metaphase I, where homologous chromosome pairs align randomly, results in different combinations of maternal and paternal chromosomes in gametes.

(b) Why is it advised to breathe air into the lungs through the nose and not through the mouth?

The nose filters dust and microorganisms using hairs and mucus, reducing infection risk.

The nasal cavity warms the air, preventing damage to delicate lung tissues.

The nose moistens air, reducing dryness in respiratory surfaces.

12. Two people X and Y drank glucose solution... (Table 1).

(a) Plot a graph of blood sugar level (vertical axis) against time (horizontal axis) for X and Y.
(Graph should show X rising sharply to a peak at 60 minutes then falling gradually; Y rising slightly then stabilizing lower.)

(b) Suggest explanations for the changes in blood sugar levels of X and Y.
For person X: Rapid rise indicates efficient glucose absorption into blood. Sharp fall after 60 minutes shows insulin was secreted effectively, promoting uptake of glucose by body cells.
For person Y: Slower rise and persistently low levels suggest either reduced glucose absorption or an insulin-related problem, possibly diabetes mellitus.

13. In mammals and birds... oxygenated blood flow to tissues is under high pressure but deoxygenated blood flow to lungs is at a lower pressure. Outline the advantages of both cases.
High pressure to tissues ensures rapid delivery of oxygen and nutrients for high metabolic demands.
It also ensures fast removal of wastes like carbon dioxide and urea.
Lower pressure to lungs prevents damage to delicate alveoli and capillaries.
It allows sufficient time for oxygen and carbon dioxide exchange in lungs.

14. (a) Write a brief description of the events which take place during fertilization in human beings.
Sperm is deposited in the female reproductive tract and swims towards the ovum in the fallopian tube.
Capacitation occurs, where enzymes modify the sperm membrane to enable penetration.
Acrosome reaction releases enzymes that digest layers surrounding the ovum (corona radiata and zona pellucida).
One sperm penetrates the ovum membrane, triggering the cortical reaction that prevents entry of other sperms (polyspermy block).
Fusion of sperm and ovum nuclei occurs, forming a diploid zygote.

(b) Write the floral formula of the hypothetical flower represented in figure 4.
Flower shown has radial symmetry, bisexual, with 5 sepals, 5 petals, many stamens, and superior ovary with 5 carpels.
Floral formula: ♂ K5 C5 A∞ G(5)

15. (a) In certain plants, a cross between red-flowered and yellow-flowered plants produces offspring in 1:1 ratio. A cross between red-flowered plants produces only red flowers.

(i) Which gene is dominant?

Red flower gene is dominant.

(ii) Write down the genotypes for red-flowered and yellow-flowered plants using suitable letters.

Let R = red, r = yellow.

Red-flowered plants can be RR or Rr.

Yellow-flowered plants are rr.

(b) Why are sex-linked defects more common in males than females?

Males have only one X chromosome, so any recessive allele on it is expressed since there is no matching allele on the Y chromosome.

Females have two X chromosomes, so a recessive allele is usually masked by a dominant allele on the other X chromosome.

Thus, males are more vulnerable to sex-linked defects like haemophilia and colour blindness.