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: 1991.**

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) Explain the appearance of an animal cell at each of the following stages of division:
(i) Pachytene:

In this stage, homologous chromosomes are fully paired (synapsed), and crossing over occurs. The chromosomes appear thickened and are aligned in pairs.

(ii) Diplotene:

During diplotene, homologous chromosomes begin to separate but remain connected at chiasmata. The chromosomes are still visible as paired structures.

(iii) Metaphase I of Meiosis:

In this phase, homologous chromosomes align along the metaphase plate, and spindle fibers attach to their centromeres.

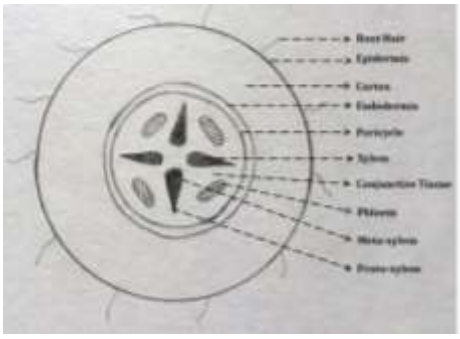
(iv) Metaphase of Mitosis:

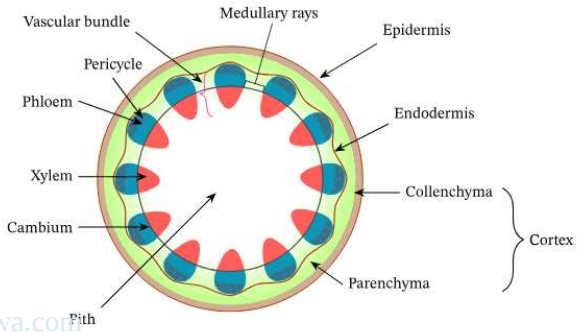
Here, chromosomes align at the equatorial plate, and spindle fibers attach to the centromeres of sister chromatids.
Chromosomes align at the equatorial plate, and spindle fibers attach to the centromeres of sister chromatids.

(b) Briefly describe the events taking place at each of the stages in Q. 1(a) above.

(i) Pachytene: Crossing over occurs, where genetic material is exchanged between non-sister chromatids of homologous chromosomes, increasing genetic variation.
(ii) Diplotene: Homologous chromosomes separate slightly, and chiasmata become visible. This stage prepares chromosomes for segregation.
(iii) Metaphase I of meiosis: Homologous chromosome pairs align at the metaphase plate, and spindle fibers ensure their proper segregation during anaphase I.
(iv) Metaphase of mitosis: Chromosomes align at the equatorial plate, ensuring each daughter cell receives an identical set of chromosomes during anaphase.

2. (a) Draw large labelled diagrams of tissue arrangement in a dicotyledonous stem and root in primary state of growth.





Dicotyledonous stem: Include epidermis, cortex, vascular bundles arranged in a ring (with xylem and phloem), and pith.
Dicotyledonous root: Include epidermis, cortex, endodermis, pericycle, xylem, and phloem arranged in a star shape.

(b) Describe the structure and function of xylem and phloem tissues.

Xylem:
Structure: Composed of tracheids, vessels, xylem parenchyma, and xylem fibers.
Function: Conducts water and dissolved minerals from roots to other parts of the plant and provides mechanical support.

Phloem:
Structure: Composed of sieve tubes, companion cells, phloem parenchyma, and phloem fibers.
Function: Transports organic nutrients, particularly sucrose, from leaves to other parts of the plant.

3. Compare the life cycle of a fern with that of a moss.

Fern:
- Dominant stage is the sporophyte.
- Sporophyte is diploid and independent.
- Produces spores that develop into a small, independent gametophyte.

Moss:
- Dominant stage is the gametophyte.
- Sporophyte is dependent on the gametophyte.
- Produces spores that develop into a protonema, which forms the gametophyte.

4. Giving one example in each case, describe the main features that are used to place organisms into each of the following groups:

Protozoa: Single-celled eukaryotes (e.g., Amoeba). Features: Lack of tissues, heterotrophic nutrition, and locomotion through pseudopodia, cilia, or flagella.
Arthropoda: Invertebrates with jointed appendages and an exoskeleton (e.g., Grasshopper). Features: Segmented body, chitinous exoskeleton, and open circulatory system.
Aschelminthes: Roundworms (e.g., Ascaris). Features: Cylindrical, unsegmented body, pseudocoelom, and complete digestive system.
Monocotyledonae: Flowering plants with one seed leaf (e.g., Maize). Features: Parallel venation, fibrous roots, and scattered vascular bundles.
Dicotyledonae: Flowering plants with two seed leaves (e.g., Bean). Features: Reticulate venation, taproot system, and vascular bundles arranged in a ring.

5. "Asexual reproduction produces offspring identical with parent, whereas sexual reproduction produces variation." Discuss these statements.

Asexual reproduction involves one parent, producing offspring genetically identical to the parent due to the absence of genetic recombination (e.g., binary fission in bacteria). Advantage: Rapid reproduction in stable environments. Disadvantage: Lack of genetic variation makes organisms vulnerable to environmental changes.

Sexual reproduction involves two parents, producing offspring with genetic variation due to meiosis and fertilization (e.g., mammals). Advantage: Genetic variation allows for adaptation and survival in changing environments. Disadvantage: Slower reproduction and requires more energy.

6. What is the role of the liver and pancreas in:

(i) digestion?

The liver produces bile, which emulsifies fats, breaking them into smaller droplets to increase the surface area for enzyme action.
The pancreas produces digestive enzymes such as amylase (breaks down starch), lipase (breaks down fats), and proteases (break down proteins) and secretes them into the duodenum.

(ii) metabolism of the end products of digestion?

The liver metabolizes glucose into glycogen for storage or releases glucose into the bloodstream. It also converts excess amino acids into urea and synthesizes plasma proteins.
The pancreas regulates blood sugar levels by secreting insulin (lowers blood sugar) and glucagon (raises blood sugar).

7. (a) Mrs. Lutu has two haemophiliac sons and two normal sons. What is her genotype and that of her husband with respect to this gene? Explain your answer.

Haemophilia is a sex-linked recessive disorder carried on the X chromosome. Since Mrs. Lutu has two haemophiliac sons, she must be a carrier (XhX), as she passes the defective gene to her sons. Her husband must be normal (XY) since males can only pass their Y chromosome to their sons.

(b) Giving reasons, explain whether Mrs. Lutu could have a haemophiliac daughter.

Mrs. Lutu could have a haemophiliac daughter only if her husband is haemophiliac (XhY). The daughter would inherit the defective X chromosome from both parents (XhXh). However, since the question implies the husband is normal, Mrs. Lutu cannot have a haemophiliac daughter under these circumstances.

8. (a) How does a mammal obtain and lose water?

Mammals obtain water by drinking fluids, consuming food with high water content, and through metabolic processes where water is produced as a byproduct.
Water is lost through urination, sweating, exhalation, and defecation.

(b) In what forms is nitrogen excreted in animals?

Nitrogen is excreted in different forms depending on the animal:
- Ammonia in aquatic animals.
- Urea in mammals.
- Uric acid in birds and reptiles.

9. (a) What do you understand by the following as used in evolution?

(i) Law of use and disuse: This concept, proposed by Lamarck, suggests that body parts that are frequently used become more developed, while those not used diminish over time. This acquired characteristic could then be passed to offspring.

(ii) Convergent evolution: This occurs when unrelated species develop similar traits due to adapting to similar environmental pressures or ecological niches (e.g., wings in bats and birds).

(b) How do the following bring about speciation?

(i) Adaptive radiation: This process occurs when a single species evolves into multiple distinct species, each adapted to a specific environment or niche (e.g., Darwin's finches).

(ii) Genetic variability: Variations in genetic makeup within a population provide raw material for natural selection, enabling populations to adapt to different environments, which can lead to the formation of new species over time.