

BIOLOGY

REVISED TESTS
FOR FORM 3 & 4



Biology Revised Tests Form 3 & 4

BIOLOGY

Revised Tests
FOR FORM

3&4



Zahoro Nkaimira

ROSE · R · KALUMBEIG

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Mathias' Daughter.

Preface

Biology is an interesting subject as it includes the study of living organisms and life processes. This subject lays a foundation of important disciplines such as zoology, Ecology, Bio Informatics, Genetics, Parasitology, Pathology, Phycology, and Taxonomy.

Biology revised tests for form three and four is built upon all concepts in biology in order to cater for the learners' need to improve their performance and understanding of biology concepts. Keeping in mind that biology is among the high scoring subject if students adopt to sufficient problem-solving techniques as well as extensive reading of text books.

Furthermore, this book proves to be of great value to all people as it attracts people to love biology subject whether in classroom setting or outside the classroom.

1. CLASSIFICATION OF LIVING THINGS – KINGDOM PLANTAE

1. (a) The kingdom plantae is divided into different divisions. Mention them.
(b) Give one example of the plants which are found in each division of kingdom plantae.
2. (a) Outline three general and three distinctive features of the division coniferophyta (conifers).
(b) Describe the structure of pinus.
3. (a) Explain the three advantages and two disadvantages of the division coniferophyta.
(b) Explain four general and three distinctive features of the division angiospermophyta (flowering Plants).
4. (a) Outline the classes of the division angiospermophyta.
(b) Explain three advantages and three disadvantages of division angiospermophyta.
(c) Differentiate between monocotyledonae and dicotyledonae.

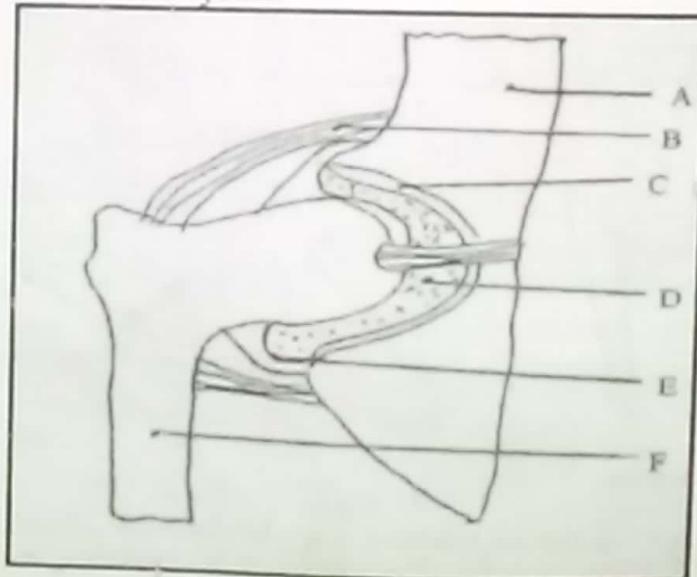
2. MOVEMENT

1. (a) Define the following terms.
 - (i) Movement
 - (ii) Locomotion
(b) Explain four forms of locomotion.
2. (a) Outline the importance of movement in animals and plants.
(b) Name the structures used for movement in:
 - (i) Amoeba
 - (ii) Fish
 - (iii) Paramecium
 - (iv) Earthworm
 - (v) Mammals
3. (a) Define skeleton
(b) Explain the types of skeleton.
4. (a) State any five functions of skeleton.
(b) Explain the major components of the human skeleton.
5. (a) Explain five types of joints.

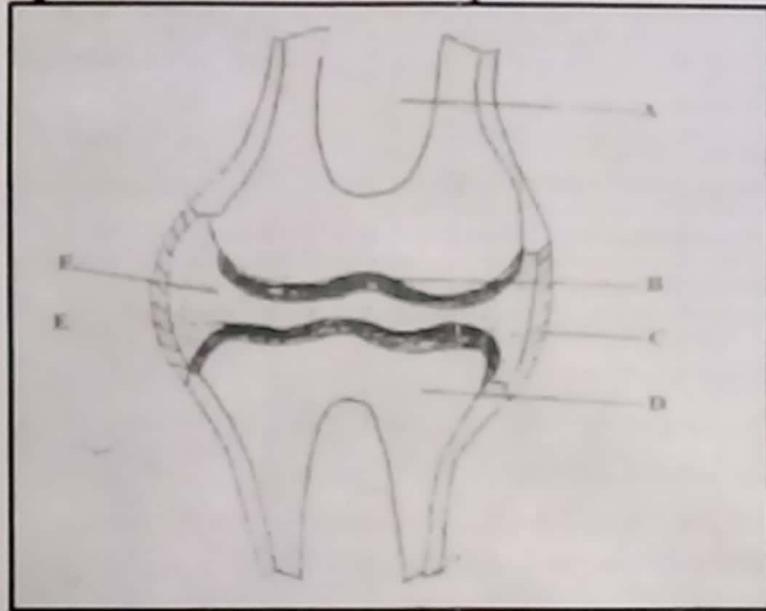
- (b) Describe adaptations of different types of joints to movement.
(c) Complete the table below by writing the location of the given joint in the body.

Joint	Location in the body
Hinge	
Ball and socket	
Pivot	
Gliding	

6. (a) The figure below shows the structure of a hip joint in the mammalian skeleton.
(i) Name the parts labelled A, B, C, E, and F.
(ii) State the functions of parts B, C and D.
(iii) Name the type of joint represented by the figure below and state the characteristics of such a joint



- (b) Study the figure below and answer the questions that follow:

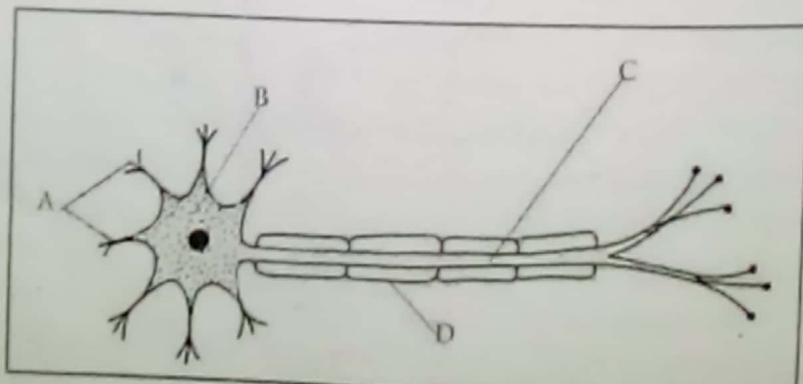


- (i) What type of joint does the figure above represent?
 - (ii) Name the structure labelled A – F
 - (iii) State the function of structure E.
7. (a) Mention the parts of human skeleton.
(b) Describe three components of axial skeleton.
8. (a) Name two types of girdles found in the human skeletal system.
(b) Describe the two main functions of the limb girdles.
(c) State the type of joint formed at the girdles.
9. (a) Give the meaning of muscle.
(b) Explain three types of muscles
- 10(a) What is muscle cramps?
(b) List down three causes of muscle cramps.
- 11(a) Explain the two types of movements exhibited by plants.
(b) State the types of tropism movements.

3. COORDINATION

1. (a) What do you understand by the term coordination?
(b) Give the meaning of the following terms as used in Biology:
(i) Irritability
(ii) Stimulus

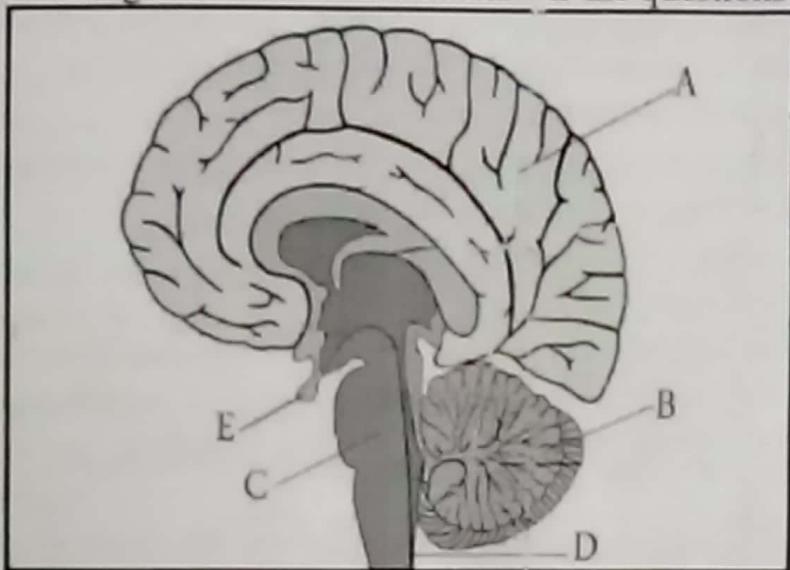
- (iii) Response
 - (iv) Receptor
 - (v) Effector
 - (vi) Nerve impulse
 - (vii) Neurone
 - (viii) Coordinator
2. (a) List four importance of coordination .
(b) Mention the components/parts of neurone.
(c) Define synapse
3. (a) Explain the types of neurons.
(b) Explain the adaptation of neurons.
4. (a) Give the meaning of:
(i) Central Nervous System
(ii) Brain
5. (a) Study the diagram below on the structure of a nerve cell and answer the questions that follow it



- (i) Name the parts labelled A, B, C and D.
 - (ii) Where does the neurone in the diagram carry impulses to?
 - (iii) Name two other types of nerve cells found in the nervous system of vertebrates and state their functions.
- (b) State four differences between nervous communication and endocrine communication.
6. (a) Mention the main parts of the brain.
(b) State the function of olfactory lobe.
7. (a) Explain the functions of the parts of the cerebrum.

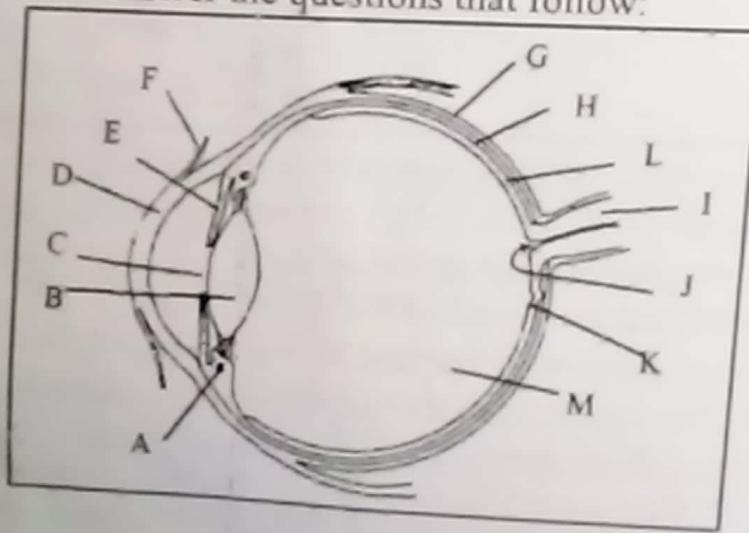
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- (b) Give the functions of each part of the hind brain.
8. (a) Study the diagram below and then answer the questions that follow.



- (i) What does the diagram above represent?
(ii) Name the parts labelled A, B, C, D and E.
9. (a) Describe the parts of the spinal cord.
(b) List down three functions of the spinal cord.
10. (a) Give the meaning of Peripheral Nervous System.
(b) Describe the components of Peripheral Nervous System.
11. (a) Define the following terms:
(i) Reflex action
(ii) Reflex arc
(b) Mention two types of reflex action.
12. (a) Differentiate between simple reflex action and conditional reflex action.
(b) Give the components of reflex arc.
13. (a) Describe the two types of receptors.
(b) What do you understand by the term sense organ?
(c) Mention the five types of sense organs.
14. (a) Draw a labelled diagram of human skin.
(b) Describe the three layers of skin.
(c) Explain five functions of the skin.
(d) Explain the adaptations of the skin to its functions.
15. (a) State the function of tongue.

- (b) Differentiate between cell bud and gustatory cell.
(c) Mention the sensation parts of the tongue and their location.
(d) Explain the adaptations of the tongue to its function.
- 16(a) Draw a well-labelled diagram of mammalian ear.
(b) Explain the adaptations of the mammalian ear to its functions.
(c) Mention three main parts of the ear.
(d) Explain the mechanism of hearing.
- 17(a) State the function of the eye.
(b) Mention and explain the function of each part of the eye.
18. The diagram below represents an eye of a human being. Study the diagram and answer the questions that follow:



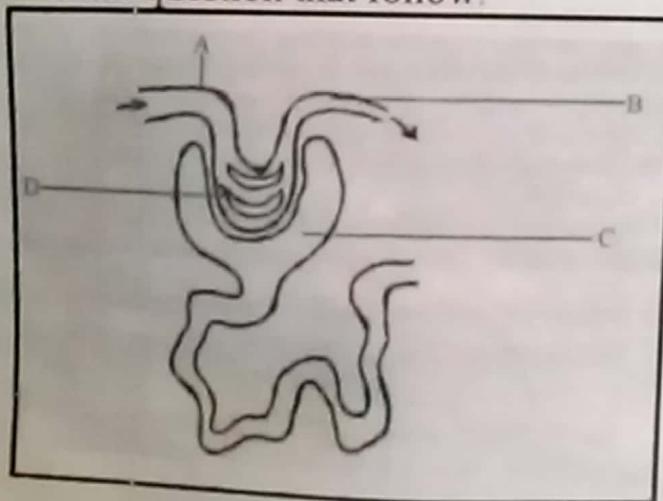
- (a) Name the labelled parts A – M.
(b) What will happen in part C if someone suddenly faces;
(i) The dim light
(ii) The bright light
- 19(a) Compare the mammalian eye and camera.
(b) What is accommodation?
(c) How is accommodation brought about in the human eye?
(d) Show the mechanisms of focusing;
(i) Near objects
(ii) Distant objects
- 20(a) Give the meaning of the following terms;
(i) Drug

-
- (ii) Drug abuse
 - (iii) Drug addiction
 - (b) Outline five proper ways of handling and using drugs.
 - (c) Mention five causes of drug addiction.
 - (d) Explain five effects of drug addiction
 - (e) Suggest four preventive and control measures of drug abuse.
 - 21(a) Draw a well-labelled diagram of endocrine system.
 - (b) Explain the roles of hormones produced by each endocrine gland.
 - 22(a) Maduda on her way to school came across a rattle-snake on the path coming right towards her. In no time she found herself up a tree.
 - (i) What gave her the ability to climb the tree so quickly?
 - (ii) Identify the different processes that went on in her body during this incidence.
 - (b) Stunted growth and severe mental retardation during early stages of development may be due to the under-secretion of a certain chemical substance.
 - (i) Identify this chemical substance.
 - (ii) What name is given to the condition described in (b)?
 - 23(a) Differentiate between hyper-secretion and hypo-secretion.
 - (b) Outline the disorders of the each endocrine gland.
 - 24(a) What is tropic response.

4. EXCRETION

- 1. (a) Define the term excretion.
 - (b) Mention the major excretory products eliminated by organisms and their sources.
- 2. (a) Outline the importance of excretion.
 - (b) Mention the primary excretory organs in human being and their functions.
 - (c) Mention the accessory excretory organs.
- 3. (a) Show the waste products produced by the following excretory organs.
 - (i) Skin
 - (ii) Lungs
 - (iii) Liver
 - (iv) Kidney

- (b) Show the relationship between nitrogenous waste products and the habitat of the organisms producing it.
4. (a) Draw a diagram of human excretory system.
(b) Explain the adaptations of the urinary system to its functions.
5. (a) Draw a well labelled diagram of a mammalian kidney showing the internal structure.
(b) Briefly explain the differences in the composition of blood in the renal artery and in the renal vein.
6. (a) Explain the process of urine formation.
(b) Define nephron
(c) Explain the adaptations of the nephron.
(d) Study the diagram below which shows a part of the human urineferous tubule then answer the question that follow.



- (i) Name the parts labelled A,B and D
(ii) What is the name given to the fluid labelled C?
(iii) Name two components of blood that will not diffuse into the part labelled C.
(iv) Name the nitrogenous waste which is present in Urine but absent in the part labelled B
7. (a) Describe four causes, five symptoms, four effects and suggest two preventive measures and treatment of kidney failure.
(b) Describe four causes, five symptoms, four effects and suggest two preventive measures and treatment of Kidney stones.

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- (c) Describe four causes, five symptoms, four effects and suggest two preventive measures and treatment of Urinary Tract Infections (UTIs).
 - (d) Describe four causes, five symptoms, four effects and suggest two preventive measures and treatment of hepatitis.
8. (a) Outline six reasons to why plants have a specialized excretory system like in animals.
- (b) Explain the mechanisms of excretion in plants.
- (c) Explain the importance of common excretory products in plants.

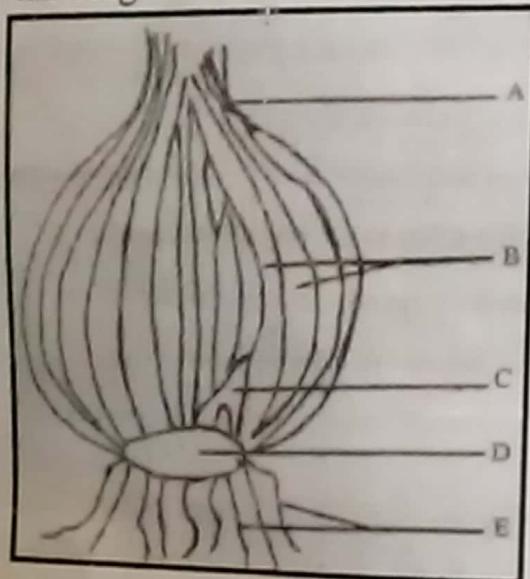
5. REGULATION

- 1. (a) What is regulation?
 - (b) Mention three types of regulation.
 - (c) Outline five importance of regulation.
2. (a) Mention three ways of heat gain by animals.
- (b) Mention three ways of heat loss by animals.
3. (a) Differentiate between endotherms and ectotherms.
- (b) Describe the adaptations of animals to hot environment.
- (c) Describe the adaptations of animals to cold environment.
4. (a) Outline the ways in which animals control over-heating in the environment.
- (b) Outline the ways in which animals control over-cold in the environment.
5. (a) Define the term "osmoregulation".
- (b) Mention five factors which affect the contents of salt and water in the body.
- (c) Outline four importance of osmoregulation.
6. (a) What is blood sugar regulation?
- (b) Briefly explain the mechanism of regulating sugar level in the blood.

6. REPRODUCTION

- 1. (a) Define the term reproduction.
 - (b) Mention four importance of reproduction.
2. (a) Mention and explain the two types of reproduction.
- (b) Differentiate between sexual and asexual reproduction by using four points.

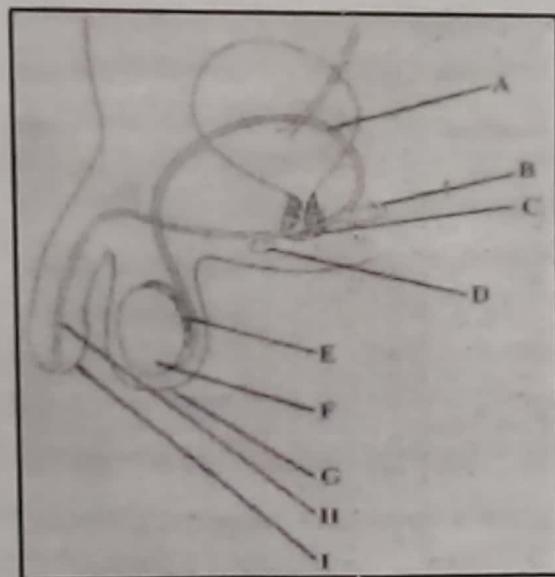
3. (a) Outline four merits and three demerits of sexual reproduction.
(b) Outline four merits and three demerits of asexual reproduction.
4. (a) Explain four ways by which plants reproduce by means of asexual.
(b) Mention two types of vegetative propagation.
(c) Explain the forms natural vegetative propagation.
(d) Study the diagram below and answer the question that follow:



- (i) Name the parts labeled A-E
(ii) What does a diagram above represent?
(iii) State the function of the part labelled B
5. (a) Define meiosis.
(b) Mention the stages of meiosis.
(c) Describe the stages of the first meiotic division.
(d) Outline two significance of meiosis.
6. (a) Draw a well-labelled diagram of a flower.
(b) Mention and state the function of each part of sterile parts of a flower.
(c) Mention and state the function of each part of female reproductive parts (pistil) of a flower.
(d) Mention and state the function of each part of male reproductive parts (stamen) of a flower.
7. (a) Define pollination.
(b) Explain two types of pollination.
8. (a) Mention three agents of pollination.

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- (b) Explain the adaptation of wind-pollinated flowers.
(c) Explain the adaptation of insects-pollinated flowers.
9. (a) What is fertilization?
(b) Mention and state the function of each part of female reproductive system.
(c) Draw a labelled diagram of female reproductive system.
(d) Mention and state the function of each part of male reproductive system.
(e) Study the diagram below and answer the questions that follow:



- (i) Name the structures labelled A – E.
(ii) State the functions of structures F and H
(iii) What does the diagram above represents?
- 10(a) Define the following terms:
(i) Sperm
(ii) Ovum
(iii) Spermatogenesis
(iv) Oogenesis
(b) Describe the parts of a sperm.
- 11(a) List down the secondary sexual characteristics in a female human being.
(b) Write down four human male secondary sexual characteristics.
- 12(a) Define the following terms:
(i) Ovulation

- (ii) Menstruation
 - (iii) Menstruation cycle
 - (b) Give the meaning of fertilization.
 - (c) The diagram below shows a human uterus during pregnancy.
 - (i) Name the parts labelled A, B, C, D, and E.
 - (ii) Give one function of the parts labelled B and C.
 - (iii) Name three substances that pass from the mother's blood to the blood of the foetus.
- 13(a) Outline the factors that may hinder fertilization.
(b) What is artificial insemination?
- 14(a) Give the meaning of multiple pregnancy.
(b) Mention two causes of multiple pregnancy.
(c) Differentiate between identical twins and fraternal twins.
- 15(a) Define the following concepts:
(i) Family planning
(ii) Contraception
(b) State the social cultural practices which enhance family planning.
- 16(a) Outline the importance of male involvement in family planning.
(b) Mention the importance of family planning and contraception.

FORM FOUR TOPICS

1. GROWTH

1. (a) What is growth?
(b) Explain the internal and external factors affecting growth in animals.
(c) Explain the internal and external factors affecting growth in plants.
2. (a) Define the term mitosis.
(b) Describe the stages of mitosis.
(c) Explain the significance of mitosis in growth.
3. (a) Write four differences between growth and development.
(b) State three factors which affect the rate of physical deterioration of human body.
4. (a) What is seed germination?
(b) Give four changes which occur during seed germination.
(c) Mention the parts of a seed and state their functions.

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5. (a) State the conditions necessary for seed germination.
 - (b) Explain the types of seed germination.
 6. (a) Give the meaning of seed viability.
 - (b) State three factors affecting seed viability.
 7. (a) What is seed dormancy?
 - (b) Outline five causes of seed dormancy.

2. GENETICS

1. (a) Give the meaning of the following terms:
 - (i) Genetics
 - (ii) Heredity
 - (iii) Variation
 - (iv) Gene
(b) Define the following terms:
 - (i) Allele
 - (ii) Genotype
 - (iii) Phenotype
 - (iv) Trait
 - (v) Dominance
 - (vi) Recessive
 - (vii) Homozygous
 - (viii) Heterozygous
 - (ix) Locus
 - (x) First filial generation
 - (xi) Second filial generation
2. (a) Give the meaning of the following terms.
 - (i) Deoxyribonucleic acid
 - (ii) Ribonucleic acid
(b) Write down the chemical composition of DNA (Deoxyribonucleic acid).
(c) Draw a diagram of DNA
3. (a) Write down the components of RNA.
(b) Draw a diagram of DNA.
(c) Mention three types of RNA.

- (d) Give five differences between Deoxyribonucleic acid (DNA) and Ribonucleic acid (RNA).
4. (a) Outline for reasons to why Mendel chose the garden peas.
(b) State the reasons for Mendel's success at his work.
5. (a) State Mendel's first and second law of inheritance.
(b) Outline the major points in Mendel's First Law of inheritance.
6. (a) Give the meaning monohybrid inheritance.
(b) Define of the following terms:
(i) Test cross
(ii) Back cross
(iii) Dihybrid inheritance
7. (a) Colour blindness is a sex linked character controlled by a recessive gene located on the X-chromosome. Only homozygous females suffer from this condition. It is more common to males. What percentage will the males suffering from colour blindness be if a normal male marries a colour blind female?
(b) If one parent is homozygous tall (TT) and the other homozygous short (tt), what will the genotype of the offspring be? Illustrate your answer.
(c) Who is an albino?
(d) Explain the problems faced by albinos under the following guidelines:
(i) Vision
(ii) Exposure to sunlight
(e) Give the genotype of the offspring produced when an albino male marries a female who is heterozygous for albinism.
(f) Explain the meaning of:
(i) Sex limited character
(ii) Sex linked inheritance
(iii) Sex determination
8. (a) What do you understand by the following terms?
(i) Incomplete dominance
(ii) Co-dominance
(b) Mention the alleles which determine blood group.
9. (a) Define the term variation
(b) Give the meaning of the following terms:

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- (i) Continuous variation
 - (ii) Discontinuous variation
- 10(a) Write four differences between continuous and discontinuous variation.
- (b) Explain four causes among organisms.
- 11(a) Give the meaning of genetic disorder.
- (b) Describe the causes and effects of the following genetic disorders.
- (i) Dawn's syndrome
 - (ii) Turner's syndrome
 - (iii) Klinefelter's syndrome
 - (iv) Haemophilia
- (c) Genetics is a branch of Biology dealing with hereditary. How can this field of Biology be applied to everyday life?

3. CLASSIFICATION OF LIVING THINGS – KINGDOM ANIMALIA

- 1. (a) Outline the general and distinctive features of the Kingdom Animalia.
(b) Mention and explain the major phyla of Kingdom Animalia.
- 2. (a) Outline six characteristics of phylum Platyhelminthes.
(b) Outline seven characteristics of phylum aschelminthes (nematoda).
- 3. (a) Give the characteristics of phylum annelida.
(b) State two advantages of earthworm.
- 4. (a) Explain the general and distinctive features of the phylum arthropoda.
(b) Mention classes of phylum arthropoda.
(b) Cite examples of organisms under each class of the phylum Arthropoda.
- 5. (a) Explain distinctive features of each class of the phylum Arthropoda.
(b) State the advantages under each class of phylum Arthropoda.
(c) Mention three disadvantages of insects.
- 6. (a) Outline the general and distinctive features of phylum chordata.
(b) Mention classes of phylum chordate.
- 7. (a) Write the distinctive features of class chondrichthyes
(b) Outline four distinctive features of class osteichthyes.
(c) Mention distinctive features of class amphibian.
(d) List down three distinctive features of class aves
(e) Give three distinctive features of class Mammalia.

8. (a) Advantages of amphibian
- (b) Mention the advantages of class reptilian
- (c) List down four advantages of aves (birds)
- (d) Outline the advantages of mammals

4. EVOLUTION

1. (a) Define evolution.
- (b) Name and explain any four theories of the origin of life.
2. (a) State three merits of Larmec's theory of evolution.
- (b) Mention any two demerit of Larmec's theory of evolution.
3. (a) Explain any four ideas of Darwin theory.
- (b) Outline three merits of Darwin theory.
- (c) Mention one demerit of Darwin theory.
- (d) Mention and explain four evidence of organic evolution.

5. HUMAN IMMUNO DEFICIENCY VIRUS (HIV)

1. (a) Give the long meaning of the following abbreviation terms:
 - (i) HIV
 - (ii) STIs
 - (iii) TDs
 - (iv) VCT
- (b) Explain four ways of transmission, symptoms, and effects of HIV/AIDS.
2. (a) Outline ways of managing and controlling HIV/AIDS and STIs.
- (b) Mention the life skills needed for home based care for PLWHA.
3. (a) Give the meaning of voluntary counselling and testing.
- (b) Outline three significance of voluntary counselling and testing in the control and prevention of HIV/AIDS and STIs.

ANSWERS

1. CLASSIFICATION OF LIVING THINGS – KINGDOM PLANTAE

1. (a) Divisions of kingdom plantae
 - Division bryophyte
 - Division angiospermatophyta
 - Division coniferophyta
 - Division pteridophyta
- (b) Example of the plants which are found in each division of kingdom plantae.
 - Division bryophyte – liverworts, mosses
 - Division angiospermatophyta - all flowering plants eg. water lily.
 - Division coniferophyta – pines
 - Division pteridophyta – ferns
2. (a) General and distinctive features of the division Coniferophyta (conifers).
General features
 - They are cone bearing plants
 - They have seeds that are not enclosed in ovaries.
 - They produce no flowers or fruits.
 - They have a well-developed vascular system.
 - Most of the members live in cool climates where they form evergreen forests.
 - Most of them have hard barks which protect inner softwood.
Distinctive features of the division coniferophyta
 - They are non-flowering but seed producing plants.
 - They have seeds born in cones shaped structures rather than in fruits.
 - They produce seeds in cones rather than inside an embryo.
- (b) The structure of pinus
 - **The stem.** The bark of most pinus is thick and scaly but some species have thin, flaking bark. The branches are produced in regular whorls appearing like a ring of branches arising from the same point.
 - **Leaves.** Generally adult pines have needle-shaped leaves which are green and photosynthetic. The leaves are in bundles or clusters.

Juvenile leaves, which follow soon after seedlings, have single, green leaves arranged spirally on the shoot.

Cones. A cone is an organ of pinus that contains the reproductive structures. The woody cone is the female cone which produces seeds, while the male cones produce pollen.

3. (a) Advantages and disadvantages of the division Coniferophyta
Advantages of conifers

- They are homes of any birds and animals.
 - They are used for decoration and in ceremonies. Many pine species make attractive ornamentals,
 - They are used to make wood products such as furniture and papers.
 - They are draught resistant, therefore, they can survive in dry areas.
- Disadvantages of conifers
- They may prevent other plants from growing as they fully shade the ground below.

- (c) General and distinctive features of the division angiospermophyta (flowering plants).

General features of angiospermophyta

- They have underground root as well as aerial shoot system.
- They have well developed conducting tissues (xylem and phloem tissues arranged in form of vascular bundles).
- They have roots that help absorption of water and material from the soil.
- Most of them have leaves that carry out photosynthesis, so they are autotrophs.

They have alternation of generation, sporophyte generation alternates with gametophyte generation.

Distinctive features of angiospermophyta

- They are flowering plants.
- They produce seeds enclosed in an ovary.
- They have double fertilization whereby each ovule receives a pollen tube that delivers two sperm cells to the embryo sac.

4. (a) Classes of the division angiospermophyta
- Monocotyledonae such as maize, rice, coconut and sugarcane
 - Dicotyledonae such as beans, groundnuts and sunflowers
- (d) Advantages and disadvantages of division Angiospermophyta.
- Advantages of angiospermophyta
- They provide food. Plants belonging to grass family are the most important food stock.
 - They provide a wide range of habitats for different species of organisms.
 - Flowers from angiosperms have great social significance as they are used in different kinds of ceremonies.
- Disadvantages of angiosperms
- Some plants are poisonous when eaten by human and other organisms.
 - Some angiosperm varieties such as marijuana, cocaine and some caffeine are drugs that can be abused when used.
 - Some angiosperm varieties such as cuscute are bad weeds.
- (e) Differences between monocotyledonae and dicotyledonae

Class Monocotyledonae	Class Dicotyledonae
Embryo has one cotyledon	Embryo has two cotyledons
No vascular cambium	There is vascular cambium in roots and stems
Floral parts are in three or multiple of three	Floral parts are in four or five or multiple of five,
Leaves are long and narrow	Leaves are broad
It has leaves with parallel venation	It has leaves with net-like venation
It has fibrous root system	It has tap root system

2. MOVEMENT

1. (a) Definition of terms
- (i) Movement refers to change of position and posture by part or the whole of an organism. It occurs both in plants and animals and takes place at cellular organism level.

- (ii) Locomotion is the movement or change of position of the whole organism from one place to another. Locomotion occurs in animals and in some protocists.
- (b) Forms of locomotion
- (i) Amoeboid movement. It is exhibited by amoeba and some mammalian white blood cells using locomotory structures called pseudopodia.
 - (ii) Ciliary movement. It is exhibited by paramecium and larvae of some aquatic animals using a locomotory structure called cilia.
 - (iii) Flagella movement. It is exhibited by organisms such as euglena, chlamydomonas, trypanosome and some bacteria using the structure called flagella.
 - (iv) Muscular movement. It is a type of movement brought about by contractile tissues called muscles. Most animals have these tissues working together with their skeletal system to bring about motion.

2. (a) The importance of movement in animals and plants

- To find a mate and to reproduce
- To escape from danger
- To seek and capture food
- To seek shelter, a suitable habitat/ climate
- To find water/soil nutrients, and hold leaves to get maximum sunlight
- To obtain support

(c) The structures for movement

- (vi) Amoeba – pseudopodia
- (vii) Fish – fins
- (viii) Paramecium – cilia
- (ix) Earthworm – setae
- (x) Mammals – limbs

3. (a) Skeleton is a rigid structure which provides shape, support and area for muscle attachment to large animals like insects, mammals, reptiles, etc.

(b) Types of skeletons

- (i) Exoskeleton. Is a hard outer cover of animals such as crustaceans and arachnids.

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- (ii) Endoskeleton. It is a rigid framework of either bones or cartilage located inside an organism and on which muscles are attached. Examples of endoskeletons are the human skeleton and mammalian skeleton.
- (iii) Hydrostatic skeleton. It is found in soft bodied animals such as earthworms.
4. (a) Functions of skeleton
- It provides a framework which supports the body and maintain the shape.
 - It protects the internal delicate organs such as the brain, heart and kidneys.
 - It operates as levers sometimes on which muscles pull to bring movement.
 - It functions as framework for anchoring muscles.
 - It stores phosphorus and calcium minerals which may then be released in the necessary amount when required.
 - It is involved in blood cells production.
- (b) The major components of the human skeleton are:
- (i) Bones. These are rigid structures made of calcium deposits and living cells.
- (ii) Cartilage. It is a form of fibrous connective tissue that is composed of closely collagenous fibres. It gives shapes to some parts of the body and it keeps bones from grinding against each other
- (iii) Joint. It is a site where two or more bones meet or connected
5. (a) Types of joints
- (i) Fixed or immovable joint. It is a joint that does not allow movement for example, structure found in the cranium.
- (ii) Pivot joint. It is a joint between atlas and axis vertebra. It permits shaking of head side to side.
- (iii) Ball and socket joint. It is found in the shoulder and hip. It allows movement in all planes.
- (iv) Hinge joint. It is found at the elbow and knee and works like a hinge of a door to allow movement in one plane.

- (v) Gliding joint. It occurs between the vertebrae, the carpal, tarsal, wrist and ankle bones. Bone surfaces move (glide) over each other to a limited extent.
- (b) Adaptation of joints to movement
 - (i) Freely movable joints are prevented from dislocation by ligaments which hold bones in place.
 - (ii) Bones are hollow to reduce their weight while maintaining their strength.
 - (iii) Bones of movable joints are covered by a layer of cartilage which reduces friction and provides cushion which absorbs compression in bones that support much weight.
 - (iv) Synovial fluid in freely movable joints lubricates the joints, reduces friction and absorbs shock.
 - (v) The spongy nature of bone terminals enables them to absorb compression caused by body weight.
- (c) To complete the given table below

Joint	Location in the body
Hinge	Knee and elbow joint
Ball and socket	Shoulder and hip joint
Pivot	Joint between axis and atlas vertebrae
Gliding	Joint between vertebrae and wrist joint

6. (a) From the figure given

- (i) Parts labelled A - F
 - A. Bone (hip)
 - B. Ligament
 - C. Articular cartilage
 - D. Synovial fluid
 - E. Synovial membrane
 - F. Femur

- (ii) Functions of C (articular cartilage)

- It is a soft part of a bone whose cells are actively dividing mitotically to make the bone to enlarge to a certain extent hence growth is attained.
- It minimizes friction as it can happen when the bones rub against each other during movement.

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Functions of B (ligament)

- It connects bone to bone at the joint.

Functions of D (synovial fluid)

- It minimizes friction at the joint when bones move due to bending or straightening of the limbs.

(iii) The figure represents a ball and socket joint. It is characterized by allowing movement in many directions including rotation.

(b) From the given figure:

(i) It is a hinge joint

(ii) Names of structures labelled A – F

A. Sponge bone

B. Hyaline cartilage

C. Fibrous capsule

D. Compact bone

E. Hyaline cartilage

F. Synovial cavity with synovial fluid

(iii) Functions of structure E

- To reduce friction between the joints during movement.

- It acts as a shock absorber.

7. (a) Parts of human skeleton

(i) The axial skeleton

(ii) Appendicular skeleton

(b) The components of axial skeleton

(i) The skull. It is made up of small bones joined together to form the cranium. The upper jaw is fused to the cranium. The lower jaw is articulated to the cranium.

(ii) Ribcage and sternum. It is made up of flattened curved bones known as ribs which articulate with the vertebral column to the back and sternum is composed of small fused bones called sternabrae.

(iii) The vertebral column. It is made up of 33 small bones known as vertebrae.

8. (a) Types of girdles

- Pelvic girdles

- Pectoral girdles

(b) Functions of limb girdles

- They support the upper part of the body especially in bipeds.
 - They provide large surface area for attachment of muscles that move the leg/arm.
- (c) Ball and socket joints
9. (a) Muscle is a bundle of fibrous tissues in an animal's body which has the ability to contract and relax thereby it produce movement or maintain position of body parts.
- (b) Types of muscles
- (i) Smooth muscles. These muscles are found in the internal organs such as alimentary canal, bladder, uterus, and blood vessels.
 - (ii) Cardiac muscles. These muscles are found in the heart and are special in that they contract and relax without getting fatigue.
 - (iii) Skeletal muscles. These muscles are attached to the skeleton and are responsible for locomotion and other voluntary movements of the body.
- 10(a) Muscle cramps are sudden involuntary contractions of the skeletal muscles which can last for seven to ten minutes.
- (b) Causes of muscle cramps
- Dehydration through sweating or diarrhea.
 - Lack of calcium or magnesium in the body.
 - Prolonged vigorous exercises e.g. running.
- (c) Prevention of muscle cramps
- Taking a salt solution or licking it to relieve cramp due to loss of salt.
 - Stretching of muscles more often by exercising.
 - Consulting a doctor for more medical advice.
- 11(a) Types of movement exhibited by plants
- (i) Nastic movement. It is non directional movement of a plant organ in response to diffuse stimuli. For example, the shrinking of the leaves of mimosa pudica when touched.
 - (ii) Tropism movement. It is the growth movement towards or away from a stimulus coming from one direction.
- (b) Types of tropism movements
- Phototropism – is a growth movement shown by part of fixed plant in response to light

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- Hydrotropism – is the growth movement in response to water.
- Thigmotropism – is growth movement in response to touch.
- Chemotropism – is a growth movement made by plants in towards chemicals.
- Thermotropism – is a growth movement in response to heat.
- Geotropism is a growth movement in response to gravity.

3. COORDINATION

1. (a) Coordination is the working together of different body parts or system in an orderly and organized manner.
 - (b) Meaning of terms
 - (i) Irritability is the ability of organism to perceive and respond to changes in the internal and external environment.
 - (ii) Stimulus is a change in the internal or external environment to which an organism responds
 - (iii) Response is the reaction of an organism to a stimulus. It may be behavioural, physiological or muscular.
 - (iv) Receptor is a specialized cell that detects stimuli and initiate transmission of impulses through sensory nerves.
 - (v) Effector is a part of the body that responds to the stimulus. This part can be either a muscle or gland.
 - (vi) Nerve impulse is a weak electric signals which travels along a nerve cell.
 - (vii) Neurone is a specialized cell which transmits nerve impulses from one part of the body to another.
 - (viii) Coordinator is a part of the body which links together all activities performed by an organism.
 2. (a) Importance of coordination
 - (i) It detects changes in the environment
 - (ii) It protects organisms from danger and/or enemies.
 - (iii) It controls growth and development of the organism.
 - (iv) It provides communication for effective functioning and survival of an organism.
 - (b) Components/parts of neurone
 - Nucleus
 - Cytoplasm

- Dendrites
 - Axon
- (c) Synapse is a gap where two neurons meet
3. (a) Types of neurons
 - (i) Sensory neurone. It is a nerve cell that transmits impulses from the receptors to the Central Nervous System (CNS).
 - (ii) Motor neurone. It is a nerve cell that transmits impulses from the central nervous system (CNS) to the effector organs such as muscles or glands where response is made.
 - (iii) Relay neurone. It is a nerve cell that conveys messages between neurons in the Central Nervous System (CNS).
- (b) Adaptation of neurones
 - They are covered with fatty myelin sheath for protection and insulation.
 - They have numerous and spread to all body parts.
 - They have numerous dendrites for connectivity with other neurones.
 - They have schwann cells that secrete myelin sheath.
 - They have elongated axons which helps in quick transmission of impulses.
4. (a) Meaning of terms:
 - (i) Central Nervous System (CNS) is the part of the nervous system consisting of the brain and the spinal cord.
 - (ii) The brain is a specialized organ that is ultimately responsible for all thoughts and movements that the body produces.
5. (a) From the diagram:
 - (i) Names of the parts labelled A -D
 - A. Dendrites
 - B. Cell body
 - C. Axon
 - D. Myelin sheath
 - (ii) Motor neurone carries impulses from the brain or the spinal cord to an effector organ causing a reaction to take place.
 - (iii) Sensory neurone and relay neurone

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- (b) Differences between nervous communication and endocrine communication.

Nervous communication	Endocrine communication
Communication is through electrical signals.	Communication is through hormones.
Electrical signals are transported through neurones.	Hormones are transported by the blood.
The response is fast	The response is slow
The response is short lasting	The response is long lasting.
Parts affected by the signals are effectors (muscles and glands).	Parts affected by the signals are internal body organs such as the liver, the thyroid gland, etc.

6. (a) Parts of the human brain

- Fore brain (olfactory lobe and cerebrum)
- Mid brain (optic fibres)
- Hind brain (cerebellum and medulla oblongata)

- (b) It is concerned with the sense of smell.

7. (a) Parts of the cerebrum and their functions

- Temporal lobe. It controls visual and auditory memories. It includes areas that help to manage some speech and hearing capabilities, behavioural elements and language.
- Parietal lobe. It focuses on comprehension. It controls visual functions, language, reading, internal stimuli, tactile sensation, and sensory comprehension.
- Occipital lobe. It controls vision
- Frontal lobe

- (b) Functions of each part of the hind brain

- Cerebellum. It is responsible for body movements which are concerned with equilibrium.
- Medulla oblongata controls all unconscious activities of the body such as breathing, heart beats, digestion, dilation and contraction of blood vessels.

8. (a) From the diagram

- (i) Human brain
- (ii) Names of the parts labelled A – E:

- A. Cerebrum
 - B. Cerebellum
 - C. Medulla oblongata
 - D. Spinal cord
 - E. Pituitary gland
9. (a) Parts of spinal cord
- Gray matter. It is the central part of the spinal cord and consists mainly of relay neurones.
 - White matter. It is the outer part of the spinal cord mainly consists of axons of sensory and motor neurones.
 - Dorsal root. It is the part of spinal cord which carries sensory nerve fibres.
 - Ventral root. It is the part of the spinal cord which carries motor nerve fibres.
- (b) Functions of the spinal cord
- It enables an animal to attain an upright posture through maintenance of muscle tone.
 - It provides pathway for the transmission of both sensory and motor impulses between the brain and other parts of the body.
 - It is responsible for the rapid responses to stimuli acting on the body surfaces.
- 10(a) Peripheral Nervous System is made up of sensory and motor neurones which enter and leave the Central Nervous System (CNS).
- (b) Components of Peripheral Nervous System
- (i) Somatic nervous system. It is composed of afferent nerves that carry information to the central nervous system (spinal cord) and efferent nerves that carry neural impulses away from the central nervous system.
 - (ii) Autonomic nervous system. It is composed of sympathetic nervous system and parasympathetic nervous system which regulate homeostasis within the body.
- 11(a) Meaning of terms:
- (i) Reflex action is a rapid, involuntary response to a certain stimulus by organism. For example, withdrawal of a hand from a hot object and

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blinking of an eyelid in response to a foreign object getting into the eye.

- (ii) Reflex arc is the route/path followed by impulses during a reflex action.
- (b) Types of reflex action
- (i) Simple reflex action. It is inborn and do not need to be learnt
- (ii) Conditional reflex action. It is mediated by the brain through previous experience eg. In Pavlov's experiment, the dog had learnt to associate the bell with the presence of food.
- 12(a) Differences between simple reflex and conditional reflex

Simple Reflex Action	Conditional Reflex action
It requires only one stimulus	It involves more than one stimuli
It involves the spinal cord mostly	It involves the brain
It is initiated by a related stimuli	It is initiated by unrelated stimuli
It is inborn	It is acquired in one's life
It is same in all members of a species	It is different in members of a species

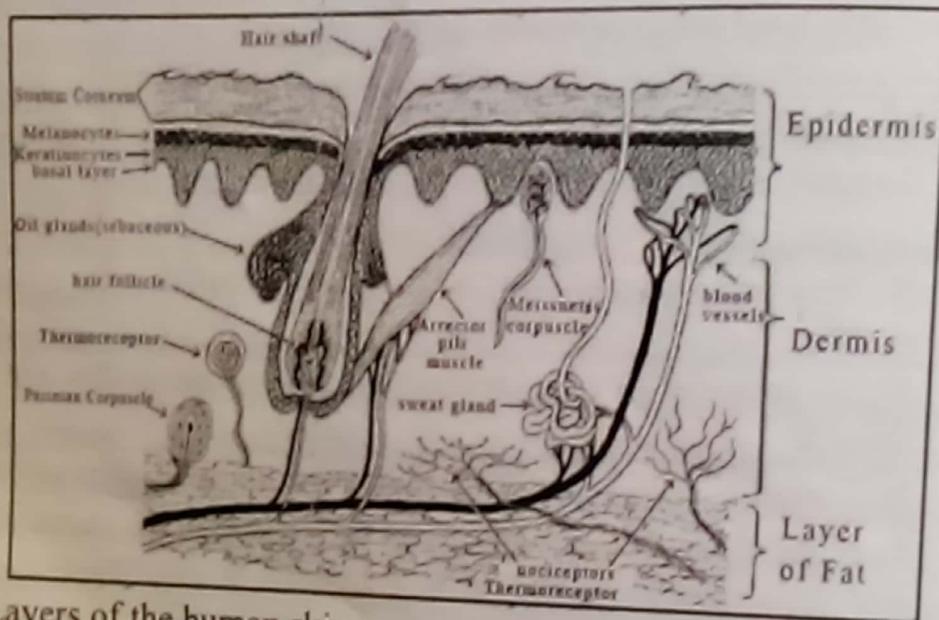
- (b) Components of reflex arc
- Receptors – detects a stimulus/change in the environment
 - Sensory neurone – send signals to relay neurone
 - Motor neurone – sends signals to effector
 - Effector – produces a response

- 13(a) Types of receptors
- (i) Enteroreceptors. They are located within the body and respond to stimuli from internal environment. Examples of enteroreceptors include thermoreceptors and osmoreceptors found in hypothalamus.
- (ii) Exteroreceptors. They are located close to the body surface and which detect changes in the external environment. Examples of exteroceptors are photoreceptors in the eye, chemoreceptors in the nasal cavity, and pacinian corpuscles under the skin.
- (b) Sense organ is a mass of specialized sensory receptor cells which perform related functions.

(c) The sense organs

- The skin
- The tongue
- The ear
- The eye
- The nose

14.(a) Diagram of human skin



(b) Layers of the human skin

- The epidermis – is the outermost layer of skin
- The dermis – it contains tough connective tissue, hair follicles and sweat glands.

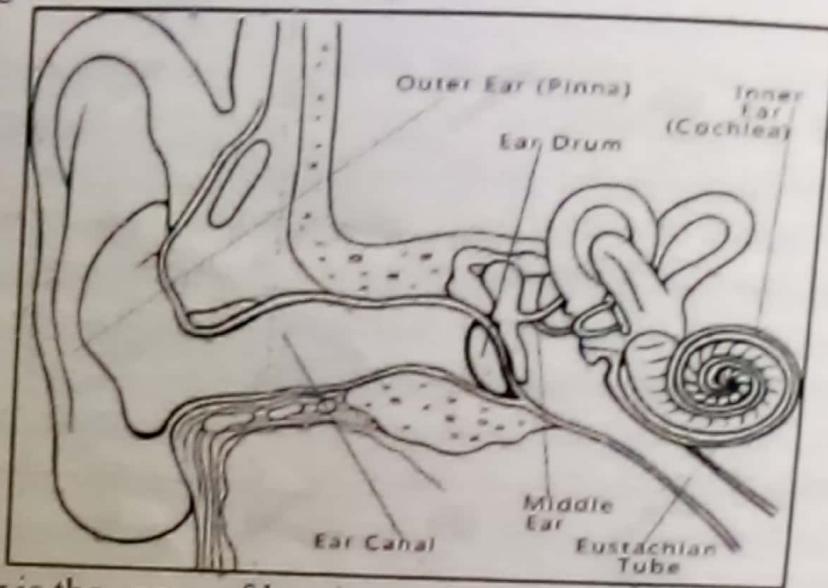
(c) Functions of skin

- When the environment around the skin changes, sensory receptors for that stimulus are stimulated and in turn convert the stimulus to electrical impulses which are transmitted to the brain via peripheral nervous system, the brain then interprets the stimulus.
- It regulates the body temperature in an organism thus helping to keep the body temperature constant.
- It produces melanin that protects the body from ultra-radiations which can cause skin cancer.

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- It prevents micro-organisms and other foreign materials from entering the body.
- It produces sweat through the sweat glands which gets rid of excess heat, water, salts some carbon dioxide and urea.
- (d) Adaptations of the skin to its functions
 - It has the hair erector muscle which controls whether the hair stands erect or lies down depending on the temperature of the surrounding.
 - It is supplied with nerves which convey impulses to the Central Nervous System to be interpreted.
 - It has blood vessels in the dermis which dilate when the body temperature is high to facilitate heat loss by radiation and constrict when temperature is low to reduce heat loss.
 - It has sweat glands which produce sweat to help to cool the body.
- 15(a) The tongue is an organ responsible for tasting
- (b) Cell bud is a cell in mammals responsible for sensation of taste, while gustatory cell is a cell responsible for sensation of taste in other vertebrates which are not mammals.
- (c) The taste sensation parts and their location
 - Sweet – it is located at the tip of the tongue
 - Sour – it is located at the sides
 - Bitter – it is located at the back of the tongue
 - Salt – it is located all over the tongue
- (d) Adaptations of the tongue to its functions
 - It has taste buds which help it to respond the stimuli such as sweet, bitter sour and salt.
 - At the base of each taste bud there is a nerve that sends the sensations to the brain.

16(a) A diagram of mammalian ear



(b) The ear is the organ of hearing and maintaining balance and posture.
Adaptations of the mammalian ear to its functions

- The outer ear (pinna) is a flap of tissue which collects sound waves and directs them into the inner ear via the auditory canal.
- The lining of the auditory canal contains wax-secreting cells which produces wax. The wax traps dust particles and other foreign bodies and hence protects the inner delicate parts of an ear from mechanical damage or microbial infections.
- The ear drum is thin and membranous that enables it to vibrate when sound waves hit it before converting the waves into vibrations and passing them on to the ear ossicles in the middle ear.
- The ear ossicles (malleus, incus and stapes) act as a lever system which can move forward and backward to amplify and transmit vibrations to the oval window.
- The Eustachian tube is hollow which allows air in and out of the middle ear to equalize the pressure between the inside and outside of the ear drum.
- The cochlea is coiled to increase the surface area of sound impulses to the brain for interpretation.
- The presence of fluid filled vestibular apparatus (semi-circular canals, sacculus, and utriculus) in the inner ear facilitates balancing of sound when the fluid is displaced.

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- (c) Parts of the ear
 - (i) Outer ear (pinna)
 - (ii) Middle ear
 - (iii) Inner ear
 - (d) Mechanism of hearing
 - The pinna collects sound waves and channels them to the ear drum through the ear canal (external auditory canal).
 - When sound waves hit the ear drum, it vibrates. The vibrations are transmitted through the ear ossicles to the oval window.
 - The ear ossicles amplify the vibrations. The vibration of the innermost ear ossicle, stapes, causes vibrations of thin membrane that separates the middle and inner ear- the oval window.
 - Movement of the oval window sets up pressure waves in the perilymph which then vibrates the endolymph in the cochlea. Vibrations of the endolymph causes the tectorial membrane above sensory hair cells of the basilar membrane to vibrate.
 - These vibrations generate electric impulses that are transmitted to the brain for interpretation via the auditory nerve.
- 17(a) The eye is the organ for vision
- (b) The parts of the eye and their functions
- Cornea – is the outer, transparent covering of the eye. It protects from elements that could cause damage to the parts of the eye. It also helps to focus light on the retina at the back of the eye.
 - Sclera – is the outermost layer of the eye. It protects the eye and maintains the shape of the eye ball.
 - Pupil – it appears as a black dot in the middle eye. It is actually a hole that takes light to enable the eye focus one the objects in front of it. It controls the amount of light that enters the eye.
 - Iris – it contains the pigment which gives the eye its colour. It has radial and circular muscles that control the size of the pupil by dilation and contraction.
 - Conjunctiva – it is a membrane that covers the cornea. It is thin and transparent so as to allow light to enter the eye. It is tough and protects the eye from mechanical damage.
 - Lens – is a transparent structure filled with a jelly-like substance. It enables the eye to focus light into the retina.

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- Retina - it is the sensory tissue that lines the inner layer of the eye. It contains light-sensitive cells (cones and rods). Cones are sensitive to bright colour and function in bright whereas rods are in dark colour and function in dim light.
- Choroid - it lies between the retina and the sclera which provides blood (oxygen and nutrients) supply to the eye. It also reduces reflection of light within the inner eye by absorbing scattered light.
- Fovea - is a region of the retina with the highest concentration of cones where most of light is focused. It is responsible for sharpest vision.
- Blind spot - It is located at the point where the optic nerve leaves the eye. The blind spot is not responsible to light because it has no rods or cones.
- Optic nerve - is a cranial nerve which contains sensory neurones. The neurones transmit impulses from the rods and cones of the retina to the brain for interpretation.
- Ciliary body/muscle - is a ring-shaped tissue which holds and controls the movements of the eye lens and thus it helps to control the shape of the lens.

18(a) Names of parts labelled A - M.

A. Ciliary body	B. Lens
C. Pupil	D. Cornea
E. Iris	F. Conjunctiva
G. Sclera	H. Choroid
I. Optic nerve	J. Blind spot
K. Fovea	L. Retina
M. Vitreous humour	

(b) Part C is pupil

- (i) In the dim light, the radial muscles of the iris contract while circular muscles relax and the pupil becomes bigger thus allowing more light to enter the eye.
- (ii) In the bright light the circular muscles of the iris contract while radial muscles relax and the pupil becomes smaller thus reducing the amount of light entering the eye.

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19(a) Comparison between mammalian eye and camera

Mammalian eye	Camera	Function
Iris	Diaphragm	Regulate amount of light
Lens	Convex lens	Focuses light
Retina	Sensitive film	Image formation
Lens change in thickness	Lens moves back and forward	Accommodation to view both near and distant objects
Choroid	Black surface	Prevents internal reflection of light

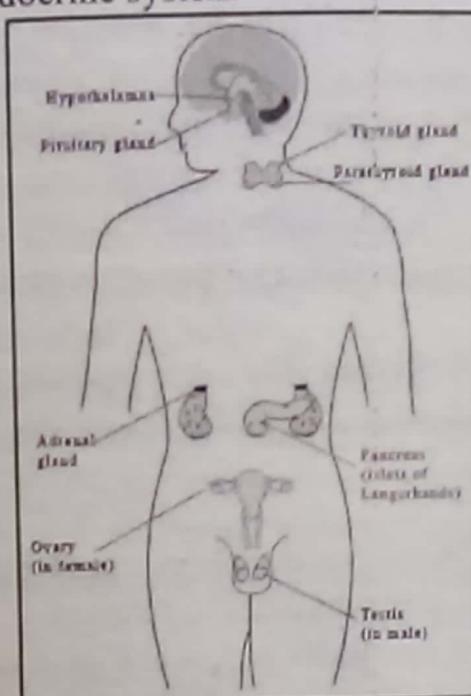
- (b) Accommodation is the ability of the eye to focus both near and distant objects.
- (c) Accommodation is possible because the lens is made up of an elastic substance and it can be stretched into a slim shape, and when this tension is withdrawn, the lens reforms into a fatter shape. The changes of shape are brought about by action of the ciliary muscles.
- (d) Mechanisms of focusing near and distant objects
- (i) Focusing near objects
- Radial muscles relax
 - Circular ciliary muscles contract
 - Suspensory ligaments relax
 - Lens becomes thick and allows light rays from near object to be focused on the retina.
- (ii) Focusing a distant object
- Radial muscles contract
 - Circular ciliary muscles relax
 - Suspensory ligament contract
 - Lens is stretched and becomes thin.

20(a) Meaning of terms

- (i) Drug is any chemical substance natural or synthetic which has known physiological effects on human or other living body.
- (ii) Drug abuse is the use of drugs in a way which is harmful to the body
- (iii) Drug addiction is the compulsive and repeated use of increasing amounts of drugs with the appearance of withdrawal symptoms when drug use ceases.

- (b) Proper use and handling of drugs
 - Avoid taking any drug without diagnosing the disease and prescription by the doctor.
 - Always stay away from peer pressures and drug addicts to avoid copying their bad habits.
 - Report any case of drug abuse or trafficking to concerned authorities.
 - Never take a dose more or less than what has been prescribed by the doctor.
 - Complete the prescribed dose even after starting getting well.
- (c) Causes of drug addiction
 - Pressure from peer group
 - Frustration/stress
 - Desire to satisfy curiosity about what the drugs do to the body.
 - To attract attention and resist the feeling of neglect.
 - As a way of escaping from bad situations in life eg. A person may take drugs so as to forget the situation of poverty.
 - Lack of life and social skills
- (d) Effects of drug addiction
 - It confuses mental faculties
 - Many drugs induce a feeling of dependency and are linked with criminal activity.
 - It can cause death
 - It can cause HIV infections due to sharing of needles used to inject drugs.
 - Many drug addicts are weak and so they cannot participate in income generating activities.
 - It can lead to birth defects among women which include giving birth to premature babies.
- (e) Preventive and control measures of drug abuse
 - Early education should be given to the peer groups
 - Treatment and rehabilitation of drug addicts should be provided
 - Keep away from drug addicts
 - Various effects of drug abuse must be announced publically.

21(a) A diagram of endocrine system



Endocrine system is a collection of glands that produce hormones which regulate metabolism, growth and development, tissue function, sexual function, reproduction, sleep and others.

- (b) Roles of hormones produced by endocrine glands
- (i) Hormones produced by pituitary gland
 - Somatotrophin (growth hormone) – it controls growth
 - Thyrotrophic hormone – it controls production of thyroxine hormone.
 - Adrenocorticotropic hormone (ACTH) – it stimulates activities of adrenal cortex
 - Follicle stimulating hormone – it stimulates development of follicle in the ovary.
 - Luteinizing hormone It brings about ovulation
 - Antidiuretic hormone (ADH) – it stimulates kidney to reabsorb water.
 - Oxytocin – It deals with the contraction of the uterus at birth.
 - Prolactin – it stimulates milk production in female mammals.
 - (ii) Thyroid gland
 - Thyroxine – it controls metabolic activities
 - (iii) Pancreas (Islets of Langerhans)
 - Insulin – it stimulates the conversion of glucose to glycogen by the liver.

- Glucagon – it stimulates the conversion of glycogen to glucose by the liver.
 - (iv) Adrenal gland
 - Adrenaline and noradrenaline – they prepare the body for emergency.
 - Aldosterone – it controls ionic balance especially sodium and potassium.
 - Glucocorticoids – it promotes gluconeogenesis
 - (v) Testes
 - Androgens – it causes the development of secondary sexual characteristics in males, promotes growth of most reproductive organs.
 - (vi) Ovaries
 - Oestrogen – it promotes development of reproductive organs and secondary sexual characteristics in females.
 - Progesterone – it maintains pregnancy by encouraging development of the uterus lining after ovulation, the embedding of the zygote in the uterus and development of the placenta.
- 22(a) (i) The sudden release of adrenaline hormone which triggered various emergency coping mechanisms enabled her to climb the tree.
(ii) Immediately after seeing the snake, the adrenal glands released more adrenaline into the bloodstream; adrenaline caused an increase in the rate and strength of heartbeat, an increase in the sugar content of the blood, and an increase in the rate of inspiration; at the same time, the blood vessels to the skeletal muscles dilated so that more blood flowed to them supplying more oxygen and glucose. All these reactions made the individual to run away immediately.
- (b) (i) Growth hormone
(ii) Dwarfism
- 23(a) Hyper-secretion is a situation in which the endocrine glands produce too much of a given hormone – it is over-secretion of hormone, while hypo-secretion is a situation in which the endocrine glands produce too low of a given hormone – it is under-secretion of hormone.
- (b) Disorders of hormonal coordination in mammals
(i) Disorders of pituitary gland due to:

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- Hyper-secretion of growth hormone – is gigantism in children and acromegaly in adults.
 - Hypo-secretion of growth hormone – is pituitary dwarfism
 - Hyper-secretion of antidiuretic hormone – is increased reabsorption of water in the kidney tubules leading to production of little urine but which is more concentrated.
 - Hypo-secretion of antidiuretic hormone is less water absorption from the glomeruli filtrate back to the body leading to production of large volume of dilute urine.
- (ii) Disorders of thyroid gland
- Hyper-secretion of thyroxin hormone – is Grave's disease and exophthalmos
 - Hypo-secretion of thyroxin hormone – cretinism in children, myoedema in adults and goitre (abnormal growth of the thyroid gland).
- (iii) Disorders of pancreas
- Hyper-secretion of insulin – hypo-glycaemia (it cause disorientation, unconsciousness and even death).
 - Hypo-secretion of insulin – I is diabetes mellitus
- (iv) Disorders of adrenal gland
- Hyper-secretion of adrenaline hormone – is hypertension, obesity, headache, increased heartbeat, weak bones, sweating and early onset of sexual development.
 - Hypo-secretion of adrenaline hormone – is low blood pressure, fatigue, muscular weakness, muscle wasting, inability to withstand stress, and increased dark pigmentation of the skin.
- (v) Disorders of testes
- Hyper-secretion of testosterone – is males to have female traits such as enlarged breasts and a wide pelvis.
 - Hypo-secretion of testosterone – is failure of males to develop some secondary sexual characteristics, poor development of the reproductive organs and weak bones and muscles.
- (vi) Disorders of ovaries
- Hyper-secretion of oestrogen – is decreased sexual desire, heavy menstrual flow and increased weight in females.

- Hypo-secretion of oestrogen – is failure of females to develop some secondary characteristics, poor development of the reproductive organs, liver, kidney and lungs.
- 24(a) Tropic response is the movements of plants in the direction of stimulus

4. EXCRETION

1. (a) Excretion is the process by which waste products of metabolism and other non-useful materials are removed from the body.
- (b) The major excretory products and their sources

Product	Source
Oxygen	Photosynthesis in plants, algae and some bacteria
Bile pigment	Product of haemoglobin breakdown
Water	Metabolism of carbohydrates
Carbon dioxide	Product of cell respiration in autotrophic organism.
Nitrogenous compounds (urea, ammonia and uric acid).	Deamination of excess amino acids (from protein).

2. (a) Importance of excretion
 - (i) It removes unwanted by products of metabolism.
 - (ii) It creates good working environment for cells.
 - (iii) It enables removals of toxic wastes which is accumulated in the body.
- (b) The primary excretory organs
 - Kidneys – they filter the wastes including urea, salt and excess water which are flushed out of the as urine.
 - Skin – it performs its function via the sweat glands which produce sweat that contains mineral salts, excess oils, water, and traces of urea and lactic acid which are then excreted out of the body through sweat pores.
 - Lungs – the lungs use cells known as alveoli to remove the carbon dioxide from the blood.
 - Lungs

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(c) Accessory excretory organs

- Liver
- Gall bladder
- Urinary bladder
- Ureters
- Urethra

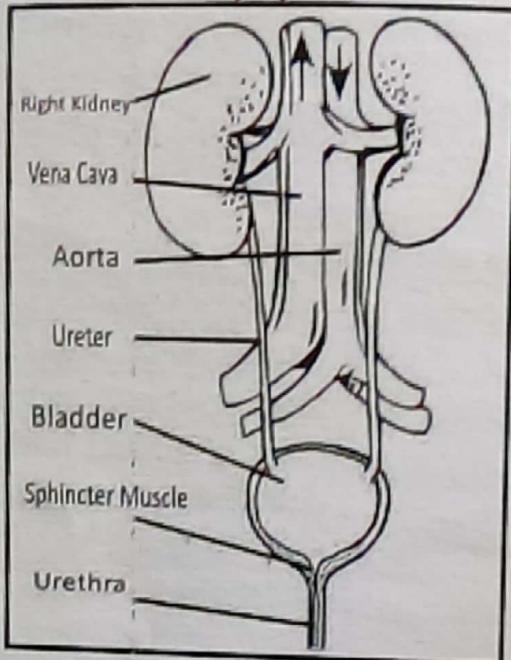
(a) Excretory organs and waste products they produce

Excretory organ	Excretory product
Skin	Excess water, urea and salt
Lungs	Carbon dioxide and water vapour
Liver	Bile pigments which pass to the duodenum through the bile duct for removal along with faeces.
Kidney	Metabolism of carbohydrates, fats and so on.

(b) Relationship between nitrogenous waste products and the habitat of the organisms producing it

Animal	Excretory product	Habitat
Protozoan	Ammonia	Aquatic
Freshwater bony fish	Ammonia	Aquatic
Marine bony fish	Urea, trimethylamine oxide	Aquatic
Mammal	Urea	Terrestrial
Birds	Uric acid	Terrestrial
Terrestrial insect	Uric acid	Terrestrial

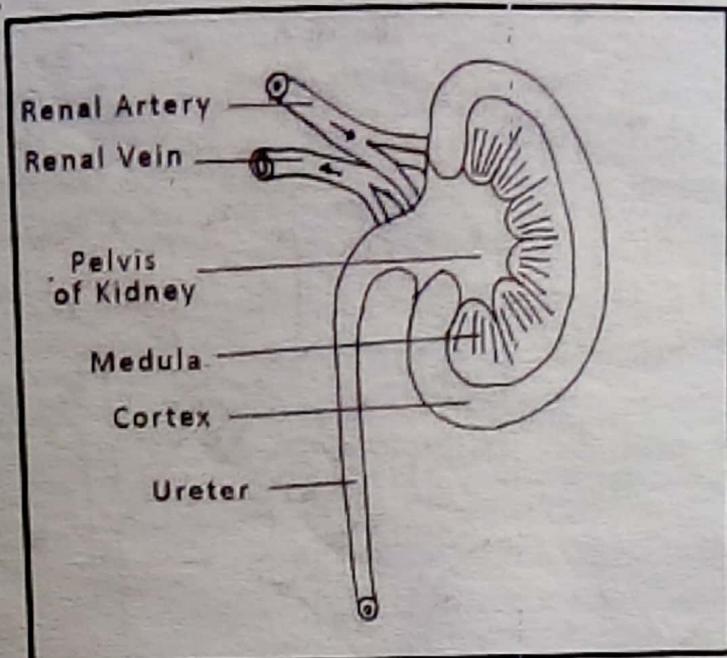
4. (a) A diagram of human excretory system



(b) Adaptation of the urinary system to its functions

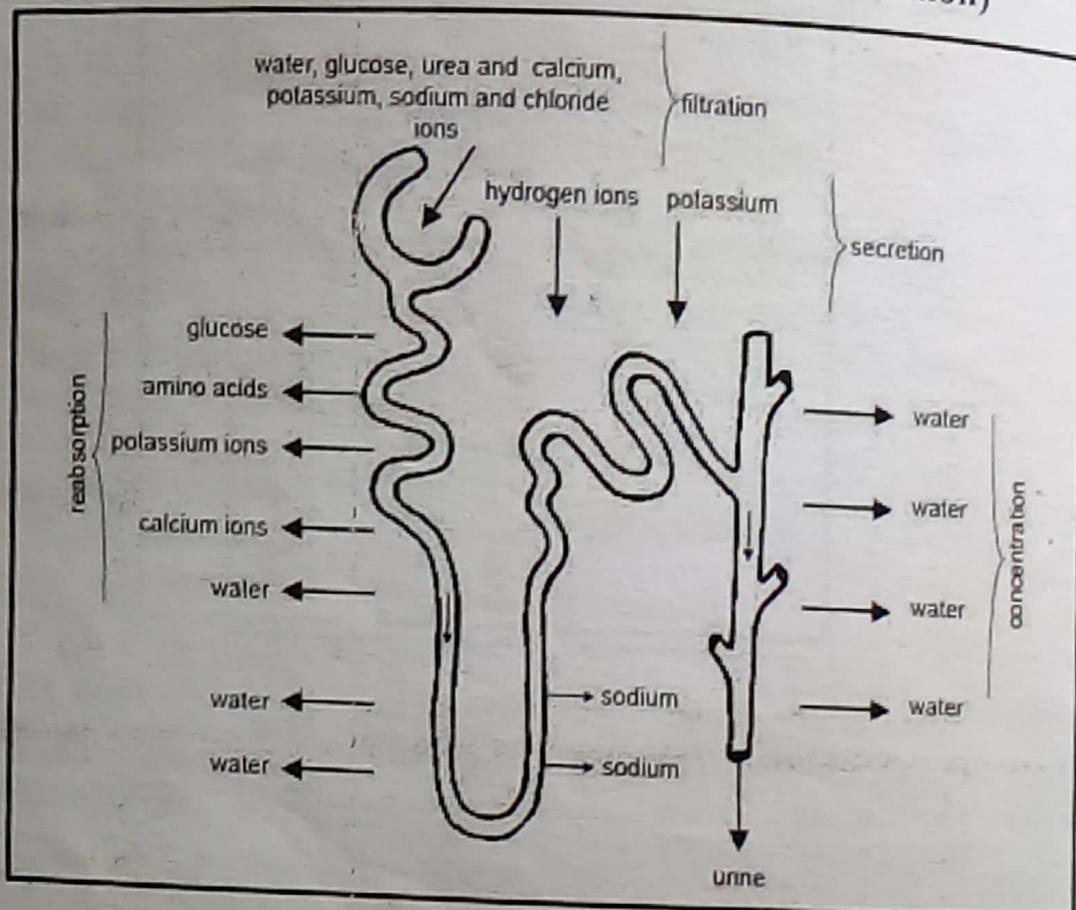
- It has a large afferent arteriole and narrow efferent arteriole which facilitate ultra-filtration.
- The glomerulus capillaries are highly coiled and semi-permeable causing a buildup of pressure in the glomerulus hence ultra-filtration.
- The glomerulus capillaries are semi-permeable to allow selective movement of materials in and out of the nephron.
- The tubules' epithelium is thin to reduce diffusion distance for faster passage and hence reabsorption of materials.
- The Bowman's capsule is cup-shaped to provide maximum surface area for filtration.
- The nephrons are numerous in number for efficient excretion of waste products.
- The tubule is supplied with a network of blood capillaries for maximum reabsorption.

5. (a) A well-labelled diagram of mammalian kidney showing the internal structure.



- (b) Renal artery carries more oxygen and urea while renal vein carries more carbon dioxide and little or no urea.
6. (a) The process of urine formation (mechanism of excretion) involves the following:-
- Filtration. It takes place within the glomeruli. Blood from the renal artery enters the glomerulus at high pressure through narrow capillaries thereby forcing ions, vitamins, amino acids, urea, glucose and water out of blood and into the Bowman's capsule. Proteins and other large molecules are retain in the blood.
 - Reabsorption. It occurs in the proximal convoluted tubule and loop of Henle. It is a process carried out by transporter proteins in the nephron cell membranes whereby amino acids, ions, vitamins and glucose are pumped back into the blood at the proximal tubule and water and salt is reabsorbed at the loop of Henle.
 - Secretion. It takes place in the distal convoluted tubules where high molecular weight molecules like drugs and toxins are secreted into the tubules. The resulting liquid is called urine. The latter passes to the collecting ducts and finally into the bladder where it is stored temporarily before being released out of the body.

Urine formation process (Mechanism of excretion)



- (b) Nephron is a numerous and coiled excretory tubule found in the kidney.
- (c) Adaptations of the nephron
 - Its tubules are long to provide a large surface area for reabsorption.
 - The tubules are well supplied with blood through a network of capillaries for efficient reabsorption.
 - The tubules are highly coiled to slowdown the flow giving it more time for reabsorption.
 - Cells lining the tubules have numerous mitochondria which provide necessary energy for active transportation of nutrients from the tubules to the blood capillaries.
- (d) From the diagram
 - (i) The parts labelled A – D
 - A. Renal Artery

- B. Renal Vein
 - D. Glomerulus
- (ii) Glomerular filtrate
- (iii) Protein
- Blood cells such as erythrocytes
- (iv) Urea
7. (a) Explain the causes, symptoms, effects and control measures of Kidney failure.
- Causes of kidney failure
- Damage to the kidney due to accident or complications during surgery.
 - Low blood volume due to excessive bleeding.
 - Poor intake of fluids
 - Obstruction of renal artery causing blocking of blood flow to the kidneys.
 - Dehydration from loss of body fluid.
 - Chronic diseases that gradually cause the kidneys to stop functioning.
- Symptoms of kidney failure
- Oedema (swelling of the legs, ankles, feet, face or hands due to excess fluids).
 - Loss of appetite.
 - High level of urea in blood leading to vomiting, nausea, weight loss, blood in urine or difficulty in urinating.
- Effects of kidney failure
- Bone damage
 - Muscle paralysis
 - Abnormal heart rhythm
 - Loss of memory
- Preventive measures/treatment
- Avoid food which is rich in potassium like citrus fruits, bananas, coffee, peanuts, and chocolate.
 - Medications e.g. Phosphorus lowering medications.
- Kidney transplant
- (b) Explain the causes, symptoms, effects and preventive measures and treatments of Kidney stones
- Causes of Kidney stones
- Lack of vitamins

- Inadequate intake of water
- Dehydration from reduced fluid intake or strenuous exercise
- Decrease in urine volume and/or an excess of stone-forming substances in the urine.
- Infection in the urinary tract
- Obstruction of the urine flow.
- Symptoms of Kidney stones
- Extreme pain and difficulty in urination
- Pain in the low back and/or side, groin, or abdomen
- Blood in the urine due to damage of the inside walls of the kidney, urethra.
- Nausea and vomiting
- Chills and fever
- Effects of Kidney stones
- It may lead to kidney failure
- It leads to severe back pains
- Toxicity due to urine staying in the blood for a long time.
- Prevention/treatment
 - Surgical treatment to remove stones
 - Taking a balanced diet that is low in protein, nitrogen and sodium.
 - Avoid beverages that contain caffeine like coffee
 - Drinking plenty of water
 - Medications
- (c) Causes, symptoms, effects and preventive measures and treatment of Urinary Tract Infections (UTIs)
 Causes of Urinary tract infections
 - It is caused by bacterial infection in the urinary tract
 Symptoms of Urinary tract infections
 - Pains during urination
 - Pains or pressure in the back or lower abdomen
 - Cloudy, dark bloody or strange-smelling urine
 - Feeling tired or shaky
 - Fever or chills
 - Frequent or intensive urge to urinate even though little comes out when you urinate.

- Effects of Urinary tract infections
 - Pains and nuisance due to urge to urinate frequently
 - Prevention/treatment
 - Drinking a lot of fluids
 - Maintaining toilet hygiene
 - Complete urination
 - Keep your genital area dry by wearing cotton underwear.
- (d) Causes, symptoms, effects and preventive measures and treatment of Hepatitis.
- Causes of hepatitis
- It is caused by virus through body fluids such as saliva, blood and semen
- Symptoms of Hepatitis
- Fatigue
 - Nausea
 - Dark brown urine and whitish faeces
 - Abdominal discomfort
- Effects of Hepatitis
- It may cause liver failure
 - It may lead to death if not treated earlier
- Prevention/treatment
- Hygienic processing of food
 - Proper disposal of sewage
 - Treatment of water
 - Screening blood before transfusion
 - Using sterilized needles and syringes
8. (a) Reasons to why plants have a specialized excretory system like in animals.
- The rate of producing waste products in plants is much lower.
 - Plants synthesize all their organic requirements according to demand.
 - Plants can store the waste products in organs that are destined to fall or die off.
 - Plants have the ability to recycle most products of metabolism.
 - Waste products that cannot be reused by plants can be rendered harmless e.g. Resin, gum, Rubber and some essential oils.

- Plants' chief excretory products are largely simple and non-toxic like carbon dioxide and oxygen unlike nitrogenous wastes in animals.
- (b) Mechanism of excretion in plants
 - Many organic waste products of plants are stored in the leaves, bark or both and are shed periodically. The shedding of leaves, fruits, and seed is called abscission.
 - Aquatic plants lose most of their metabolic waste by diffusion to the surrounding water.
- (c) Economic importance of excretory products in plants
 - Tannin – is used to treat leather
 - Rubber – is used in shoe and tyre making
 - papain – is used in food industry as meat tenderizer
 - Rennin – is used in manufacturing of varnish and gum
 - Quinine – is used to make anti-malaria drug
 - Caffeine – is a mild stimulant
 - Oil – is used to manufacture of perfume and ointment for insect bites.

5. REGULATION

1. (a) Regulation is the process of controlling the internal body environment and needs.
- (b) Types of regulation
 - (i) Temperature regulation
 - (ii) Blood sugar regulation
 - (iii) Osmoregulation
- (c) Importance of regulation
 - It ensures proper functioning of cells since hormones, enzymes and many other substances in the body of living things only function properly under certain conditions.
 - It ensures osmotic and salt balance between cells and their environments.
 - It prevents accumulation of toxic materials round cells.
 - It ensures survival of organisms.
 - It maintains healthy concentration gradient between the cell and environment.

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2. (a) The ways of heat gain by animals
- Metabolism of food stuffs
 - Shivering
 - Absorption
- (b) The ways of heat loss by animals
- Convection
 - Sweating
 - Urination
 - Breathing out
 - Conduction
3. (a) Endotherms or homoiotherms are animals such as mammals and birds that maintain a relatively constant body temperature independent of external temperature, while ectotherms or poikilotherms are animals such as invertebrates, fish, amphibians, and reptiles whose body temperature fluctuates with that of the environment.
- (b) Adaptations of animals to hot environment
- Aestivation. It is a behavioural pattern where an organism goes into a deep sleep to avoid warm weather conditions.
 - Wearing of light clothing (human beings)
 - Spending most of the day in burrows where temperatures remain approximately constant. Kangaroo, rats.
- (c) Adaptations of animals to cold environment
- Possession of fur. It is a thick layer of subcutaneous fat and feathers which provide insulation for animals living in cold areas.
 - Hibernation. It is a behavioural pattern whereby an organism goes into a deep sleep to reduce its metabolic process to the lowest rate to avoid cold weather.
 - Small body surface area to volume ratio e.g. rounded bodies of whales seals and polar bears increase ability to conserve heat by minimizing loss from the body surface.
4. (a) Control of over-heating
- Sweating. Sweat produces a cooling effect on the body thereby lowering the body temperature.
 - Panting. Animals of the dog family pant rapidly with their tongues hanging outside. This situation causes evaporation from the lungs and mouth hence cools the body.

- Vasodilation of arteries. Superficial capillaries below the skin become wide so that more blood flows near the surface and so more heat is lost to the surrounding by convection, conduction and radiation.
 - Relaxation of hair erector muscles. When the hair erector muscles relax, the hair lies flat. This allows heat to escape from the skin surface.
 - Decreased metabolic rate. This situation leads to less generation of heat and therefore the body temperature falls.
 - Behavioural modification for example, wearing of light clothes, take cold drink, rest in shades, use fans or air conditioners.
- (b) Control of over-cold
- Shivering. It is an involuntary rhythmic contraction of muscles which serves to generate heat during cold weather.
 - Increase in metabolic rate. Due to the increase of metabolic rate, more heat is produced in structures such as the liver and skeletal muscles.
 - Vasoconstriction of blood capillaries. This situation in turn reduces the temperature gradient of the body and environment and heat loss decreases.
 - Erection of skin hairs. The hair erector muscles erect causing the skin hair to stand and collect air round them which act as insulation for heat loss.
 - Behavioural modification for example man wears heavy clothes, takes hot drinks.
5. (a) Osmoregulation is the maintenance of constant internal salt and water concentration in an organism. It is the process by which the osmotic pressure of blood and tissue fluid is kept constant.
- (b) Factors affecting content of salt and water in the blood
- Hormonal abnormalities. When less Antidiuretic hormone (ADH) is produced it leads to increased content of water in the blood and vice versa.
 - Amount of water taken in the body. Large intake of water causes blood to have too much water while fewer intakes causes less water in the blood.

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- Climatic condition. During hot weather there is increased sweating which cause loss of water by evaporation thus reduced amount of water in the blood, the vice versa occurs during cold weather.
 - Amount of salt taken in the body. Putting less salt in the food causes reduced salt in the blood, while putting too much salt in the food causes increased amounts of salt in the blood.
 - Dehydration
- (c) Importance of osmoregulation
- It ensures proper functioning of nerves in transporting impulses
 - It maintains a healthy concentration gradient around cell membranes.
 - It ensures that the concentration of salt and sugar in body fluids is kept at a healthy level.
 - It ensures that water does not accumulate in the cells or tissue fluids.
 - It ensures the internal environment of cells is suitable for proper functioning of cells.
6. (a) Blood sugar regulation is the maintenance of a relatively constant blood glucose level of the body.
- (b) Blood sugar in mammals is regulated using hormones which are insulin and glucagon. The hormones are secreted by a specialized group of pancreatic cells called islets of Langerhans. Insulin stimulates the liver to convert glucose to glycogen thereby reducing the concentration of glucose in the blood. When blood sugar falls below normal levels the islets of Langerhans secrets glucagon which stimulates the liver to convert stored glucagon to glucose thereby raising the blood sugar level.

6. REPRODUCTION

1. (a) Reproduction is the ability of living things/organisms to form new individuals of the same species from those already in existence.
- (b) Importance of reproduction
- It ensures continuation of life on the earth
 - It increases the population of organisms
 - It plays a crucial role in the balance of nature
 - It ensures availability of food to organisms which feed on other organisms.

2. (a) Types of reproduction

- (i) Sexual reproduction. It is a type of reproduction in which new organism is produced when a male gamete fuses with a female gamete. It involves the fusion of specialized cells from two individuals.
- (ii) Asexual reproduction. It is a type of reproduction whereby production of offspring is from single organism without the production of gametes. It does not involve fusion of gametes.

(b) Differences between sexual and asexual reproduction

Sexual reproduction	Asexual reproduction
Two parents are involved	A single parent is involved
Involves gametes	No gametes produced, only spores
Offsprings are not identical to parents	Offsprings are identical to parents
Diploid zygote formed by fertilization	No zygote formation
Population increases slowly	Population increases rapidly

3. (a) Merits and demerits of sexual reproduction

Merits of sexual reproduction

- It ensures genetic stability
- It ensures perpetuation of life
- It brings variation hence imperfections in individuals are reduced in each generation.
- It leads to the interaction among organisms.

Demerits of sexual reproduction

- Offspring may inherit undesirable characteristics from parents.
- The reproduction takes long time.
- It depends on presence of two parents
- It produces few numbers of offspring

(b) Merits and demerits of asexual reproduction

Merits of asexual reproduction

- It results into an individual with the same genetic constitution as their parent.

- There is maintenance of good qualities of the parents since there is no variation between parents and offsprings.
 - There is fast maturation of offsprings.
 - It does not depend on the processes of pollination, seed or fruit dispersal.
- Demerits of asexual reproduction
- Undesirable characteristics from the parents may be passed from the parents to the offsprings since only one individual organism is involved.
 - Organisms mature fast which could result into over-population.
 - New organisms may fail to withstand changing environment conditions due to lack of variations.
4. (a) The ways by which plants reproduce by means of asexual
- Fragmentation. It is a way of asexual reproduction in which organisms break into two or more parts eg. Worms such as nematodes and flat worms.
 - Sporulation. It is asexual reproduction by the use of spores. The spore develops from single cell as a result of mitosis, forming a structure known as sporangium. The sporangium wall bursts when it is well developed to release the spores which when placed in a suitable area they germinate into new organisms. Organisms which reproduce by sporulation include ferns and mosses.
 - Budding. It is a type of asexual reproduction in which a new organism arises as an outgrowth (bud) of the older organism. Examples of organisms which reproduce by budding include yeast and hydra.
 - Vegetative propagation. It is a type of asexual reproduction found in plants in which a bud grows and develops into a new plant. The detached plant root, stem or leaves at some stages grows and develops into an independent plant.
- (b) Types of vegetative propagation
- (i) Natural vegetative propagation
 - (ii) Artificial vegetative propagation
- (c) Forms of natural vegetative propagation
- Bulb. In this form, each bud grows to form a shoot which produces a new bulb at the end of the growing season. Onion plants are good examples of bulbs.

- Stem tubers. These are short swollen underground stems which store food such as starch. Yam and potato plants are examples of stem tubers.
- Root tubers. These are swollen adventitious underground roots. Sweet potatoes and cassava store their food in root tubers.
- Rhizomes. These are horizontally growing underground stems bearing leaves, buds and adventitious roots. Examples are iris and fern plants.
- Stolons. These are slender stems creeping horizontally as they grow along the ground surface. Example is strawberry plants.
- Suckers. These are short horizontal branches arising from the main stem or just below ground level. Examples of sucker plants include bananas, sisal and pineapples.
- Tap root. It is the main root that arises from radical. It may become swollen and act as storage organs. Example of tap root plant is carrot.

(d) From the diagram

(i) Parts labelled A – D

- A. Membraneous or tunic leaf
- B. Fleshy scale -leaf
- C. Lateral bud
- D. Stem (disk)
- E. Adventitious root

(ii) Bulb

(iii) To store food

5. (a) Meiosis is a type of cell division which takes place in the reproductive organs to produce haploid (sex cells) known as gametes.

(b) Stages of meiosis

(i) Meiosis I

(ii) Meiosis II

(c) Stages of the first meiotic division

(i) Prophase I

- Chromosomes contract, thicken and become visible.

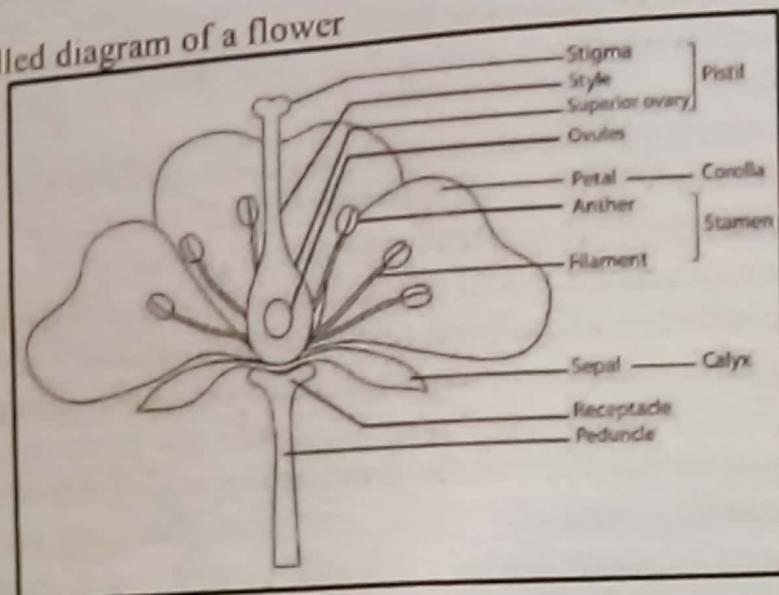
- Nucleolus disintegrates and disappears.

- Homologous chromosomes come together (synapsis) forming bivalent.

- Chromatids crossover by chiasmata exchanging genetic material.

-
- (ii) Metaphase I
 - Bivalent homologous chromosomes move to the equator of spindle fibres.
 - (iii) Anaphase I
 - Two homologous chromosomes part and migrate to opposite poles of spindle fibres.
 - (iv) Telophase I
 - Chromosomes reach their destination.
 - The spindle apparatus breaks down and disappears.
 - Nuclear membrane reforms around each set of chromosomes.
 - The cell divides into two.
 - (d) Stages of the second meiotic division
 - (i) Prophase II
 - Centrioles replicate
 - New spindle
 - (ii) Metaphase II
 - Chromosomes migrate to the equator of the spindle fibres.
 - (iii) Anaphase II
 - Sister chromatids part and migrate to opposite pole.
 - (iv) Telophase II
 - Spindle apparatus disappears.
 - The nucleus reappears and nuclear membrane appears
 - Chromosomes regain their thread-like structure.
 - Chromatids uncoil and the cell divides into two.
 - Four daughter cells are formed with haploid set of chromosomes.
 - (e) Significance of meiosis
 - (i) It brings about genetic variation.
 - (ii) It facilitates stable sexual reproduction, ensuring correct number of chromosomes is produced.

6. (a) A labelled diagram of a flower



(b) Sterile parts of a flower

- Pedicel – is a stalk or stalk-like part bearing a single flower in an inflorescence.
- Receptacle – is the place on the stem where floral organs originate and attach.
- Sepals – are the parts that look like little leaves that cover flower before it blooms. They cup the flower to protect it while it grows.
- Petals – are the delicate and usually brightly coloured part that gives the flower its character.

(c) The female reproductive parts of a flower (Pistil)

- Ovary – it contains ovules, which are unfertilized female gametes.
- Style – is a long tube that attaches the stigma to the ovary.
- Stigma – is a small swelling at tip of the style receives pollen grains.

(d) The male reproductive parts (Stamen)

- Anther – it produces the pollen grains that contain the sperm needed for fertilization.
- Filament – is a slender stalk that supports the anther.

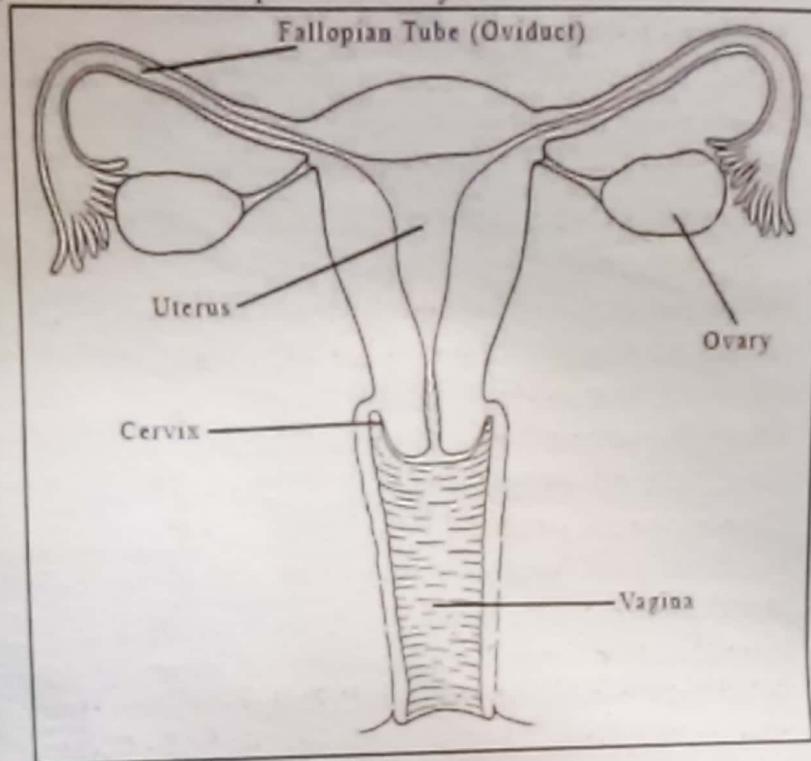
7. (a) Pollination is the transfer of pollen grains from the anthers to the stigma of a flower.

(b) Types of pollination

- (i) Self-pollination. It is the transfer of pollen grains from the anthers to the stigma of the same flower.

- (ii) Cross pollination. It is the transfer of pollen grains from the anthers of the flower to the stigma of another flower of the same species.
8. (a) Agents of pollination
- Wind
 - Birds
 - Insects
- (b) Adaptation of wind-pollinated flowers
- They usually have no petals and if present are small, and dull coloured that do not attract insects or birds.
 - They have feathery stigmas with large sticky surface, freely hanging out of the flowers.
 - They have large anthers which produce large amounts of pollen grain.
 - There is no nectar produced.
 - Flowers are not scented.
 - Filaments grow long so stamens hang out of the flower and shake in the wind to disperse pollen.
- (c) Adaptation of insect-pollinated flowers
- Large brightly-coloured petals which attract insects.
 - They produce nectar.
 - The stigma and anthers are held firmly in position within the flower.
 - Flowers are scented to attract insects.
 - The anthers are small in size and produce few but large pollen grains.
 - Filaments are short
 - The stigmas are short, small and sticky.
9. (a) Fertilization is the union of the male and female gametes to form a zygote.
- (b) Parts of female reproductive system
- Ovaries. Are located near each kidney. They produce ova, oestrogen and progesterone as female sex hormones.
 - Fallopian tube. It is also known as egg tube/oviduct. It is a funnel shaped opening in which fertilization normally takes place within it.
 - Uterus. It is a region where implantation and development of an embryo occurs.
 - Vagina. It is the posterior part of the female reproductive duct connecting the uterus with the exterior. It is the region that sperms are deposited during copulation. It acts as a birth canal.
 - Cervix -

(c) A diagram of female reproductive system



(d) Parts of male reproductive system

- Testis. They produce sperms. As endocrine glands they secrete male sex hormone called testosterone for development of secondary sexual characteristics.
 - Epididymis. It acts as a temporary store for sperms.
 - Vas differens. It conveys sperms from the epididymis to the penis.
 - Seminal vesicles. Together with the prostate gland, secrete a liquid which provides nourishment and protection to sperms.
 - Penis
 - Urethra
 - Sperm duct
 - Scrotum
- (e) From the diagram of male reproductive system
- (i) Structures labelled A - I
- A. Vas deferens
 - B. Seminal vesicle

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- C. Prostate gland
- D. Cowper's gland
- E. Epididymis
- F. Testis
- G. Scrotum
- H. Urethra
- I. Penis

(ii) Functions of F (Testis)

- To produce male reproductive gametes (sperms)
 - To produce male sex hormones (testosterone)
- Function of H (Urethra)
- Passage of sperms
 - Passage of Urine

(iii) The diagram represent a male reproductive system.

10(a) Meaning of terms

- (i) Sperm is a male reproductive cell.
- (ii) Ovum is a female reproductive cell.
- (iii) Spermatogenesis is the formation of male gametes (sperms).
- (iv) Oogenesis is the formation of female gametes (eggs).

(b) Parts of a sperm

- Acrosome – it dissolves egg membrane during fertilization.
- Nucleus – it contains genetic material
- Tail – it is used to propel the sperm forward

11(a) Female secondary sexual characteristics

- Enlargement of the mammary glands and hips.
- Deposition of fat which gives them more round appearance.
- Development of pubic hair.

(b) Male secondary sexual characteristics

- Shoulders are widen.
- Voice deepens.

- Pay more attention to female sex.

- Development of hairs on their chins and pubic areas.

12(a) Definitions of terms

- (i) Ovulation is a process whereby ovum (egg) is released from the ovary to the uterus. It normally occurs after 28 days.
 - (ii) Menstruation is the monthly discharge of blood, mucus, and epithelial cells from the uterus through the vagina.
 - (iii) Menstruation cycle is the period between one and the next menstrual cycle (28 days).
- (b) Fertilization is the process whereby a sperm and an egg fuse to produce a zygote. It occurs when a sperm meets an ovum as it passes down the oviduct. When this occurs a zygote is formed.
- (c) From the diagram
- (i) Names of the parts labelled A –E.
 - A. Placenta
 - B. Umbilical cord
 - C. Amniotic fluid
 - D. Embryo
 - E. Womb (uterine wall)
 - (ii) The function of C (amniotic fluid) is to protect the developing embryo from physical change.

The functions of B (umbilical cord) are:

- It transports food materials from the placenta to the embryo.
 - It transports oxygen from the placenta to the embryo.
 - It transports wastes from the embryo to the placenta eg. urea.
 - It transports carbon dioxide from the embryo to the placenta.
 - It transports mineral salts from placenta to the embryo.
- (iii) Substances which pass from mother's blood to the blood of the foetus are:-
- Food substances such as glucose and amino acids
 - Oxygen gas
 - Mineral salts
 - Water
- 13(a) Factors which may hinder fertilization
- Ova are not released in normal monthly cycle.
 - The woman may make antibodies that destroy the sperm.
 - Very few sperms are produced in one ejaculation.

- The fallopian tubes may be blocked.
The vas deferens may be blocked.
- (b) Artificial insemination is a procedure used to treat infertility that involves insertion of semen into woman's womb.
- 14(a) Multiple pregnancy is a situation in which more than one foetus is carried in a single pregnancy. The results of this situation is the formation of twins.
- (b) Causes of multiple pregnancies
- More than one ovum released into the reproductive tract.
- One fertilized ovum splitting up into more than one embryo resulting to twins.
- (c) Identical twins are twins formed when a single sperm fertilizes an ovum and the resulting zygote divides into two embryos, while fraternal twins are twins formed when two different sperms fertilize two ova and each of which forms a separate zygote.
- 15(a) Definition of concepts
(i) Family planning is a decision made by a person freely on how many children he or she may want to have and when he or she wants to stop.
(ii) Contraception is the practice of deliberately preventing a woman from becoming pregnant.
- (b) Social practices which enhance family planning
(i) Abstinence. It is the avoidance of sexual intercourse
Advantages of abstinence
- It is the most effective method of preventing conception.
- The approximated rate of failure of this method is 0%.
- (ii) Calendar (rhythm) method. It is the avoidance of sexual intercourse during fertile periods. Different signs such as changes in body temperature and vaginal mucus thickness which accompanies menstrual cycle are used to detect days which can lead to pregnancy.
- (iii) Coitus interruption (withdrawal). It is the withdrawal of penis from the vagina just before ejaculation. It is not 100% effective because sometimes sperms may have been deposited in the vagina before ejaculation.
- (i) Barrier methods of preventing pregnancy
Condom. A male partner wears a condom on his penis before sex so that there is no direct contact between the vagina and the penis and

- when sperms are ejaculated they do not get into the vagina. It is not 100% effective method because, the condom can burst due to friction.
- (ii) Diaphragm or cap. A rubber cap is inserted into the vagina to cover the cervix hence preventing sperms entering the uterus. It is applied with contraceptive jelly, creams or foams that kill sperms.
 - (iii) Spermicides. They are jellies, creams, douches, suppositories and foams that are applied into the vagina before sex in order to kill sperms.
 - (iv) Oral contraceptives. These are synthetic steroids (mixture of male hormones, oestrogens and progesterone) which interfere with the mechanism of ovulation.
 - (v) Intra-uterine Devices. These are plastic or metal devices of various shapes inserted inside the uterus through the vagina to prevent implantation of a fertilized egg e.g. loop coil, copper-seven.
 - (vi) Tubal ligation. It is the cutting and sealing of the fallopian tubes in females to prevent transport of eggs from the ovary to the uterus.
- 16(a) The importance of male involvement in family planning
- Couples decide to practice child spacing so that they can cater of their needs.
 - It helps to improve the health of a mother.
- (b) Importance of family planning and contraception
- It reduces the need for unsafe abortion.
 - It enables a couple to get the number of children that they can care for.
 - It avoids unwanted pregnancies.
 - It ensures good health for the mother and children

FORM FOUR TOPICS

1. (a) Growth is the progressive development of living thing.
- (b) Internal and external factors affecting growth in humans.
- Internal factors affecting growth in humans
 - Hereditary. Animal growth is affected by the genetic make-up of organism. Certain genetics constitution favour greater growth rates and greater body sizes while others do not.

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- Growth hormones. Over-secretion or deficiency of growth hormones has an effect in growth of animals. Gigantism and cretinism are opposite patterns of growth caused by over and under secretion of growth hormones.

External factors affecting humans

- Poor diet. Lack of nutrients especially proteins that are vital for growth leads to stunting. A stunted child look short for his or her age.
- Diseases. Diseases may produce toxins that interrupt normal body processes and so delay growth.
- Temperature. Animal growth is faster in warm climate compared to cool climate. Warm temperature favours an increase in the rate of metabolism and very low temperature slows down metabolism.
- Availability of oxygen. The amount of oxygen has much effect on the growth of terrestrial animals as it is readily available in temperature.

(c) Internal and external factors affecting growth in plants

Internal factors affecting growth in plants

- Hereditary factor. Various characteristics of a plant are controlled by genes. These affect physical appearance and the size of plant.
- Growth hormones. They affect growth eg. auxin hormone promotes growth in plants.
- Apical dominance. It is the inhibition of growth of lateral bids by the presence of growth apical bid.

External factors affecting growth in plants

- Light. It is necessary for photosynthesis to take place. Absence of light makes plant leaves yellow, it also makes the stems thin.
- Temperature. It affects the rate of metabolism and growth. Extremely high temperatures kill cells and enzymes thus metabolism cannot take place.
- Availability of carbon dioxide and oxygen. Carbon dioxide is necessary for food production needed for growth where oxygen is key to metabolism of food to provide energy for growth as well.
- Relative humidity. It affects the rate of transpiration in plants. High rate of transpiration causes water stress on plants; this in turn affects plant growth.
- Biotic factors. Diseases, pests, weeds and harmful substances affect plant growth drastically.

2. (a) Mitosis is the process of cell division whereby the chromosomes are duplicated and distributed equally to the daughter cell.
- (b) Stages of mitosis
- (i) Interphase
 - It is a stage between one cell division and the next.
 - The cell undergoes activities to prepare for cell division.
 - The cell synthesizes new materials and replication of cell organelles occurs.
 - (ii) Prophase
 - Chromosomes shorten and thicken.
 - Each chromosome consists of two chromatids held together by centromere.
 - The nucleolus disappears and spindle fibres formed.
 - Nuclear membrane breaks down.
 - (iii) Metaphase
 - Chromosomes migrate to the equator of the spindle attached to the spindle by a centromere.
 - (iv) Anaphase
 - Chromatids separate at the centromere.
 - Daughter chromatids are pulled to opposite poles of the cell.
 - (v) Telophase
 - Chromatids reach opposite pole of the cell.
 - The spindle fibres disappear.
 - The nucleolus disappears.
 - Nuclear membrane is formed around each set of chromosomes.
 - In animal, cell the nuclear membrane constricts and finally divides into two daughter cells each with the same number of chromosomes as the parent cell.
 - In plant, a cell wall is formed dividing into two daughter cells which contain the same number of chromosomes as the parent cell.
- (c) Significance of mitosis
- It results into the formation of two identical daughter cells.
 - It is used to repair and regeneration of body parts.
 - It replaces cells that are constantly dying like cells of skin and the gut.
 - It is the basis of sexual reproduction.

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It results into genetic stability, because daughter cells retain the number of chromosomes as parent cell.

Differences between growth and development

3. (a)

Growth	Development
It is the increase in size, height, weight, etc.	It is the improvement in the functioning of the body process.
It is easily measured and observed.	It cannot be measured easily.
It is limited, it starts with birth to reach the maximum at maturity.	It is a continuous, unending process throughout life.
It is limited to specific areas	It is concerned with various aspects and parts of the body and behavior as a whole.
It involves only quantitative change	It involves both qualitative and quantitative changes.

(b) Factors which affect the rate of physical deterioration of

(c) human body

- Smoking. Smoking leads to premature balding, skin wrinkling and osteoporosis.
- Alcoholism. Prolonged use of alcohol leads to damage of the central nervous system and brain hence increases the risk of heart stroke and breast cancer for women.
- Drug abuse. It weakens the immune system and causes premature aging.
- Poor diet. Poor diet reduces life span as underfeeding causes malnutrition. Overfeeding leads to obesity and diabetes which cause premature aging.

4. (a) Chemicals and radiations.

(i) Meaning of terms

(ii) Seed germination is a process whereby a seed grows/changes from inactive state and develops into plant.

Intercalary growth is a lengthwise growth in plants as a result of cell division in the meristem, located below the top of an organ for example in the internodes of the stalks of grasses and at the base of the leaves.

- (b) Changes which occur during seed germination
- Seed absorb water and enlarge.
 - The testa bursts and the radicle emerges.
 - The radicle continues to elongate and gives rise to many roots.
 - As the radicle elongates, the plumule is curved. At this stage, young plant is called a seedling.
- (c) Parts of a seed and their functions
- (i) Embryo. It contains cotyledon, radical, epicotyls, and hypocotyls.
 - Radicle develops into a root
 - Cotyledon has nutrients which are utilized during germination.
 - (ii) Seed coat (testa). It encloses and protects fertilized ovule.
 - It allows water and air in and out of the seed through a core called micropyle.
 - (iii) Endosperm. It is a nutrient tissue
5. (a) Conditions necessary for seed germination
- (i) Water. Water is a necessary condition because;
 - It dissolves food substances, hence enables transport to the growing parts of the embryo.
 - It makes up cell sap vacuoles which leads to increase in cell.
 - Hydrolysis of starch to glucose in turn is respired to release energy for growth. When water is absorbed by the seed, it leads to softening and rupture of the seed coat to give way to growth of the embryo.
 - (ii) Oxygen. It is required in respiration to produce energy for cell division and food transport to growing regions.
 - (iii) Optimum temperature. Germination requires a certain temperature since it is an enzyme-controlled reaction. Many seeds germinate at temperature slightly above 16-24 degrees centigrade.
 - (iv) Light. Some plant seeds need darkness while others need light in varying degrees.
- (b) Types of seed germination
- (i) Epigeal germination. It is a type germination in which cotyledons are brought up to the soil surface. It occurs in plants such as beans, sunflower in which hypocotyls grow faster than epicotyls.

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- (ii) Hypogea germination. It is a type of germination in which the cotyledons remain underground. It occurs in plants such as maize and pigeon pies in which epicotyls grow faster than hypocotyls.
6. (a) Seed viability is the ability of a seed to germinate and grow to become a plant.
(b) Factors affecting seed viability
 - Seed maturity. Only fully matured seeds can germinate.
 - Temperature and moisture. Seeds do not germinate if the temperature is too low or too high. In too dry conditions, also seeds do not have enough water to soften the testa.
 - Testa. Too thick testa prevents water into the seed whereas too thin testa hydrates seed before germination.
 - Storage conditions. Storage seeds in too cold or too hot place kills the embryo.
7. (a) Seed dormancy is a temporary inhibition of growth in a seed. Metabolism rate becomes very low so that seed only stay alive but does not grow.
(b) Causes of seed dormancy
 - Thicker testa
 - Immature embryo
 - Lack of necessary conditions for germination e.g. water, optimum temperature, oxygen and light.
 - Lack of hormones which stimulate growth and enzymes.
 - Growth inhibitors eg. Abscistic acid.

2. GENETICS

1. (a) Meaning of terms.
(i) Genetics is the study of heredity and variation in organisms.
(ii) Heredity is the passing on of characteristics from parents to the offspring.
(iii) Variation is the observable differences in organisms from the same species.
(iv) Gene is the basic unit of inheritance for a given characteristic.
(b) Define of the common terms used in genetics
(i) Allele is a different form of the same gene occupying the same position on a chromosome.

- (ii) Genotype is the genetic makeup of an organism or an individual.
 - (iii) Phenotype is the observable characteristics of an organism resulting from interaction between the genotype and environment. It is the outward appearance determined by a gene.
 - (iv) Trait is a genetically defined characteristic shown by an organism e.g. skin colour.
 - (v) Dominance is a condition where an allele can express itself in the presence of other alleles. For example, in height "Tt", 'T' tallness is the dominant over 't' shortness.
 - (vi) Recessive is a condition where an allele can express itself when they are in homozygous form but does not express its effect on the presence of a dominant trait.
 - (vii) Homozygous is the condition in which alleles at a given locus are the same eg. "TT" for tallness and "tt" for shortness.
 - (viii) Heterozygous is a condition in which alleles at a given locus are different eg. "Tt", 'T' for tallness and 't' for shortness.
 - (ix) Locus is a position of an allele within a DNA molecule.
 - (x) First filial generation is a generation produced by crossing homozygous parents.
 - (xi) Second filial generation is a generation produced by crossing individuals of the first filial generation organisms.
2. (a) Genetic materials
- (i) Deoxyribonucleic acid (DNA) is a double stranded helical molecular chain of nucleic acid found within the nucleus of a cell.
 - (ii) Ribonucleic acid (RNA) is a single stranded poly nucleotide molecule within the nucleus of a cell.
- (b) Chemical composition of DNA
- Deoxyribose sugar
 - Phosphate group
 - Four organic bases (guanine (G), cytosine (C), adenine (A), and thymine (T)).
- (c) A diagram of the structure of DNA
3. (a) Components of RNA
- Ribose sugar
 - Phosphate group

Biology Revised Tests Form 3

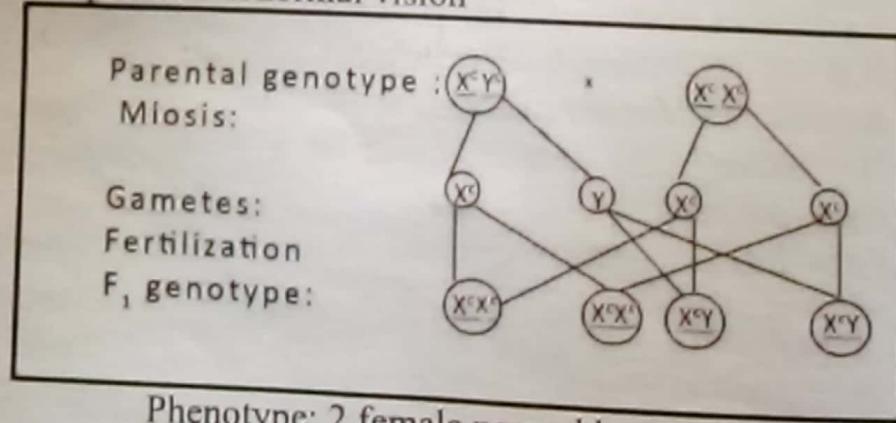
- Four organic bases (guanine (G), cytosine (C), adenine (A), and uracil (U)).
- (b) A diagram of the structure of RNA
- (c)
 - Messenger (mRNA)
 - Transfer (tRNA)
 - Ribosomal (rRNA)
- (d) Differences between DNA and RNA

Deoxyribonucleic acid (DNA)	Ribonucleic acid (RNA)
It has a deoxyribose sugar	It has ribose sugar.
It has organic bases which are cytosine, thymine, guanine and adenine.	It has organic bases which are cytosine, guanine, adenine, and uracil.
It is a double stranded molecule.	It is a single stranded molecule.
It is found in the nucleus of a cell and in mitochondria.	It is found in a nucleus of a cell, cytoplasm, and ribosome.
It has small grooves which makes it harder for enzymes to attack.	It has large grooves which makes it easier to be attacked by enzymes.
It is self-replicating.	It is synthesized from DNA when needed.

4. (a) Mendel chose the garden peas because of the following reasons:
- The garden peas has many physical properties.
 - The garden peas matures very fast.
 - It produces many seeds and hence many offspring.
 - It is self-pollinating but can be cross-pollinated.
- (b) Reasons for Mendel's success at his work
- He studied only one character at a time, thus simplifying the observations made.
 - Each character was expressed in two clearly contrasting features without intermediate.
 - Accurate records were kept all for experiments and the results obtained.
 - Sufficient data were obtained to have statistically significant result.

5. (a) Mendel's first law of inheritance states that, the characteristics of an organism are determined by internal factors which occur in pairs and only one gene can be carried in a single gamete".
 Mendel's second law, law of independent assortment state that, "any one pair of characteristics may combine with any one of another pair".
- (b) Major points in the Mendel's First Law of Inheritance
- Genes can exist in more than one form.
 - An organism inherits two alternative forms of a gene for a particular trait, one from each parent.
 - During the production of gametes, pair of alleles separate. Thus each gamete has one allele for each trait.
 - When the two alleles in pair are different, one is dominant while the other is recessive. This condition is called complete dominance.
6. (a) Monohybrid inheritance is the inheritance of one pair of contrasting characteristics or traits at time. Mendel crossed pure breed tall plants and pure dwarf plants.
- (b) Meaning of terms
- (i) Test cross is the cross that involves crossing an individual of unknown genotype with homozygous recessive individual.
 - (ii) Back cross is a cross that involves crossing individuals of known genotype with homozygous parents.
 - (iii) Dihybrid inheritance is the crossing of two characteristics in which each is controlled by a different gene at a different locus.

7. (a) Key: C – represents normal vision
 c – represents abnormal vision



Phenotype: 2 female normal but carrier
 2 male abnormal vision (colour blind)

Biology Revised Tests Form 3C&P

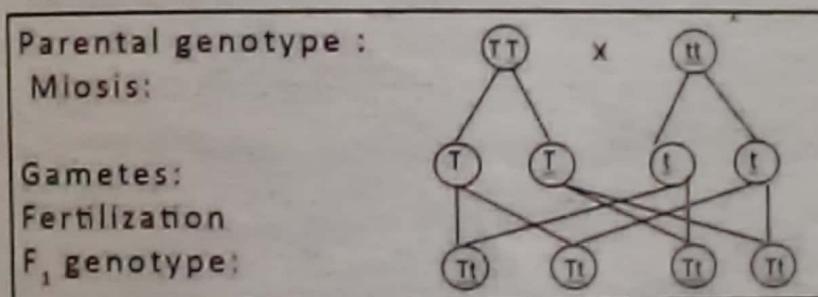
Total males (sons) in the F₁ generation = 2
 Phenotypic ratio of sons suffering from colour blindness

$$= \frac{\text{sons suffering from colour blindness}}{\text{Total sons in the F1 generation}}$$

$$= \frac{2}{2} \times 100 = 100\%$$

Therefore 100% of the sons in F₁ generation will be suffering from colour blindness.

- (b) Key: T – represents the gene for tallness (dominant)
 t – represents the gene for shortness (recessive)
 The genotypes of offspring in F₁ generation will be Tt



- (c) An albino is an organism with inborn genetic disorder characterized by complete or partial absence of a pigment (melanin) in the skin, hair and eyes due to absence or defect of an enzyme necessary for its production.
 (d) Problems faced by albinos
 (i) Vision – Albinos cannot control the amount of light entering their eyes, so their vision is interfered in bright light.
 (ii) Skin – lack of melanin in the skin can lead sunburn due to ultraviolet light when an albino is exposed to sunlight for an extended period.
 (e) Let 'A' represent the dominant gene and 'a' represent the recessive gene for albinism.

Parental phenotypes: Albino male x Heterozygous female

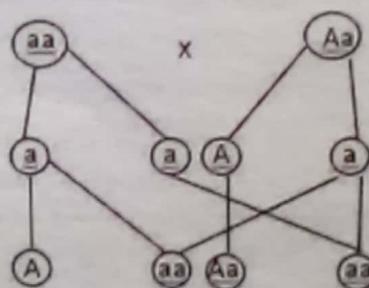
Parental genotype :

Miosis:

Gametes:

Fertilization

F_1 genotype:



- (f) Definition of terms

 - (i) Sex limited character is a character which is restricted to one sex only e.g. beard in males
 - (ii) Sex linked inheritance are traits whose alleles are on one of the sex chromosomes (either on X alone or on Y alone) and which are observed for one sex more than the other e.g. hemophilia and color blindness.
 - (iii) Sex determination sex in human beings is determined by a set of chromosomes, the X and Y – chromosomes. For an individual to be a female they must have both chromosomes x (i.e. xx) For a male however, one chromosome should be x and the other Y. females are thus said to be homogametic while males are said to be heterogametic.

8. (a) Definition of terms

 - (i) Incomplete dominance is a condition in which no allele is dominant or recessive, but both express themselves equally resulting in an intermediate characteristics in the offspring. For example, when red and white flowered varieties of four o'clock plant are crossed, all the plant of the first filial generation produce pink flowers.
 - (ii) Co-dominance is a condition in which genes from both parents are dominant and are phenotypically expressed in offspring. For example, a red cow crossed with white bull, first filial generation have equal patterns of red and white fur.

(b) Alleles which determine blood group

 - Allele A – responsible for presence of antigen A
 - Allele B – responsible for presence of antigen B and is a co-dominant with allele A.

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Allele O – is responsible for no antigen and is a recessive to both allele A and B.

9. (a) Variation is the difference between cells, organisms, or group of organisms of any species.

(b) Meaning of terms

(i) Continuous variation is a type of variation which show intermediate forms between any two extremes, that is, there are no clear-cut distinction the two extremes. For example height and weight.

(ii) Discontinuous variation is a type of variation which show no intermediate forms, that is, there are is clear-cut distinction from one form to another. For example, sex, blood group, fingerprint, rhesus factors, albinism and rolling the tongue

10 (a) Differences between continuous and discontinuous variation

Continuous variation	Discontinuous variation
Show no clear-cut distinction	Show clear-cut variation
Show intermediate forms between extremes	No intermediate forms
Character influenced by environment	Character not influenced by environment
It does not disturb the genetic system of the organism.	It disturbs the genetic system of the organism.
It is very common	It appears occasionally

(b) Causes of variation among organisms

- Meiosis. During meiosis there is segregation of pairs of chromosomes producing a variety of different gametes. In turn, this situation reduces the chances of individuals to be the same. Crossing over of chromatids during the prophase stage also brings variation.

- Mutation. The individual who has undergone mutation is known as a mutant and appears different from the rest of the population.

- Fertilization. During fertilization the nuclei of the male and female gamete fuse. In this way, desirable and undesirable qualities of parents can be combined in the offsprings.

- Environmental factors. These factors include climate, water, light, diet, and others. For example, light intensity causes physical variation in plants.

- 11(a) Genetic disorder is an abnormality which results from problems in the genes of an organism and it is inherited.
- (b) The causes and effects of genetic disorders
- (i) Causes and effects of Dawn's syndrome or Mongolism
Mongolism is a chromosomal abnormality in which there is extra chromosome number 21.
It is caused by the presence of an extra chromosome number 21.
Effects of Mongolism
- It causes heart diseases
 - Having thick tongue
 - Having cardiac malfunctions
 - Mental retardation
- (ii) Causes and effects of Turner's syndrome (xo)
This is a genetic disorder of female caused by absence of second sex chromosome.
Causes of Turner's syndrome
- It is caused by the absence of X chromosome in normal XX chromosome
- Effects of Turner's syndrome
- Women become infertile
 - It may cause mental abnormalities
- (iii) Klinefelter's syndrome
This is a non-disjunction or genetic disorder resulting from failure of the XY or XX chromosomes of the gametes to separate and hence being inherited together. An individual has two XX chromosomes and one Y chromosome (XXY).
- Causes of Klinefelter's
- It caused by failure of XY chromosomes of gametes to separate hence makes XXY chromosomes to be inherited.
- Effects of Klinefelter's syndrome
- Males may have small testes
 - Development of breasts for males
 - Low intelligence

(iv) Haemophilia

This is the hereditary disorder whereby blood clotting is delayed causing prolonged bleeding. People with haemophilia may bleed for more than two hours.

Causes of haemophilia

- It is caused by a recessive allele "h" carried on the X chromosome.

Effects of Haemophilia

- It causes the failure of blood clotting

(c) Application of genetics

- Determination of blood groups. Genetics is very essential in human life as it enables determination of blood groups so as the donor blood can be transfused to needy patients without causing any adverse reaction.
- It is used in plant and animal breeding. The process of choosing animals and plants that have desirable traits such as increased yields, tolerance to drought, resistance to disease and faster growing involves genetics.
- Genetics information is used to advise couples who have genetically disorders about the chances of their children inheriting the disorders.
- Genetics information could also be used in choosing partners for marriage.
- It is used in biological warfare. Genetic engineering has enabled large scale production of infectious micro-organisms and releasing them to enemy targets.
- Medicine. Genetic engineering is used in the production of insulin in large quantities using Escherichia coli bacterium; it is used to produce vaccines from viruses, production of clotting factors such as fibrinogen.
- It is applied in agriculture. Genetically modified organisms are used to break down wastes from home and industries, some plants such as pyrethrum are being propagated through tissue cultures.
- Criminal investigation. The police can use DNA fingerprints to catch criminals. This technique can identify individuals on the basis of their genetic information.

3. CLASSIFICATION OF LIVING THINGS – KINGDOM ANIMALIA

1. (a) General and distinctive features of kingdom Animalia

General characteristics of the Kingdom Animalia are as follows:

- Animals are eukaryotic, multicellular and heterotrophic organisms.
- They have multiple cells with mitochondria and they depend on other organisms for food.
- Most of the animals inhabit seas, fewer are seen in fresh water and even fewer on land.
- Bodies of animals are made of cells organized into tissues which perform specific functions. In most animals' tissue are organized into complex organs, which form organ systems.
- The animal cell contains organelles like the nucleus, mitochondria, Golgi complex, ribosomes, endoplasmic reticulum, lysosomes, vacuoles, and others.
- Animals are made up of many organ systems that aids in performing specific functions that are necessary for the survival of the organism.
- Most of the animals are bilaterally symmetrical, while primitive animals are asymmetrical and cnidarians and echinoderms are radially symmetrical.
- Most animals have the ability to move, they show rapid movement when compared to plants and other organisms.
- Most animals reproduce sexually, by the fusion of haploid cells like the eggs and the sperms.

Distinctive features of the Kingdom Animalia

- They are eukaryote organisms
- They have no cell wall
- They are heterotrophic organisms
- They are multicellular (invertebrate/ vertebrate)
- Nervous systems are primitive to advanced sensory systems
- All sexual, some also asexual
- They are locomotive organisms- ability to move at some point and time through life cycle

(b) Major phyla of kingdom animalia

- Phylum porifera- They are primitive organisms, most of them are salt-water sponges. They do not have organs or nerve cells or muscle cells. Approximately, 8,000 species exist today. Examples are sycon, euspongia and spongilla.
- Phylum Coelentrata (Cnidaria). This group is composed of jelly-fish and other lower aquatic animals. Approximately, 15,000 species exist today. Examples are Aurelia and adamsia.
- Phylum platyhelminthes- This group consists of flat worms. They inhabit both marine and fresh water habitats and they are mostly endoparasites found in animals. Examples are taenia and fascicola.
- Phylum aschelmeinthes- It is a group of round worms, most of them are parasites. This phylum consists of about 80,000 parasitic worms.
- Phylum Annelida- They are present in aquatic, terrestrial and are free-living or parasitic in nature. This phylum comprises of segmented worms. Examples are earthworm, leech, etc.
- Phylum Arthropoda- This is the largest phylum which consists of insects. There are over 1 million species of insects existing today. Examples are locusts, butterfly, scorpion, and prawn.
- Phylum Mollusca- It is the second largest phylum. They are terrestrial and aquatic. Examples are pila and octopus.
- Phylum echinodermata- This consists of sea stars and sea urchins. There are about 6,000 species. Examples are asteria and ophiura.
- Phylum Chordata- Animals of this phylum have a feature of presence of notochord, a dorsal hollow nerve cord and paired pharyngeal gill slits. Within this phylum advanced group called vertebrates which include fish, amphibians, reptiles, birds and mammals.

2. (a) Characteristics of Platyhelminthes

- Bilaterally symmetrical.
- Body having 3 layers of tissues with organs and organelles.
- Body contains no internal cavity.
- They possess a blind gut, that is, it has a mouth but no anus.
- Have protonephridial excretory organs instead of an anus.
- Have normally a nervous system of longitudinal fibres rather than a net.
- Generally dorsoventrally flattened.

- Reproduction mostly sexual as hermaphrodites.
 - Mostly they feed on animals and other smaller life forms.
 - Some species occur in all major habitats, including many as parasites of other animals.
- (c) Characteristics of phylum aschelminthes (nematoda)
- Mostly parasitic (in animals and plants), a few free living called as flukes.
 - Body is long, cylindrical, and fusiform (pointed at both the ends).
 - Body wall is composed of cuticle, epidermis and musculature.
 - Presence of a false body pseudocoelom not lined by epithelium.
 - Digestive system is complete.
 - Respiration by simple diffusion.
 - They have jointed legs.
 - Nervous system consists of a nerve ring and many longitudinal nerve cords.
 - Only sexual reproduction. Sexes are separate with sexual dimorphism.
 - Males are usually shorter than females
3. (a) Characteristics of phylum annelida
- Bilaterally symmetrical and vermiform.
 - Body has more than two cell layers, tissues and organs.
 - Body cavity is a true coelom, often divided by internal septa.
 - Body possesses a through gut with mouth and anus.
 - Body possesses 3 separate sections, a prosomium, a trunk and a pygidium.
 - Has a nervous system with an anterior nerve ring, ganglia and a ventral nerve chord.
 - Has a true closed circulatory system.
 - Has no true respiratory organs.
 - Reproduction normally sexual and gonochoristic or hermaphoditic.
 - Feed a wide range of material.
 - Live in most environment.
- (b) Advantages of earthworms
- They are important in soil creation.

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- They play important role in the maintenance of food chains in marine environments.
- 4. (a) General and distinctive features of the phylum arthropoda
 - General features of the phylum arthropoda
 - Their bodies are segmented just as annelids.
 - They have appendages, which serve a variety of purposes such as gaseous exchange, food gathering, locomotion and direction of stimuli.
 - They have an exoskeleton or cuticle that is secreted by the epidermis.
 - They have jointed appendages used for various functions such as feeding, locomotion and sensory purposes.
 - They have developed distinct regions of the body, namely the head, thorax and abdomen.
 - The head possesses sensory receptors such as eyes and antennae as well as feeding appendages.
 - The head is more developed in annelids with a larger brain.
 - Some classes of the phylum e.g. insects have developed flight which greatly increases opportunities for finding food and escaping from predators.
- Distinctive features of the phylum arthropoda
 - They have an exoskeleton made up of a chitin and sometimes-calcareous matter, which may either be rigid, stiff or flexible.
 - Each segment in arthropoda typically bears a pair of jointed appendages used for locomotion or feeding or sensory purposes.
- (c) Classes of phylum arthropoda
 - Class crustacean. Examples are crabs, crayfish, water flea, lobster, and shrimps.
 - Class insect. Examples are cockroach, butterfly, grasshopper and housefly.
 - Class chilopoda. Example is centipede
 - Class diplopoda. Example is millipede
 - Class arachnida
- (d) Examples of organisms under each class of the phylum Arthropoda
 - Class crustacean.** Crustacean is a class of organisms whose bodies are covered by a hard shell called carapace. Examples of crustaceans are woodlice, water flea, Cray fish, crabs, lobsters, shrimps and barnacles.

- **Class insect.** Insects are the most successful organisms on earth since they possess an exoskeleton, which reduces water loss from the body. Insects are the largest group of arthropods. However they mainly inhabit terrestrial habitats. Examples of insects include grasshoppers, houseflies, butterflies, bees and termites.
 - **Class chilopoda.** Class chilopoda is made up of centipedes. The centipede is mainly found on land.
 - **Class diplopoda.** Class diplopoda is made up of millipedes. Millipedes are common in damp places.
 - **Class Arachnida.** Arachnida are terrestrial arthropods. Examples of arachnids are spiders, ticks, scorpions and mites.
5. (a) Distinctive features of each class of the phylum Arthropoda
- (i) Distinctive features of class crustacean
 - Crustacean are mainly found in marine and fresh water thus they occupy aquatic habitats.
 - Their gaseous exchange is by means of gills or through the body membrane.
 - Their bodies are divided into two main parts: the head and thorax are fused to form a Cephalothorax the second part is the abdomen
 - They have a pair of compound eyes each on a raised stalk
 - They have two antennae
 - They have four pairs of mouthparts namely maxilla, mandible, labium and labrum
 - They have five pairs of limbs that are modified for swimming
 - (ii) Distinctive features of class insect
 - Insects have three body parts namely the head, thorax and abdomen.
 - They have one pair of antennae.
 - They have a pair of compound eyes. In some cases simple eyes are also present.
 - They have three pairs of walking legs per segment of the thorax.
 - Most insects have one or two pairs of wings on the second or third segment of the thorax. Some insects have no wings.
 - They breathe by means of air holes called spiracles and carry out gaseous exchange through the tracheoles of the tracheal system.

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- They undergo complete or incomplete metamorphosis with a larva stage.
- They mainly occupy terrestrial habitats.
- (iii) Distinctive features of class chilopoda
- They have a clearly defined head while the rest of the segments are similar.
 - They have a pair of antennae.
 - They have one pair of mouthparts known as mandibles.
 - They have simple and compound eyes, although some lack compound eyes.
 - They have a pair of legs in each body segment.
 - They carry out gaseous exchange by means of tracheoles of the tracheal system.
 - They feed on insects and worms.
 - They occupy terrestrial habitats.
 - They have one pair of poison claws.
- (iv) Distinctive features of class diplopoda
- They have a clearly defined head. All the other body segments are basically similar.
 - They have one pair of antennae.
 - They have one pair of mouthparts namely, the mandibles.
 - They have simple and compound eyes, although some lack compound eyes.
 - They have two pairs of legs in each body segment.
 - They carry out gaseous exchange through tracheoles of the trachea system.
 - They feed on plants.
 - They inhabit terrestrial habitats.
 - They have a cylindrical body.
- (v) Distinctive features of class aracnida
- Arachnids have two body parts. The head and thorax are fused to form cephalothorax or prosoma, the abdomen is referred to as opithosoma.
 - They do not have mouthparts. However they have one pair of appendages for sensing prey and another pair for capturing the prey.
 - This pair of appendages is known as chelicerae. Thus they have a carnivorous mode of feeding.

- They have simple eyes.
 - They have four pairs of walking legs.
 - They carry out gaseous exchange by the lung book or trachea.
 - A lung book consists of folds of ectoderm with slit like opening on the surface of the abdomen.
 - Arachnids do not have wings.
 - They inhabit terrestrial habitats.
- (d) State the advantages under each class of phylum Arthropoda.
- (i) Advantages of crustaceans
 - Human beings use crustaceans as food especially lobsters, shrimps, crabs and crayfish.
 - Some of them are used for decorations in the homes especially crabs and crayfish.
 - Most crustaceans attract tourists during their visits especially along the beaches.
 - (ii) Advantages of class diplopoda
 - The millipedes can be useful like earthworms; they help to aerate the soil
 - (iii) Advantages of class insect
 - Most insects are naturally useful in pollination e.g. bees and flies.
 - Other insects e.g. bees are able to make various substances like honey and wax that are consumed by humans and wax is used for making candles.
 - Some insects like termites and earthworms help to turn the soil over and so keep it loose and aerated.
 - Most insects are vectors of several species of disease causing organisms e.g. mosquito is the vector for plasmodium that causes malaria in humans. Flies are vectors for filarial worms that cause river blindness in humans.
- (e) Disadvantages of insects
- Many insects transmit diseases to people by transmitting contaminated material by means of their appendages e.g. houseflies transmit cholera by carrying contaminated stool to whatever can be consumed by human beings.

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- They cause damage to crops and forestry, locusts and some larvae e.g. feed on crops.
 - They spread diseases to humans and other domestic animals e.g. female anopheles spreads malaria, while tsetse flies spread sleeping sickness.
6. (a) General and distinctive features of phylum chordata
- They have a notochord in the embryonic stage which later is replaced by a vertebral column as in lungfish or it may both be surrounded by a vertebral column as in some chordata.
 - Their nerve cord is hollow and placed dorsally to the gut.
 - They have gill slits at least during the embryonic stage.
 - They have tail which is behind the anus.
 - They have limbs formed from more than one body segment.
- (c) Classes of phylum chordata
- Class chondrichthyes. Examples are dogfish, shark, skates, and rays.
 - Class osteichthyes. Example is tilapia fish
 - Class amphibian. Examples are frog and toad
 - Class reptilian. Examples are snakes, lizards, crocodiles, tortoise and others.
 - Class aves. Examples are eagle, owl, chicken and others.
 - Class mammalia. Examples are man, dog, cow, whale and others.
7. (a) Distinctive features of class chondrichthyes
- The skeleton is made up of cartilage
 - The body is covered with placoid scales
 - The caudal fin has two lobes that differ in size
 - Each pair of gills is in a separate compartment
 - The mouth and two nostrils are ventrally placed
 - Males have Copulatory structures called claspers
- (f) Distinctive features of class osteichthyes
- The skeleton is made up of bones.
 - The body is covered with ganoid scales.
 - The mouth is terminally placed and nostrils are forced on the dorsal surface.
 - All pairs of gills are found in common chamber and the chambers are covered by an operculum.
 - Have lateral line for detecting changes in pressure.

- Eggs are fertilized externally.
 - They have paired pectoral and pelvic fins.
- (g) Distinctive features of class amphibian.
- Their skin is always moist example frogs.
 - They have bony skeleton.
 - They are poikilothermic organisms.
 - Their life cycle involves larva form called tadpole.
 - They have gills which are present in the early stages of the development of the tadpole.
 - They have a heart which has three chambers with two auricles and one ventricle.
 - There is gaseous exchange by gills in the tadpole and in the adult it takes place in the lungs, skin and the mouth lining.
- (h) Distinctive features of class aves
- The body is covered with feathers.
 - The anterior pair of limbs is modified into wings.
 - The mouth is modified into a beak or bill for feeding.
 - They are homoeothermic.
 - They have four chambered heart.
- (i) Distinctive features of class Mammalia
- Their body is covered with hairs.
 - They have mammary glands.
 - They have teeth of different types and shapes.
 - They have diaphragm.
 - Their red blood cells have no nucleus.
 - They have sweat glands.
 - The body temperature of mammals is constant.
8. (a) Advantages of amphibian
- They are ecologically important
 - They are used in research specimen
 - Some amphibians are eaten as food
 - Some amphibians have unique features. Example abnormally big sizes attract tourists

- They have typical characteristics of larger animals hence they are among the most preferred specimens for biological studies
- (e) Advantages of class reptilian
 - Reptiles act as attractive features e.g. colour of snake
 - Reptiles are used as a source of food for other species example birds feed on snakes
 - Reptiles are used in decorations in houses
- (f) Advantages of aves (birds)
 - Flesh of several species is used as food for human beings example chicken, duck
 - The feathers of birds are used for decorations
 - Birds are also used for the pollination of seeds and fruit dispersal
 - Some birds like Ostriches are attractive to tourists
 - Some species of birds are used for biological control
- (g) Advantages of mammals
 - Most mammals serve as source of food for human beings example cows, goat and sheep.
 - Mammals help in production of manure example manure from cows, goats.
 - The bones of mammals are used for production of animal charcoal.
 - Most wild animals in national parks and game reserves attract tourists.
 - Some domestic mammals such as cows and donkeys are trained to perform human duties such as cultivation of crops.

4. EVOLUTION

1. (a) Evolution is the gradual development of organisms from simple form to more complex forms over a long duration of time.
- (b) Theories of evolution of life
 - Theory of Special Creation. According to this theory life was non-existent before a particular time. Then the Supreme Being (Supernatural power) created all living things and there was life on Earth from then henceforth. Major religions like Christianity, Islam and Buddhism have theories that support special creation.

- Theory of Chemical Evolution. The theory proposes that life on earth arose as a result of chemical reactions which took place. Early components of the atmosphere namely water vapour, methane, ammonia, and nitrogen reacted under solar radiation forming complex components such as amino acids which are the basis of life.
 - Theory of Spontaneous Generation. This theory proposes that life arose spontaneously from non-living matter. Aristotle stated that matter contained active particles which could produce living organisms when conditions are suitable.
 - Steady State Theory. According to this theory, the earth has always existed and has no origin, it has always been able to support life and therefore it did not have a moment of creation.
 - Lamarck's theory of evolution (Lamarckism) – use and disuse part. Lamarck theory of evolution observed that the more an individual uses a part of its body, the more that part develops and if an individual fails to use a part of the body, it weakens and becomes disappeared. Lamarck's theory of evolution (Lamarckism) – inheritance. Lamarck's theory of evolution also observed that individuals adapt to their environment and pass on the traits of offsprings, the offsprings then adapt further, thus advancing the evolution process.
2. (a) Merits of Lamarck's theory of evolution
- Lamarck theory lead to further studies on evolution of species
 - It gave rise to discovery of genes and genetics which is now widely used in many fields of biology
 - Upon rejection of his theory Lamarck decided to study about invertebrates which made great contribution in development of Zoology.
 - According to this theory, advantageous traits are perpetuated in species from one generation to another.
- (b) Weaknesses of Lamarckism theory
- The theory proposed that acquired characteristics in life time are inherited.
 - Modern genetics shows that phenotypically acquired characteristics which do not affect the genotype of an individual cannot be inherited.

3. (a) Darwin's main observations

- Every generation of organisms have more off springs than parents. However, the number of adult organisms remains generally stable from generation to generation. Therefore is a struggle for existence that causes many off spring to die before becoming adults.
- There are many variations in a species. Variations are passed from parents to their off spring. Advantageous variations enable survival in the environment organism with disadvantageous variation due. This is called survival of the fittest.
- Off springs with favourable variations grow into adults and reproduce therefore favourable variations accumulated in the species; enabling adaptation to the environment, this gives rise to new specie.
- A change in the environmental conditions favours other characteristics of the organisms. The effect of these changes on the organisms is that other features become more prominent than before resulting in evolution.
- Variations exists within a population

(b) Merits of Darwin's theory

- The theory enabled scientists to carry further studies, leading to new discoveries that suggest the origin of life.
- Helped scientists to understand about drug resistance and evolution of germs like bacteria and viruses leading to new strains
- Enable further research to find cure or vaccines of germs, bacteria and viruses

(c) Shortcoming of Darwin's theory

- He failed to explain how variations in populations arose and were maintained from one generation to the next.

(d) Evidence of organic evolution

- **Comparative anatomy.** Comparative anatomy is the study of biological structures in different organisms. The scientists look at structures that are similar in different organisms or species. Example limbs of vertebrates such as human beings, goats and wings of birds are used for different purposes but they have a basic design structure, this is known as homologous structure. Example fore limbs of humans are for manipulation, fore limbs of birds (wings) are for flight and fore

limbs of a goat are for walking; this shows that all these animals are from common ancestors. Analogous structures are the ones, which look different, but they perform similar functions e.g. insect, birds and bats all have wings used for flight but they have different structural organization.

- **Fossil records.** Fossils are remains of organisms that lived in the past preserved naturally in rocks or on ice. The study of fossils is known as paleontology when fossils are dated scientists can estimate the age of that organism. Method used by scientists to know the age of fossils is carbon dating using isotope of Carbon 14.
- **Comparative embryology.** In comparative embryology embryos of different vertebrates at early stages are compared and they are seen to have resemblances. Species that show similar embryonic development are assumed to be closely related although the adult may be quite different.
- **Vestigial organs.** These are structures, which have been greatly reduced and ceased to be functional. Presence of vestigial organs is an indication that they existed in ancestral forms but as a result of evolution such structures have been so much reduced to the extent of losing or greatly changing their original function. Examples of vestigial structures are wings of flightless birds such as ostriches and penguins.

5. HUMAN IMMUNO DEFICIENCY VIRUS (HIV)

1. (a) Long meaning of terms
 - (i) HIV- human Immunodeficiency Virus
 - (ii) STIs- Sexual transmitted diseases
 - (iii) TDs – Transmitted diseases
 - (iv) VCT – Voluntary counselling and Testing
- (b) Ways of transmission, symptoms and effects of HIV/AIDS
 - (i) Transmission of HIV/AIDS
 - Sexual intercourse with infected person
 - Blood Transfusion from an infected person
 - Organ transplant from an infected donor

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- An infected mother to her child during pregnancy, birth or breastfeeding.
 - Using unsterilized surgical instrument e.g. scalpel, needles etc.
 - Sharing toothbrushes, sharing blades, nail cutter with infected person
- (ii) Symptoms of HIV/AIDS
- Loss of weight up to 10% and more
 - Persistent fever that lasts longer than a month
 - Chronic diarrhea for more than one month
 - Coughing for more than a month
 - Itchy rashes on the skin
 - White layer in the mouth and throat
 - Swollen gland especially in the neck and armpit
 - Genital rashes
 - Shortened breath
- (iii) Effect of HIV/AIDS
- Infected people are sometimes neglected and denied the opportunity to positively continue living
 - It diminishes individual's ability to work and support one's family
 - It brings devastation to the family and communities by causing premature death of people during their prime years of life.
2. (a) Ways of managing and controlling HIV, AIDS and STIs
- Avoid irresponsible sexual behavior. Follow ABC guide: Abstain from sexual intercourse. This is the best method of prevention for the unmarried people, be faithful to one sexual partner
 - Use condom during sexual intercourse
 - Use sterilized instruments during surgery, circumcision and delivery.
 - Wear disposable gloves when you touch other people's bodily fluids.
 - Only screened blood and organs should be used for
 - Transfusion and transplants.
 - Go for HIV and AIDS test in order to know your status.
 - Do not share toothbrushes and blades.
 - People with HIV and AIDS should be given anti-retroviral drugs (ARVs) which help to slow down the progression of the diseases in the body.

- Pregnant women should attend pre-natal clinic where they can be treated to prevent mother to child transmission.
 - HIV positive mothers should not breastfeed their newborn babies.
 - Life skills needed for home based care for people living with HIV/AIDS
- (b) People with HIV and AIDS can live healthy lives for a longtime if they get proper care and support. We can care for them and support them in the following ways:
- Giving them well-balanced meals in adequate quantities.
 - Allowing them to rest when they feel unwell.
 - Taking them to a health center as soon as they start developing signs of illness.
 - Providing them with ARVs which help to slow down the advancement of the condition.
 - Allowing them to work and exercise if they can.
 - Behaving in a loving way toward them.
 - Listening to them and helping them when they have a problem.
 - Counseling them to stop behaviors that could worsen their condition. Example: taking drugs or having many sexual partners.
 - Keeping their bodies, clothing and bedding clean.
3. (a) Voluntary counselling and testing is the process that is undertaken when a person wants to find out if she/he is affected with HIV.
- (b) Significance of counseling and voluntary testing in the control and prevention of HIV/AIDS and STIs
- It allows adolescents to find out their own HIV status in order to evaluate their behavior and its consequences.
 - VCT clinics usually have 45 minutes counseling sessions that provide information about HIV and AIDS and testing process
 - VCT can help improve advocacy and reduce stigma by giving people the opportunity to talk anonymously and confidentially with a counselor about their HIV status.

Glossary

Embryo: A plant or animal as it develops from a fertilized egg.

Endotherms: An organism that uses the environment to regulate its body temperature

Fermentation: A process by which energy is released from large molecules in absence of oxygen. It produces lactate in animals and carbon dioxide and ethanol in plants and microorganisms

Fertilization: Is the fusion of a male gamete and a female gamete to produce a zygote.

Homozygote: A condition in which allele of a particular gene

Olfactory lobe: Part of the brain responsible for sense of smell

Oogenesis: Is the process by which female gametes are formed in animals

Osmoregulation: Is the maintenance of concentration of body fluids such as salt and water in the body

Oestrus cycle: Is a physiological process induced by reproductive hormone in most placental mammals except human and apes during which endometrium is broken down and released through stoma

Parthenogenesis: Is the process whereby an egg of an insect develops into an adult without fertilization

Phenotype: Is the physical outward appearance of an organism

Pollination: Is the transfer of pollen grain from stamen to the stigma

Reproduction: Is the ability of organisms to produce young ones of their own kind

Rods: Photoreceptor cells sensitive to low light intensity and detect black and white colour

Spermatogenesis: Is the process of forming male gametes in an animal

Sex linkage: A characteristics is said to be sex linked if their gene which determines it are found on sex chromosomes

Testosterone: A hormone secreted by the testes, responsible for male secondary sexual characteristics

Tropism: Is the directional movement of a plant parts towards the external stimulus (plural stimuli)

ABOUT THIS BOOK

Biology revised tests for form three and four contains:

A comprehensive summary of most obvious basic concepts covered in form three and four

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