BIOLOGY ESSAYS FOR EASY REVISION.

1 (a) **Describe the digestion of a starchy meal along the human alimentary canal.** S (13 mks)

Answer - Starch in food is first broken down in the mouth by action of teeth/ chewing; This increases the surface area exposed enzyme action; saliva contains salivary amylase which breaks down some starch to maltose; saliva has a slightly alkaline pH which is optimum for the enzyme; The food moves down to the oespophagus and stomach; where the acidic pH, due presence of dilute Hcl, prevents further action of salivary amylase; In the duodenum, pancreatic amylase continues digestion of starch to maltose; Pancreatic amylase is produced in the pancrease; and enters the duodenum through pancreatic ducts; the acidic chyme is neutralized by the sodium bicarbonate in bile/ pancreatic juice; Maltose digestion continues in the ileum; whose walls secrete succus entericus/ intestinal juice; which contains enzyme maltase; which breaks down maltose to glucose; (Max 13 marks)

(b) **Describe the process of urea formation**. (7marks)
answer Excess amino acids / proteins; are transported to the liver

2. (a) Describe how gaseous exchange occurs in terrestrial plants. (13 marks) **Answer**

Gaseous exchange takes place in a spongy mesophyl

During the day air diffuses into large air spaces of spongy mesophyll; through stomata; the Carbon (IV) Oxide in the air diffuses into Photosynthetic cells; in solution form; during photosynthesis Carbon (iv) Oxide is used while oxygen is produced. Oxygen diffuses out of the leaf; through stomata;

During the night; air diffuses into the air spaces (of spongy mesophyll), the air dissolves into film of moisture; then oxygen diffuses into the cells; and is used in respiration during which carbon (iv) oxide is produced, the Carbon (iv) Oxide diffuses out of the leaf; through stomata; due to concentration/diffusion gradient;

Gaseous exchange takes place through epidermis (of young leaves and stems); epidermis of the root carries out gaseous exchange with air in the soil; some plants have pneumatophores/breathing roots; in which gaseous exchange occurs through lenticels; (found in

older stems)

3. (a) Distinguish between a community and a population. (2mks)

Answer A community consists of all plants and animals (organisms of different species in a habitat) interacting with each other; while a population consist of individuals of the same species in a habitat;

(b) Briefly describe how the population of grashoopers in a given area can be estimated. (8mks)

Answer Use capture recapture method; catch the grasshoppers and mark using permanent ink; records and release; to allow time to mix; recapture and count the marked and unmarked; total population is equal to the number marked and unmarked in second sample multiplied by number of marked grasshoppers in the first sample; divide by the number of grasshopper marled in the second sample that were recaptured.

(c) Explain how the various activities of man have caused pollution of air.

Answer Sulphur based chemical; eg sulphur (iv) oxide gas,H2S,Cl2,Hcl gas produce by

(food processing) industries/sewage matter; affect gaseous plants leaves;

-Aerosols; CFCs spray to control (plant) disease and pests also affect respiratory organs of animal; the chemicals are redounds and persistent (not easily broken down/ deplete the ozone layers; smokes/ fumes produce in areas with (heavy industries and (high density of motor vehicle/fire which burn fuel/oils, wood; reduce visibility fumes also settle on leaves and stop photosynthesis; (excessive) production of Carbon(iv) oxide causes the green house effect/temperature inversion as a result of heating in lower layers of atmosphere; acc pesticides, herbicides, insecticides.

- Sound/ noise t produce by machine/heavy vehicles/aircraft; affects hearing in animals; Dust; industrial production of (cement) generates dust; which finally settles on plants leaves limiting photosynthesis; removal of vegetation/cutting of trees; interferes with the carbon cycle; radioactive emission; from nuclear reactors/mines/x-ray/machines, bombs cause mutation/cancer/death;

(10mks)

4. Describe how the mammalian ear is a daprted to its function. (20mks)

Answer The ear is an organ involved in perceiving sound and maintaining body balance and posture it is made uo of the following sections:-

- **Pinna** – Funnel shaped structure, made up skin and cartilage; it receives sound waves and directs them; to the ear tube;
- **External auditory meatus** – a tubulex canal lined with hairs and wax secreting cells; allows passage of sound waves to the middle ear; the hairs and wax trap dust particles that enter the ear;
- **Tympanic membrane**- thin flexible sheet like structure; receives sound waves and pass the vibrations to the ossicles;
- **The Ossicles (stepes, anvil & incus)** -; amplify vibration from the tympanic membrane;
- **Enstecluian tube** – connect pharynx and middle ear ; it balance pressure on both sides of the tympanic

membrane/outer and middle ear;

- **Oval window**- a thin flexible membrane that opens into the inner ear; it (receivs) and passes vibrations to the inner ear.
- **Semi Circular canals arranged in planes**; to maintain balance and postures;
- **Cochlea** – coiled tube filled with endolynph, has sensory cells ; for transition on nerve impulse to the brain;

5. Describe how the human skin is adapted to its function. (20mks)

- Cornified layer; made up of dead cells Rat protect against mechanical damage/desicators/ entry of microbes.
- Glandular layer; made up of living cells that give rise to cornified layer.
- The malphigian layer, has actively living cells that give rise to new epidermal cells that contain melanin that protect the skin against ultraviolet rays.
- Has hair which stand erect to trap air when cold low temperature to reduce heat loss/ insulate/ lies flat to allow heat loss when the temperature is high.
- Has nerve endings; which are sensitive to stimuli/touch/ heat/ cold/ poisonous/pain.
- Has subcutaneous fat/ adipose tissues; that insulate the body against heat loss.
- Has arteries/ capillaries blood vessels; that supplies food/ oxygen/ remove excretory products.
- Arteries vasodilates when temperature are high to loose heat by radiation/ convection/ vasoconstriction when temperatures are low to which conserve heat.
- Has sebaceous gland; which secretes sebum an antiseptic/ water repellant substance/ prevent drying / cracking of skin/ make skin sapple.

6 a) **State three aspects of light that are important in photosynthesis**. (3mks)

- Light intensity
- Liht duration
- Light wavelength/ quality

b) **Describe how the leaves of plants are adapted to carry out photosynthesis**. (17mks)

Answer

- Wide/ broad/ flat lamina; to provide large surface area for absorption of Co2 and light for photosynthesis.
- Thin to ensure a short distance for Co2 to reach photosynthesis cells(factor diffusion of gases)

- Thin transparent upper epidermis; to allow easier penetration of Light to photosynthetic cells.
- Presence of stomata/ guard cells for efficient/ faster/ rapid diffusion of Co2 into the leaf/ O2 out/ gaseous exchange.
- Palisade cells contain many chloroplast; which are next to upper epidermis to receive maximum light for photosynthesis.
- Chloroplasts have chlorophyll; to trap light.
- Leaves have leaf veins; xylem to conduct water to photosynthetic cells phloem to translocate products of photosynthesis to other parts of plant.
- Large/ intercellular air spaces in the spongy mesophy/ layer; for storage of Co2 and for easier gaseous exchange.
- Waxy water proof cuticle; to reduce water loss and reflect excess light.
- Leaf mosaic/ non- overlapping leaves; for maximum exposure to light.

7 a) **Describe how water molecules are absorbed from the soil and moves to the leaves in a tree.** (10mk)

Answer Water exists as a thin film in the soil between soil particles; the concentration of cell sap is greater than that of the surrounding solution in the soil; Thus drawing water molecules across the cell wall and cell membrane into the root hair cells; by osmosis; water drawn into the root hair cell dilutes the cell sap/makes it less concentrated than that in the adjacent cell; water moves into the cortex cells (of the root); across the endodermis by active transport; into the xylem vessels of the root); then conducted up into the xylem (vessels) of the stem; water is pushed/rises up the stem by root pressure; (in the xylem vessels) water rises by capillarity; cohesion and adhesion forces; into xylem of leaves; water moves as a continuous uninterrupted water column in the xylem vessels up the tree to the leaves.

b) **Describe the mechanism of inhalation in human beings.** (10mk)

Answer External intercostals muscles contract; internal intercostals muscle relax; Rib cage move outwards; and upwards; Diaphragm muscles contract; Diaphragm flatten; volume in thoracic cavity increases; pressure reduces; Atmospheric air enters the lungs; inflate; (correct sequence must be followed)

8a) **Describe adaptations of the reproductive system of a male mammal to its function.** (10mk)

Answer. Position of scrotal sac in abdominal cavity provide cooler temperature for sperm devolvement/spermatogenesis; Has seminiferous tubules, highly coiled whose lining consist of actively dividing cells; Between them are interstitical cells which produce androgens; Seminiferous tubules unite to form epididymis; a coiled tube; which provide surface for sperm storage; Seminal vesicles provide alkaline fluid which nourishes spermatozoa; / prostate gland secretes alkaline fluid to neutralize the vaginal fluids; it also activates sperms; / Cowper's gland secretes an alkaline fluid that neutralize acidity along the urethra; penis which projects from the body; made of spongy tissue, muscle and blood vessel; erects by having spaces in its spongy tissue filled with blood enabling it to penetrate vagina during coitus, to deposit sperms in the female reproductive tract;

b) **Explain how the following vertebrae are adapted to their function.** (10mk)
(i) Cervical vertebra.
(ii) Thoracic vertebra.

(i) Cervical Vertebra.

- Has vertebraterial canal for passage of vertebral artery and nerves;
- It has branched and broad transverse process to provide surface for attachment of neck muscles;
- Short neutral spine for attachment of neck muscles;
- Wide neural canal for passage of spinal cord;
- Centrum and a neural arch for protection of the spinal cord;
- Prezygapophysis and postzygapophysis for articulation with the vertabra in front and behind;
- Atlas has broad surface for articulation with condyles of the skull and this allows the nodding movement of the heard;
- Axis has a projection of the centrum, the odontoid process that fits into atlas and allows for the rotatory / turning movement of the head;
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(ii) Thoracic Vertebra.

- Long neural spine for muscles attachment;
- Short transverse process for muscle attachment and for articulation with the ribs;
- Neural arch and centrum protect the spinal cord;
- Large centrum to support the body weight;
- Facets for articulation with other vertebrae adjacent to it;
- Turbercular and capitular demifacets for articulation with the rib;

NB. Structure and function 1mark.

9(i) **Blood has two broad functions namely protective and transport. Describe how the blood protects the body**. (4mks)

Answer White Blood cells; - engulf; and destroy bacteria / pathogens; by producing antibodies; which neutralize acterial toxins.Blood platelets; - cause clotting; on fresh wounds preventing entry of bacteria into tissues; prevent loss of blood; water and mineral salt;

(ii) Describe the structural adaptation of the mammalian heart to its function. (16mks)

Answer. It is muscular I has cardiac muscles; which are myogenic (does not need nervous stimulation) to pump blood;

it is supplied by vagus and sympathetic nerves; which controls the rate of heart beat depending on body's physiological requirements;

It has tricuspid; and Gicuspid valves between atrium and ventricles which prevent back flow of the blood into the right and left ventricles respectively.

Presence of muscular tendous attached to the walls of ventricles and to the atria-ventricular valves from turning inside out due to changes in the pressure in the ventricles.

Heart is supplied by coronary artery; which supplies food and oxygen to the cardiac muscles for their pumping action; the coronary vein in the heart removes metabolic wastes; the heart is enclosed by the pericardial membrane; that secretes a fluid which lubricates it reducing friction on the walls as it pumps; the heart is divided into two by the atria-ventricular septum; that prevent mixing of oxygenated blood and deoxygenated blood; the left ventricles has a thick muscular wall; to pump blood at higher pressure to the distant body tissues.

10. **Describe how the structure of a flowering plant is adapted to its photosynthetic functions**. (20mks)

Answer Leaf has broad (flat) lamina / surface; to provide large surface area for absorption of Carbon IV Oxide! sunlight;

A leaf is thin; to allow light / Carbon IV Oxide to pass through a short distance to reach photosynthesis cells; (Faster diffusion of Carbon IV Oxide).

Presence of stomata; (ensure efficient) diffusion of Carbon IV Oxide into the leaf;
A leaf has cuticle! epidermis that are transparent; to allow penetration of light to the palisade cells; (Photosynthesis cells).
Palisade cells contain large numbers of chloroplasts; for photosynthesis;
Palisade cells are located next to upper epidermis; to enable them receive maximum sunlight;
(Veins in the leaf) have xylem; to conduct water and mineral salts to photosynthetic cells / palisade cells;
Phloem tissues (in leaf vein); removes products of photosynthesis.
Air spaces in spongy mesophyll; allow gases to circulate easily;

11. **Describe the process of fertilization in flowering plants.** (20mrks)

Answer Fertilization is the fusion of the male and female nuclei in the embryo sac; The male gamete is contained in the pollen grain; produced in the anthers; The female gamete is found in ovules; within the embryo sac; After pollination, the pollen grain absorbs nutrients from the stigma; and develops an outgrowth called the pollen tube; which grows down the style to the embryo sac taking along the male gametes with it; The pollen grains usually adhere to the stigma as a result of the stigma cells secreting a sticky substance; which also stimulates the pollen grain to germinate sending down its pollen tube; The growth of the pollen tube into the stigma, through the style to the ovary, is by pushing its way between the cells where it gets its nourishment

from the surrounding tissues;
As the pollen grain germinates; the tube nucleus occupies a position at the tip of the growing pollen tube; The generative nucleus divides by mitosis; into two male gamete nuclei; which follow behind the tube nucleus as the pollen tube grows down the style. The pollen tube enters an ovule through the micropyle; and when it reaches the centre of the ovule it penetrates the wall of the embryo sac and bursts open; the tube nucleus disintegrates leaving a clear way for the entry of the male nuclei; One of the male nuclei fuses with the egg cell nucleus; to form a diploid zygote; which develops into an embryo; while the other male nucleus fuses with the polar nucleuto form a triploid nucleus; This gives the double fertilization in flowering plants;

12(a) **State characteristics of gaseous exchange surface.** (4mrks)

Answer i) They are densely supplied with blood capillaries highly vascularised for transportation of gases
ii) They are thin wailed facilitate easy diffusion of gases and also to reduce the distance covere)y the diffusing gases.
iii) They are moist dissolve gas
iv) They have a large surface area for gaseous exchange.

(b) **Describe the mechanics of gaseous exchange in mammals.** (16mrks)

Answer. During inhalation/inspiration; the external intercostals muscles contract; while the internal intercostal muscles relax; raising the rib cage upwards and outwards; muscles of the diaphragm contract; making it to flatten; the volume of the thoracic cavity increases; as pressure decreases; higher pressure in the atmosphere forces air into the lungs inflating it;
During exhalation; the external intercostals muscles relax while the internal intercostals muscles contract; moving the rib cage downward and inwards; the diaphragm muscles relax; diaphragm retains its dome shape; volume of the thoracic cavity reduces; increasing pressure; higher pressure forces air out of the lungs.

13 a) **Describe how the following evidences support the theory of organic evolution: geographical distribution, fossil records and comparative anatomy** (10mks)

Answer. Evidence of Evolution

Fossil records//Palaeontology;

These are remains of organisms preserved in some naturally occurring materials e.g. sedimentary rocks for many years; They give direct evidence of the type of organisms that existed at a certain geological time//show a gradual increase in complexity/morphological changes of organisms over a long period of time e.g. skull of man

Geographical distribution;

present continents are thought to have been a large land mass joined together; continental drift led to isolation that lead to different patterns of evolution; e.g. camels of Africa resemble the Ilamas of S. America// tiger of Asia resemble jaguars of S. America // unique Marsupials of Australia; (accept any valid example)

Comparative anatomy/taxonomy;

- Members of a phylum show similarities indicating common ancestry; These organisms have similar functions e.g. presence of digestive, urinary, nervous systems e.t.c;

- Homologous structures like pentadactyl limbs in different animals like monkey and rats have similar borne arrangement hence same origin but modified to perform different functions// adaptive radiation//divergent evolution; vestigial organs//coccyx Appendix;
- Analogous structures like wings of birds and wings of insects with different embryonic origin but perform same function//convergent evolution;
(maximum 10mks) **N/B- Mention of each evidence 1mk each**

b) **Explain tropic responses in plants and their survival values** (10mks)

Answer. Phototropism
This is a growth curvature in response to direction and intensity of light Shoots are positively phototropic while roots are negatively phototropic

Chemotropism
This is a growth curvature in response to a gradient of chemical concentration; developing pollen tubes grow towards chemicals secreted by the embryo sac;

Geotropism
This is a growth curvature in response to gravity; Shoots are negative geotropic while roots are positively geotropic;

Hydrotropism
This is a growth curvature in response to water/moisture; Roots are positively hydrotropic;

Thigmotropism
This is a growth curvature in response to contact with solid objects; shown by tendrils/climbing stems which twine around objects;
Survival values of tropic responses

- Phototropism exposes the leaves in position to maximum light absorption thereby enhancing photosynthesis;
- Chemotropism enables pollen tubes to grow towards the embryo sac to facilitates fertilization;
- Geotropism enables plant roots to grow deep into the soil thus offering firm anchorage to the plant;
- Hydrotropism enables the roots of the plant to seek water;
- Thigmotropism enables the plants to obtain mechanical support, especially plants lacking woody stems;

14a) **Describe the structural adaptations of mammalian heart to its Functions** (10mks)

- It is muscular//Has cardiac muscles which are myogenic;//capapble of contracting and relaxing without nervous stimulation to ensure the heart beat without stopping;
- Supplied by vagus and sympathetic nerves; which control the rate of heart beat depending on body's physiological requirement;
- Has tricuspid and bicuspid valves//arteria ventricular valves; to prevent back flow of blood into wrong directions;
- Has semi lunar valves at the base of pulmonary artery and aorta; to prevent back flow of blood into right and left ventricles respectively;

- Presence of valve tendons attached to the walls //arteria ventricular walls; prevent arteria ventricular valves // tricuspid and bicuspid valves from turning inside out;
- Supplied by coronary artery; to supply food and oxygen t the cardiac muscles for their pumping action;
- Coronary vein; draws away metabolic wastes;
- Heart is enclosed by pericardial membrane; which secrete fluids which lubricates//reduces friction on the walls as it pumps;
- Pericardial membrane is lined with a layer of fat to act as shock absorber; hold the heart in position; checks over dilation of the heart;
- The heart is divided into two by (artria ventricular) septum; which prevents mixing of oxygenated and deoxygenated blood;
- The sino-artria node// pace maker; initiates a wave of excitation leading to contraction and relaxation of cardiac muscles;
- The artria–ventricular node; in the heart spread out waves of excitation through out the heart.

The structure tied to function wrong function cancel the mark of the structure. Correct structure minus function do not qualify for a mark

b) **Explain the role of osmosis in organisms** (10mks)

Answer. Role of osmosis in organisms
Absorption of water from the soil;
Root hair cells of plants absorb water from the soil by osmosis; it also helps in water distribution from cell to cell in the body.

Support;
Water taken into the cells increase cell turgor hence cells become firm /rigid/turgid; and therefore turgidity in the cells provide support to plant organs;
Opening and closing of stomata;
Guard cells become turgid; when they take in water by osmosis; Turgid guard cells cause the stomata to open; when the guard cells lose water by osmosis they become flaccid leading to the closure of the stomata;

Feeding of insectivorous plants;
The plants trap insects using special structures that suddenly change there turgor pressures when disturbed; the change in turgor pressure enables the special structures/ leaves to close trapping the insect which are then digested to provide amino acids;

Osmoregulation;
In kidney tubules of animals; water is withdrawn from the tubules through the tubular walls through osmosis; the water then enter the surrounding blood capillaries, this helps the animal to regulate its body osmotic pressure;

15. Blood has two broad functions, namely protective and transport.

(a) Explain how blood is involved in transport, stating the constituents of blood involved.

Answer. Red blood cells; transport oxygen from the lungs to body tissue; (in the form of oxyhaemoglobin)

Transport carbon IV oxide; from body tissue to the lungs; (in the form of bicarbonate)

Plasma; Transport dissolved food nutrients/glucose/amino acids; from the small intestines to the liver and other body tissues; transport hormones/enzymes; from secretory glands to tissues where required; transport urea; from tissues to the kidneys for excretion; distribute heat; (12mks

(b) **Describe how blood protects the body** (8marks)

Answer. White blood cells; engulf; and destroy bacteria/pathogens by producing antibodies; which destroy

them/produce antitoxins which neutralize bacteria toxins;

Blood platelets; cause blood clotting; on fresh wounds preventing entry of bacteria/pathogens into tissues; prevents loss of excess blood, water and mineral salts;

16. Describe how seeds and fruits are adapted to different modes of dispersal. (20marks)

Answer. Wind dispersal;

Small and light; to float in air/blown by air; Have wings; to increase buoyancy;

Have hairs/parachute shaped; to increase buoyancy in air.

Animal dispersal;

Are succulent; to attract animals;

Scented; to attract animals.

Have small and hard seeds resistant to digestive enzymes;to prevent digestion once swallowed;

Have

hooks; to attach to fur/hair of animals;

Brightly coloured; to attract animals;

Water dispersal;

Water proof epicarp; to prevent entry of water or soaking;

Fibrous mesocarp; with air spaces to increase buoyancy in water;

Self-explosive mechanism;

Have lines of weakness; where they break to release seeds;

Have rings of pores; through which seeds are released;

17. Describe how the mammalian male reproductive system is adapted to perform its functions. (20 marks)

Answer. Penis; Highly vacularised/spongy, sensitive glands. Long to allow entry into the vagina; becomes erect when blood flows to the blood spaces, testis contains numerous somniferous tubules; containing premedical germ cells for spermatogenesis takes place; the process is favored by slightly lower temperature than that o the body, contain sterol cells which nourish sperms until they are mature; Long coiled Epididymis; for storage of sperms; A muscular Vas deferens; than upon contraction pushes sperms out and allows ejaculation; to increase chances of fertilization, sperms have a tail and a head with a large number of mitochondria; to provide energy for swimming to each the egg/ovum. Seminal vesicle/cowpers glands/prostate gland; produce seminal fluid to provide a medium for sperms to swim.

18. Describe the structure and functions of various organelles in a mature animal cell. (20marks)

Answer.Mitochondria; urethra; conducts urine and sperms out of the body. Has a double membrane surrounding it and inner membrane folded to form cristae which increases the surface area for attachment of respiratory golgi body/apparatus, are stack of membrane bound like sac/is a system of membranes sacs/hollow spaces; that transports glycoproteins/carbohydrates and proteins; They package glycoproteins; secrete mucus/enzymes/synthesized proteins.

Lysosomes
Are spherical in shape and enclosed by a single membrane; contain hydrolytic enzyme which destroy worn out organelles, micro-organism/ingest food/breakdown large molecules.

Endopasmic reticulum
Are membrane bound cavities in cytoplasm; smooth endoplasmic reticulum site for lipid/sterot transport.
Rough endoplasmic reticulum ahs ribosome on its surface; and transport proteins.

Centrioles
Rod shaped; located outside the nuclear membrane, for formation of fibs and cilia

Cytoplacm;
It's a fluid medium; where chemical reaction occurs, contains organelles and inclusions (e.g. glycogen granules, fat droplets and dissolved substances).

Cell membrane
Encloses all cell organelles; has phosplipid layer between two protein layers/it's a lipoprotein layer has pores that selectively allows substances to pass in and out of the cell/its semi permeable.

Nucleus
Has a double membrane/nuclear membrane around it, which has pores to allow substances in and out of the nucleus; Has nucleoplasm, which contain nucleolus/chromatin, nucleus controls all cell activities, Nucleolus manufactures ribosomes and centrioles.

Ribosomes
Are spherical in shape and suspended in cytoplasm and attached on endoplasmic reticulum; synthesis proteins.

19. Describe the structural adaptations of the mammalian heart to its function. (20mks)

- It is muscular/has cardiac muscles; which are myogenic (does not need nervous stimulation) to pump blood;
- It is supplies by vagus and sympathetic nerves; which controls the rate of heart beat; (depending on body's physiological requirements)
- It has tricuspid valves and bicuspid valves; (between atrium and ventricles) which prevent back flow of the blood into the right and left ventricles respectively.
- Present of valve tendons attached to the walls of ventricles and to the atrium ventricular walls; to prevent atria-ventricular valves from due to changes in the

pressure in the ventricles;
- Heart is supplied by coronary artery; which supplies food and oxygen to the cardiac muscle for their pumping action; the coronary vein; in heart removes metabolic wastes;
- The heart is enclosed by the pericardium membrane; that secretes a fluid which lubricates it (reducing friction on the walls as it bumps);
- The heart is divided into two by the atria-ventricular septum; that prevent mixing of oxygenated blood and deoxygenated blood;
- The left ventricles has a thick muscular wall; to pump blood at higher pressure to the distant body issues;
- The outer part of the pericardium has a fatty layer; which act as a shock absorber; keeps the heart in position.
- The Sino Atrial Node (S.A.N) the pacemaker region); which initiate the wave of contraction leading into contraction and relaxation of muscles; the arterial-ventricular node; in the heart spreads out waves of contraction throughout the heart creating the heart beat;

20. Describe how water moves from the soil to the leaves in a tree. (20mks)

Answer.- Water exists as a thin film in the soil between soil particles; The concentration of cell sap is greater than that of the surrounding solution in the soil; Thus drawing water molecules across the cell wall and cell membrane into the root hair cells; by osmosis; water drawn into the root hair cell dilutes the cell sap/makes it less concentrated than that in the adjacent cell; water moves into the cortex cells (of the root); across the endodermis by active transport; into the xylem vessels of the root); then conducted up into the xylem (vessels) of the stem; into xylem of leaves; water is pushed/rises up the stem by root pressure; (in the xylem vessels) water rises by capillarity; cohesion; and adhesion forces; water moves as a continuous uninterrupted water column in the xylem vessels up the tree to the leaves.
- As water vaporizes from the spongy mesophyll cells; their cell sap becomes more concentrated than that of the adjacent cells; This increases the osmotic pressure of the spongy mesophyll cells; As a result water flows into the cells from other surrounding cells; which in turn takes in water from xylem vessels within the leaf veins; This creates a pull/sunction force/transpiration pull; that pulls a stream of water from xylem vessels in the stem and roots; The transpiration pull maintains a continuous column of water from the roots into the leaves (transpiration stream);

21. Explain how the tracheal system in arthropods is adapted for gaseous exchange (10mks)

Answer. Have a muscular valve that controls opeing and closing of spiracles to allow entry of air and prevents excessive loss of water from the body tissues by evaporation
- Has spiral bands of chitin to keep it open to maintain its shape, prevent it from collapsing hence permitting gaseous exchange

- Tracheoles lack spiral bands of chitin so as to permit more gaseous exchange through them as chitin would have hindered gaseous exchange
- At the end of the tracheoles is a thin film of moisture that facilitates dissolution of gases
- Each tracheole moves as closer to the cells as possible to minimize diffusion distance, hence faster exchange of respiratory gases
- Opening of spiracles is surrounded by a tuff of hairs to trap dust particles and microorganism and prevent excessive water toss by evaporation

b) **Explain the mechanism of opening and closing of the stomata using photosynthetic theory**

Answer.

During the day the guard cells have chloroplast and they carry out photosynthesis producing sugars
- The sugars increase the osmotic pressure of cell sap of guard cells
- The cells draw water from neighboring epidermal cells by osmosis, there is expansion of guard cells and increase turgidity
- The guard cells swell and bulge outwards causing stomata to open
- During night there is no light and photosynthesis stops, sugars manufactured during the day is converted to starch lowering the osmotic pressure in guard cells
- The guard cells lose water to neighboring epidermal cells by osmosis and become flaccid and shrink towards each other cloving the stomata

22.(a) **A dicotyledonous stem offer support to the plant. Give three necessities for this support**

Answer.

_ To expose the leaves to sunlight for photosynthesis;
_ Expose flowers to agents of pollination;
_ Expose fruits and seeds to agents of dispersal (3mks)

(b) **Describe the adaptation of the stem of a dicotyledonous plant to its function** (17mks)

Answer. The stem has several strengthening tissue; that provide support i.e. collenchyma and schlerenchyma;
These tissue; are strengened by lignin;
-Xylem tissue; made up of xylem vessels and tracheids. The xylem tissues have thickened walls by lignin; to prevent walls from collapsing during transpiration;
- Xylem vessels are narrower; to facilitate upward movement of water by capillarity;
-Xylem vessels have boardened pits; lateral movement of water and mineral salt;
- Phloem tissue contain contractile cytoplasmic strands ; to push organic food substance from one sieve tube to the next;
- Phloem tissue contain plasmodesmata; that joins companion cells to sieve elements; allowing for passage of protein and ATP to be used in translocation of substances;
- Cambium tissue for secondary growth within the vascular bundles;
- Parenchyma tissue /cells stores water and food hence support through turgidly;
-Suberin in the stem prevents excess loss of water and entry to pathogens;
-Lenticels that facilitate gaseous exchange ;
-Some stems have parenchyma cells with chlorophyll for photosynthesis;

23. Describe the dentition of carnivorous mammals and their adaptation to the mode of Feeding

Answer.

- Have sharp pointed incisors ; for tearing and stripping flesh from bones
- Have canines that are long / curved / pointed; for piercing , grasping and holding the prey;
- Have got the carnassial teeth (upper fourth premolar and lower first molar) with smooth sides; sharp edges to shear and slice flesh from tendons and crush the bones;.
- Have powerful jaw bones for powerful muscle attached ; This prevents dislocation of jaws for cutting and shearing of flesh;
- Have sharp and curved claws ; for holding and grasping prey; (10mks)

(b) **Explain the different forms of chromosomal mutation** (10mks)

Chromosomal mutation change involves number or structure chromosome i.e.
- Deletion; Part of chromosome break away and does not rejoin to the original chromosome. Leads to loss of some genes;
- Duplication; chromosome replicate itself either in whole as a portion of itself. This causes extra
– homologous chromosome;
- Inversion; a part of chromosome gets detached, rotates at 180^0 then rejoins to the original chromosome;
- Non disjunction chromosomes i.e. polyploidy;.
- Translocation; A part of the chromosome detatches itself from one chromosome and attaches to another non; this is failure to segregate in a pair of homologous chromosome during meiosis ; leading to some cells having extra set of chromosome and others without chromosome; 11mks, max – 10mks)

24. (a)**Explain the conditions necessary for germination in seeds.** (12 marks)

Answer. i) **Water (moisture);**

- Activates germination enzymes;/ breaks seed dormancy
- Provides medium for enzymes to act;
- Is a medium for transportation of dissolved food;
- Softens seeds coat, which burst open to allow emergence of radicle and plumule;
- Hydrolysis of food during germination;

ii) **Oxygen**

Oxidation of food during respiration to provide energy for germination;/cell division and formation of new tissues ;

iii) **Optimum temperature**

- Suitable for action of germination enzymes which hydrolyse stored food;
- Low temperature below 0^{0c} inactivates germination enzymes slowing down germination rate;

- High temperature above 40^0c denatures germination enzymes stopping germination;

iv) **Enzymes**

- Breaks down food by oxidation

- Food stored are in insoluble form e.g. carbohydrates fats and proteins and hence must be acted upon by the enzymes ;

Example

Starch $\xrightarrow{\text{amylase}}$ maltose $\xrightarrow{\text{maltase}}$ glucose;
Lipids $\xrightarrow{\text{lipase}}$ fatty acids and glycerol;
Proteins $\xrightarrow{\text{protease}}$ amino acids;

v) **Viability;**

- Refers to percentage change that a seed will germinate and when planted;
- Only seeds with live and healthy embryos will germinate and grow;
- Seeds stored for a long time lose their viability;

vi) **Hormones**

- These stimulate certain metabolic pathways in the germination process;

(b) **Describe the role of the following hormones in growth and development of plants**.

i) Auxins (4 marks)

answer.- Promotes cell division /cell elongation /influence tropic response;

- Promote fruit formation (parthonocarpy);
- Promotes formation of abscission layer /brings about; leaf fall;
- Promotes cell differentiation of vascular tissue;
- Causes apical dominance /inhibits growth and development of lateral duds;
- Promotes growth of adventitious roots on stems;
- IAA and cytokinins induces healing of wounds;

ii) Gibberellins (4 marks)

answer. -Promotes cell division /cell elongation in dwarf plants;

- Parthenocarpy /initiating formation of fruits without fertilization.
- Formation of side branches of stem /end apical dominance;
- Inhibit growth of adventitious roots;
- Activates hydrolytic enzymes during germination /promotes germination of seeds /breaks seed dormancy;

-Affects leaf expansion and retards leaf abscission;

25a) **what is meant by the following terms**

i) Excretion

Answer. -the separation and elimination of waste products of metabolism from the body; 1mk

ii) Secretion

Answer.- the release of useful substances by the body ; (1mk)

iii) Egestion

Answer- the removal of indigestible and undigested substances from the body; (reject ingested) 1mk

iv) homeostasis

Answer. - the maintenance of constant internal environment in an organism; (1mk)

(b) **Explain how the osmotic pressure in the human blood is maintained at normal level.** (12marks)

Answer. an impulse to the pituitary gland; The pituitary gland is stimulated to produce more ADH; Which make kidney tubules more permeable to water; and more water is reabsorbed into the blood lowering the osmotic pressure to normal ;

when osmotic pressure of blood decreases; (osmoreceptors in) hypothalamus and pituitary gland are less stimulated; less ADH is produced ;which make the kidney tubules less permeable to water ;less water is reabsorbed into When osmotic pressure of blood increases above the normal level;(osmoreceptors in) hypothalamus is stimulated to sent the blood raising the osmotic pressure to normal;

(c) **Describe how the oxygen in the alveolus reaches the red cells**. (4 marks)

Answer. Inhaled oxygen dissolves in the moisture in the alveolus; the oxygen concentration in the blood is lower than the alveolus; oxygen diffuses; through the alveolus epithelium, capillary walls into the red blood cell;

26(a) How are lungs adapted to their function?

- ✓ Has numerous alveoli; that provide large surface area for efficient gaseous exchange;
- ✓ Epithelial lining between alveoli wall and blood capillaries is thin; to provide a shorter diffusion distance for easy gaseous exchange;
- ✓ It is highly supplied with blood capillaries; that transport oxygen and carbon (IV) oxide to and from the body tissues respectively;
- ✓ Lungs are covered with pleural membrane; which is gas tight thus changes in pressure within the lungs can occur without external interference;
- ✓ Lungs is spongy & has numerous alveoli; that accumulate large volume of gases.

(b)**Describe the mechanism of opening and closing of the stomata using the photosynthesis theory**.

Answer. Opening

- ✓ In the guard cells there are chloroplasts; which carry out photosynthesis in the presence of light;
- ✓ During the day glucose is produced in the guard cells; this increases osmotic pressure; compared to the neighbouring epidermal; water is drawn from the epidermal cell cells into the guard cells by osmosis; their turgidity increases;
- ✓ The inner walls of guards cells are thicker than the other wall; so outer walls stretch more than the inner walls causing guard cells to bulge outwards; causing stomata to open;

Closing

- ✓ During the night there is no light; no photosynthesis takes place in the guard cells; Glucose in the guard cells is converted into starch. This lowers the osmotic pressure of the guard cells than the neighbouring cells;
- ✓ Water is then drawn from the guard cells by osmosis into the epidermal cells making them to be flaccid
- ✓ Thinner outer wall shrink and the curvature of the thicker inner wall reduces; the stomata close;

27.(a) **Describe the various mechanism of fruit and seed dispersal**.

Answer. Water dispersal

- ✓ Such seeds and fruits enclose air in them to lower their density for buoyancy;
- ✓ They have fibrous/spongy to lower the density for buoyancy;
- ✓ Have impermeable seed coat or epicarp to prevent water from entering during floatation so as to avoid rotting;
- ✓ The seeds can remain viable while in water and only germinate while on a suitable medium;

Wind dispersal

- ✓ They are light; and small; to be easily carried by wind currents due to lower density;
- ✓ Have developed extension which create a larger surface area; so as to be kept afloat in wind currents e.g. Parachute like structures, Wing like surface;

Animal dispersal

- ✓ Brightly coloured to attract animals
- ✓ Fleshy to attract animals;
- ✓ Some have hook like structures to attach on animals fur

Self-dispersal

- ✓ They have weak lines on the fruit wall along which they burst open to release seeds, which get scattered. This occurs when temperature changes suddenly.

(b) **Describe the various events that occur in a flower after fertilization**.

- ✓ Inner and outer integuments develops into the seed testa.
- ✓ The ovary wall forms fruit wall
- ✓ The ovule develops into seed (s)
- ✓ The corolla dries and withers away.
- ✓ The calyx may persist or dries and wither away
- ✓ Stigma and style shrivels, dries and wither away.
- ✓ The androecium (male part) shrivels dries and withers away.
- ✓ Triploid nuclei develop into primary endosperm of the seed.
- ✓ The zygote formed develops into embryo.

28(a) **Explain the adaptations of Kidney tubules to their function** (10mks)

Answer. Long and lightly boiled to increase the surface area for absorption.
The tubule lining has monolithto increase its surface area
Riley supplied with a blood capillaries for efficient transport and reabsorption.
highly coiled distal and proximal can heated tubules slow down movement of filtration to allow more time for reabsorption .
The loop of hence has a counter current flow system of the blood and glomerular filtrate so as to maintain steep concentration gradient for the diffusion of reabsorpted products

(b) **Describe the role of pituitary gland in female reproductive system.** (10mks)

PSH – which stimulates the development of grawfian follide ;

stimulates the corpus interm to secret progesterone;
LH- Stimulates maturation of gratin follicle and ovulation

- stimulates the corpus interm to secret progesterone;
- Oxygen – stimulates the construction of the where wall to bring about parturation
- stimulates production of melt of the mammary gland (melt let down)

29 (a)**Discuss the economic importance of fungi** (10mks)

- Some fungi are used as food e.g mushrooms

- Some fungi are used for fermentation in baking and brewing industries
- Some fungi are used in production of organic acids like citric acid;
- Some are used in production of antibiotics; e.g penicillium; for production of penicillin.
- Saprophytic fungi decompose dead and decaying organic matter; releasing nutrients to the soil;
- Some fungi are used in scientific research e.g ***Neurospora crassa*** is used in genetic research;
- Some fungi causes human diseases such as ringworm, candidiasis;
- Some cause plant diseases like coffee berry disease, late blight
- Some cause food spoilage
- Some cause food poisoning e.g ***Aspergillus niger*** which produces aflatoxine

(b) **Describe the photosynthesis theory of the opening of stomata in plants**(10mks)

Answer. The guard cells have chloroplasts; where photosynthesis takes place; during the day sugar is produced;
which is osmotically active; this increases osmotic pressure of guard cells; thus drawing water molecules from neighbouring epidermal cells; by osmosis; and became turgid; The outer thinner walls stretch more than inner walls; causing the guard cells to bulge outwards; opening the stomata;

30. Explain how mammalian body maintains constant water balance during osmoregulation (20mks)

Answer. Dehydration; leads to low water level in the body; leads to high osmotic pressure of the body fluids; the hypothalamus detects this; sends impulses to the pituitary gland; to release antidiuretic hormone/vasopressin into blood; ADH stimulates nephron tubules; to be more permeable to water molecules; this makes **more** water to be reabsorbed from glomerular filtrate; to the bloodstream; hence less amount of urine released;

But during large intake of water increases the level of water in the body; this lowers osmotic pressure of body fluids; leading to less stimulation of pituitary gland by hypothalamus the pitutory gland is less stimulated to produce less antidiuretic hormones;

The nephron tubules become less permeable to water; less water is reabsorbed from glomerular filtrate; and more urine is produced;

31 (a) **Describe the process of fertilization in a flowering plant.** (15mks)

Answer. Pollen grains astick in the stigama surface; that surface of stigma produces a chemical substance ; which

stimulates the pollen grain to produce a pollen tube/germinate. The pollen tube grows down (into the tissue of the syle) from where it derives nutrient; the generative nucleus divides to give rise to two male nuclei and the embryo sac contains eight nuclei, 2 synegads, ovum two polar nuclei,three antipodal cels, when pollen tube reaches the micropile the vegetative nucleus/pollen tube nucleus in the pollen tube disintegrates and make nucleus fuses with the egg cell and form the zygote.

The other male nucleus fuss with the two polar nucei to form a tripod nucleus.
The process involves double fertilization.

(b) **State the changes that take place in a flower after fertilization.**

Answer. Intergument changes into seed coat/testa
Zygote into embryo
Ovary wall into pericarp
Ovary into fruit
Ovule into sedd
Tribloidnucleues into endosperm
Style dries up/fall of leaving a scar/corolla dries up (falls off) stamen dry up
(rejdegerationdisinergrates)

32 (a) **Discuss eye accommodation**. (10mks)

Answer. Accommodation is the ability of the eye to focus both far and near objects;
For accommodation of a distant object ciway Muscles realx; creating a tension on suspensory ligametns /suspensory ligments contract; the lens become flattenedotr less conveys; minimizing the refractive power of lens; bringing light rays from afar object to focus on the retina;

For a accommodation of a neat object aliany muscles contracts relaxing lesion on suspensory ligametns/sensory ligaments spherical in shape; this increase the refractive power of lens; that brings light rays from a near object to focus on the retina;

(b) **Discuss the process of hearing in man.** (10mks)

Answer. funnel shaped pinna collects sound waves; and directs them to the auditory meatus/ear drum;
Ear drum vibrates and transforms sound wave into vibrations; the vibrations core transmitted to the ear ossiclis where they are amplified and transmitted to the oral window. Vibrations front eh oral windo. Vibrations from the oral window creates pressure waves on the fluid/perlymph in cochlea; movement of fluid in cochlea causes sensory hairs to be stimulated /torched; generating an impulse; the impulse is transmitted to the brains via auditory nerve for interpretation on pitch. intensity and direction of sound;

33. **Describe the structure and function of various parts of the skin** (20mks)

a) Epidermis has three layers
i) Cornified layer; Made of dead cells that protects against desiccation/mechanical damages;
ii) Granular layer; made of living cells that replace worn out cells of cornified layer;
iii) Malpighian layer; which actively divide to give rise to new epidermal cells

- Has melanin which screens against UV light; cells producing melanin synthesise vitamin D

b) Dermis cells

(i) Has blood capillaries that supply food/and oxygen/remove excretory products; or arteries that vasolidate when temperatures are low

(ii) Has sweat glands; that produce sweat which consists of water and salts/sodium chloride /urea and lactic acid; as sweat evaporates, latent heat of vaporization is taken away from the body therefore reducing the body temperatures; under cold conditions, little sweat is produced hence little latent heat of vaporization is taken away from the body therefore conserving heat;

(iii) Has hair follicles which have hair; which insulates the body against heat loss/hair stand erect to trap air when the temperature is low; hair lie flat to allow heat loss when temperature is high; through this the skin acts as a temperature regulator.

(iv) Nerve endings; which are sensitive to various stimuli; the skin therefore acts as a sensory organ.

(v) Sebaceous gland; which produce oily substance sebum which is water repellant/antiseptic; prevents drying and cracking of the skin.

(vi) Subcutaneous fat; which insulates the body against heat loss.

34.(a) **During a voting exercise tension was high one of the aspirants was furious and wanted to face a very aggressive opponent. Explain the physiological changes that occur in his body to prepare him for the fight.** (14mks)

Answer. Adrenal glands secret adrenaline into blood stream; cardiac frequency/heart beat increases; while arterioles leading to skeletal muscles dilate; causing more blood to be directed to the tissues; to convey more oxygen; and glucose; and also remove carbon (iv) oxide and other metabolic wastes; liver convert glycogen to glucose; metabolic rate/respiration in skeletal muscles increase; to supply energy; intercostals muscles and diaphragm contract and relax; faster increasing depth of breathing; to supply more oxygen; and remove excess carbon (iv) oxide from the lungs

(b) (i) Identify each of the following responses described below.

(a) A person coughs whenever a foreign body irritates the respiratory tract

Answer. Reflex action; (1mk)

(b) Whenever a bell is rung, a dog is presented with a meal. After several days of practice, the dog salivates once the bell is rung even if food is not available

Answer. Conditioned reflex; (1mk)

(ii) State the difference between the two responses identified in (b) above (4mks)

REFLEX ACTION	CONDITIONED REFLEX
Single stimulus bring about response	Original stimulus associated with a new stimulus to bring response

Independent of experiences	Requires experience
Sensory component remains the same	Primary sensory component replaced by secondary component
Reflex simple	Reflex modified

35. a) **Differentiate between Homologous and Analogous structures.** (4 mks)

Answer. - Homologous structures;
Structures of same embryonic origin; that become modified in the course of evolution to perform different functions in different ecological niches;
- Analogous structures;
Structures of different embryonic origin; that become modified in the course of evolution to perform similar functions in the same ecological niches;

b) Describe how natural selection brings about adaptation of a species to its environment (16marks)

- Organisms in the same environment are always competing for resources such as food,mates,shelter etc;
- There follow struggle for existence and those organism that are well/best adapted to survive and breed in the prevailing environmental condition survive to the reproductive maturity and give rise to off spring of the next generation;
- The less/poorly adapted die young hence leading to survival for the fittest ;
- The favourable characteristic possessed by the fittest organism are genetic hence are passed on to the offspring ;
- This lead to a natural occurrence of variation within a species;
- The variations that are genetic are passed on/transmitted to successive generations of offspring;
- Consequently there is a gradual change in the characteristics of the species making it better adapted to its environment;
- Accumulation of small variation over along period of time lead to the emergence of new forms of life i.e. species;
- If suited to and well adapted to the new environment these new form reproduce successfully and pass on their characteristics;
- If not suited these new form are eliminated by nature, leaving mutant forms which are better adapted to the environment;
- Through this process nature selects those organism with better adaptations;
- While ensuring the elimination of those not able to adapt to the changing environment ;
- Thus the changing environment forces an organism /species to adapt/be eliminated;

36. **Describe the role of hormones in the human menstrual cycle** (20 mks)

- Anterior lobe of pitutary gland secretes follicle stimulating hormone; FSH

causes Graafian follicle to develop in the ovary; and also stimulates ovarian tissues to secrete oestrogren; oestrogen cause the repair of uterine wall;oestrogen also stimulates anterior lobe of pituary gland to secrete luteinizing hormone; LH cause ovulation also causes graafian follicle to change into corpus inteum LH stimulates corpus liteum to secrete progesterone which causes proliferation of uterine; wall in preparation for implantation; progesterone inhibit the production of FSH; thus no more follicles develop and oestrogen production drops/reduces;

- In the next two weeks progesterone level rises; and inhibits production of LH; from the pituitary gland; corpus luteum stops secreting progesterone and menstruation occurs; when the level of progesterone drops; anterior lobe of pituitary gland starts secreting FSH again; and cycle repeats;

37. Giving examples give an account of the evidence of organic evolution.

Answer.- COMPARATIVES - ANATOMY

Comparisons of structure of different organisms show resemblances in structure; and functions; e.g. digestive systems; homologous structure; like pentadactyl limb; invertebrates are similar but perform different functions, showing common ancestry; analogous structure; are morphologically different but perform similar functions; showing convergent in evolution.

-Comparative embryology

Embryos of verterbrates have great similarity showing common ancestry; e.g. the long thin and other body system;

-Cell biology; comparative serology

Cells from different organism have similarity in structure; and functioning; closely related animals have similar plasma proteins; suggesting common origin.

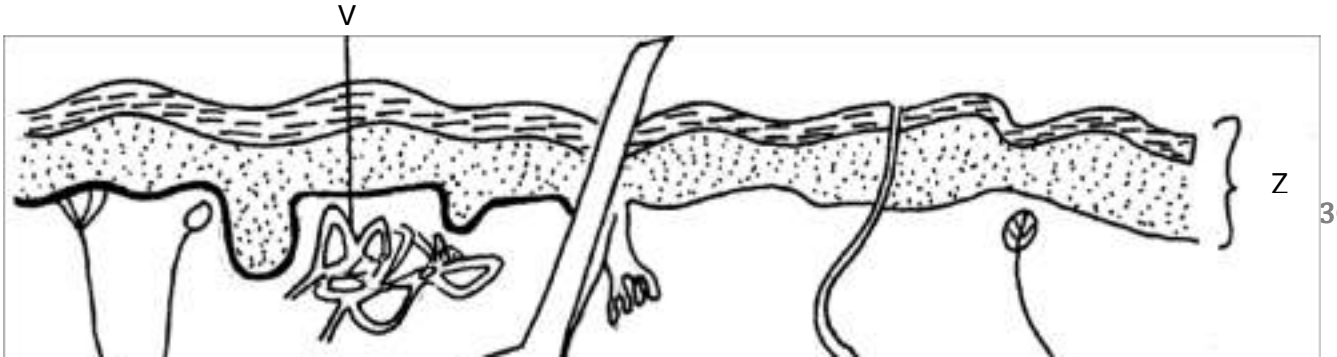
-Geographical distribution

Organism originated from a common dispersal center; when the continents were joint, continental drift occurred isolating the organisms bring different patterns of evolution due to adaptation e.g. the gala pages finches.

-Taxonomy

Classification and evolution relationship great similarity in organism of the same area e.g phylum having less, common features while species have the highest.

The diagram below shows the skin structure. Use if to answer the questions that follows:



(a) Name the part labeled

V – Capillary loap

W- pacinian Corpuscle (sensitive to pressure)

X-vein

Y-Artery

Z-epidermis

(b) Discuss the functions of the following parts of the skin.

(i) The malpighian layer (3mks)

Answer. Give rise to the new epidermis, has melanin that give color to the skin, give protection against harmful ultraviolet rays from the sun,

(ii) Granular layer (1mk)

Answer. It gives rise to the cornfield layer

(iii) Cornified layer (1mk)

ss

38. Explain the different evidences of evolution 20 marks

Answer. Comparative anatomy / taxonomy;

Members of a phylum / group show similarities ; organisms have structures / organs performing the same function ; e.g. digestive system ; nervous system same function etc (any correct example 1mk)

The pentactyl limb / any correct example; these are called homologous organs / structures; hologous (same origin but have different function; Analogous structures / different structures performing the same function e.g. wings of insects, bat and birds; Analogous – different origin but performing same function;

Fossil records / Paleontology; remains of organisms preserved in naturally occurring materials for many years; show morphological changes of organisms over a long period of time; e.g. skull of man (leg of horse)

Comperative embryology; embryos of vertebrates have similar morphology; suggesting the organisms have a common origin / ancestry ;

Geographical distribution; continents present are thought to have been a large landmass; joined together; as a result of continental dift; esolation; occurred bringing about different patterns of evolution; e.g. glamas in the amaxons resemble the camel / any other correct example e.g. kangaroo in Australia Jaguar in S. Ameica; camel in Africa;

Comparative serology / physiology ; antigen – antibody reactions / RH factor/ blood groups / haemoglobin structure reveal some phylogenetic relationship among organisms / common ancestry.

39. Describe the adaptations of the ileum to its function 20 marks

Answer.

- Has secretory glands / crypts of lieberkuln which secretes enzymes (maltase / sucrose / peptidase / lipase to complete digestion of lipids / sugar / proteins.
- Goblet cells secrete mucus allows for smooth movement of food / protect wall of ileum from action of digestive enzymes
- Very long to provide large surface area for absorption
- Highly folded / coiled to slow movement of food to allow more time for digestion / absorption / increase surface area for absorption.
- Has numerous villi which increase surface area for absorption / microvillus which further increase surface area for absorption.
- Ileum wall / villi have thin epithelium which is only one cell thick to reduce distance over which digested food has to diffuse.
- Villi are highly vasculised / have a rich network of blood capillaries for rapid transport from small intestines / maintain a steep concentration gradient.
- Villi have lacteals for absorption of fatty acids and glycerol
- Cells of ileum wall have a large count of mitochondria to release energy that aid in active transport across the epithelium. Max 20mks

41. a) **Explain how the tracheal system in arthropods is adapted for gaseous exchange**

(10mks)

Answer.

- Have a muscular valve that controls opeing and closing of spiracles to allow entry of air and prevents excessive loss of water from the body tissues by evaporation
- Has spiral bands of chitin to keep it open to maintain its shape, prevent it from collapsing hence permitting gaseous exchange
- Tracheoles lack spiral bands of chitin so as to permit more gaseous exchange through them as chitin would have hindered gaseous exchange
- At the end of the tracheoles is a thin film of moisture that facilitates dissolution of gases
- Each tracheole moves as closer to the cells as possible to minimize diffusion distance, hence faster exchange of respiratory gases
- Opening of spiracles is surrounded by a tuff of hairs to trap dust particles and microorganism and prevent excessive water toss by evaporation

(b) **What are the possible causes of incomplete fossil records?** (10 marks)

-Whole organisms or their parts have decomposed.
-Body parts may have been scavenged upon.
-Poor environmental conditions did not such their fossilization.
-Fossils might have been destroyed by geological activities such as earthquakes, faulty and mass movement.
-Distortion or destruction by parts of an organism during fossilization/ sedimentation which may give wrong impression of the structures.
-The body may be too soft for fertilization.
-the probability of fossilization in generally low.

42. Describe the methods by which plants get rid of their waste products. (20 marks)

Diffusion;
Gaseous waste products such as carbon (IV) oxide; oxygen and water vapour; diffuse through the stomata/cuticle/lenticels; into the environment;

Transpiration;
Excess water vapour; is excreted through transpiration;

Deposition;
Some toxic wastes such as alkaloids and nitrogenous compounds e.g. nicotinic, caffeine, quinine, cocaine and glycosides/sugar compounds such as colchicines (any two examples); are converted into non-tonic insoluble forms; and deposited in certain tissues of the plant or aging structures; Those deposited in aging structures are lost when these structures die or drop during leaf fall or fruit fall;

Exudation;
Resins, tannins, gums latex, rubber, oils, mucilage and oxalates are released in fluid form at a slow rate/exuded through the bark a the stem, pores of fruit;

Guttation;

In conditions of high humidity; some plants particular hydrophytes; excrete excess water; through specialized tissue called hydathodes; water is secreted in form of droplets;

Recycling
Substances such as carbon (IV) oxide and metabolic water from respiration are used in photosynthesis; while oxygen from photosynthesis is used in respiration;

43. Explain five milestones in the evolution of man that have made him the most dominant species on earth. (10 marks)

- Man has a larger brain giving him move intellectual capacity and this has enabled him to exploit the environment fully.
- Ability to speak/use language to communicate clearly with his fellow men.
- Bipedal locomotion, upright posture that frees the hands and rises them to manipulate the environment and carry objects.
- A prehensile/grasping hand that enables him to handle things with a high degree of precision.
- Forward facing eyes which gives him a three dimensional view for the purpose of judging distances and have wider angle of view.

b)**Describe how Mesophy plant is adapted to its habitats:** (10mks)

Answer.
- Trees may grow very tall in forests ecosystem due to competition for light as vegetation is very dense
- Some plants are climbers which support themselves on large tree in an attempt to reach light
- Some plants are epiphytes growing on tree branches to reach light
- Some undergrowth plants have numerous chloroplasts which are sensitive to low light intensity to enable them carry out photosynthesis in low light intensity
- Many plants have leaf mosaic that minimise overlapping and overshadowing and increase exposure of leaves to light
- those in areas with adequate water supply posses broad leaves with thin cuticle and many stomata on both sides of the leaf to increase transpiration
- Those in dryer areas have fewer stomata w3hich are mainly located on the lower surface to reduce transpiration.
- Some which leave in wet areas have shallow roots to absorb less water
- Large tall trees have developed butress roots or prop roots for extra support.
- Those in dryer areas have deep roots to absorb water from water table
- Some have waxy and glossy surface to reflect light to reduce absorption of light hence

reduce transpiration also to drip off rain water.

44. **Describe how water moves from soil to the leaves** (20mks)

Answer, The cell sap of the root hair cell is highly concentrated due to the presence of the food component of the plant root such as starch. Water and mineral salts in the soil is in dilute form and therefore has lower concentration as compared to the cell sap of the root hairs.

Water and dissolved mineral salts therefore moves from hypotonic solution in the soil into the cell sap of the root hairs which is hypertonic by osmosis. This process makes the content of the root hair cell sap to form a mixture of diluted molecule of low concentration compared to that of the piliferous layer of the root. Water and dissolved mineral salts move from the cell sap of the root hairs by osmosis into the piliferous layer which is of higher concentration. Movement of water and dissolved mineral salts into the piliferous layer then makes it of lower concentrated compared to the adjacent cortex cell concentration. Water moves by osmosis into the cortex cells by osmosis from the piliferous layer which is of lower concentration. This makes cortex cells become hypotonic by diluting the cell content compared to the adjacent endodermis. Dissolve mineral salts and water molecules from the cortex into the endodermis cells by osmosis. The endodermis cell sap becomes less concentrated due to dilution with water molecules compared to the adjacent pericycle cell sap. As more water enters the pericycle its content become lowly concentrated compared to the adjacent xylem vessels.

This leads to movement of water by osmosis in to the xylem vessels. Through the xylem, water is conducted up by various mechanism of transpiration such as root pressure, capillary, adhesive and cohesive forces and transpiration pull. This water the occupies the spongy mesophyl cells of the leaf.

45. **Discuss the adaptations of the human eye to its functions** (20mks)

Answer. -The **sclerotic** layer which contains tough connective tissue fibres which helps it to support and protect the other parts of the eye ball.
-The **choroids** which contain many blood capillaries which supply oxygen and nutrients of the retina and removes metabolic wastes from eye.
-Its highly pigmented, to prevent reflection of light within the posterior chamber of the eye ball.
-The **retina** which contains photoreceptor cells called cones and rods. It is said to be the light sensitive part of the eye. Cones are adapted for light and colour vision while rods are adapted for dim light vision.
-The **vitreous humour**-Which is under turgor pressure. It helps to maintain the shape of the posterior chamber of the eye ball. It also plays an important part in the refraction of light rays

enabling them to be focused on the retina.
-**The cornea**, transparent and curved which helps to play an important role in focusing of the image on the retina. It accounts for the largest refraction of light rays.
-**The aqueous humour** –Contains oxygen and nutrients, which nourish the cornea and the lens. It is under pressure thus helping to maintain the shape of the anterior chambers of the eye. It also plays a part in the refraction of light rays enabling them to be focused on the retina.
-**The Iris is heavily** pigment, to prevent entry of light into the eye except through its central aperture called the pupil. It contains circular and radial muscles which constrict or dilate the pupil depending on the intensity of light.
-**The lens** is elastic, therefore allows changes in its shape depending on the tension exerted through the suspensory ligaments. This enables it to bring light rays coming from either near or far objects into sharp focus on the forea.

-The ciliary's body Contains the ciliary muscles whose contraction and relaxation alters the tension exerted on the suspensory ligaments.
-This in turn alters the shape of the lens enabling it to focus for both near and distant objects.
-**The eyelids** which are movable and opaque structures can be closed through a reflex action to protect the eye from too much light or from foreign objects.
- **The eye muscles** help to move the eye ball within the orbit. The lateral rectus muscles move the eye up and down whole the oblique muscles, move the eyeball in its up and down movement.
-**The lachrymal gland** which continuously secretes a watery, saline and antiseptic fluid called tears. The tears moisten the cornea and wash foreign particles out of the eye.
-**The eyelashes,** which are many hairs, protect the eye from the entry of small foreign particles.
-**The eyebrows** raised portion of the skin above the eye, thickly covered with hair, whose functions are to prevent sweat and dust from entering the eye.

46. a) **Describe how the heart beat is controlled and maintained** (10 marks)

Answer. The sino autrial node initiates and maintains the heartbeat; by generating a wave of electrical signals that spreads through both atria; making them contract simultaneously; the signal then spreads to the autria-ventricular node (AVN); during which the atria empty into the ventricles; the signals spreads to the purkinje fibres; then conduct signals to the apex of the heart; and through the ventricular walls; these signals triggers a wave of powerful contraction of both ventricles; from the apex towards the atria driving blood in large arteries; the cardiac muscles are myogenic hence not controlled by nervous stimulation.

b) **Describe the structure and function of thrombocytes** (10 marks)

Answer. Thrombocytes are blood fragments that are irregularly shaped; they lacked a nuclear and they play a major role in blood clotting process.

When a damaged blood vessel is exposed to air; the inactive enzyme prothrombin is converted to active enzyme thrombin; under influence of thromboplastin factors like Ca^{2+}; thrombin the converts soluble plasma proteins fibrinogen; into insoluble protein fibres fibrin; fibrin forms a fine mesh over the wound trapping blood cells; and large proteins to form a soft fibrin clot; serum oozes out through the clot; and due to exposure to air it dries up and hardens to form a scab; which serves to protect soft underlying tissue and allow it to heal quickly.

47. a) **Define the term secondary thickening** (2mrks)

Answer. Secondary thickening is the increase in girth width / circumference of the stem branches and roots of woody plants

b) **Briefly describe how secondary thickening occurs in woody plants** (14mrks)

Answer. Secondary thickening is facilitated by meristematic cells / cambium; located between phloem and xylem tissue in the vascular bundles of the plants;
The cambium cells divide radially; to form a ring / cylinder of cambium tissue; with xylem inside the ring; and phloem outside the ring; cells of the cambium divide to form secondary phloem outside ;Later vascular cambium / cambium between the vascular bundles divide to form secondary parenchyma; thereby increasing the growth of the medullary rays; much more xylem cells are formed than those of the phloem; thus pushing the phloem and the cambium ring outwards;
The rate of growth is dependent on the seasons / rains ; resulting in annual rings;
cork cambium divides to form new cork/bark to accommodate the expending tissue and secondary cortex inside

c) i) **State two ways in which growth in plants is different from that in animals** (2mrks)

Answer. - Growth in plants continues throughout plant life while in animals it stops at adulthood.
– Growth in plants occurs at the apices / apical growth while that of animals is distributed throughout the body;

ii) **State how ecdysis affects the growth of insects** (2mrks)

Answer. Elysis allows the new soft tissues to grow faster; causing an increase in the mass of the Sinsect

48. a) **Discuss the application of anaerobic respiration in industry and at home** (15mks)

Answer. **-Sewage Treatment; √**
The micro-organisms present in sewage breakdown the contents of the sewage an anaerobically into less toxic forms;√
- Brewing industry ;√
Manufacture of alcoholic drinks (wines, beer and spirits) are produced by fermentation (using Yeast);√Beer is produced by fermentation of maltose found in grains/ wines are produced by fermentation of fruit sugar;√
- Dairy industry;√
e.g. Yoghurt is made by fermenting sugar in milk;
- Production of power alcohol / gasohol /methanol;√ for driving machines and engines.

- Production of Biogas from plant and animal waste ;√ The organic matter in cow dung broken into gases like methane;√

- Baking industry;√

Yeast is added to dough mixture causing it to rise ;√ due to production of carbon (iv) oxide bubbles arising from fermentation;√

- Commercial production of organic acids;√

For example citric acid and vinegar used for food preservation;√

- **Making of compost manure;√** Organic matter in plant material is broken down anaerobically to form organic manure;√

- **Silage making;√** Fresh green plant materials are partially fermented to form silage ;√ used as sanimal feed.

49. a) Give four effects of hypothyroidism (4 marks)

Answer. - Creatinism in children

- Muyodedema in adults
- Reduced heartbeat rate
- Reduced breathing rate
- Low body temperature
- Mental and physical sluggishness
- Weigh gain

(b) **Briefly describe the process of hearing in man** (16 marks)

Answer. The pinna' picks up and concentrates sound waves; directing them into their auditory canal; from where they strike the ear drum; causing it to vibrate; and transform sound waves not sound vibrations; vibrations from the eardrum are transmitted to the malleius; which transmits them to the incus; then to the stapes; the three ear osicles amplify sound vibrations; as they transmit them to the oral window;

From the oval window vibrations are transmitted to the perilumph; of the cochlea; in the cochlea the vibrations stimulate sensory cell hairs; to generate nerve impulses;

Which are transmitted to the brains; via the auditory nerve; for interpretation; the brain interprets the impulses as sound; of specific pitch and loudness;

50. Explain the adaptations of xerophytes to their habitat (20 marks)s

Answer,- Leaves are reduced in size to reduce surface area over which transpiration occurs;

- Shedding of leaves during drought/hot conditions to reduce S.A thick waxy cuticle to minimize the rate of cuticular transpiration;
- Leaves have thick waxy cuticle to minimize the rate of cuticular transpiration;
- Some leaves are folded to reduce S.A exposed to sun's rays hence reducing rate of transpiration;
- Some have sunken stomata which accumulate water vapor in deep pits; reducing saturation deficit hence reducing rate of transpiration;
- Most of them have reduced number of stomata to reduce the rate of transpiration;
- Some experience reversed stomatal rhythm to reduce transpiration rate;

- Some have deep roots to absorb water form deep the soil; // other shave superficial roots to absorb water after short/light shower of rain;
- Some plants store water in large parenchyma cells contained in succulent stems and leaves;
- Some are drought evaders i.e. germinate. Flower and produce seeds during short rainy season before drought sets in;

51.(a) Explain each of the following biological phenomena:-

(i) **The root of a horizontally placed seedling usually curves downwards**. (3mks)

Answer. The auxins are positively geotropic √ diffuse to the lower region of the root tip. High auxin concentration inhibits √ growth in roots thus lower region of root grows slowly; then upper part, thus curvature downwards √.

(ii) **The shoot of a horizontally placed seedling curves upwards**. (3mks)

Answer. Auxins are positively geotropic, diffuse to lower region of the shoot tip high auxin concentration stimulates growth in shoot, lower region with high auxin grows faster, than upper part, thus curvature upwards √.

(b) **A student sitting under a shade of a tree on a hot sunny day shifted her eyes from the shade to the sunlit jet in the sky and then looked back at a page on her book. Describe thechanges that occurred in her eyes**. (14mks)

Looking at the sunlight jet	Looking back at a page
• Circular muscles in the iris contract; while the radial muscles in the iris relax • The pupil becomes small; • Less light passes through the pupil to get into the eye; • Ciliary muscles in the ciliary bodies relax; • Suspensary ligments become stot/tension increases in the suspensory ligaments; • The lens becomes long and thin; • The jet is brought to focus	• Circular muscles in the iris relax while radial muscles contact; • The pupil becomes large; • More light passes through the pupil to get into the eye • Ciliary muscles in the ciliary bodies contract • Suspensory ligments loosen/tension is reduced or lost in the suspensory ligaments; the lens becomes short and thick; • The printed words in the page are brought to focus