Paper-1

Q. 1 (A) Answer in short. **4**

(1) State the biological importance of molybdenum.

(2) State the site of origin and the chemical nature of estrogen.

(3) What is the chemical nature of an enzyme. State its structural units.

(4) Distinguish Inulin and Insulin.

(B) Write the short notes on: **8**

(1) Anaerobic respiration

(2) Regulation of secretion of the hormones of anterior pituitary gland.

(3) Mechanism of enzymatic action

(4) Properties of proteins

(C) Answer precisely: (any two) **8**

(1) Explain the types of RNA.

(2) Describe - Monosaccharides.

(3) Describe any two growth promoting plant hormones.

Q. 2 (A) Answer as asked for: **(4)**

(1) State the location and function of velamen tissue.

(2) Give two points of differences between exarch vascular bundle and endarch vascular bundle.

(3) Write the function of epithelial layer in maize seed.

(4) Define: Root pressure.

(B) Describe briefly: **8**

(1) Significance of transpiration.

(2) Give scientific explanation: The organs of hydrophytes are light, spongy and soft.

(3) Living Mechanical tissue. (Diagram essential)

(4) Gynaecium of a typical flower.(Diagram essential)

(C) Answer precisely: (Any two) **8**

(1) Explain: Dark phase of photosynthesis.

(2) Describe giving diagram, the histological structure of a dicot leaf.

(3) Explain the vegetative adaptations in ginger, carissa, fern and passion flower . (Diagrams essential)

Q. 3 (A) Answer in short: **6**

(1) What is synapse?

(2) What is meant by serial homology?

(3) Define:portalvein.

(4) State the names and location of bones possessing olecranon process and deltoid ridge.

(5) State the location and chemical constitution of Nissl's granules.

(6) State the name of the bones that form the cranium of frog.

(B) Answer brietly as asked for: **6**

(1) Describe, giving diagram, the structure of medullated nerve fibre.

(2) Hyoid Apparatus.

(2) (3) Sexual dimorphism in frog.

(C) Answer precisely: (any two)

(1) Reflex action. (Diagram essential).

(2) Course of blood circulation in the heart of frog. (Diagram is not essential).

(3) Describe the physiology of urine formation.

Q.4 (A) Answer in short: **4**

(1) What are degenerate codons ?

(2) Give the contribution of Bateson and punnet in the field of biology.

(3) What do you mean by acrocentric chromosome ?

(4) What is petite mutant yeast?

(B) What is crossing over ? Explain how this phenomnon occurs during cell division**.** **3**

(C) Answer precisely: (any two) **8**

(1) Write an explanatory note on: mitochondrial DNA

(2) Explain, with the help of any one chart, the inheritance of colourblindness in man.

(3) Origin of chromosomal abnormalities.

(D) Draw a neat diagram of dorsal and ventral view of frog brain.

OR

Describe the process of gastrulation with necessary diagram.

Q. 5 (A) Answer in short: **6**

(1) What is ARC? Explain.

(2) Give full names : NMR, MAB.

(3) Explain : biogeochemical cycle.

(4) What is food-web?

(5) Give any two symptoms of hysteria.

(6) What is metastasis?

(B) Answer as asked for: **8**

(1) Describe the article or instruments of genetic engineering .

(2) T- cell immunity.

(3) Describe the principal zones of the global environment.

(4) Give reasons: conservation of wildlife is important for ecological balance.

(C) Write precise notes on: (any two) **6**

(1) Symptoms of cancer.

(2) Effects of air pollution on health.

(3) Antigens and antibodies of blood groups.

Answer

A. 1 (A) Answer in short :

(1) Molybdenum helps in the fixation of nitrogen in plants which in turn helps in growth. It is an important component of the intestinal enzymes in animal.

(2) Estrogen is the steroid hormone secreted from the ovary.

(3) Enzymes are the proteinaceous substances. Their structural units are the amino acids.

(4) Inulin is a pdysaccharide, whereas insulin is a hormone proteinacious in nature.

(B) Write short notes on:

(1) Anaeorobic respiration:

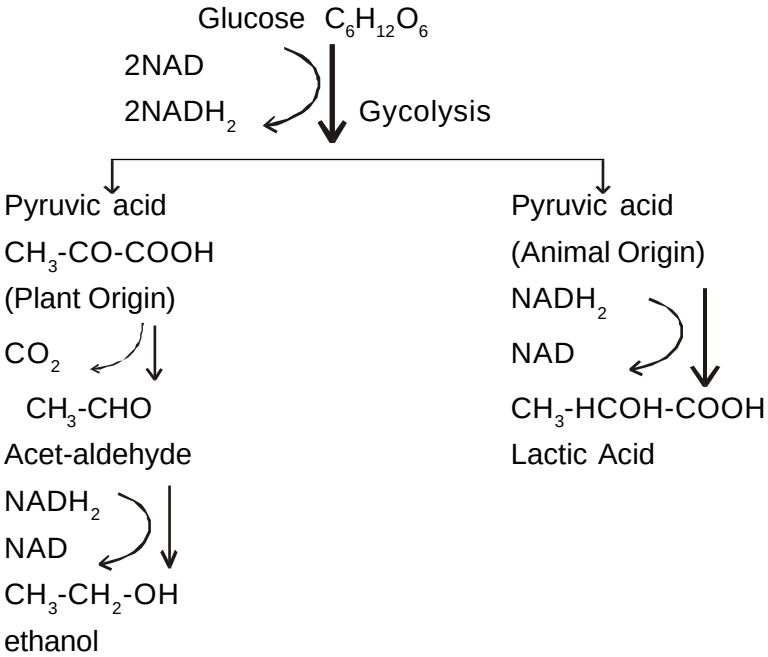
Oxidation of nutrients taking place without utilizing oxygen is called anaerobic respiraton .

$$C_6H_{12}O_6 \xrightarrow[\text{in medium of plant origin by microbes}]{} 2CH_3 - CH_2 - OH + 2CO_2 + 54\,k.Cal$$
(ethanol)

$$C_6H_{12}O_6 \xrightarrow[\text{in medium of animal origin}]{} 2CH_3 - HCOH - COOH + 54\,k.Cal$$
(Lactic acid)

In certain bacteria, yeast and other fungi, endoparasites animal muscle cells, the process of release of energy from glucose occuring without utilizing oxygen, is known as anaerobic respiration.

The first phase of anaerobic respiration is glycolysis in which 2 molecules of pyruvic acid and $4H^+$ are formed from a molecule of glucose. These $4H^+$ reduce 2 molecules of NAD to $NADH_2$ which reduce molecules of pyruvic acid as follows instead of entering ETS.



In anaerobic respiration pyruvic acid undergoes incomplete oxidation and some organic by-products are produced.

(2) Secretion of Hormones of pituitary gland is influenced by external stimuli. The posterior lobe is directly influenced by the CNS Secretion by the pituitary gland is influnced by the hypothalamus. Various types of secretions are produced by the hypothalmus. Such secretions, which initiate the release of hormones are called Releasing hormones (RH)

(3) Mechanism of enzymatic action.

The theory of enzyme-substrate complex was proposed to explain the mechanism of enzyme

action. According to this theory, each enzyme has specific active site, at which the enzyme binds with the substrate and function in a two-step reaction:

First, the enzyme(E) binds with substrate(s) to form enzyme substrate complex(ES). This ES complex degrades to enzyme(E) and product(P).

$E + S \rightarrow$ ES Complex

$ES \rightarrow E + P$

where E $\rightarrow$ Enzyme
S $\rightarrow$ Substrate
P $\rightarrow$ Products

Each enzyme acts on a specific substrate as a specific key opens a specific lock (Lock and key mechanism)

(4) Properties of protein:

(i) Protein has an alkaline – NH_2 group at one end and an acidic - COOH group at the other end. Hence, it acts as an alkaline, as well as, an acidic electrolyte. Thus, proteins are amphoteric.

(ii) Proteins are soluble in water, in dilute solution of acids, bases & alcohols.

(iii) Proteins get denatured at a very high temperature, as well as in strong acid, bases and alcohols.Proteins get destroyed when exposed to strong radiation like x-rays uv-rays.

(iv) Some Proteins like keratin are insoluble in all the solvents.

(C) Answer precisely: (any two)

(1) Types of RNA: RNA is a type of nucleic acid.

There are three main types of RNA :

(i) messenger -RNA (m-RNA)

(ii) transfer –RNA (t-RNA)

(iii) ribosomal –RNA (r-RNA)

m-RNA:

This is also called nuclear RNA. This RNA is synthesised by a template chain of chromosomal DNA. The molecular weight of different m-RNA varies. The m-RNA carries coded genetic message transcribed from DNA for synthesis of specific type of protein. The m-RNA is degraded after its function is over. After its formation it is translocated to the ribosomes.

t-RNA:

It is also known as soluble RNA(S-RNA).There are sixty one types of t-RNA in the cytoplasm. t-RNA is also synthesised by DNA. During protein synthesis each t-RNA picks up a specific aminoacid and brings it to the ribosome. Aminoacid brought by t-RNA are sequentially arranged according to the geneticcodes on RNA and linked by peptide bonds. This is how primary protein molecules are synthesized.

r-RNA:

This RNA is located in ribosomes.80-85% of the total RNA in the cell is r-RNA. r-RNA is synthesised in the molecules. The r-RNA occure in the ribsomes and plays an important role in protein synthesis.

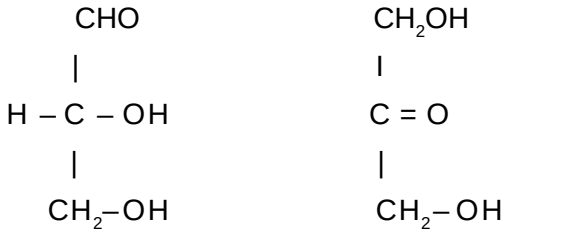
(2) Monosaccharides:-

Monosaccharides are simple sugars. In these types of carbohydrates the values of n and m in the empirical formula $C_n(H_2O)_m$ are most often the same and structurally they have more than one hydroxyl (-OH) groups. A monosaccharide with a free aldehyde (-CHO) group is called an aldose sugar, while the one with a free ketone (>C = O) group is termed as ketose sugar.

Thus monosaccharides or other carbohydrates are called polyhydroxyaldehydes or polyhydroxyketones. These sugars are sweet in taste, soluble in water and can pass through the cell membrane. These carbohydrate molecules cannot be further hydrolysed to simpler forms, hence they are called monosaccharides. Trioses, pentoses and hexoses are the types of monosacharides found in the body of living organisms.

Monosaccharides are classified on the basis of the number of carbon atoms in their molecules. For example, Triose ($C_3H_6O_3$), Tetrose ($C_4H_8O_4$), Pentose ($C_5H_{10}O_5$), Hexose ($C_6H_{12}O_6$) etc.

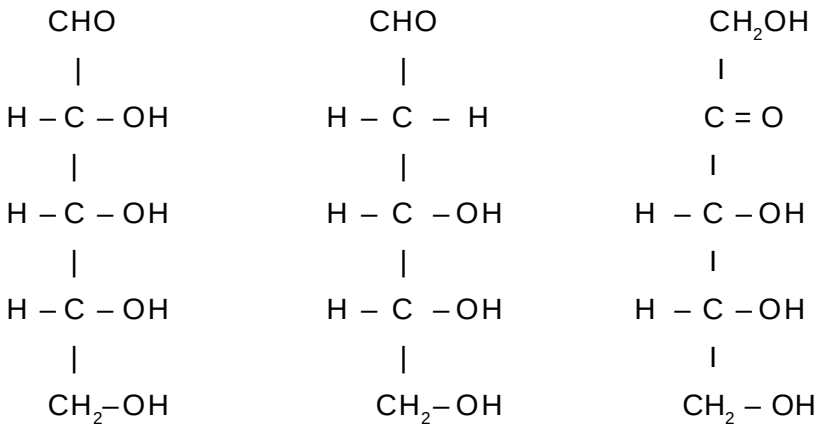
Trioses ($C_3H_6O_3$): Glyceraldehyde and dihydoxyacetone are the examples of trioses. Phosphoglyceraldehyde (PGAL) synthesised during the dark reaction of photosynthesis is an example of the phosphate of aldotriose sugar. Similarly, dihydroxyacetone phosphate fromed during respiration, is an example of the phaosphate of ketotriose sugar.



Glyceraldehyde Dihydroxyacetone

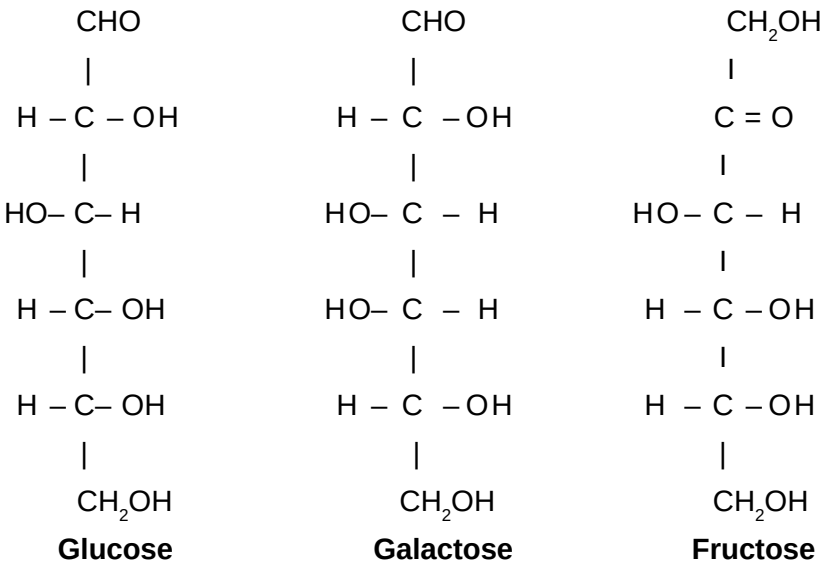
Pentose sugar ($C_5H_{10}O_5$)

The deoxyribose sugar which occurs as part of the structure of DNA, and the ribose sugar found in the structure of RNA and ATP of aldopentose sugar. During the dark reaction of photosynthesis, the sugar involved in the constitution of RUDP(Ribulose diphosphate) is an example of ketopentose sugar.



Ribose De Oxyribose Ribulose

Hexoses ($C_6H_{12}O_6$) : The hexose sugars most commonly include glucose, fructose and galactose. Fructose is a ketohexose found in the juice of fruits. Glucose and galactose are aldohexoses. Glucose is formed by digestion of starch, while digestion of milk yields galactose and glucose. These sugars provide energy to the body.



(3) Growth promoting plant hormones:

The cells of the apical meristem in the plant produces certain organic chemical substances. These chemical substances have considerable impact on the growth and development of the plants.

The growth promoting plant hormones are:

(i) Auxins

(ii) Gibberellin

Auxins:

The coleoptile of monocot plant such as grasses turn its tip in the direction of light. From these experimental studies it was revealed that there is some definite growth promoting chemical in the stem apex. This substance was indentified as auxin, which is chemically found to be Indole acetic acid (IAA) such types of growth promoting hormones are indole aceto nitryl (IAN) and indole acetaldelyde (IAAL).

Auxins accelerate the process of growth by stimulating the cambium cells and inducing rapid cell division. Auxins are used for inducing seed germination, development of roots, producing seedless fruits and for inducing flowering in plants. In agriculture the auxins are used to prevent and minimize immature fruit fall and to distroy the weeds.

Gibberellin:

The fungus gibberalla contain some growth promoting chemical which was indentified and named as gibberellin. They induce the secretion of amylose that converts the starch in to sugar. The germination of seed becomes possible by utilizing this sugar. This hormone accelerates the rate of cell division and cell elongation, causing the increase in the height of plant. It removes the dormancy of seeds and buds and is also helpful in inducing flowering and obtaining seedless varieties of fruits.

A. 2 (A) Answer the following questions.

(1) Velamen tissue is present on the roots of orchids (epiphytes) which is capable to absorb water from the atmospheric humidity and rain.

(2)

Exarch bundle	Endarch bundle
(i) If in the Xylem bundles the protoxylem are found on the outerside and metaxylem towards the centre. Such a arrangement is known as exarch bundle	(i) If in the xylem bundles, the protoxylem lies towards the medulla and the metaxylem lies towards the periphery.
(ii) If is found in dicot roots.	(ii) It is found in dicot stems

(3) The cells of epithelial layer produce digestive enzymes which digest organic nutrients present in the endosperm.

(4) Root pressure:

The pressure, under which the water accumulated in the turgid cells of the cortex is passed on into the xylem elements, is called root pressure.

(B) Describe briefly:

(1) Significance of Transpiration –

(a) A continuous absorption and conduction of water in plant occurs due to traspiration.

(b) The temperature of the plant in maintained.

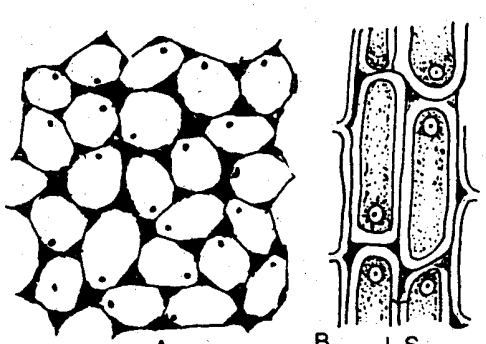
(c) Transpiration keeps the atmosphere cool.

(d) Excess of water gets rid off through transpiration.

(2) The organ of hydrophytes are light, spongy and soft because of Aerenchyma tissue. This tissue consist of small cells,so arranged to form large air spaces. This helps the plant to float on the surface of water and to obtain sufficient light for photosynthesis. Some of the airspaces show special type of partition walls which provides, them mechanical strength.

(3) Living mechanical Tissue:

Collenchyma is a living mechanical tissue. This is a simple permanent tissue. The primary cell wall of this tissue cells is made up of cellulose and inner walls show the thickening of pectin, which is a corbohydrate. Such thickening is more prominent in the angular walls which come in contact with other cells. The tissue renders elasticity and flexibility to the organs. It is found in tender stem, petiole and such other organs of the plants.



Collenchyma

(4) Gynaecium of a typical flower:

This is the innermost essential whorl of a typical flower. Its units are called carpel. Each carpel consist of a (i) stigma (ii)style (iii) ovary.

Stigma :

It is present at the distal end of a style. Its surface is rough, spiny or hairy and sticky or slimy due to mucilagenous secretion. Pollen grains brought by pollination settle on the \stigma

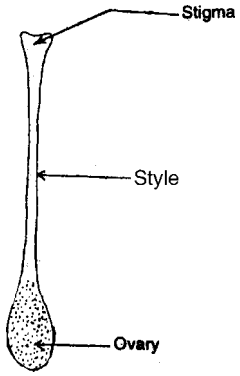
which provides suitable condition for the germination of the former.

Style :

It is a solid delicate, filamentous structure connecting stigma with the ovary. It enables the stigma to receive the pollen grains and forms a passage for the pollen tube. The style falls off after fertilization.

Ovary :

It is a sac-like basal part of the carpel or pistil in which one or several ovules are produced. The ovules are attached to the ovary by means of placenta. The arrangement of placenta and the ovules in relation to the ovary is called placentation. The ovules produced female gametes in them.



(C) Answer precisely: (Any two)

(1) Dark reaction:

This reaction occurs in the presence or absence of light Calvin, Bensen and Bassam studied the pathway of carbon and the important steps in the dark reaction with the use of radioactive C^{14}.

The sequence of events occurring during dark reaction are as follows:

(i) 3 molecule of ribulose diphosphate(RuDP) join with 3 molecule of CO_2 to form 3 molecules of an unstable compound which in turn join with 3 molecules of H_2O to form 6 molecules of phosphoglyceric acid (PGA).

(ii) 6 molecules of PGA interact with 6 molecules of $NADPH_2$ obtaining energy from ATP and set free 6 molecules of NADP as well as an unstable compound (formed by combination of PGA and $NADPH_2$) which in turn loses $6H_2O$ and form 6 molecules of phosphogylceraldehyde (PGAL).

(iii) 5 molecules of PGAL take up phosphate from ATP and form 3 molecules of RuDP through a series of reactions. Thus, 3 RuDP used in itially are regained.

(iv) The remaining one PGAL gets converted into its isomer DHAP (dihydroxy acetone phosphate). Now, this DHAP with one more PGAL from next reaction get transformed in to a molecule of fructose 1,6 - dlphosphate in the presence of the enzyme aldolase. The latter in turn gets converted in to fructose 6-phosphate $\rightarrow$ glucose 6-phosphate $\rightarrow$ glucose through the process of dephosphorylation. During this process of dephosphorylation, 2 ATP are formed.

(2) Internal structure of a dicot leaf :

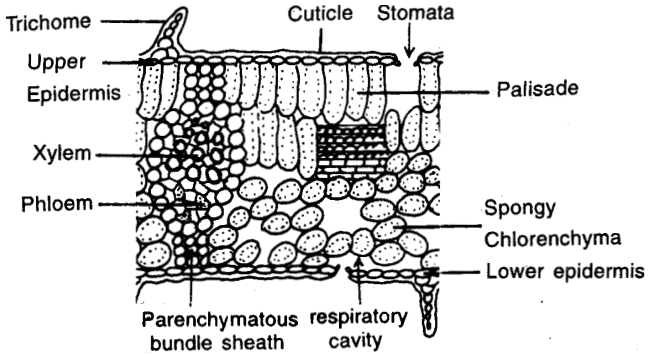
(1) Epidermal tissue system : The leaf being a flattened organ, the epidermal tissue can be described separately as upper epidrmis and lower epidermis. Each of these epidermis is made up of a single layer of parenchymatous cells, having multicellular trichomes and stomata. The outer surface of the epidermal cells are cutinized . The number of stomata is

more in lower epidermis than in the upper one.

(2) Ground tissue system : This tissue system forms the mesophyll which consists of chlorenchyma. The chlorenchyma consists of two layers of more or less compactly arranged palisade beneath the upper epidermis and spongy chlorenchyma above the lower epidermis. The chlorenchyma performs the function of photosynthesis.

(3) Conducting tissue system : The sunflower leaf shows reticulate venation. Hence its transverse section shows vascular bundles cut transversely, obliquely or longitutinally. The larger vascular bundles resemble those in stem except that they lack in cambium and bundle cap and they are surrounded by parenchymatous bundle sheath that extend upto upper or lower or both epidermis. The smaller vascular bundles are simple in structure and are surrounded by a single layer of parenchymatous cells. The xylem in the vascular bundle lies on the upper side and the phloem on the lower side.

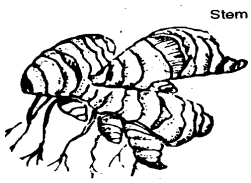
The mesophyll being divided into palisade and spongy chlorenchyma, the leaf is described as dorsiventral leaf.



T.S. of sunflower leaf

(3) Ginger:

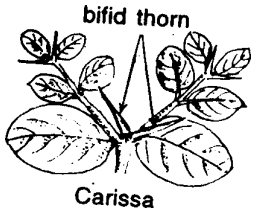
It is an example of stem modification and it is an rhizome. In ginger, the underground stem for food storage grows horizontally and show all the characteristics such as nodes, internodes, leaves, apical bud, axillary buds. Some adventitious roots arise from the surface of the stem.



Ginger

Carissa:

It is a plant showing dichotomous branching, the apical buds in it become modified into strong, leafless, sharply pointed, bifed thorn. The modification is for protection against animal, as well as to reduce transpiration.



Carissa

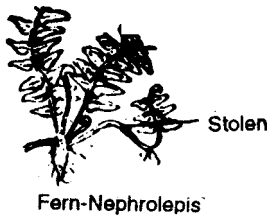
Passion flower:

In this plant the stem being weak and tender the axillary bud developed into a long, spirally coiled and sensitive tendril which twines around the support and thereby helps plant in climbing. It as an example of stem-tendril climber.


Passion flower

Fern :

In fern the underground, vertical stem called rhizome, from which several compound leaves arise. Some of the axillary buds grow into long slender branches. Such a branch grows upward and bend downward like an arch and produces roots and shoot when come in contact with the soil, and produces a new plant. Such a branch is known as stolon.



Fern-Nephrolepis

A. 3 (A) Answer in short:

(1) Synapse :

The nerve ending of the dendron of other neuron are not directly and physically connected with each other but keep extremely minute gaps between the point of contact and form a functional contact. Such an arrangment of interconnection is called a synapse..

(2) Portal vein :

In vertebrates some veins are such which enter some other organs instead of opening in the venacava and capillaries . Such vein, having capillaries at both ends, are called portal veins. All the veins that participate in the formation of the portal vein together form portal system. The name of the organ in which a portal vein enters and capillarise, is associated with the portal vein and portal system. Thus, in frog, there are two portal systems.

(i) Renal portal system

(ii) Hepatic portal system

(4) Deltoid ridge → Humerus bone

Olecranon process → Radio ulna

(2) Just as the forelimb bones are distributed in the region brachium, antibrachium, wrist, palm and fingers, hind limb are also distributed in five regions thigh, shank, ankle, and toes. The number or structure of the bones in the corresponding regions of the two types of limbs shows marking similarity. Such a phenomena known as serial homology.

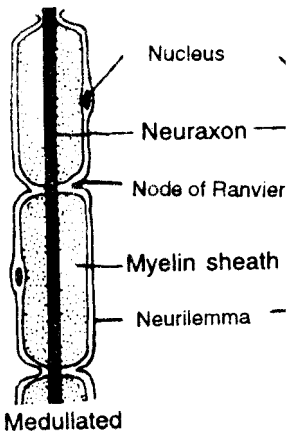
(5) Cyton is the principal component of neuron, which contain cytoplasm and nucleus. The cytoplasm contain Nissl's granules around the nucleus. These granules are thought to be nutritive and are composed of nucleoproteins.

(6) Cranium is formed of six bons namely paired frontoparietal bones, and exoccipital bones, a sphenethmoid and a parasphenoid bones.

(B) Answer briefly as asked for:

(1) **Medullated nerve fibre:**

The axon as well as dendrons are individually enveloped by an insulating coat in order to prevent the diffusion of impulse in the neighbouring processes. Such as insulated cell process of the neuron is called a nerve fibre. Both the types of these processes are enclosed in a series of Schwann's cells. These cells are cylinderical in shape. The outer-most layer of each Schwann's cell is called neurilemma which is continuous with that of the neighbouring Schwann's cells. Beneath the neurilemma lie the neruroplasm and a nucleus of the cell. The neuroplasm of different Schwann's cells remains continuous.

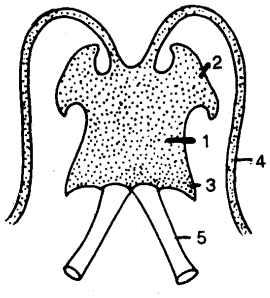


Medullated nerve fibre

Between the cytoplasm and the axon or dendron there lie a large number of compactly arranged layers of lipoprotein which together form an insulating medullary sheath or myelin sheath. This sheath is not continuous with that of neighbouring Schwann's cells. As a result a constriction is formed between two adjacent cells, which is known as node of Ranvier. The central elongated core of the nerve fibre is called neuraxon which is the axon or dendron. The impulse is conducted

through the neuraxon. The nerve fibre having well developed myelin sheath is known as medullated or myelinated nerve fibre.

(2) **Hyoid apparatus :**



1. Body of the hyoid 2. Alary process 3. Posteriolateral process 4. Anterior cornua 5. Posterior cornua

Hyoid apparatus

Hyoid apparatus is located in the floor of the buccal cavity between the two arms of the mandibular arch. It is chiefly formed of a dorsoventrally flattened plate of hyaline cartilage and a pair of rod-like cartilage bones. Its broad central part lying beneath the tongue is called the body of hyoid. There is a pair of flat wing-like alary processes on the two anteriolateral sides of the body of hyoid and a pair of somewhat pointed posterio-lateral processes. A pair of long, flat and thin anterior cornua arise from the anterior margin of the body of hyoid, which form an arch towards the outer side and extend backward to join below the fenestra ovalis of the auditory capsule. Similarly a pair of posterior cornua arise from the posterior margin of the body of hyoid. These posterior comua are the only bones of the hyoid apparatus. They are short and more or less cylindrical and the opening of the glottis lies between the two posterior cornua. The hyoid apparatus provides surface for the attachment of tongue muscles and respiratory muscles. Thus the hyoid apparatus indirectly helps in the ingestion of food and bringing about oscillating movement of the floor of the buccal cavity during the process of breathing.

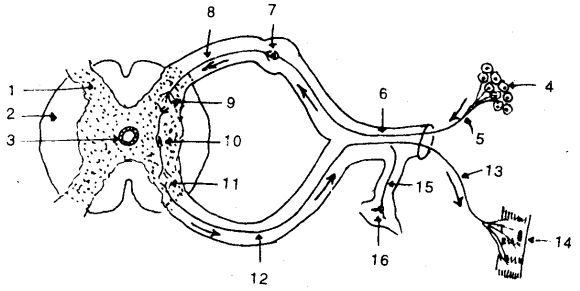
(3) Sexual dimorphism in frog:

	Male		**Female**
(i)	Abdomen is narrow	(i)	Abdomen is broad
(ii)	Presence of nuptial pad in the index finger for copulation	(ii)	No nuptial pad
(iii)	Vocal sacs are seen arising from the floor of the buccal cavity	(iii)	No Vocal sacs
(iv)	It has bright yellow colour	(iv)	It has dull olive green

(C) Answer precisely: (Any two)

(1) Reflex action:

The process of showing involuntary response to a type of stimulus without any information to and knowledge of the volantury centers of the brain is called a reflex action. The voluntary centers of the brain may or may not receive the information after the reflex action is completed but they are in no case informed before the action takes place. The reflex centers being located in the spinal cord as well as in the brain and takes place through either or both of them.



1. Gray matter 2. White matter 3. Central Canal 4. Receptor organ 5. Dorsal branch (Afferent nerve fibre) 6. Spinal herve 7. Dorsal ganglion 8. Dorsal root 9. Sensory nerve cells 10. Reflex centre 11. Motor nerve cells 12. Ventral root 13. Ventral branch (efferent nerve fibre) 14. Effector organ 15. Ramus communicans 16. Sympathetic ganglion

In the reflex action occurring through the spinal cord, any organ connected with sensory nerve endings acts as a receptor organ. The stimulus received by the receptor organs is transmitted through the sensory nerve fibre, to the reflex center located in the dorsolateral sides of the spinal cord, through the dorsal ganglion in the dorsal root of the spinal nerve. The sensory impulse is analysed in the reflex center and the decision about the nature of response is taken there. The impulses regarding the decision are transmited to the effector organs such as muscles and glands, through the motor nerve fibre. Thus the impulse arising due to the stimulation of receptor organ possess through sensory nerve fibre, dorsal ganglion, dorsal root of spinal nerve, reflex center, connector nerves, motor center, ventral root of the spinal nerve, motor nerve fibre to the effector organ. The structural part of this entire path of spinal reflex is called reflex arc.

(2) Course of blood circulation in the heart of frog:

When the sinus venosus contracts and simultaneously the two auricles relax, the blood from the former enter the right auricle through the sinuauricular apeture. At the same time the blood drained from two lungs is passed in to the left auricle through the opening of common pulmonary vein. Now both the auricles contract simultaneously and pour the blood in to the ventricle through auriculo- ventricular aperture. With the contraction of two auricles the valves in the sinu-auricular aperture close the latter and thereby prevent the backflow of blood into the sinus venosus. Experiments conducted on the heart of frog by two scientists Foxon and Vanderveal have clearly shown that the blood entering the ventricle from the auricles through a common auriculo-ventricular aperture becomes mixed. Now when the ventricle contracts the blood exerts force on the auriculo-ventricular valve which causes the closure of the auriculo-ventricular aperture. The chordaetendinae pull the valve towards auricles. This keeps the valve in proper position which prevents the backflow of blood from the ventricle into the auricles. So the blood from the ventricle is forced to enter the truncus arteriosus from where it is flown to all the different parts of the body through all the three pairs of aortic arches, viz. carotid, systemic and pulmocutaneous arches. When the truncus arteriosus contracts the backflow of blood to the ventricle is prevented by three semilunar valves in the former.

The frog, being a poikilothermic (cold blooded) animal, has quite low metabolic rate. So its oxygen requirement is also low which can be easily fulfilled even by mixed blood. Hence the survival of frog is not endangered by the mixed blood supply.

(3) Physiology of urine formation:

The process of separation of excretory substance from blood flowing through the kidneys and removal thereof in the form of urine occurs principally in there phases :

(i) Ultrafiltration .

(ii) Reabsorption .

(iii) Secretion

Ultrafilation :

The lumen of afferent renal arteriole being wider than that of efferent renal arteriole, the blood flows through the former more forcefully than through the latter. Thus, there is a constant difference in pressure between the incoming and outgoing blood through the glomerulus. This

causes ultrafiltration of blood through the very thin walls of the blood capillaries and the inner wall of Bowman's capsule. It is a process of passive transport since no energy is used from ATP for this process. The filtrate entering the uriniferous tubule contains not only a large amount of water and nitrogenous wastes but also several useful substances like glucose, amino acids, mineral salts and ions etc. After ultrafiltration the residual blood flows from the glomerulus into the efferent renal arteriole. This blood contains blood corpuscles, proteins, fatty substances and many of the filterable substances left unfiltered.

Reabsorption:

This process occurs through the cells of the uriniferous tubules and the blood capillaries surrounding them. The uriniferous tubules being very long and convoluted, the filtrate flows through it quite slowly. The flow of the filtrate is aided by the ciliary movement of the ciliated epithelium lining the inner surface of convoluted tubules. Various substances from the filtrate are reabsorbed on the basis of selective permeability of the cell membrane of the cells lining the uriniferous tubules. The reabsorption of water and chloride ions follows the diffusion gradient and hence occurs by passive transport, while the reabsorption of glucose, amino acids and other substances occurs at different rates due to the selective permeability of the cell membrane and against the diffusion gradient. Hence energy from ATP is required for this process and as such it is a process of active transport. About 99% of the total filtrate gets reabsorbed in the blood which includes a large amount of useful substances including water and therefore the phenomenon of reabsorption is of great significance.

The reabsorption of water and mineral salts is regulated under the influence of the hormone aldosterone and vasopressin. Thus, these hormones play an important role in osmoregulation.

Secretion:

The process of secretion occurs from the blood flowing through the blood capillaries around the uriniferous tubules to the lumen of the tubules. The blood flowing through the afferent renal vein and its capillaries contains a large amount of excretory substances which are first absorbed by the cells of the uriniferous tubules and then secreted into the lumen of the tubules. Both the above processes of absorption and secretion by the cells of the uriniferous tubules involve active transport. As a result of secretion of excretory substances the filtrate becomes more concentrated which is now known as urine.

The urine so formed, enters the collecting tubules from which it flows through the ureters and poured in the cloaca drop by drop. From cloaca the urine enters the urinary bladder and stored therein. When the bladder gets completely filled with urine it exerts pressure on the voluntary muscles of the abdominal wall, which contract and induce the involuntary contraction of the urinary bladder. At the same time the sphincter muscles of the cloacal aperture relax to open the latter and thereby facilitate the expulsion of urine to the outside.

A. 4 (A) Answer in short:

(1) Degenerate codons :

There are six genetic codons for the leucine, serine, and arginine while there are two or five genetic codons for other amino acid. Hence, major amino acids consist more than one genetic codons and these genetic codons are known as degenerate codons.

(2) Bateson and punnet (1906) experimentaly proved the phenomena of linked genes and linkage.

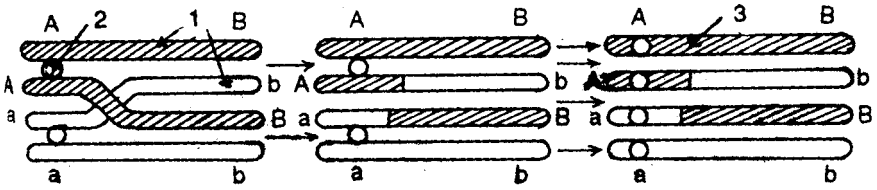
(3) The centromere is located closer to one end of the chromatid and therefore the chromatids on opposite side are very long, While on the other side of the shorter cromatid, a small round structure can be observed, attached by a very thin thread. This is part of the chromatid and is termed as satellite. These thin strands at satellite region are temed as Nucleolar organiser region.

(4) "Petite" the mutant yeasts grow slowly, produced fewer, smaller colonies and have a defective, aerobic respiratory mechanism , because they lack a functional cytochrome system.

(B) Crossing Over:

In the living cell homologous chromosomes normally occur in many pairs. Of a pair, one chromosome is of paternal origin and the other is inherited from the mother. During development of the gametes these chromosomal pairs undergo reduction division. At the same time of division, during Prophase 1 of meiosis, i. e., at the zygotene stage, these homologous pairs come near to each other. They devide along the length of the chromosome to form 4 chromoatid strands. A terminal segment of the chromatid of its homologous chromosome. In substages, pachytene and diplotene the one-one sister chromatids of each homologous chromosome in a pair are closely associated and cross each other at one, two or more places to form chiasma. Lastly in substage, diakinesis during the course of repulsion of chromosomes, sister chromatids break at the chiasma to exchange the segment with each other. An endonuclease enzyme is responsible for the breakage of the segment, while an enzyme, ligase, is responsible for rejoining the segment. This exchange of genes has been termed as Crossing-over. As a result the genetic configuration on both homologous chromosomes of a pair is altered.

Morgan showed the complete linkage rarely occurs because linked genes do not always remain together. Linked genes are often separated due to exchange of chromosomal segments in crossing-over during meiosis the new gene combinations are formed. This phenomenon has been termed as crossing-over.



1. Sister Chromatid 2. Centromere 3. Chromosome after division

(C) Answer precisely: (any two)

(1) Mitochondrial DNA:

Mitochondria , chloroplasts, lysosome and other such cell organellesr also have their own DNA, which acts as cytoplasmic hereditary material and determine the inheritance of certain specific character.

The genetic codons of m-DNA differ from those of chromosomal DNA. Moreover, it produces certain mutation by altering the genetic information. As a result, the phenotypic character of the offsprings get changed, which shows the inheritance in a manner, quite different from the Mendelian one.

The study of inheritance in yeast, by B. Ephrussi and other, has shown that the morphological and physiological characteristics of yeast cells are influenced both by Cytoplasm and nucleus.

A mutant variety of yeast showing mutation in vegetative growth, was discovered while

studying the character regulated by m-DNA in yeast. This mutant variety of yeast shows a very slow growth rate and forms very few and very small colonies. Hence, such a type of yeast is described as petite.

Three varieties of petite mutant yeast have been found (1) Normal petite (P^+) (2) Suppressive petite (P^-) and 3) Netural petite (P^o)

Certain evidences show that petite gene (P^+) is connected with m-DNA. Ephrussi has shown that in such petite yeast cell, the mitochondria are of abnormal type. Their inner membrane is also abnormal. The cytochrome system there in is absent. Hence, such petite yeast cell show defective aerobic respiration and produce much less amount of ATP.

The m-DNA of the supperesive petite (P^-) is defective or quite altered in its constituion from the original m-DNA. The neutral petite (P^o) totally lacks in m-DNA.

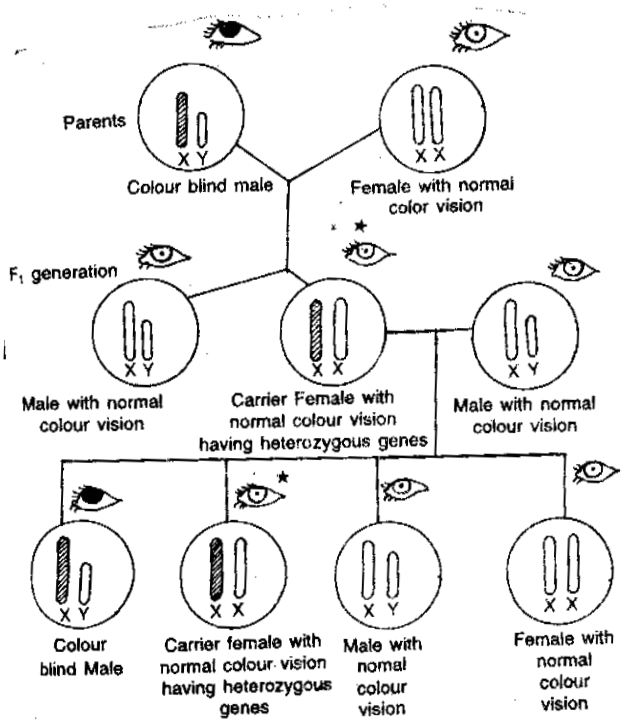
Thus, mutation of m-DNA or total absence of m-DNA may be responsible for the phenotype defects in the petite varities of yeast.

(2) Colour blindness:

Colour blindness in man is due to X-linked recessive genes. A man with colour blindness cannot identify certain colour specially red and green. The defect is more common in male than in female.

Females have 2X-chromosome (xx). If one of the x-chromosome carries the defective gene then the 2nd X-chromosome has the homologous dominant gene and hence in the female the expression of the recessive defective genes does not occur. Therefore females with such a heterozygous gene combination are causes of such diseases, while in the male, there is only one X-chromosome (xy). If such a X-chromosome carries a defective gene, due to the absence of a second X-chromosome with dominant gene the recessive characters will be expressed in the male.

If both the X-chromosomes carry recessive gene (homologous) then the defect is expressed in the female. The character of both the X-chromosome having defective genes is rare compared, to one of the chromosome carrying such a gene. Due to this, such hereditary diseases are expressed more commonly in male than in female.

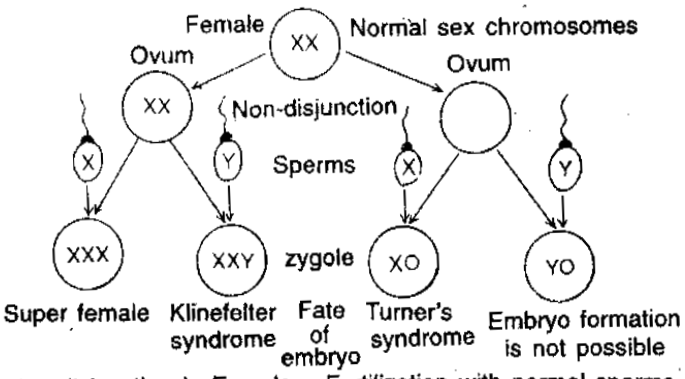


(3) Origin of chromosomal abnormalities :

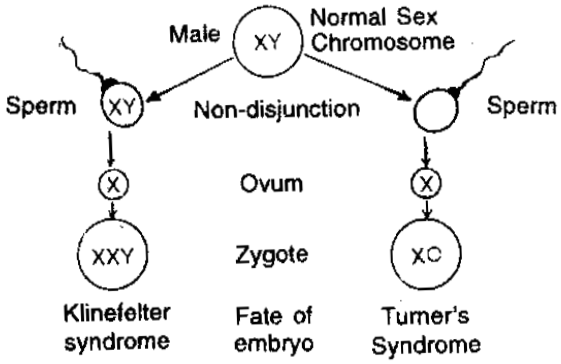
In several cases, during the production of gametes, when reduction division is taking place or at the time of mitosis there can occur abnormalities in the chromosomes.

At the time of reduction division, in the different stages sometimes, one or more of a pair of homologous chromosomes may enter the same lagmete while the other gamete does not receive any of the chromosomes of that pair. In this way, where the homologous pair of chromosomes fail to separate, it is known as non-disjunction.

During mitosis, the centromeres of 2 chromatid of any chromosome pair fail to divide on time during cell division. These chromatids fail to separate from each other and remain in the same daughter, cell, then the cells that constitute that part of the body will aneuploidy or polyploidy and develop cancer or turn malignant, while during meisosis (reduction division) gametes with non-disjunction are produced and such a gamete when participlates in fertilization, then the offsring may develop certain defects or disease conditions.



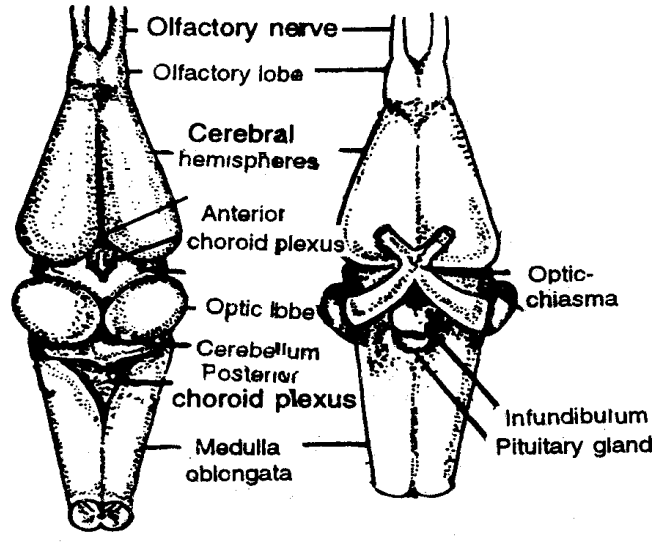
Non-disjunction in Female – Fertilization with normal sperms



Non-disjunction in male – Fertilization of normal ovum

Non-disjunction may take place in either the autosomes or the sex chromosomes.

(D)



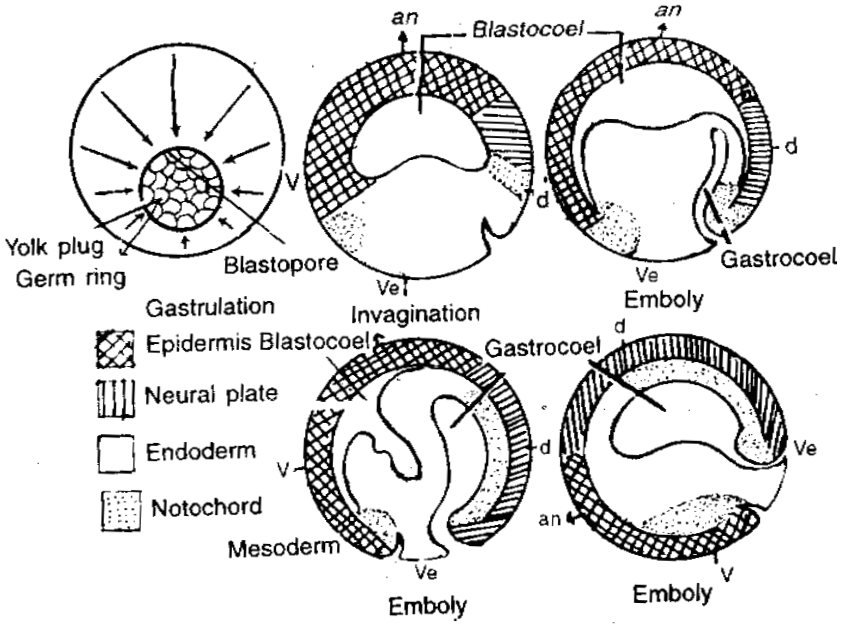
a. Dorsal view b. Ventral view

Brain of frog

OR

Gastrula Stage : Gastrulation is a dynamic process in which, along with the continuity of cell division, the cells of the different prospective areas migrate to their final sites where they form the structural and functional part of the organs later on. During this process the embryo loses its spherical form and becomes oval in shape. Hence the gastrulation is also known as morphogenesis. At the end of this process the gastrocoel (archenteron or primitive gut) and three germinal layers are formed.

Gastrulation is a very complex process during which the processes of invagination and epiboly occur. These two processes occur almost simultaneously, as a result of which the gastrula is formed.



Invagination : As a first step in the process of gastrulation a small horizontal groove arises beneath the grey crescent in the vegetal hemisphere, Through this groove the prospective endodermal cells start in-vaginating the direction of blastocoel and gradually migrate more and more on the inner side.

Epiboly : The invagination of endodermal cells is followed, by that of prospective mesodermal cells. With the progress of invagination of the prospective endodermal cells, the prospective ectodermal cells go on extending in the direction of vegetal hemisphere covering the adjacent cells. The ectodermal cells showing epiboly become flattened. The process of such spreading of the ectodermal cells is known as epiboly.

Germ-ring : With the advancing epiboly as well as invagination the small horizontal groove gradually extends laterally and finally ventrally form a continuous ring-like structure called germ ring. The upper ' margin of the germ-ring is called dorsal lip from which the invagination progress of germ-ring laterally and the invagination-occurring therein the lateral lips are formed. On completion of germ-ring formation the ventral margin of the ring forms ventral lip.

Yolk-plug : When the germ ring formation is completed, almost the entire embryo, except a small round patch of endoderm, gets covered by ectodermal cells. The endodermal patch encircled by the germ-ring is known as yolk-plug.

Emboly : During the progress of germ-ring the invagination of the endodermal cells first form the lining of the archenteron (gastrocoel). This process of invagination is also known as emboly. Simultaneously with the invagination of endodermal cells the prospective mesodermace show epiboly which is followed by emboly to enter inside the embryo, and arrange themselves above the endoderm and beneath the ectoderm.The largest number of cells invaginates from the dorsal lip, a somewhat smaller number of cells invaginates from the lateral lips while the smallest number invaginates from the ventral lip.

Archenteron : With the progres in the size of archenteron the blastocoel goes on diminishing in size and finally disappears altogether. The cavity which is finally formed is known as archenteron, shaping up as a primitive gut.

Blastopore : The germ-ring, now constricts due to invagination and emboly and the yolk-plug becomes smaller. As a result, a small pore called blastopore appear immediately beneath the dorsal lip.

Torsion of embryo : The cells in the prospective areas seen in the blastula stage move and get arranged at the site of their ultimate destination. The centre of gravity changes due to the formation of glastrocoel from one side and degenration of the cells of yolk. Hence the embryo rotates to about 100°, and swims in water keeping archenteron up wards. Embryo becomes triploblastic .

A. 5 (A) Answer in short:

(1) ARC – AIDS related complex. The symptoms of AIDS are collectively known as ARC complex.

(2) NMR – Nuclear Magnetic Resonance

MAB – Man And Biosphere.

(3) Biogeochemical Cycle:

The material cycle like carbon nitrogen cycle which are inter-linked with the biotic factors like producers, consumers, decomposer, and transformers is known as bio-geochemical cycle.

(4) The transfer of energy from one trophic level to the next trophic level through the process of eating and being eaten up is known as food-chain and a interlinked food chain is known as food web.

(5) The person getting an attack of hysteria shows the following symptoms.

(i) Body becomes stiff.

(ii) Choking of breath.

(6) Metastasis is the phenomenon of spreading of cells from the malignant tumour of cancer to different parts of the body through blood or lymph is called metastasis.

(B) Answer as asked for :

(1) The tools required for obtaining any products through genetic engineering technique includes:
(1) Host cell (2) vector (3) Desired DNA and (4) Specific enzyme.

(2) T-cell immunity:

In the foetus the lymphocytes arise from the liver and in the adult, they arise from the bone marrow. The lymphocytes are concerned with immunity. Those lymphocyters which migrate to the thymus gland are called T-cells. After coming in contact with the antigen, the T-cells are able to multiply and produce a large number of new T-cells.

The killer T-cell directly attract the antigen and destroy it. The helper T-cell induce the B-cells to produce antibodies. The suppressor T-cells perform the function of identifying the non-self antigen and, thereafter, of rendering the B-cells and T-cells ineffective. Thus , the suppressed T-cells keep control over the entire immune system.

(3) The main layers of atmosphere from the earth's surface towards the space are troposphere, stratosphere, mesosphere and thermosphere while the farthest layer is known as exosphere. The exosphere has minimum density and it gradually merges with the space.

The atmosphere up to the height of 100 kilometer above the surface of the earth contain a homogenous mixture of gases in motion. This region is known as homosphere. The region of the atmosphere beyond the homosphere is called heterosphere.

(4) Conservation of wildlife is important for ecological balance because, each wildlife is an important member of food-web of its ecosystem in addition to the economic importance. Wildlife is of great

importance since it can prove itself as a gene bank. Man makes use of several impoved varieties of plants and animals in the field of agriculture, animal husbandry and fishery etc.

(C) Write precise notes on: (any two)

(1) Symptoms of Cancer:

(a) Non-healing ulcer in the cheek mucosa or in any other part of the body.

(b) Voice change or sore throat for a prolonged period of time.

(c) Some part of the breast becoming thickened or tumorous.

(d) In women, the blood or badly smelling secretion passesout from the vagina, even without menstruation.

(e) Symptoms such as constipation and indigestion continue for a long time or difficulty in swallowing food and drinks for a prolonged period of time.

(f) Change in the habits of natural call in passing stool and urine.

(g) Any change in the number and size in the moles and warts.

(2) Effect of Air pollution on health

(1) The common complaint is of headache when the air contains pollutants such as benzene, NO_2 and aldehyde.

(2) When ammonia (NH_3)is also present along with the above pollutants, it causes irritation in the eyes along with headache.

(3) Oozing of watery fluid, ,mucous etc. from the nose, repeated sneezing and irritation in the nasal mucosa occur when air pollutant is SO_2.

(4) Cough and caughig increases when the air contain SPM (Suspended particulate matter and SO_2.

(5) Complaint of chest pain due to NO_2.

(6) Anginal pain and changes in ECG are recorded due to CO in air.

(7) Carboxy haemoglobin is found in the cases of heart aliment such as heart attack, in which the amount of Co increase to about 4-6%

(8) Due to increased amount of atmosphere Co, the arteries become stiff and there is its serious effects on the brain.

(3) Antigens and antibodies of blood groups.

The human blood serum contains special type of antibodies. The plasma membrane of erythrocytes in the human blood have certain antigen on its surface. These are called agglutinogens. The antibody that function against this antigen is called agglutinin.

Based on these agglutinogens mainly few types of blood groups, (eg) A, B, AB and O. There is inborn presence of agglutinin against A and B type of antigen, so a person having blood group A having agglutinogen A on in RBC always has antibody b (agglutinin – b) that opposes the antigen B, in its blood serum. Such a serum is known as antiserum b. So if the seum of blood plasma of a person having blood group A is mixed with the blood of a person having blood group B, the agglutinin would interact with agglutinogen-B and cause agglutination of the latter which results in the clumping of RBC. A person with blood group O contain both antibody a and b in its serum and agglutinogen A and B are absent. The antiserum of known type are used to check and determine the blood group of any person. The human blood may also contain Rh antigen on its RBC, but its antiserum does not occur by birth (i.e. by heredity). Hence, the antiserum for testing the Rh group is produced in the body of other mammals through the phenomenon of acquired immunisation which is called Rh - factor. The person who posses this antigen, is called Rh-positive (+ve) and who lacks this is called Rh-negative (-ve).

■