

Paper – 4

- Q. 1 (A) Answer the following objectives :** (4)
- (1) What maintains the pH in the cell?
 - (2) On removal of which element the enzyme carbonic anhydrase is inactivated?
 - (3) What are growth regulators?
 - (4) Which is the special characteristic of the animal hormones?
- (B) Do as directed.** (8)
- (1) Explain the importance of Boron and Molybdenum.
 - (2) Write a short note on Types of proteins.
 - (3) Explain the structure and formation of the nucleic acids.
 - (4) Write a short note on the chemical discovered in the rice field.
- (C) Describe : (Any Two)** (8)
- (1) The structure of enzymes.
 - (2) Anaerobic phase of aerobic respiration.
 - (3) Sex hormones.
- Q. 2 (A) Answer the following objectives.** (4)
- (1) Name the plants in which the arrangement of the root system is in an acropetal succession
 - (2) What is clove?
 - (3) State the location and the function of intervascular cambium.
 - (4) Define hypophysis.
- (B) Write short notes on:** (8)
- (1) leaf
 - (2) Bulbils
 - (3) Mechanism of stomatal transpiration.
 - (4) Plasmolysis
- (C) explain : Any Two.** (8)
- (1) Describe various types of cross Pollination
 - (2) Bean seed germination.
 - (3) The tissue concerned with conduction of water and dissolved mineral salts.
- Q. 3 (A) Answer in brief:** (6)
- (1) State the location and function of tessellated epithelium.
 - (2) Define synapse.
 - (3) Give the names of the wrist bones.
 - (4) What is the difference between chyle and chyme.
 - (5) Give the location and function of periganglionic gland.
 - (6) Give the location and function of fat bodies.

- (B) write short notes on :** (6)
- (1) significance of fertilization.
 - (2) Blastula.
 - (3) Lymph – composition and its importance.
- (C) Describe any two.** (8)
- (1) Transport of CO₂ through blood.
 - (2) Significance of portal system.
 - (3) What is serial homology ? Explain this phenomenon with reference to the limb bones.
- Q. 4 (A) Answer to the point** (4)
- (1) What is splicing?
 - (2) Give the scientific contribution of Linus Pauling.
 - (3) What is the inheritance of Y-linked genes?
 - (4) What is Cis and Trans arrangement of genes?
- (B) Explain : Genetic Code.** (3)
- (C) Answer the following: Any Two.** (8)
- (1) Giving suitable example explain the decisive role of ovum in cytoplasmic inheritance.
 - (2) Write a brief account of semiconservative concept of DNA replication. (diagram is essential).
 - (3) Describe any three errors of metabolism which occur due to mutation in genes.
- (D) Draw a neat labeled diagram. (Any one)** (5)
- (1) systemic venous system of frog.
 - (2) Internal structure of heart of frog.
- Q. 5 (A) Give short answers** (6)
- (1) What is biosphere?
 - (2) Define energy farming?
 - (3) State the laboratory test for AIDS. Which test is more reliable?
 - (4) Define : Fossil Fuels.?
 - (5) Write the full form of SPET.
 - (6) What is Allergen ?
- (B) Answer as per instructions Explain:** (8)
- (1) Why is a blood bank indispensable?
 - (2) Who is superior Man or nature?
 - (3) Explain the three steps of organic reaction that takes place during the production of biogas.
 - (4) Explain the preventive measures against AIDS.
- (D) Answer as per instructions : Any Two** (6)
- (1) Explain hybridoma technique. (diagram essential)
 - (2) Describe the effect of water pollution on health.
 - (3) Describe the production of steroids and antibiotics.

ANSWER**A. 1 (A) Answer the following objectives.**

- (1) What maintains the pH in the cell ?

The buffer system within the cell cytoplasm maintains the pH in the cell.

- (2) On removal of which element the enzyme carbonic anhydrase is inactivated?

On removal of Zn element the enzyme carbonic anhydrase is inactivated.

- (3) What are growth regulators?

The chemical substances produced by the plants in small quantity which have considerable impact on growth and development of the plants are termed as growth regulators.

- (4) Which is the special characteristic of the animal hormones?

The special characteristic of the animal hormones is that "A hormone belonging to the individual of one species may be similar to the corresponding hormone of the individual of other species."

(B) Do as directed.

- (1) Explain the importance of Boron and Molybdenum.

The importance of Boron and Molybdenum is as under.

Boron:

- It is associated with the transport of sugars in plants.
- It plays an important role in the production of fruits and flowers, cell division and certain other processes.

Molybdenum :

- It helps in the fixation of nitrogen which in turn helps in Growth.
- It forms a component of intestinal enzyme in animals.

- (2) Write a short note on Types and properties of proteins.

The types and properties of proteins are as under.

Types :

- There are thousands of proteins in any particular species of living organisms. The protein structure of different species differ from each other. 20 amino acids play an important role in forming different types of proteins just as different alphabets in any language forms large number of words in different combinations. The words in different combinations combine to form different sentences. These 20 amino acids forms a very large number of polypeptides and proteins such as :

Primary protein :

- When polypeptide chains is linear and filamentous the protein structure is said to be a primary protein.

Secondary protein :

- When there are different types of bonds in different number and location in polypeptide chain forming folds and loops, then the protein structure is said to be a secondary protein.

Tertiary or quaternary protein :

- Two or more polypeptide chains are interconnected to form tertiary or quaternary protein.

- (3) Explain the formation and structure of nucleic acid. (diagram not necessary).

There are two types of nucleic acids Deoxyribonucleic acid (DNA) & Ribonucleic acid (RNA). Both the nucleic acids are formed of polynucleotide chain. Polynucleotide chain is formed of many

nucleotides. Nucleotide is formed when nucleoside binds with a phosphate moiety, A nucleoside is formed when a pentose sugar binds with a nitrogen base. The nucleotides bind with each other by a phosphodiester bond to form a polynucleotide chain. DNA has two polynucleotide chains whereas RNA has a single polynucleotide chain.

Structure:

- Watson & Crick discovered in the 19th century a complete & precise model of DNA (in 1953).
- The molecular model shows two polynucleotide chains arranged parallel to each other, running in opposite directions.
- The two chains are connected with each other by weak hydrogen bonds in a definite manner and are spirally twisted & appear like a spiral ladder.
- The purine base of one nucleotide of one polynucleotide chain is linked to the pyrimidine base of another nucleotide of the opposite polynucleotide chain i.e. Adenine of one chain is linked with Thymine of the opposite chain by two weak hydrogen bonds known as π bond. Guanine of one chain is linked with cytosine of the opposite chain by three weak hydrogen bonds called σ bond. Thus the purine and pyrimidine bases are in equal proportion in each molecule of DNA.
- The length of one complete spiral of DNA is 34 \AA while the width is 20 \AA .
- If the sequence of nitrogen base on one polynucleotide chain of DNA is A C G T C A G T A, then the sequence of nitrogen base on the corresponding chain will be T G C A G T C A T. Uracil is absent in DNA.
- RNA has Adenine, Guanine as purine bases and cytosine and uracil as pyrimidine bases.

(4) Write a short note on the chemical discovered in the rice field.

The chemical discovered in the rice field is Gibberellin.

- Two Japanese scientists observed in the rice field some rice plants had unusual height.
- These plants were infected by a fungus called Gibberella.
- This fungus Gibberella contains some growth promoting chemical identified and named as gibberellin.
- There are different types of gibberellins
- All these types are able to induce the secretions of enzyme amylase that converts the starch into sugar.
- The germination of seed becomes possible by the utilization of this sugar.
- This hormone accelerates the rate of cell-division and cell elongation, as a result of which the internodes become longer causing the increase in the height of the plant.
- It removes the dormancy of seeds and buds and is also helpful in inducing flowering and obtaining seedless varieties of fruits.

(C) Describe : Any Two.

(1) The structure of enzymes.

Structure:

- In some enzymes, along with protein, a nonprotein part is linked. The protein part is called

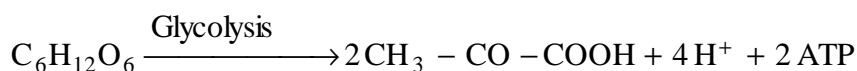
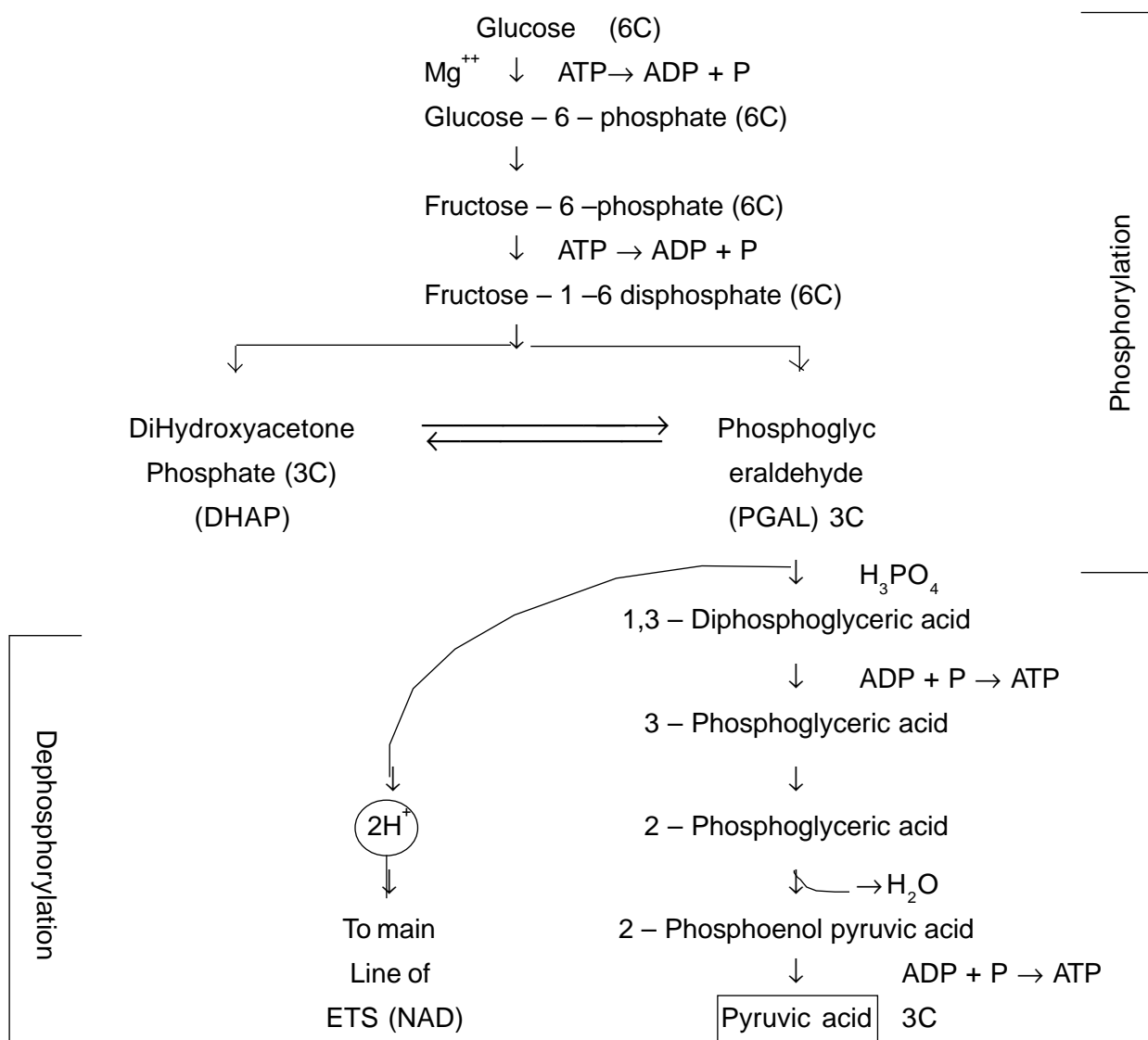
apoenzyme and the non-protein part is called prosthetic group.

- Among the prosthetic groups metallic ions such as zinc, iron, magnesium, sodium or cobalt or any organic substance may be present.
- The prosthetic groups may also be known as co-enzyme or co-factors.
- Organic substance like Nicotinamide adenine dinucleotide (NDA), Nicotinamide adenine dinucleotide phosphate (NADP), Flavin mono nucleotide (FMN) flavin adenine dinucleotide (FAD), etc are co-enzymes.
- The co-factors are the metallic ions which renders the enzyme active and makes it effective.
- Some co-enzymes have vitamins as part of their molecules.
- Deficiency of vitamins causes a reduction in the activity of such enzymes which leads to certain disorders in body functions.
- Sometime enzymes occur in inactive form & becomes active only in the presence of certain chemical or medium eg, Pepsinogen present in the gastric juice secreted by the stomach of the vertebrates is converted into active pepsin only in presence of dilute HCl in the stomach.
- The presence of certain metallic ions is necessary for the activation of some enzyme, eg. Removal of Zn from enzyme carbonic anhydrase causes inactivation of that enzyme.
- Sometimes more than one metallic ion is required for the activation of the enzyme eg. Enzyme enolase is activated in the presence of magnesium, manganese and zinc.

(2) Anaerobic phase of aerobic respiration.

- Cellular respiration whether occurs aerobically or anaerobically starts with glycolysis in which O_2 is not utilized. Hence it is called anaerobic phase of aerobic respiration. It is common for both the processes.
- Glycolysis occurs in cytoplasm.
- Necessary enzymes are obtained from cytoplasm itself.
- Glucose an energy rich compound (potential energy) is inactive which is required to be activated for being phosphorylated for which ATP is utilized
- The process is divided into two sub-phases. Phosphorylation and Dephosphorylation.
- In phosphorylation ATP molecules are used and in dephosphorylation ATP molecules are synthesised.

The process of glycolysis can be briefly shown as follows:



The equation for glycolysis can be given as follows:

Glucose

Pyruvic acid

Phosphorylation :

- A molecule of phosphate (phosphoric acid) released from ATP combines with glucose to form glucose 6 – phosphate. (glucose monophosphate). Here glucose & phosphate are linked where phosphate joins with glucose at the 6th carbon atom of glucose – 6 – phosphate is converted in to its isomer fructose – 6 – phosphate.
- Fructose – 6 phosphate in turn is phosphorylated by another ATP and converted in to fructose 1-6-disphosphate
- A type of lyase – an enzyme aldolase split the fructose –1-6 diphosphate into two molecules of triose phosphate (viz, a molecule of dihydroxyacetone phosphate and a molecule of phosphoglyceraldehyde)
- DHAP & PGAL can be interconverted DHAP is unable to participate directly in the process. It is used only after it is converted into PGAL.

- A molecule of H_3PO_4 joins with PGAL to convert the later into 1-3 –Diphosphoglyceric acid (DPGA) with the liberation of $2H^+$ ions. (In aerobic respiration the $2H^+$ ions, so released go to the main line of ETS)

Dephosphorylation :

- In this DPGA reacts with ADP to form phosphoglyceric acid PGA and ATP.
- The PGA loses a molecule of water and gets converted into phosphoenol pyruvic acid.
- Phosphoenol pyruvic acid reacts with ADP to form pyruvic acid.
- During these process twice $2H^+$ and twice 2 ATP (ie 4 ATP) are formed.
- During phosphorylation 2 ATP molecules are used therefore in glycolysis the net gain of ATP is $4 - 2 = 2$ ATP and 2 molecules of pyruvic acid are formed from one molecule of glucose.

(3) Sex – Hormones.

- The sex-glands not only produce sex-cells ie gametes but they also secrete hormones called sex-hormones.
- Testes and ovaries, therefore are known as endocrinal glands.
- The sex-hormones influences the production of sex-cells, manifestation of sexual characters and behaviour of the organisms.

Testes: It is a male reproductive organ.

- It produces hormones collectively called androgens, chief among them is testosterone.
- FSH of the pituitary gland and testosterone of the testis influence the production of the sperms as well as development and maturation of the spermatozoa. (male sex-cells) in the seminiferous tubules.
- Testosterone is produced by the interstitial cells called the leydig cells.
- The function of the leydig cell is dependent on the interstitial cell stimulating hormone (ICSH) of the pituitary gland.
- Testosterone being a male sex-hormone stimulates the male reproductive organs and accessory (dormant) sexual characters. Similarly, a strong muscular body facial and other body hair (chest) and other masculine features are characteristics dependent on the male sex-hormone the testosterone.

Ovary: It is a female reproductive organ .

- It is partially an endocrinal gland. It secretes the female sex hormone called estrogen.
- The development of oviducts (fallopian tubes) uterus, vagina, mammary glands (breasts) etc is mainly due to the influence of estrogen. Feminine gracefulness, development of breasts etc are manifestation of the action of estrogen.
- During woman hood (adulthood) another hormone called progesterone helps in preparing the uterus for conception and induces conditions favourable for the nurture (breast feeding) of an infant.
- The development of ova in the ovary is brought about by the combined action of FSH, LH and LTH. Similarly the functional development of ovarian follicles, producing estrogen depends upon FSH and LH.
- After ovulation, ie release of ovum, the subsequent elaboration of progesterone is facilitated by formation of corpus luteum.
- A total lack of gonads (sex glands) leads to the absence of sex hormones resulting in infertility and the absence of secondary sexual characters.
- If the sex-glands are destroyed or if they undergo degeneration after puberty then appreciable changes do not occur with regard to secondary sexual characters.

- Conversely, degeneration of gonads prior to puberty results in conspicuous alteration in sexuality, secondary sexual characters and sexual development.

A. 2 (A) Answer the following objectives :

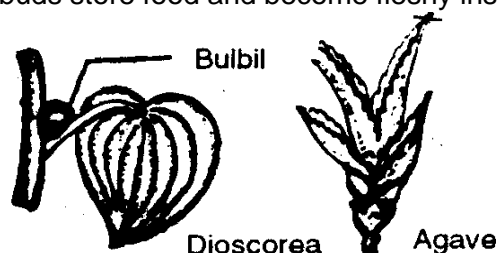
- (1) Name the plants in which the arrangement of root is in acropetal succession.
Plants like Datura and Vinca have the arrangement of root in acropetal succession.
- (2) What is clove ?
In garlic each of the axillary bud in the axil of the scaly leaves has stored food material in one of its scaly leaves. Each such bud is enclosed in a tough, scaly membranous leaf and is known as a clove.
- (3) State the location and function of intervacular cambium.
Location of intervacular cambium: it is found on the lateral sides of the growing stem and root
Function It is responsible for the formation of secondary tissues which increases the diameter of the stem & the root.
- (4) Define hypophysis:
The terminal cell of the suspensor which is closely associated beneath the octant is called hypophysis cell.

(B) Write short notes on :

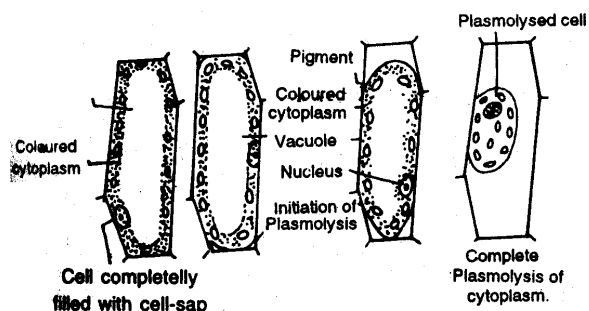
- (1) leaf :
 - It is an important part of the plant
 - It always develops from the node of the stem.
 - It may be scaly or usually green, dorsoventrally flattened having limited growth and life span.
 - The green colour is due to chloroplast in most of its cells.
 - A typical leaf consists of a leaf base, petiole stipules and the lamina.
 - The leaf is said to be petiolated or sessile on the basis of presence or absence of petiole eg leaf of sunflower is petiolated and that of maze is sessile.
 - The leaf may be simple or compound.

Normal functions of leaf :

- Due to large number of chloroplasts in leaves they are able to synthesize organic food through photosynthesis.
 - They lose a large amount of water through stomata by a process called transpiration.
 - They also perform gaseous exchange through stomata for respiration.
- (2) Bulbils :
 - When an axillary bud or a floral bud becomes fleshy by storing food and performs the function of vegetative propagation instead of developing into a branch or a flower, it is called a bulbil.
 - In dioscorea, the axillary bud stores food and becomes fleshy and hard.
 - It detaches from the parent plant and germinates under favourable condition and gives rise to a new plant.
 - In agave the floral buds develop in bunches on a long floral axis.
 - Some of these floral buds store food and become fleshy instead of developing into flowers.



- In both of these plants vegetative propagation takes place when the plant is passing through the active phase of growth during favourable conditions for perpetuation of life.
- (3) Mechanism of stomatal transpiration.
- Due to the effect of atmospheric temperature the relative humidity in the atmosphere decreases during the day time.
 - At this time the internal environment in the leaf is saturated with moisture
 - According to the simple law of diffusion the water vapour thus diffuses from the leaf through stomata into the atmosphere.
 - Since the amount of water in the cells decreases, the cells obtain water from the adjacent xylem elements to compensate the loss.
 - This is a continuous process during day time while at night it occurs almost negligibly.
 - Through the process of photosynthesis the guard cells synthesize glucose during the day time as they contain chloroplasts and a major part of glucose is converted into starch.
 - The CO_2 produced as a result of respiration as well as that which is in close vicinity of the stomata is used in the process of photosynthesis.
 - As a result of reduction in the quantity of CO_2 the PH increases in the guard cells which therefore becomes alkaline.
 - Due to this the permeability of their walls increases and the water from the surrounding epidermal cells is absorbed by them.
 - The guard cells, thus, become turgid and cause the opening of the stoma.
 - Photosynthesis does not occur after sunset, for want of light, as a result CO_2 is not utilized and it accumulates in the environment.
 - As a result the PH decreases in the guard cells thus becomes acidic to some extent.
 - So the guard cells lose their turgidity and close the stomata
 - The stomata thus remain closed at night.
- (4) Plasmolysis : The solution of relatively higher concentration is called a hypertonic solution while the one having relatively lower concentration is called a hypotonic solution. The solution having relatively similar concentration is called an isotonic solution. When the coloured cells of the epidermis of Tradescantia leaf are kept in hypertonic sugar solution and observed after some time under the microscope, the cytoplasm is seen to have shrunk and separated from most part of the cell wall. This phenomenon of shrinking of protoplasm is known as plasmolysis. This process can also be easily observed in the coloured cells of petals of rose, tomato peel etc., as the cytoplasm is colourful.



(C) Explain any two :

- (1) Cross Pollination:-

Wind pollination: Several plants such as cocounut palm, date palm, Indian hemp, maize and several species of grass show wind pollination. The wind pollinated flowers are unisexual. They are generally dull in colour and lack showiness, odour and nectar. Their pollen grains

are very small, round, smooth and very light in weight and are produced in a very large number. The pollen grains do not absorb moisture easily and hence do not become heavy. This is suitable for wind pollination. The pollen grains of *Pinus* are winged (an adaptation for wind pollination).

Water Pollination:- This type of pollination occurs on the surface of water or inside the water. In *Vallisneria* plant, it occurs on the surface of water. In this plant the male flowers get detached from the plant and float on the surface. The female flowers have long and slender peduncle. The flowers reach the surface when the coiled peduncles become straight and elongated. The male flowers surround the female flowers. At this time the anthers burst and the sticky pollen grains stick to the stigma of pistil. After this type of pollination the spirally coiled peduncle contracts and pulls the female flower under water.

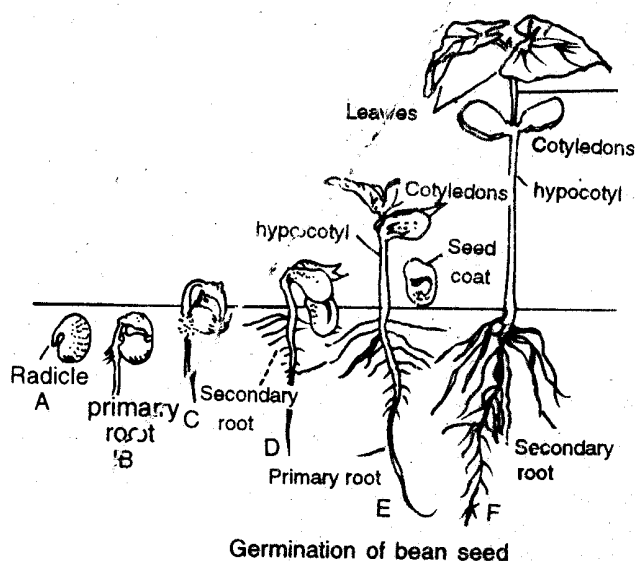
Insect Pollination:- This is a very common type of pollination in plants. Most of the insect-pollinated angiospermic plants have large, beautifully coloured and attractive flowers with pleasant odour and sweet nectar. Their arrangement is also such as to attract the insects. The flowers, if small, are in clusters. The pollen grains are round, smooth and sticky or having spiny or hairy surface. Such pollen grains stick to the hairy surface of the body parts of the insects such as honey bees, moths, butterflies etc. and are carried to other flowers thereby causing pollination.

Pollination by birds:- Some small birds with long beak are in search of nutritive food like nectar or honey from the flowers. Such birds visit the flowers and unknowingly cause pollination. *Bombax*, *Aloe*, *Yellow oleander* etc. are bird-pollinated plants. Such plants have bell or funnel-shaped corolla and nectar in the flowers. The petals have attractive colours such as red, yellow, blue etc.

Pollination by bats:- The bat is a nocturnal, flying mammal. It visits large flowers having strong odour. It flies swiftly at night and carries pollen grains with itself to quite a long distance. *Kigelia* is a tree that shows pollination of its flowers by bats.

(2) Bean seed germination (diagram is necessary)

- The seed is sown in the loose and moist soil; it imbibes water through the micropyle due to which it becomes active and enlarged.
 - As the entire seed swells, the cells obtain energy from the stored nutrients by the process of respiration.
 - The radicle develops first, which elongates and emerges through the micropyle.
- Germination of Bean Seed.



- The radicle elongates in the direction of soil and water and gravitational force and forms the primary root.
- On continuous absorption of water the seed swells more and more which results in bursting of

seedcoats.

- The hypocotyl grows and elongates into a loop-like structure and emerges from the soil.
- The hypocotyl lies in connection with the radicle at one end and the plumule at the other end.
- The primary root gradually develops from the radicle and produces branches and sub-branches and forms normal tap root system.
- The hypocotyl grows straight and erect thereby pulling out the cotyledons with the enclosed and well protected plumule from the seed coats.
- The two cotyledons become separated from each other owing to the reduction of nutrients there in, while the plumule develops and produces the first leaf beneath the apical bud.
- Subsequently the leaves develop with the growth of the seedling.
- The shoot between the two cotyledons and the primary root is called hypocotyl, where as that beneath the cotyledons and the first leaf is called epicotyl.
- The two cotyledons come out above the soil during the seed germination of bean seed, thus the bean seed germination is called epigeal germination.

(3) The tissue concerned with conduction of water and dissolved mineral salts.

The tissue concerned with conduction of water and dissolved mineral salts is termed as xylem.

- Most of the components of this tissue have their walls lignified, hence they provide more mechanical strength.
- The components of xylem are as under:

(1) Tracheids :

- They are fundamental components of xylem.
- They are unicellular, long and cylindrical structures tapering at both ends.
- Their highly lignified walls are not uniform, The thickenings forms the secondary layer of the cell wall.
- The thickenings in the wall are of different types such as spiral annular, reticulate, scalariform pitted or bordered pitted.
- The tracheids formed earlier shows annular or spiral thickening, but those formed later show the other types of thickenings.
- The tracheids are the dead cells found in pteridophytes, gymnosperms and primitive angiosperms.

(2) Trachea :

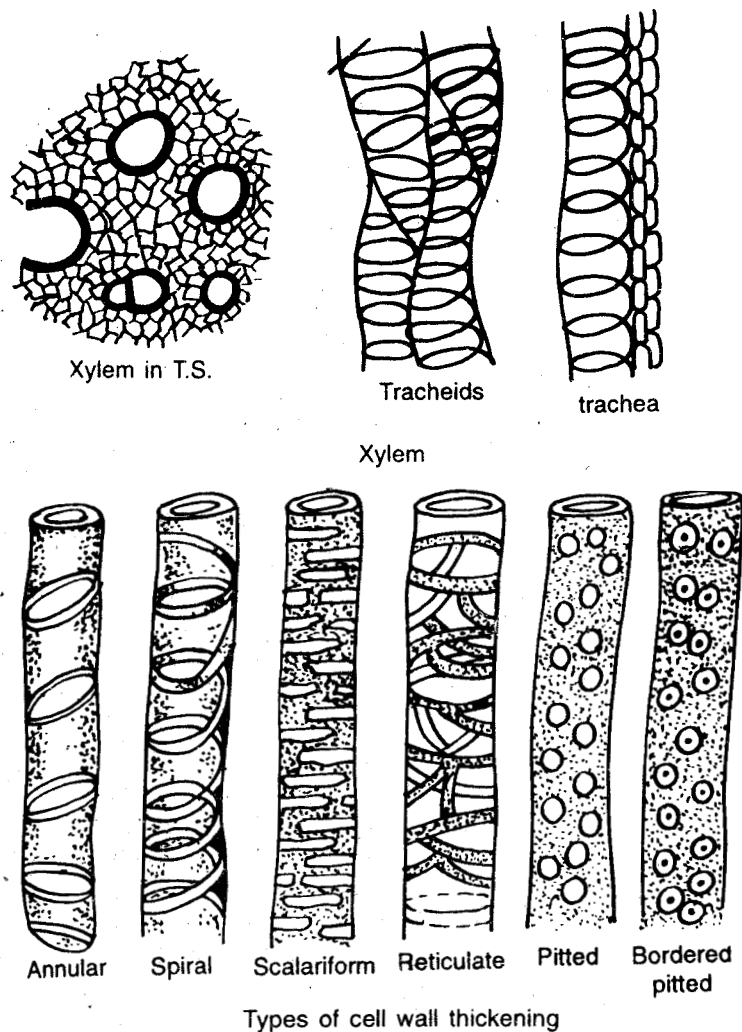
- The tracheid cells are arranged one above the other in a linear manner lose their partition walls and form a continuous tubular structure for conduction of water & dissolved mineral salts.
- Trachea show various types of thickenings in their walls.
- The conducting capacity of trachea is better because of their larger lumen.
- Due to lignin thickenings the trachea provides mechanical strength and rigidity.
- They are found in certain pteridophytes, certain higher gymnosperms and in angiosperms.
- They are absent in several aquatic angiosperms, saprophytic and parasitic plants and fleshy plants.

(3) Xylem parenchyma

- The living parenchymatous cells associated with xylem are known as xylem parenchyma
- The cells associated with primary xylem are thick walled.

- They may contain starch grains, oil droplets and certain other cell inclusions and are believed to help in lateral conduction.
- They are also known as wood parenchyma.

(4) Xylem sclerenchyma (wood fibres) :



- The fibrous cells associated with xylem are called xylem sclerenchyma.
- They are believed to have originated along with tracheids.
- Their walls are more thickened and hence smaller than tracheids with narrower lumen.
- They provide mechanical strength and rigidity to the organs.

A. 3 (A) Answer in brief

- (1) State the location and function of tessellated epithelium.

Tessellated epithelium are seen in the wall of blood vessels.

As this tissue is very thin, it is concerned with diffusion and filtration processes.

- (2) Define "Synapse".

The nerve endings of the axon of one neuron and the nerve endings of the dendron of other neuron are not directly and physically connected with each other, but keep extremely minute gaps between the points of contact and form a functional contact, such an arrangement of interconnection is called a synapse.

- (3) Give the names of wrist bones

The wrist bones are called carpals. They are six in number arranged in tow rows. The proximal

row consists of a radial, an inter, mediale and an ulnare, while distal row consists of a trapezium, a trapezoid and capitatohametum.

- (4) What is the difference between chyle and chyme.

Digestion is completed in the small intestine when the food is converted into alkaline fluid form which is called chyle.

The food which enters from stomach to duodenum is partially digested and becomes acidic which is called chyme.

- (5) Give the location and function of periganglionic gland.

In the neural canal, near the intervertebral foramen, there is a dorsally located periganglionic gland, gland of swammerdam, which secretes white and bright calcareous material. This secretion hardens and renders tensile strength to the root of spinal nerve.

- (6) Give the location and function of adipose tissue.

In both male and female frogs several fat bodies are attached to the anterior ends of kidneys.

Fat body formed of adipose tissue having lot of stored fat in its cells. This fat provides energy for survival during hibernation and aestivation.

(B) Write short note on: Significance of fertilization.

Generally the unfertilized egg does not develop into embryo and produce a new animal Fertilization is, Therefore, essential.

The haploid egg and the haploid sperm produced during gametogenesis meet and fuse with each other in the process of fertilization and establish the diploid state in the zygote.

The specific diploid number of chromosomes of the species is maintained. The maturation of the egg cell is completed only after the entry of the sperm in it.

The process of fertilization adds new vigour and activeness in the egg cell which becomes active for embryo development.

- The fertilization brings about the combination of characters of both the parents in the offsprings.
- The grey crescent formed in this process determines the future anterior posterior axis and the axis of bilateral symmetry in the spherical zygote.

- (2) Blastula (figure is not required)

- A very small cavity arises in the animal hemisphere as a result of cleavages. It is called segmentation cavity which makes its first appearance at the end of 8 celled stage of the embryo.
- With the continuation of further cleavages this cavity becomes more and more distinct and enlarged. It is now called blastocoel which is filled with some fluid. Thus, the embryo becomes hollow.
- Its roof is formed of 2-3 layers of micromeres and the floor is formed of megameres. The embryo having blastocoel is called blastula. The zygote floats on the surface of water with the animal hemisphere and animal pole on the upper side due to its telolecithal form.
- The blastocoel being formed in the embryo in the animal hemisphere. It further adds to the stability of the embryo in keeping the animal pole above.
- Externally blastula stage shows only micromeres and megameres and internally the blastocoel in addition to the above cells. Thus a fate map of prospective areas can be drawn even in the blastula stage of the embryo. Prof vogt experimented on the frog embryo using improved staining technique and found some more prospective areas.

- (3) Lymph- composition and importance.
- When the blood is flowing through the blood capillaries, some of its constituents ooze out through the thin walls of the capillaries and flow around the tissue cells in the intercellular spaces.
 - Certain types of WBC such as lymphocytes and basophils traverse through the cells of the walls of the blood capillaries and come out along with the fluid part. This fluid and the WBC there in separated from the blood flow amidst the tissue cells and known as lymph.
 - The lymph is a colourless, alkaline fluid containing only certain types of WBC and totally devoid of RBC.
 - It contains more water and metabolic wastes and less amount of protein as compared to that in the blood plasma.
 - Even fibrogen is less in lymph than in blood plasma.
 - The lymph has the property of clotting as is in blood. The lymph acts as a fluid agent for the exchange of nutrients, respiratory gases as well as soluble metabolic wastes between the blood and the tissue cells.
 - All the parts of the body of frog possess a complex network of thin walled lymph vessels formed by their union with each other. Lymph provides an important fluid medium for the physiological process like nutrition, respiration, excretion etc.

(C) Describe any two of the following :

- (1) Transport of CO₂ through blood.
- CO₂ set free as a result of tissue respiration is transported through blood in different forms which is a complex process. Transport of CO₂ coming from body tissues.-
 - A very small amount of CO₂ coming from tissues dissolves in the water of blood plasma, while major part enters in RBC which is transported as physical solution to the respiratory surface.
 - A considerable amount of CO₂ entering the blood reacts with plasma proteins of blood plasma in the presence of sodium and haemoglobin in RBC in the presence of potassium to form carbamino proteins (NaPr) and carbamino haemoglobin (KHb) respectively.
 - These carbamino compound are transported through blood to the respiratory surface where CO₂ is separated and diffused out. A major part of CO₂ is transported in the form of bicarbonates as follows.-
 - CO₂ reacts with water (H₂O) in the blood plasma as well as RBC to form H₂CO₃.
 - In blood plasma some of the H₂CO₃ formed combines with carbamino protein compound (NaPr) and forms NaHCO₃ and HPr, while some H₂CO₃ combines with buffer Na₂HPO₄ and forms NaH₂PO₄ and NaHCO₃
 - In RBC, CO₂ and H₂O combine and form H₂CO₃ with the help of the enzyme carbonic anhydrase. The acidity in the RBC increases due to formation of H₂CO₃.
 - To neutralize this, the formed H₂CO₃ combines with carbamino haemoglobin compound (KHb) to form KHCO₃ and HHb with the formation of H₂CO₃. To neutralize this, the formed H₂CO₃ combines with the formation of KHCO₃ the alkalinity increases in RBC. Hence the osmotic pressure increases, as such the RBC imbibe water from the blood plasma and swell. Continuation of this process may cause haemolysis.
 - The cell membrane of RBC is permeable to anions only the Cl⁻ dissociate from NaCl in blood plasma and enter the RBC to react with KHCO₃ and form KCl and HCO₃⁻. This is called chloride

shift. The HCO_3^- ions come out of RBC and react with Na^+ ions to form NaHCO_3 in the blood plasma.

- Thus with chiefly NaHCO_3 in the blood plasma and KCl and HHb in the RBC, the blood reaches the respiratory surface.

(2) Significance of Portal System -

The veins drain blood from different organs and collect different substances from them to be carried towards the heart, while the portal vein capillaries in Certain definite organs to come in direct contact with maximum number of cells, thereby providing them a large surface area for absorption of material from the blood.

- Significance of Renal portal system -
- The hind limbs of frog are the most active organs. Hence the blood coming from them contains a considerably large amount of metabolic wastes. The blood comes into the kidneys through the renal portal system.
- The cells of the uriniferous tubules are able to absorb the metabolic wastes from these capillaries and render the blood free from harmful wastes.

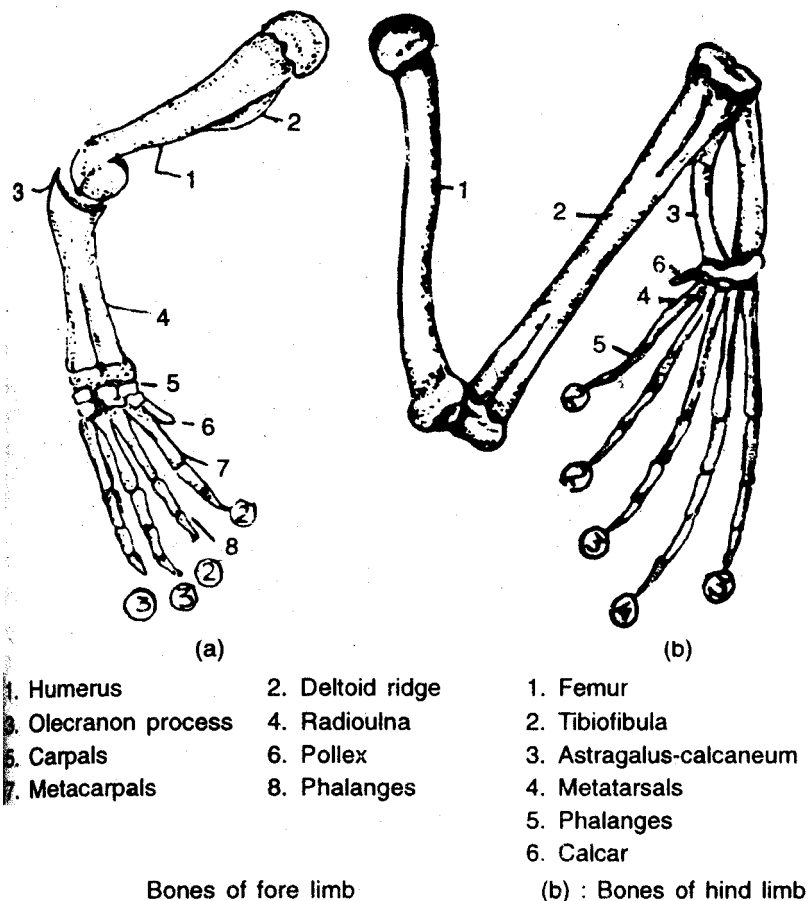
Significance of Hepatic portal system

- The surplus glucose from that absorbed by the blood from the digestive tract is absorbed by the hepatic cells and converted and stored as glycogen which is consumed for obtaining energy during aestivation and hibernation.
- Bacteria and other microbes that have entered the blood through the rectum or any other part of the body are engulfed and destroyed by the hepatic cells.
- The poisonous and badly smelling substances etc. produced as a result of incomplete oxidation of proteinous substances in the large intestine by bacteria are removed by hepatic cells.
- The hepatic cells first convert them into ammonia and then into Urea by combining with CO_2 .
- The surplus amino acids from those absorbed by the blood from the intestine undergo deamination after getting absorbed by the liver cells.
- The amino group ($-\text{NH}_2$) so separated is converted into glucose and stored in liver in the form of glycogen.

(3) What is serial homology ?

Explain this phenomenon with reference to the limb bones.

- Hind limb bones include a femur, tibiofibula, tarsals, calcars, metatarsals and phalanges, which are all cartilage bones.
- The hind limbs being used for jumping and swimming they are much longer than the fore limbs.
- Hence all of their bones are relatively longer and stronger.
- Just as the fore limb bones are distributed in the five regions, brachium, antebrachium, wrist palm and fingers, the hind limb bones are also distributed in the five regions, thigh, shank, ankle, sole and toes.
- The number or structure of the bones of the corresponding regions of the two types of limbs show marking similarity such a phenomenon of corresponding similarity is called serial homology which is also exhibited in the vertebral column and the girdles of frog.



A. 4 (A) Answer to the point

(1) What is splicing ?

During the formation of mRNA, only the transcribed portion of exon gets separated and are joined together to form a straight mRNA chain. This is called splicing.

(2) Give the scientific contribution of Linus pauling.

Linus pauling first described sickle cell anaemia disorder.

(3) What is the inheritance of Y-linked genes.

Certain genes are located only on the Y-chromosome, of which many are involved in the mechanisms of sex determination and differentiation.

– In man the growth of hair on the ears rims and beard and development of testes are controlled by genes located on the Y-chromosome and hence they are expressed only in the male. Such genes are termed as holandric genes, such characters are transmitted from the father to the son.

(4) What is Cis and Trans arrangement o genes ?

Cis linkage is the term used it both dominant genes are linked on one chromosome and both recessive genes on other homologous chromosome.

– In trans linkage is the term used, if one dominant gene and one recessive gene on one chromosome and a recessive and other dominant genes are linked on other homologous chromosomes.

(B) The Genetic Code: The various nucleotides of DNA template are arranged in a definite linear sequence along the length of a DNA strand. Each nucleotide is recognised by its nitrogenous base. This sequence of nucleotides forms a definite chemical code which determines the specific sequence of amino acids to be arranged on the ribosomes for the purpose of protein synthesis.

There are only four types of nitrogenous bases (A, C, G & T) in the DNA molecule. The genetic code comprises of a definite order or arrangement of these four bases. If each base

represents as a code for one amino acid, then they can represent only four amino acids. In the same way, if two similar or different nitrogen bases form a duplex code, then a maximum of 16 amino acids can be coded, which are not sufficient for 20 amino acids. Hence the code must consist of a sequence of more than 2 nitrogenous bases. If a sequence of three same or different nitrogen bases from the genetic code, then 64 possible triplet codons can be formed from the different combinations of the 4 nitrogen bases. These numbers are sufficiently enough to represent 20 amino acids. Nirenburg and his co-workers experimentally proved that each amino acid is represented by one or more triplet condons. There is a single triplet genetic code (AUG and UGG) for the amino acid methionine and tryptophan. Three genetic condons are for iso-luecine. There are six genetic condons for the leucine, serine and arginine, while there are two or four genetic condons for other amino acids. Hence, major amino acids consist more than one genetic condon and these genetic condons are known as degenerate condons. The degenerate condons do not overlap each other and also one genetic code does not represent more than one amino acid. So that the chances of genetic mutation decreases due to these degenerate condons.

(C) Answer the following

(1) Giving suitable example, explain the decesive role of ovum in cytoplasmic inheritance.

- Carl correns and his co-workers suggested the possibility of inheritance pattern of plastids may be regulated by cytoplasm.
- Correns explained this phenomena based on experiments carried out in the '4'-O cloak plant, *Mirabilis jalapa*.
- When a pollen of a flower on the branch (male) with completely green or pale or variegated leaves were used to pollinate the flower on the branch (female) of a completely green variety, the offsprings always developed a completely green leaf phenotype.

P	Carpel of a flower on completely green branch (female)	X	pollen of a flower on green pale or variegated (male)
		↓	

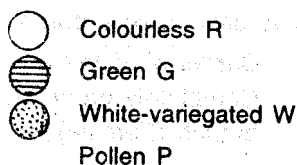
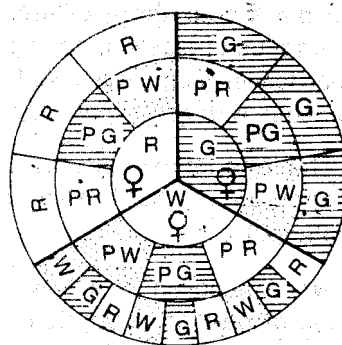
F1 only completely green variety

- When a pollen of flower on a branch (male) with completely green leaves was allowed to pollinate the carpel of the flower on the branches (female) having green, pale or variegated, leaves, the offepring always showed all three mixed characters (green, pale or varieg ated) variety braches.

P	carpel of flower on branch with green pale or variegated leaves	X	pollen of flower on branch with completely green leaves
		↓	

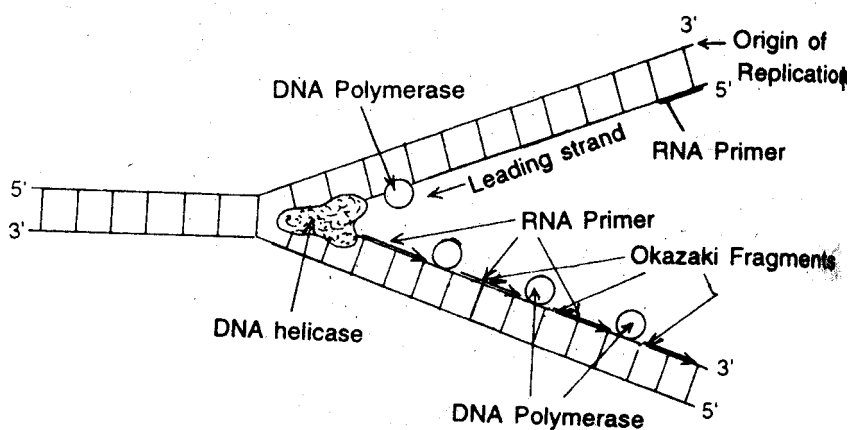
F1 offspring with green, pale, variegated leaves.

- The offspring obtained by various crosses as mentioned above, has shown “maternal effect”, because ovum has a large quantity of cytoplasm as compared to pollen. Thus it is possible to regulate the characters due to the presence of plastids DNA for its pattern of inheritance. shown in the figure the central circle represents the type of branch that produces flower which are pollinated. Intermediate circle represents branch from which pollen is used and other circle shows progeny.



Extra-Nuclear inheritance
in *Mirabilis jalapa*

- (2) Write a brief account of semi conservative concept of DNA replication (diagram is essential)



26.3 : DNA Replication

When a cell divides a similar DNA is (genetic material) transferred from the parent cell to the daughter cell produced by this division. Each cell must therefore replicate its DNA content. Through replication from the parent DNA a new DNA strand is synthesised DNA is a double helix, formed of 2 strands held together with weak hydrogen bonds and basic protein.

- To begin replication special “helicases” enzyme opens up the segments along the DNA double helix.
- The energy is obtained from ATP for this process. Each DNA separated strand acts as a template.
- New DNA synthesised on a specific sequence of Nitrogenous bases of the template
- The RNA polymerase creates a short strand, a RNA primer which is complementary for each related DNA strand. Once the primer is in position the enzyme DNA polymerase starts the process of DNA replication.
- One of the new strands called the leading strand grows in the 5' → 3' direction DNA polymerase

is able to add new nucleotides continuously to form the complementary daughter strand in the 5' → 3' direction. New nucleotide monomers are added continuously and join one by one to the 3' end of the growing new strand by phosphodiester linkages.

- The new strand of DNA produced anti parallel to the other parental DNA strand is known as lagging strand, which also grows in 5' → 3' direction.
- The DNA polymerases are unable to join nucleotides continuously in the growing direction of the new strand, hence the DNA on lagging strand cannot be synthesised straight. But the daughter DNA for this template is there fore synthesised discontinuously in short pieces called OKAZAKI FRAGMENTS.
- The nucleotides of RNA primer are also removed one by one. The newly produced okazaki fragments are joined with each other by the help of DNA ligase enzyme, to form 5' → 3' DNA strand, which remains close and parallel to the original antiparallel 3' → 5' DNA strand.
- Thus each parental DNA strand synthesizes a complete molecule of DNA by forming its own new counter strand. Hence each new DNA among the two DNA produced by one parental DNA, comprises of one parental DNA strand and other newly synthesised strand in this way the production of each DNA molecule maintains the semi conservative concept.

(3) Describe any three errors of metabolism which occur due to mutation in genes.

Abnormalities arise from changes in chromosomal structure and number, so also changes in the structure of the genes cause several defects in metabolism. Due to breakage in the chromosome and their irregular reconstitution eg.: Ionising radiation such as x-rays and several chemicals.

Phenyl ketonuria (pku): Generally the amino acid phenyl alanine is found in the normal diet with the help of the liver phenyl alanine hydroxylase it is converted to the amino acid tyrosine. In the disorder phenyl ketonuria, due to the alteration of a homozygous recessive gene the enzyme phenyl alanine hydroxylase is not produced. As a result, this disorder arises. This homozygous recessive gene has been termed as the pk gene. In this disorder therefore, phenylalanine is converted to phenyl pyruvic acid, which increases in concentration in the blood. This has an adverse effect on the nervous system and reduces the intelligence.

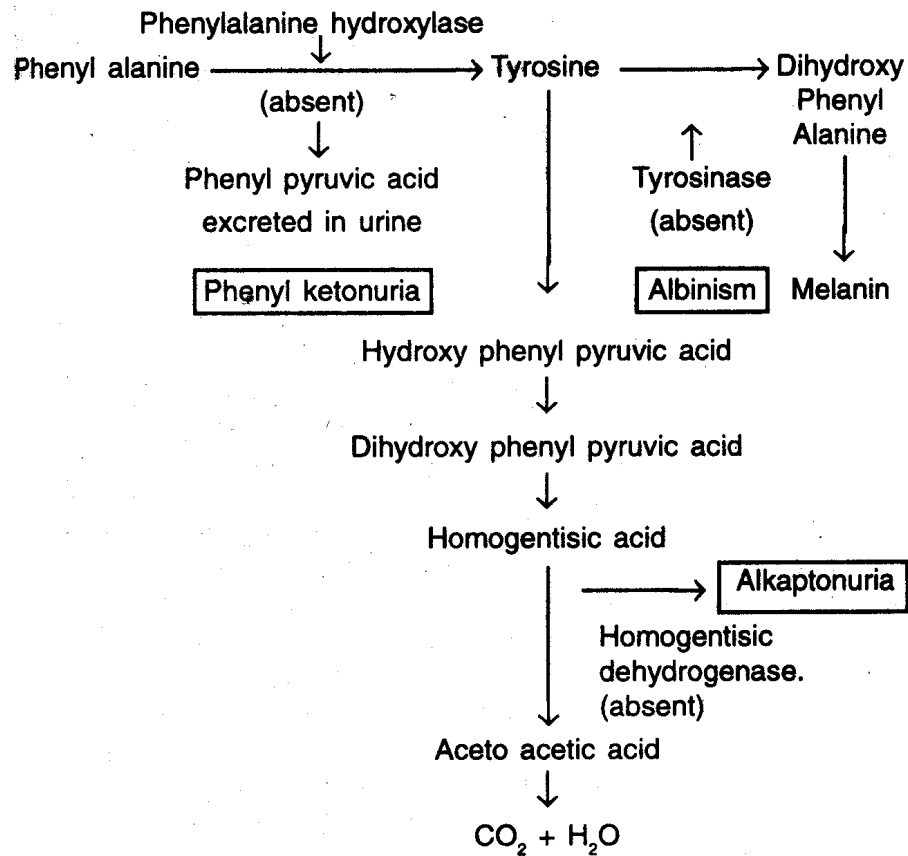
Alkaptonuria:-

An autosomal recessive gene is associated with this disorder. This disorder results from the absence of an enzyme homogentisic acid dehydrogenase. The urine turns black because of the presence of homogentisic acid .

Albinism

Due to a deficiency of the enzyme tyrosinase, tyrosine is not converted to melanin. The skin and hair remain white and pigmentless. The iris of the eyes are also blue in colour. In such cases, the individuals are extremely sensitive and cannot withstand much light.

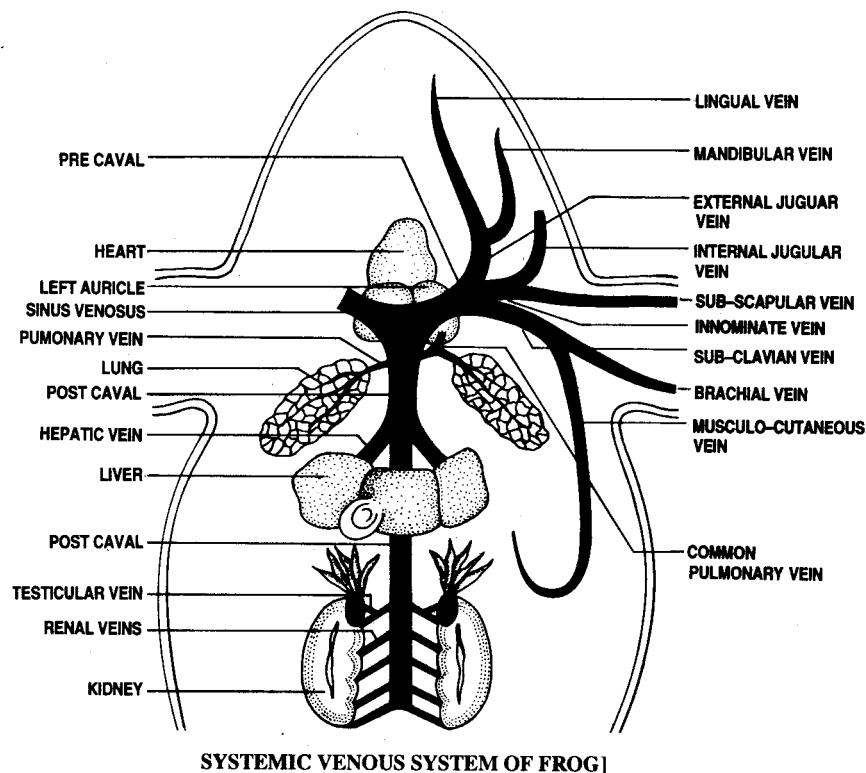
- The following chart explains the metabolic disorders

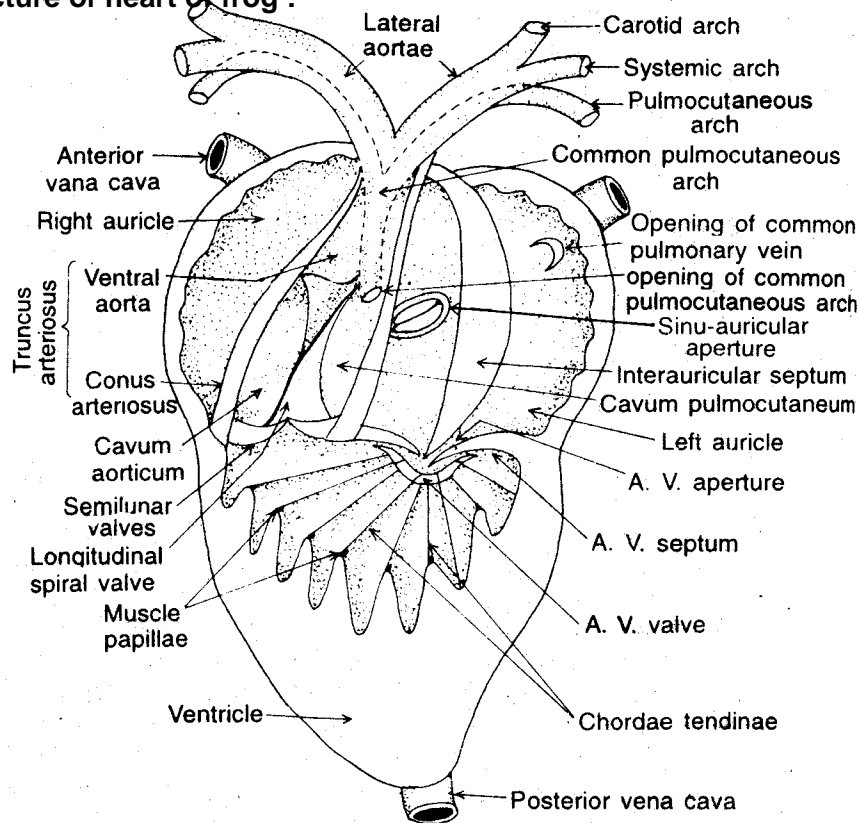


(D) Draw neat and labeled diagram (anyone)

- (1) Systemic venous system of frog (2) Internal structure of heart of frog

(D) (1) Systemic venous system of frog :



(D) (2) Internal structure of heart of frog :**Heart of frog (Internal Structure)****A. 5 (A) Give short answers :**

(1) What is biosphere?

The layer which forms a cloak or covering around the earth surface has been termed as the biosphere.

(2) What is energy farming?

Selective plantation of trees for the purpose of energy has been termed as energy plantation.

(3) State the laboratory tests for AIDS which test is more reliable?

AIDS can be diagnosed by the following tests.

(1) ELISA test → means enzyme linked immuno absorbent assay.

(2) Western Blot test (W.B.test). By this test can be ascertained most reliably whether a person is infected by HIV or not. This test is quite expensive it is a sure test.

(4) Define fossil fuels.

The energy sources like minerals, coal, petroleum and natural gas are called fossil fuels.

(5) Write the fullform of SPET.

Single photo emission tomography.

(6) What is Allergen?

Substances which are responsible for the production of an allergy are called allergens.

(B) Answer as per instructions

(1) Why is a blood bank indispensable?

Blood transfusion is the term used when a person, who has suffered blood loss and requires

blood during an accident or due to haemorrhage in digestive tract, during abortion or during surgical operation is given the blood.

- Lack of blood can be fatal and if blood is not given immediately, the patient can die.
- Blood transfusion is not possible without matching of the blood.
- Quite a few persons die due to Lack of blood transfusion.
- A blood bank collects blood from donors, tests the same and stores (preserves) the same groupwise, and makes blood available for transfusion whenever needed.
- Blood bank not only tests the blood group but also ensures that the blood available for transfusion is infection free.
- It also maintains records of name, address, Telephone number, blood group etc of donors so that they could be contacted when blood is required in an emergency.

(2) Who is superior man or nature?

There are several imbalances and ill effects on environment caused by man it is experienced that man is capable of changing the environment but he cannot alter the natural laws as man cannot change his basic requirements.

- Of today man goes to the height of mountain, at deep bottom of seas or fly to space or other planets, his basic needs for the continuity of his life and life maintenance are not going to change.
- Thus, it has become a moral responsibility of man to protect environment for the benefit of his own and other organisms.
- It is necessary to do it also to protect our own species.

(3) Explain the three steps of organic reaction that take place during the production of biogas.

Biogas is produced by anaerobic fermentation of any biomass. Biogas is composed of 50 to 70% methane 30–40% carbon dioxide alongwith smaller amounts of hydrogen, nitrogen and hydrogen sulphide.

- Anaerobic micro-organisms carry out the organic degradation of organic polymers and produce suitable monomers.
- In this process, digestive enzymes of cellulose, protein and lipids play a role.
- Micro organisms do not degrade the lignin, therefore inorganic salts and lignin remain precipitated.
- In the second step, monomers are converted to organic acids by micro-organisms.
- Lastly, this acid is converted into methane by particular methanogenic anaerobic bacteria.
- Decomposition of cellulose takes a longer time, hence the production of biogas takes place after some time.
- The use of dung as raw material for biogas is much better use of dung and profitable than using it only as fertilizer or fuel.

(4) Preventive measures against AIDS.

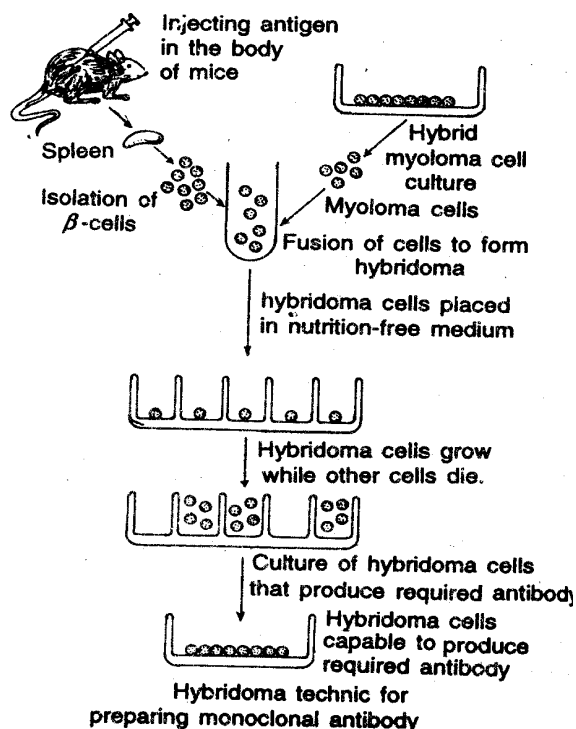
- The injection syringe used once for the AIDS patient should in no case be used for any one else
- Sexual contact with many persons should be strictly avoided.
- The blood transfusion should be avoided unless inevitable.
- Even when the blood transfusion is unavoidable the blood of professional donors should in no case be used.
- The blood of voluntary donor should also be used only after its thorough examination.

- When the surgical operation is pre-planned the patient should deposit his or her own blood in the blood bank well in advance and should insist to use the same at the time of operation.
- Only disposable syringe and injection needle should be used for getting oneself injected. The evil of consuming narcotic drugs should be checked right in its initial stage.
- To prevent the transmission of AIDS in the future generation the HIV positive women should strictly avoid pregnancy and take precautionary measures to avoid the spread of AIDS in other persons.

(C) Answers as per instructions (any two)

(1) Explain hybridoma technique (diagram essential)

- This is the most modern technique by which special type of monoclonal antibodies against the harmful effects of cancerous cells as well as against the substance invading the body.



- An antigen is injected in the body of mice. After a few days the spleen of such mice is taken out in which the lymphocytes have produced against the injected antigen.

- Lymphocytes are fused with cancerous cells in the presence of fusogen.

- The cell, so formed by the fusion of two such cells, is known as hybridoma, which is capable of cell division.

- Such hybridoma cell can produce only one specific type of antibody which is known as monoclonal antibody.

- These cells are cultivated to increase in number.

- These cells are, then tested individually for their ability of antibody production.

- The selected hybridoma cells are allowed to multiply in the culture medium and, thus, the necessary amount of antibody can be obtained.

(2) Describe the effects of water pollution on health.

Just as clean air is an essential requirement so also pure, clean water is essential for a good healthy life.

- When drinking water from certain sources get mixed and contaminated with dirty and polluted water it becomes infested with diseases causing bacteria, fungi and several other diseases causing organisms. Hence this causes an epidemic of disease like cholera, dysentery, typhoid jaundice and skin diseases.
- During monsoon large quantities of pesticides and chemical fertilizers, toxic chemicals contaminate rivers, causes severe toxic effects to various body organs.
- Effluents from industries, causes damage to organ like brain, liver, kidney, alimentary canal.
- Mercury, when converted to methyl mercury becomes toxic which affects the chromosome separation.
- DDT when enters in the body, effects on the nervous system and sex hormones.

- In addition to that it accumulates in human tissues and increases the chances of formation of tumours induction of cancer and also induce body malformation.
 - (3) Describe the production of steroids and antibiotics
- Steroids originate from plants as well as animals.
- Steroids of plant origin can be obtained cheaper and by less expensive techniques. Hence steroids like those of animal origin can be transformed from the steroids of plant origin by using the fungus *Rhizopus stolonifer* through the process of hydroxylation and dehydrogenation.
 - Such steroids are used as anti-inflammatory and a cancer drugs, for developing immunity against asthma, organ transplantation as well as for family planning.
 - Some of the microorganisms can produce certain chemical substances which inhibit the growth of other organisms or kill them altogether such chemical substances are called antibiotics.
 - Walks man was the first to use the term antibiotics.
 - Alexander Flemmings discovered the antibiotics penicillin from the fungus penicillin.
 - Walksman and woodruff discovered Actinomycin and streptothricin.
 - Various fermentation techniques are employed in order to increases the production of different new antibiotics.
 - The treatment by these antibiotics is certainly reliable and almost safe.
 - Three groups of micro-organisms made use of for a large scale production of antibiotics are eubacteriales Actinomycetales and fungi
 - The advanced Countries like America and Japan have paid attention to improvise the genes of the microorganisms useful for antibiotic production.

