BIOLOGY- (56) SECTION - I

Q.1

Sol. (i) (A) Test (1)

(ii) (C) Independent assortment (1)

(iii) (A) Polyblend (1)

(iv) (B) Humification (1)

(v) (B) Transduction (1)

(vi) (B) 18 (1)

(vii) (A) *Salvia* (1)

Q.2

Sol. (A)

(i) Law of Dominance (1)

(ii) The Enzyme responsible for delay in ripening of tomato fruit is polygalacturanase (1)

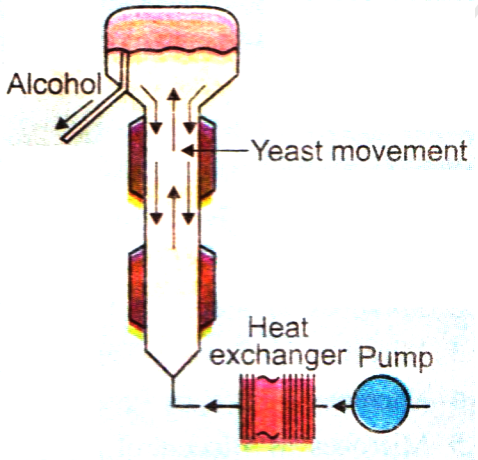
(iii) Methanogenic bacteria are the bacteria responsible for converting organic acids into methane. (1)

(iv) The high yielding semi-dwarf varieties of whweat selected and introduced in India in 1963 were Sonalica & Kalyansona ½ + ½ **(1)**

(v) In triple fusion, second male gamete nucleus gets fused with 2 nuclei from secondary nucleus, hence it is called as triple fusion. **(1)**

(vi) CO_2 fixation, release of oxygen and pollination are the ecological services for the benefit of mankind. ½ + ½ **(1)**

Sol. (B)



(Scientific Diagram ½ Mark, three Laebles 1 and ½ Mark)

Sol. (C)

(i) Global warming is caused by greenhouse effect -

(1) The gases of the atmosphere that cause rise in earth's temperature are called green house gases.

(2) They are mainly CO_2(59%), CFCs(19%), Methane (15%), Nitrogen gases (6%) & others (1%)

(3) Global warming caused by greenhouse effect depends upon the amount of CO_2 present in the atmosphere. An increase in the CO_2 concentration in the atmosphere retains heat energy of the sunrays & increases earth's temperautre.

(4) Green house gases are discharged in the earth's atmosphere through various sources like burning of fossil fuels destruction of forests, cement plants etc. CFCs are released chiefly through industrial activities, refrigerators & air - conditioners

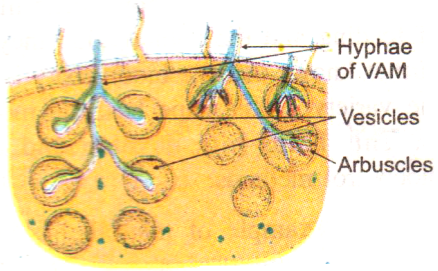
(5) It has been observed that CO_2 alone increase temperature by about 50%, CFCs by 20% methane by 15% & other air pollutants by 10%.

(6) Thus global warming caused by greenhouse effect. **(Any four correct points ½ Mark each = 2)**

(ii) (1) VAM is vesicular arbuscular mycorrhizae.

(2) In this, the hyphae live in the intercellular spaces of root cortex and send projections into the root cortical cells.

(3) These branches (inside the cell) may be swollen to form vesicles or become a finely branched mass, called arbuscules.



(Correct Diagram 1 mark, Explanation 1 Mark)

(iii)

S.No.	Light Reaction	Dark Reaction
1.	Takes place in grana	Takes place in stroma
2.	Light is essential/ Dependant on light	Independent of light
3.	Synthesis of ATP & $NADPH_2$	Utilization of ATP & $NADPH_2$
4.	Release of O_2 as byproduct	No release of O_2 during the process
5.	Carbohydrates are not formed	Carbohydrates are formed

(Any Four Correct Differences ½ mark each)

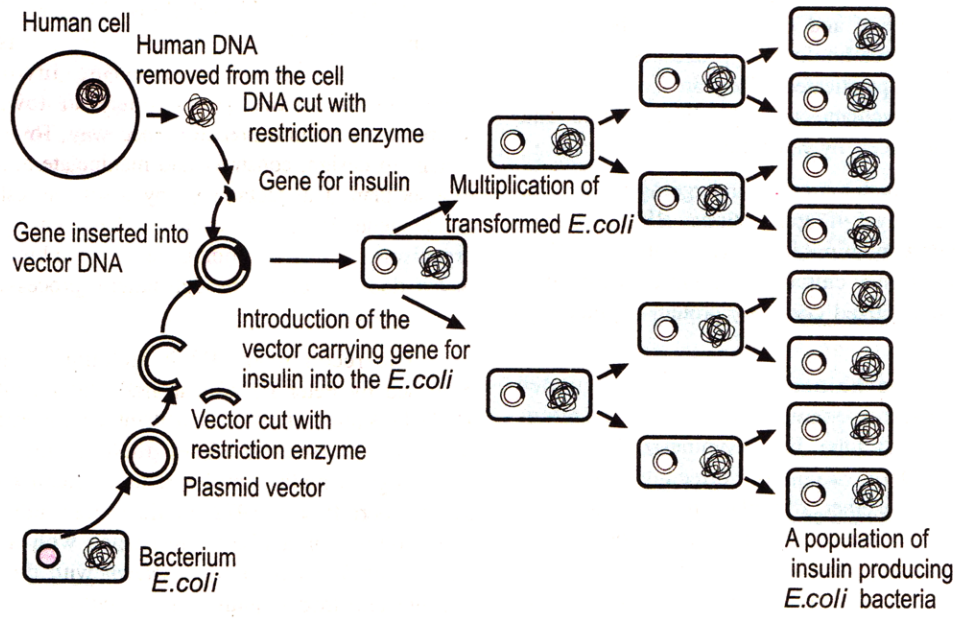
(iv) Mendel selected the garden pea plants for his experiment becasue

(1) Garden pea is an annual plant & completes the life cycle within three to four months. Due to short life span he could grow 3 generations in a year.
(2) Small herbaceous plant hence can be managed in a small space.
(3) Naturally self pollinating but large flowers to carry out cross pollination very easily
(4) Many varieties with contrasting characters available, No intermediate characters.
(5) Many seeds per pod producing more numbers of offsprings
(6) Easily available plant in near viscinity. **(Any four correct points ½ Mark each = 2)**

Q.3 (A)

(i) Steps in recombinant DNA technology :

1. Isolating genomic DNA of a 'donor'. The cell or organism from which the required gene is taken is called 'donor'.
2. Fragmenting this DNA using "molecular scissors" (Enzymes-Restriction Enzymes)
3. Screening the fragments for a 'desires gene'(Gel Electrophoresis).
4. Inserting the fragments with desired gene into a 'cloning vector'. (a plasmid, consmid, or pahse DNA), so as to develop a recombinant DNA or chimeric DNA.
5. Introducing the recombinant vector into a competent host cell.
6. Culturing these cells to obtain multiple copies or clones of desired fragment of DNA.
7. Using these copies to "Transform" sutiable host cells so as to express the desired gene.



(Correct Diagram 1 Mark , Any four correct points ½ Mark each = 2)

(ii) Tissue culture: - The culturing or growing isolated protoplasts or cells or tissue or organ on nutrient medium under controlled aseptic conditions to produce complete plant or plant parts is called tissue culture. **The methodology of tissue culture :-**

(1) Explant :

Plant part that is excised from the original plant and is used for initiation of a culture is known as explant e.g. root apex, shoot apex, pollen grains, etc. The explants are sterilized properly and placed on solid nutrient medium. The cells from explants absorb nutrients and start multiplying.

(2) Callus formation and its culture : -

Callus is an unorganised mass of loosely arranged parenchymatous cells which develop from parent tissue due to prolifertion of cells.

All the cells of callus are identical becasue they are produced by mitosis only.

(3). Organogenesis :-

Growth hormones like auxins and cytokinins in proper proportion are provided to the callus to induce formation of organs.

(4). Sub-culturing :-

The callus is transferred to fresh medium to form subculture. It permits rapid multiplication of culture material.

(5). Plant regeneration :-

Each callus is transferred to regeneration medium containing growth hormones. Plantlets can be obtained from cultured cell by transplanting.

(6). Transplanting :

The healthy plantlets are transferred to soil in pots. They are kept in growth chambers and then to glass houses. Gradual exposure of plantlent to the environment is called hardening. The hardened plants are transferred to the field.

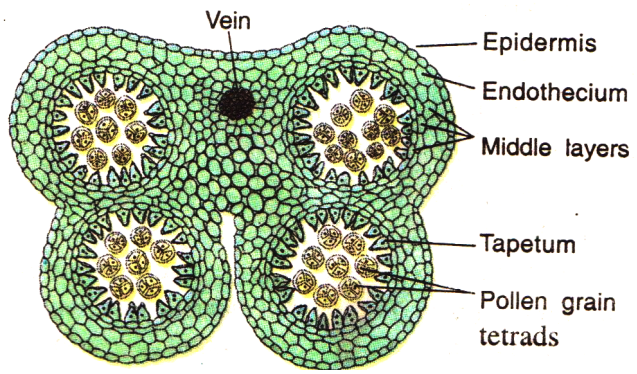
(Correct Defination 1 Mark , Any four correct points ½ Mark each = 2)

(iii) Vegetative propagation is a kind of asexual reproduction which occurs with the help of vegetative organs like root, stem, leaf or bud.

S.No.	Stem tuber	Tuberous root
1.	Modification of stem to store reserve food material	Modification of root to store reserve food material
2.	Shows presence of nodes & internodes	Nodes & internodes absent
3.	Develop from lateral branches from under ground part of stem	Develop from the nodes of stem
4.	E.g. Potato	E.g. Sweet potato

(Correct Defination 1 Mark , Any four correct points ½ Mark each = 2)

Q.3 (B)



(Scientific Diagram 1 Mark, Any four correct Laebles ½ Mark Each)

Q.4

Sol. (i) In 1953 James Watson and Francis Crick proposed DNA structure based on X-ray crystallographic studies.

(ii) DNA molecule consist of two long stands coiled around a common imaginary central axis to form a double helix. It look like a twisted ladder.

(iii) Each strand consist of number of nucleiotides. Each nucleotide is made up of deoxyribose sugar, phosphate group and nitrogen base.

(iv) The combination of sugar and nitrogen base is called.nucleoside. Together with phosphate called nucleotide.

(v) The sucessive nucleotide of the same strand are linked by 3'— 5' phosphodister linkage i.e. phosphate attached to 5th carbon of sugar of nucleotide is joined to 3rd carbon of another.

(vi) The two stands are equidistant and parallel all along their length. Each transverse step is made up of nitrogen bases which are purines and pyrimidines.

(vii) Double helix :. The strands of DNA molecule are spirally twisted (coiled) around each other. The side arms of ladder are called *banister* or *railing* and the steps are called *rungs.*

(viii) The base pairs forms rungs or steps and a back bone of strand forms railing. Backbone of strand is formed by sugar phosphate chain.

(ix) Base pairing : The nitrogen bases present on one strand, pair with the nitrogen bases of opposite strand.

(x) Purine base A always pairs with pyrimidine base T by two hydrogenbonds and purine base.

(xi) G alwayS pair with the pyrimidin.e base C with 3 hydrogen bonds.

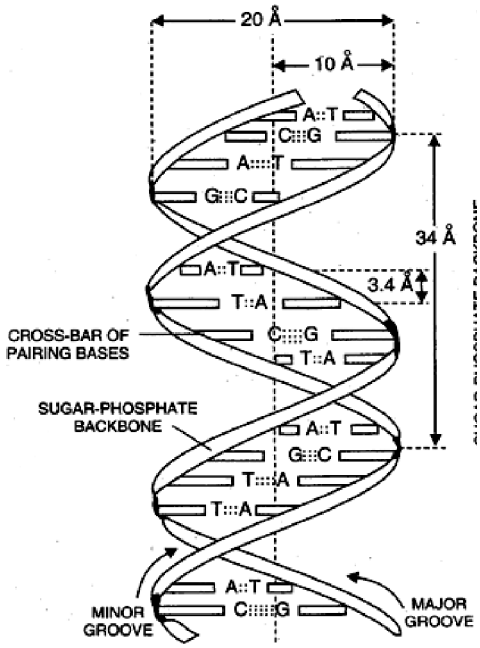
(xii) This pairing is termed as complementory base pairing.,

Purine : Pyrimidines

Adenine = Thymine (A T or T = A)

Guanine = Cystosine (G =.C or C = G)

Purines (adenine and Guanine) has double ring and Pyrimidines (Cystosine and thymine) has single ring.



(Scientific Diagram 2 Mark, Any 10 correct points ½ Mark Each)

OR

Q. 4

Sol.

1. Condensation :-

Acetyl coenzyme -A reacts with oxalo-acetate which is a 4-C compound present in matrix of mitochondrion and a 6-C compound called citric acid or citrate is formed Thus citrate is the first stable compound of Krebs cycle. One water molecules is used in this reaction. The enzyme *citrate synthetase* catalyses the reaction.

$$\underset{(4-C)}{OAA} + \underset{(2-C)}{Acetyl\ Co-A} + H_2O \xrightarrow{\text{Citrate synthetase}} \underset{(6-C)}{Citrate} + Co-A$$

(2) Isomerisation :-

In the next step 6-C citrate is first converted into 6-C, Cis aconitate (removel of H_2O) and then into 6-C isocitrate (addition of H_2O)

$$\underset{(6-C)}{Citrate} \longrightarrow Cis-\underset{(6-C)}{aconitate} + H_2O$$

$$Cis-\underset{(6-C)}{aconitate} + H_2O \longrightarrow Iso-\underset{(6-C)}{citrate}$$

3 Oxidation :-

Next reaction involves oxidation of Isocitrate (by removal of hydrogen) to form 6-C oxalo succinate. $NADH_2$ is formed in this reaction.

$$Iso-\underset{(6-C)}{citrate} + NAD \longrightarrow Oxalo-\underset{(6-C)}{succinate} + NADH_2$$

(4) Decyroboxylation :-

Decarboxylation of 6-C oxalo succinate. Results in the formation of 5-C a-Ketoglutarate with the liberation of CO_2 .

$$Oxalo-\underset{(6-C)}{succinate} \longrightarrow \alpha-\underset{(5-C)}{ketoglutarate} + CO_2$$

(5). Oxidative Decyroboxylation :-

α – kelogutarate acid (5 - C) then undergoes oxidation (by removal of hydrogen) Decyroboxylation to form 4 C succinyl Co - A : It takes place in the presence of Co - A and NAD. $NADH_2$ is formed and CO_2 is released.

$$\underset{(5C)}{\alpha - \text{ketoglutarate}} + NAD + Co - A \longrightarrow \underset{(4-C)}{\text{Succinyl } Co - A} + NADH_2 + CO_2$$

(6) Hydration and Phosphorylation :-

4-C succinyl-CoA is hydrolysed to succinate (4-C) in the next step. One H_2O is used and Co-A is regenerated. The reaction is exergonic. Energy released is used for the formation of GTP (Guanosine triphosphate) from GDP and H_3PO_4 . Subsequently GTP is converted to ATP in presence of ADP.

$$\underset{(4-C)}{\text{Succinyl } Co - A} + H_2O \xrightarrow{GDP \longrightarrow GTP} \underset{(4-C)}{\text{Succinate}} + Co - A$$

(7) Oxidation (Dehydrogenation-III):

In this step, succinate (4-C) is oxidized by dehydrogenation to form fumarate (4-C). The hydrogen removed in this reaction reduces the coenzyme FAD (Flavin Adenine Dinucleotide) to $FADH_2$. The reaction is catalyzed by the enzyme *succinate dehydrogenase.*

$$\underset{(4-C)}{\text{Succinate}} + FAD \longrightarrow \underset{(4-C)}{\text{Fumarate}} + FADH_2$$

(8) Hydration :

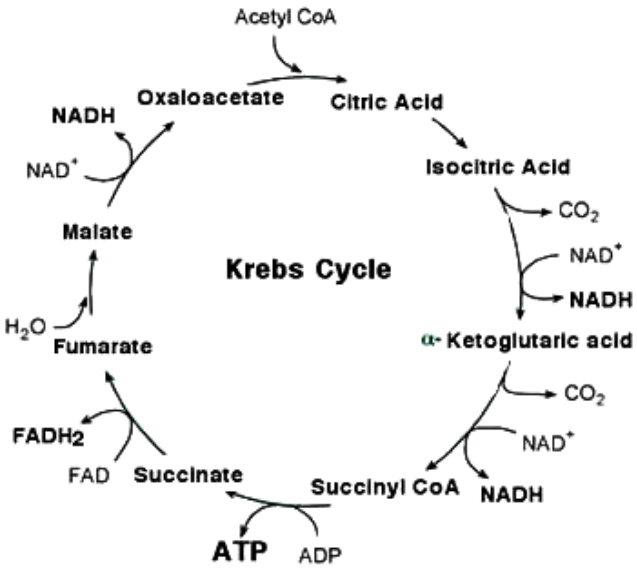
Fumarate (4-C) accepts a water molecule to produce malate (4-C). This occurs in presence of the enzyme *fumarase.*

$$\underset{(4-C)}{\text{Fumarate}} + H_2O \longrightarrow \underset{(4-C)}{\text{Malate}}$$

(9) Oxidation (Dehydrogenation-IV) :

Malate (4-C) is oxidized by removal of hydrogen and oxalo-acetate (4-C) gets regenerated. The hydrogen removed in this reaction is taken up by the coenzyme NAD to form $NADH_2$. The reaction is catalyzed by the enzyme *malate dehydrogenase.*

$$\underset{(4-C)}{\text{Malate}} + NAD \longrightarrow \underset{(4-C)}{\text{Oxalo} - \text{acetate}} + NADH_2$$



(Scientific Diagram 2 Mark, Any 5 correct points 1 Mark Each)

SECTION - II

Q 5.

Sol. **Select and write the most appropriate answer from the given alternatives for each sub question.** **[7]**

(i) (A)
Cystic fibrosis

(ii) (B)
Webbing of neck

(iii) (A)
Sperm

(iv) (D)
Biston betularia

(v) (B)
Cross breeding

(vi) (C)
Modified cardiac muscles

(vii) (A)
Mutualism

Q. 6

Sol. **(A) Answer in 'one' sentence each.** **[6]**

(i) The sum total of genes of all individuals of interbreeding population is called gene pool.

(ii) Haemophilia , Night Blindness , Myopia

(iii) Human Genome project

(iv) Tussar silk and eri silk

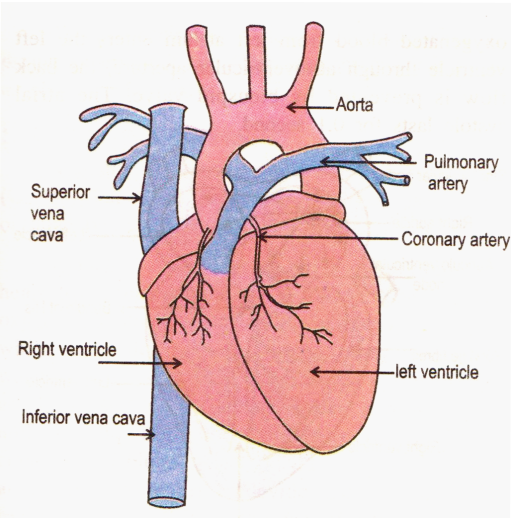
(v) T wave

(vi) In Situ

Q.6

Sol. **(B)**

Sketch and label ventral view of human heart. **[2]**



[Marking scheme = 1 mark for Diagram and 1 mark for Labels]

[Marking scheme = 1/2 mark for each correct point ; Minimum 4 points]

(iv) Significance of fertillization :

i. It stimulates the secondary oocyte to undergo second maturation division to release IInd polar body and to form haploid ovum.

ii. It restores diploidy in the zygote (2n).

iii. Fertilization membrane prevents the polyspermy.

iv. It combines the character of two parents and introduces variation in offspring, which helps in evolution.

v. Centrioles of sperm from the spindle initiate the cleavage of zygote.

vi. It determines the sex of the offspring.

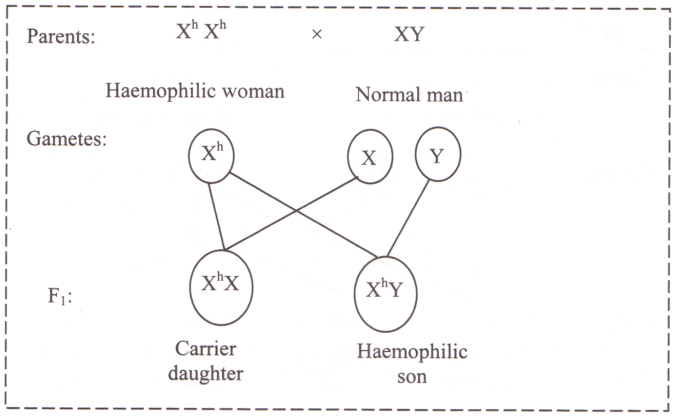
vii. Fertilization stimulate the zygote to undergo further development.

[Marking scheme = 1/2 mark for each correct point ; Minimum 4 points]

Q.7

Sol. **(A) Attempt any TWO of the following:** **[6]**

(i)



[Marking scheme = 3 mark for the correct explanation]

(ii)

Blood Group	Antigen	Antibody	Can give blood to	Can receive blood from	Genotype
A	A	b	A , AB	A,O	A,A OR O
B	B	a	B , BA	B,O	BB or BO
AB	A,B(Both)	None	AB	All (Universal recipient)	AB
O	None	a,b(Both)	All(Universal donor)	O	OO

[Marking scheme = 3 mark for the correct explanation]

(iii)

(a) The conservation of endangered species of plants and animals is necessary for the following reasons.

i. To preserve biodiversity.

ii. To maintain ecological balance

iii. To maintain the number of individuals of a species

iv. To build national economy

callosum. It is the largest commissure in human brain. A cavity filled with CSF is present in each hemisphere which is termed as lateral ventricle. The roof of lateral ventricle- pallium. In cerebral hemisphere, the outer layer grey mater is 2 to 4 mm thick. It is called Cerebral cortex. It is highly convoluted and shows many folds. The elevations are called as gyri and depressions are called as Sulci. They increase total amount of grey matter and number of folds associated with the intelligence of the individual. Each cerebral hemisphere has three deep sulci namely central, lateral and parieto-occipital. they divide the cerebral hemisphere into four lobes namely.

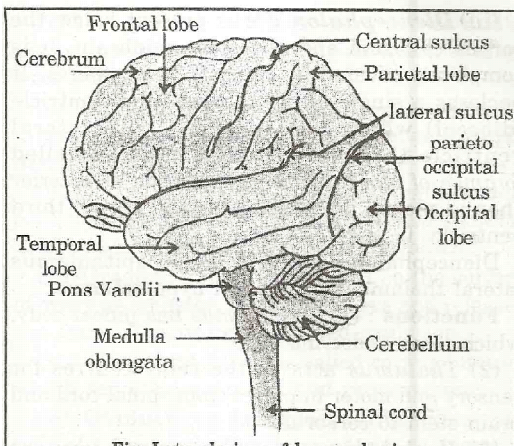


Fig. Lateral view of human brain

(a) Frontal lobe has motor areas for movements of voluntary muscles, pre-motor areas for movement of involuntary muscles. It also has association areas.

(b) Parietal lobe has areas for the sensation of heat, cold, pain, pressure, touch and light.

(c) Temporal lobe has acoustic area for hearing.

(d) Occipital lobe has visual area for sight or vision.

Functions of cerebrum:

(1) It is the seat of intelligence. It governs mental abilities like thinking, learning, reasoning, memory and emotions.

(2) It is also the seat of consciousness and exerts strong control over reflexes such as laughing and weeping.

(3) Cerebral cortex shows 3 types of areas

(i) Sensory areas, which receive sensation of sensory impulse.

(ii) Motor areas, which give out motor impulses for movements.

(iii) Association areas, which analyse, process and store the information.

[Marking scheme = 2 marks for neat labelled diagram; 4 marks for explantion of structure; 1 mark for functions]

OR

Q.8. With the help of a neat, labeled diagram describe the human male reproductive system

Sol. Male reproductive system consists of the following parts :

(1) Testes (2) Scrotum (3) Vasa efferentia (4) Vasa deferentia (5) Ejaculatory duct

(6) Urethra and (7) Penis

Accessory Sex glands : (i) Seminal vesicle (ii) Prostrate gland (iii) Cowper's gland (iv) Semen

(7) Penis :

It is cylindrical erectile pendulous organ situated in the pubic region in front of scrotum. Urethra passes throughout the length of penis. It has erectile **tissue which has blood supply and makes it erect.**

The penis contains two postero-lateral tissues called corpora cavernosa and a median *corpus spongiosum.* Near the tip of penis, the corpus spongiOSum is enlarged to form a soft and highly sensitive glans penis. It is covered by a loose retractable fold of skin called *prepuce or foreskin.*

Accessory sex glands :

(1) Seminal vesicle ;

Two pouches on the posterior wall of urinary bladder. They secrete *viscous fluid.*

Viscous fluid contains fructose, fibrinogen and prostaglandins. It contributes about 60% of total volume of semen. Fructose provides energy to sperms for swimming, Fibrinogen helps in Coagulation of semen after ejaculation. Prostaglandins help the process of fertilization

(2) Prostate gland :

Prostatic fluid is a whitish liquid forming about 30% of total volume of semen.

It neutralises the acidity of vaginal secretion. At pH 6 to 6.3, sperms become motile and facilitate the process of fertilization.

(3) Cowper's gland :

These are also known as bulbo-urethral glands. They are pea-sized and situated on either side of membranous urethra. These glands secrete alkaline viscous fluid which neutralises the acidity in the last part of penis due to previous urination and also lubricates the vagina of female genital tract.

(4) Semen :

It is ejaculated during copulation it is whitish fluid which contains spermatozoa and mixture of secretion from 3 glands. A single ejaculation releases 3 to 4 ml of semen containing 300 million sperms. However only one sperm fertilizes the ovum.

The release of large number of sperm ensures the process of fertilization.

[Marking scheme = 2 marks for neat labelled diagram; 5 marks for explantion of structure]