



MARCH-2019 (AP)

PREVIOUS PAPERS**IPE: MARCH-2019(AP)****Time : 3 Hours****SR.ZOOLOGY****Max.Marks : 60****SECTION-A****I. Answer ALL the following VSAQ:****10 × 2 = 20**

1. Name different types of papillae present on the tongue of man?
2. What are the columns of Bertin ?
3. Write the difference between actin and myosin.
4. What is organ of Corti?
5. Name the gland that increases in size during childhood and decreases in size during adulthood. What important role does it play in case of infection?
6. What is erythropoietin ? What is its function ?
7. It is true that 'MTP is not meant for population control'. Then why did the Government of India legalize MTP ?
8. Mention the advantages of 'Lactational amenorrhea method.'
9. Mention any four fish by - products
10. How many amino acids and polypeptide chains are present in insulin ?

SECTION-B**II. Answer any SIX of the following SAQs:****6 × 4 = 24**

11. Draw a neat labelled diagram of L.S. of a tooth.
12. What are the major transport mechanisms for CO₂ ? Explain.
13. Describe the structure of synovial joint with the help of a neat labelled diagram.
14. Write short notes on immunoglobulins.
15. Describe erythroblastosis foetalis.
16. Distinguish between homologous and analogous organs.
17. What is meant by genetic drift? Explain genetic drift citing the example of Founder Effect.
18. Write briefly about different waves and intervals in an ECG.

SECTION-C**III. Answer any TWO of the following LAQs:****2 × 8 = 16**

19. Write notes on the working of the heart of man
20. Describe male reproductive system of a man. Draw a labelled diagram of it.
21. What is criss - cross inheritance

IPE AP MARCH-2019 **SOLUTIONS**

SECTION-A

1. Name different types of papillae present on the tongue of man?

A: There are 3 types of papillae (small projections on the upper surface of the tongue)

- 1) '**Fungiform**' papillae: These are located at the margin and tip of the tongue.
- 2) '**Filiform**' papillae: These are located on the upper surface of the tongue.
- 3) '**Circumvallate**' papillae: These are located at the base of the tongue.

2. What are the columns of Bertin ?

A: Columns of Bertin: These are the projections of the cortex into the medulla that separate the renal pyramids in the human kidney.

3. Write the difference between actin and myosin.

A:	Actin	Myosin
	1) Actin is a thin contractile protein	1) Myosin is thick contractile protein
	2) Actin is present in light band called isotropic band .	2) Myosin is present in dark bands called anisotropic band .
	3) Actin filaments are connected to Z line	3) Myosin filaments are connected to M line.

4. What is organ of Corti?

A: 1) The sensory ridge formed by the cochlear epithelium, on the basilar membrane is called 'Organ of Corti' .

2) It contains **hair cells**, which act as **auditory receptors**.

5. Name the gland that increases in size during childhood and decreases in size during adulthood. What important role does it play in case of infection?

A: 1) **Thymus gland** increases in size during childhood and reaches its maximum size at puberty. It degenerates in old persons.

2) It helps in differentiation of T-lymphocytes which provide cell mediated immunity. It promotes the production of antibodies to provide humoral immunity.

6. What is erythropoietin ? What is its function ?

A: 1) **Erythropoietin** is a hormone produced by **Juxta glomerular cells of kidney**.

2) It stimulates production of RBC by regulating the proliferation and differentiation of erythroid progenitor cells in bone marrow.

7. It is true that 'MTP is not meant for population control'. Then why did the Government of India legalize MTP ?

A: MTP means Medical Termination of Pregnancy.

MTP is legalised in India with some restrictions to save

- 1) Unwanted pregnancy caused due to 'unprotected inter course'.
- 2) Pregnancy in case of Rapes.
- 3) Mother from 'continuation of pregnancy' .

8. Mention the advantages of 'Lactational amenorrhea method.'

A: **Advantages of Lactational amenorrhea method(Breast feeding):**

- 1) As long as the mother breast feeds her child, the chances of conception are almost zero.
- 2) Breast fed babies have enhanced immunity and protection against allergies.

9. Mention any four fish by - products

A: **Fish by-products:**

- 1) Shark liver and cod liver oil.
- 2) Omega 3 fatty acids in sardines and salmon.
- 3) Fish guano - fertiliser from waste fish.
- 4) Isinglass - prepared from air bladder and used in clarification of wines.

10. How many amino acids and polypeptide chains are present in insulin ?

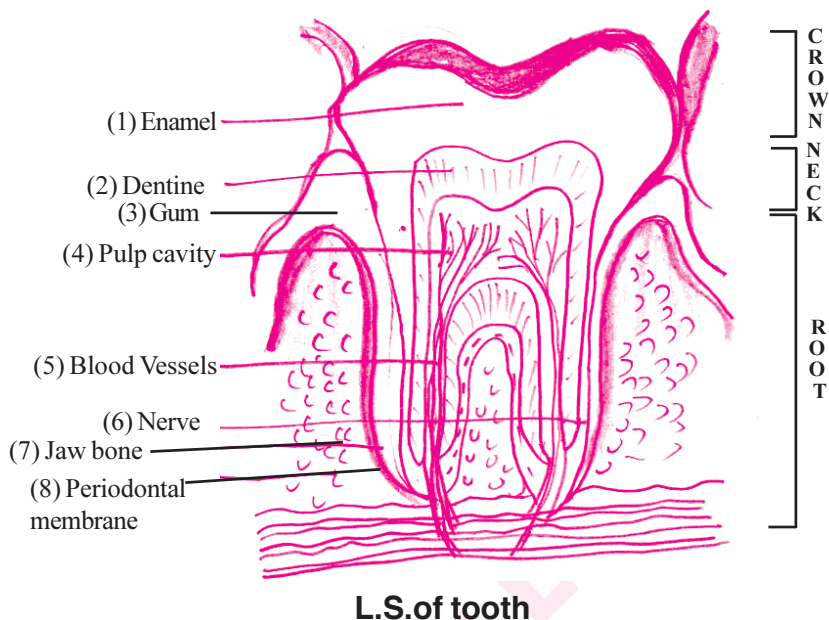
A:

- 1) 51 amino acids are present in insulin.
- 2) 21 amino acids form polypeptide chain A.
- 3) 30 amino acids form polypeptide chain B.

SECTION-B

11. Draw a neat labelled diagram of L.S. of a tooth.

A:



12. What are the major transport mechanisms for CO_2 ? Explain.

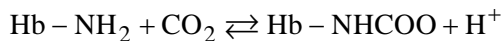
A: **Transport Mechanism of CO_2 :**

CO_2 is transported to lungs in three different ways.

(1) 7% as carbonic acid (2) About 20-25% as carbamino compound (3) About 70% as bicarbonates.

1) As carbonic acid: 7% of CO_2 combines with H_2O to form carbonic acid. It is transported to lungs where it is dissociated into water and CO_2 .

2) As carbamino compound: About 20-25% of CO_2 combines with free amino group of haemoglobin and forms carbamino haemoglobin. It is a reversible reaction.



3) As bicarbonates: About 70% of CO_2 combines with water to form H_2CO_3 in the presence of carbonic anhydrase. In RBC, the carbonic acid dissociates into $\text{HCO}_3^- + \text{H}^+$.

4) At the alveolar site where pCO_2 is low, the reaction proceeds in the opposite direction, leading to the formation of CO_2 and H_2O .

5) Thus CO_2 is mostly trapped as bicarbonate at the tissues and transported to the alveoli, where it is released out as CO_2 .

13. Describe the structure of synovial joint with the help of a neat labelled diagram.

A: 1) **Synovial Joint** is a 'freely moving joint' between two bones.

2) Structural parts of Synovial Joint:

- i) Articular Capsule
- ii) Articular Cartilage (Hyaline)
- iii) Synovial Cavity

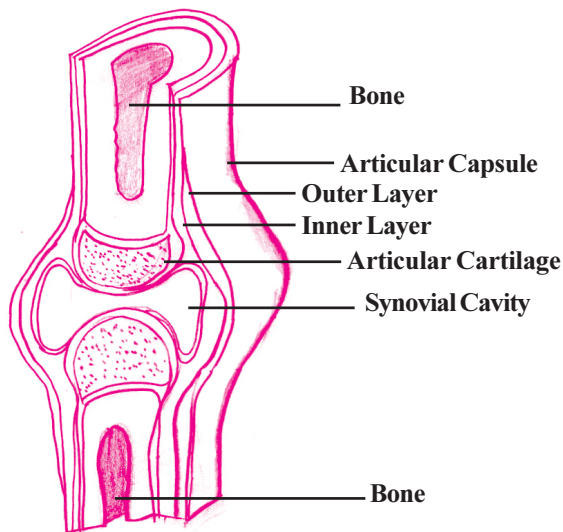
3) Articular Capsule consists of two layers.

Outer fibrous layer keeps the bones together without dislocating.

Inner layer seals the synovial fluid.

4) The ends of joint bones are formed with smooth Articular Cartilage which minimises friction between bones.

5) Synovial cavity is filled with 'Synovial fluid' which acts as Lubricator and Shock Absorber.



Structure of Synovial Joint

14. Write short notes on immunoglobulins.

A: Immunoglobulins(Antibodies):

1) **Antibodies are produced by B lymphocytes** when pathogens enter the body.

2) Antibodies are antigen specific.

3) Based on the mobility, there are two types of antibodies ; free antibodies and surface antibodies.

4) Circulating antibodies are present in blood and lymph.

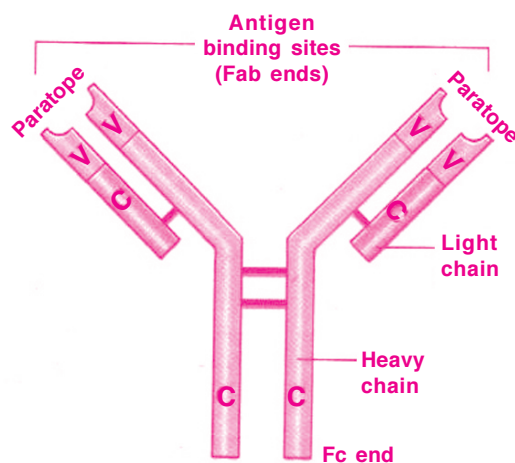
5) Surface antibodies are present on the surface of B cells and memory cells.

6) **Structure:** Antibody is **Y shaped** molecule with **four polypeptide chains**.

7) Two of them are long and identical heavy chains (H) and the other two small light chains (L). It is represented by H_2L_2 .

8) The two chains are linked by disulfide bonds. One end of the molecule is called Fab end to which the antigen is attached. The other end is Fc end, by which it may be attached to B-cells.

9) Based on the structure, the antibodies are five types namely IgD, IgE, IgG, IgA and IgM.



Structure of Antibody

15. Describe erythroblastosis foetalis.

- A:** 1) **Erythroblastosis foetalis** (Haemolytic disease) is an **alloimmune condition** that develops in an Rh positive foetus, whose father is Rh positive and mother is Rh negative.
- 2) The genetic consequence in this marriage is the Rh incompatibility between the mother (Rh^-) and the growing foetus (Rh^+)
- 3) At the time of delivery, the Rh^+ blood cells may enter the mother's blood through ruptured placenta.
- 4) Mother's immunity system is sensitized and Anti Rh antibodies are produced.
- 5) The first child is safe because delivery is over and antibody formation in mother takes time.
- 6) During the second pregnancy, if the second child is Rh positive, these antibodies cross the placental border and enter the foetal blood circulation. The blood cells of the Rh positive foetus are destroyed causing HDN (Haemolytic Disease of New born)
- 7) To compensate loss of cells, foetal hemopoietic system releases erythroblasts (early stage of RBC) into circulation. That is why this disease is called erythroblastosis foetalis.
- 8) Now a days the mother is given anti D (anti Rh anti bodies), when she is pregnant which prevent the formation of antibodies during pregnancy i.e., to prevent sensitization of mother's immunity system.

16. Distinguish between homologous and analogous organs.

- A:** Homologous and Analogous organs are evidences of evolution from comparative anatomy.

Homologous organs	Analogous organs
1) The organs which have similar structure and origin but not necessarily the same function are called homologous organs.	1) The organs which have different origin but have same function are analogous organs.
2) They suggest divergent evolution.	2) They suggest convergent evolution.
3) Ex: The forelimbs of vertebrates, Flipper of Whale, wings of birds, hand of man and wings of bat	3) Ex: Wings of butterfly and wings of birds.
4) All these organs have same arrangement of bones but their functions vary to suit their mode of life.	4) When the animals live in same habitat and lead a similar mode of life they tend to have same body form.

17. What is meant by genetic drift? Explain genetic drift citing the example of Founder Effect.

- A:**
- 1) **Genetic Drift:** The change in the frequency of a gene that occurs merely by chance and not by selection in small populations, is called genetic drift.
 - 2) A gene is with two alleles. If the frequency of a particular gene is 1%, the probability of losing that allele by chance from the small population is more. The end result is either fixation or loss of that allele. The probability of reaching the end point depends on the size of population.
 - 3) Genetic drift tends to reduce the amount of genetic variation within the population, mainly by removing the alleles with low frequencies. Genetic drift can be exemplified by the founder effect.
 - 4) **Founder effect:** If a small group of individuals from a population start a new colony in an isolated region, those individuals are called the founders of the new population. The allelic frequency of their descendants are similar to those of the founders rather than to either ancestral parent population.

Ex: Presence of O⁺ blood group is nearly 100% in Red Indians.

18. Write briefly about different waves and intervals in an ECG.

A: E.C.G: ECG stands for electro cardiograph. It records electrical changes in the heart.

12 Sensors are placed at 12 places and the leads are connected to ECG machine.

I) Waves:

- 1) **P-Wave:** It represents atrial systole.

Its duration is 0.1 s.

- 2) **QRS complex wave :**

It represents ventricular systole.

Its duration is 0.08 to 0.1 s.

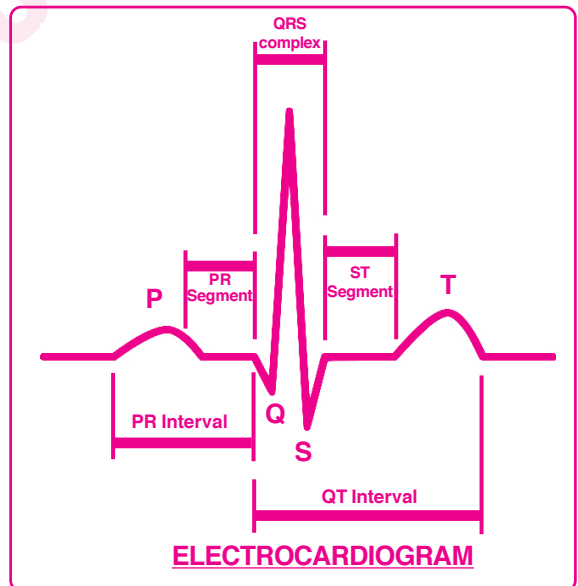
Q wave is a small negative wave

R wave is a tall positive wave

S wave is a small negative wave.

- 3) **T- wave:** It is a positive wave.

Its duration is 0.2 s.



II) Intervals:

- 1) **P-R interval:** It is the time between onset of P wave and onset of Q wave.

Its duration is 0.12 to 0.2 s.

- 2) **Q-T interval:** It is the interval between onset of Q wave and the end of T wave.

It depends on heart rate. Its duration is 0.4 sec.

If the heart beat is faster then the interval is shorter.

- 3) **R-R interval:** It is the duration of one cardiac cycle. Its duration is 0.8 sec.

SECTION-C

19. Write notes on the working of the heart of man.

[TS 16][AP 15,16,17,18,19]

A: Working of heart: It involves 4 phases.

- | | |
|--|-------------------------|
| I) Generation & conduction of action potentials. | II) Cardiac cycle |
| III) Cardiac Output | IV) Double circulation. |

I) Generation & conduction of action potentials: The contractions of heart chambers are due to the **action potential** generated by **nodal tissue SAN**. They cause the contraction of atria.

II) Cardiac cycle: The cardiac events that occur from the beginning of one heart beat to the beginning of the next beat is called cardiac cycle. It lasts for about **0.8 seconds**

Cardiac cycle consists of 3 phases (1) atrial systole (2) ventricular systole (3) cardiac diastole

(1) Atrial systole: The SAN generates an action potential which stimulates both the atria and to contract simultaneously causing the 'atrial systole'.

- (i) It lasts for about **0.1 s**.
- (ii) This **increases the flow of blood** into the ventricles by about 30%.
- (iii) The remaining blood flows into the ventricles before the atrial systole.

(2) Ventricular systole: The action potential reaches AVN. It is a **relay centre**. The electrical impulses pass through bundle of His and purkinjefibres. This causes ventricular systole.

- (i) It lasts for about **0.3 s**.
- (ii) The atria undergo relaxation along with the ventricular systole.
- (iii) It increases the pressure causing the closure of the AV valves.
- (iv) This **prevents the 'backflow'** of blood.
- (v) It results in the production of the **first heart sound** known as '**Lub**'.
- (vi) As the ventricular pressure increases further, the semilunar valves are open. This allows the blood to flow into the aortic arches.

(3) Cardiac diastole: The ventricles now relax and the ventricular pressure falls.

This causes the closure of the semilunar valves which prevents the back flow of blood.

- (i) It lasts for about **0.4 s**.
- (ii) This results in the production of the **second heart sound** known as '**Dup**'.
- (iii) All the heart chambers are now again in a relaxed state (joint diastolic phase). Soon another cardiac cycle begins.

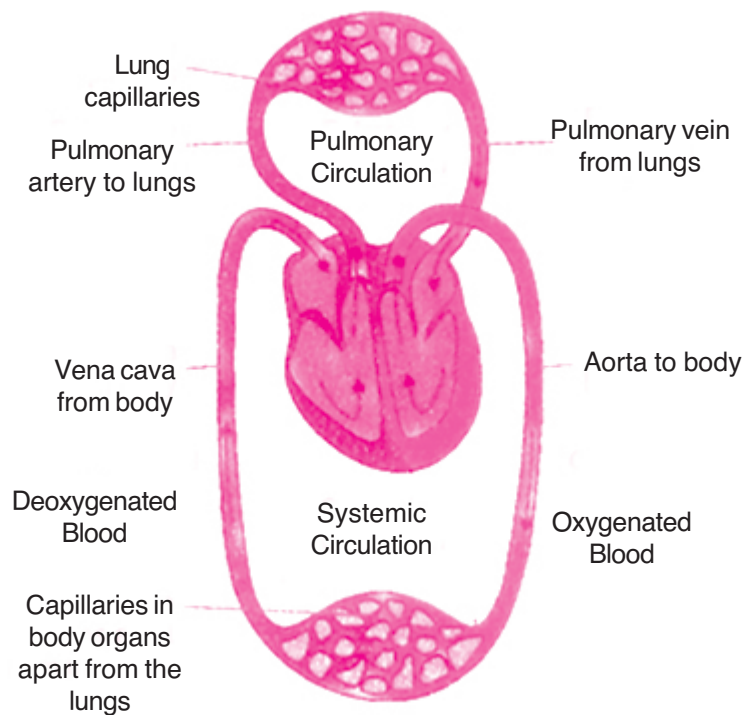
III) Cardiac Output: The volume of blood pumped out by each ventricle for each heart beat is known as stroke volume. The volume of blood pumped out by the heart from each ventricle per minute is called cardiac output.

Cardiac output = stroke volume(70ml) × No.of beats per minute(72 beats) = 5040 ml/min or approximately 5 liters.

IV) Double Circulation: There are 2 independent circulations.

(1) Pulmonary circulation: Blood from the right ventricle flows through pulmonary arteries to lungs. The blood is aerated and goes back to left atrium through pulmonary veins.

(2) Systemic Circulation: The left ventricle pumps the blood through systemic arch to various parts of the body through arteries. Blood collected from various parts of the body by veins is brought back to the right atrium through venaecavae.



DOUBLE CIRCULATION

☞ Not compulsory to draw this in the Public Exam.

20. Describe male reproductive system of a man. Draw a labelled diagram of it.

A: MALE REPRODUCTIVE SYSTEM

[AP 16,17,18,20][TS 16,17,18,19,22]

Male Reproductive system consists of 6 parts:

I) Testes II) Epididymis III) Vasa deferentia IV) Urethra V) Penis VI) Accessory glands

I) Testes:

- (1) Testes or testicles are a pair of oval pinkish **male primary sex organs**.
- (2) They are suspended outside the abdominal cavity within a **pouch** called **scrotum**.
- (3) Sperms do not develop at body (abdominal) temperature. So they go into scrotum.
- (4) The scrotum is connected to abdominal cavity through inguinal canal.
- (5) Inside the scrotum, testis is held by gubernaculum.
- (6) Spermatic cord is formed by the blood vessels, nerve and vas deferens. This cord runs from abdomen to each testis through inguinal canal.
- (7) Tunica albuginea project inside the testis as septa. There are about 250 testicular lobules in each testis. Each lobule contains 2 or 3 highly coiled seminiferous tubules.
- (8) Each seminiferous tubules consists of germinal epithelium and sertoli cells.
- (9) Germinal epithelium produces sperms.
- (10) Sertoli cells nourish the sperms.
- (11) The regions outside the seminiferous tubules called interstitial spaces contain Leydig cells.
- (12) They produce male hormone testosterone called androgens.
- (13) Testosterone controls the development of secondary sexual characters and spermatogenesis.
- (14) Seminiferous tubules open in rete testis. Rete testis opens into vasa efferentia. Vasa efferentia open into a highly coiled epididymis.

II) Epididymis :

- (1) It is a **narrow tightly coiled tube** located along **posterior** surface of each testis.
- (2) Vasa deferentia leave the testis and open into epididymis .
- (3) **Epididymis** provides space for **maturation** and **storage of sperms**.
- (4) Epididymis is divided into 3 regions
 - (i) caput epididymis (ii) corpus epididymis and (iii) cauda epididymis.
- (5) Caput epididymis receives the sperms from the testis through vasa efferentia.

III) Vasa deferentia:

- (1) The Vasa deferentia is a long, narrow, muscular tube.
- (2) It starts from the tail of the epididymis, passes through the inguinal canal into the abdomen and loops over the urinary bladder.
- (3) The two ducts open into urethra at the centre of the prostate gland.

IV) Urethra:

- (1) The **urethra originates from the urinary bladder** and extends through the penis to its external opening called urethral meatus.
- (2) The **urethra** provides an **exit for urine** as well as for semen during ejaculation.
- (3) Urethra is shared terminal duct of the reproductive and urinary systems.
- (4) Urethra is the urinogenital duct of man passes through penis to open outside.

V) Penis:

- (1) The penis serves as a **urinal duct**.
- (2) It is the **intromittent organ** that transfers spermatozoa to the vagina of a female.
- (3) It has **3 columns of tissue**. Two upper **corpora cavernosa** and **one ventral corpus spongiosum**.
- (4) The terminal enlarge part is glans penis covered by loose skin (fore skin) called **prepuce**.
- (5) Skin and a subcutaneous layer enclose all three columns, which consist of special tissue that helps in erection of the penis to facilitate insemination.

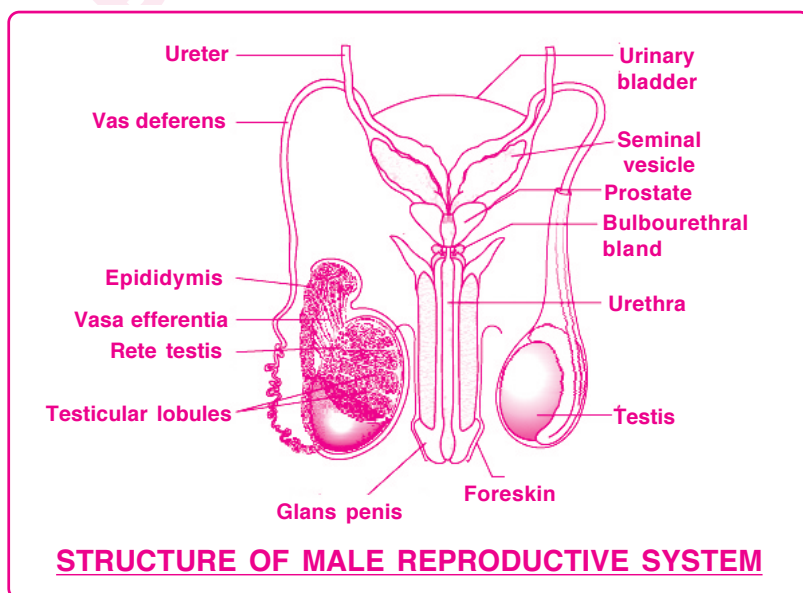
VI) Male accessory genital glands:**(1) Seminal vesicles:**

- (i) A pair of simple tubular glands is present below the urinary bladder. Each seminal vesicle opens into the corresponding vas deferens.
- (ii) Its secretion constitutes 60% of total seminal fluid. It is alkaline and viscous fluid.
- (iii) **Fructose acts as the main energy source of the sperm.**

(2) Prostate gland: (i) It is present below the urinary bladder. Its contribution to seminal fluid is 15-30%. (ii) Its secretion is **slightly acid**. It **activates the sperms** and provides nutrition.

(3) Bulbourethral glands:

- (i) These are present below the prostate gland. They add an alkaline fluid to semen during the process of ejaculation.
- (ii) The fluid secreted by these glands **lubricates the urethra**.



21. What is crisscross inheritance? Explain the inheritance of one sex linked recessive character in human beings. [AP 15,17,19][TS 15,16,19]

A: I) Criss Cross inheritance: T.H.Morgan observed sex linked inheritance in *Drosophila melanogaster*. The X-linked recessive character present in a man is inherited to his grandson through his daughter. This type of inheritance is called criss-cross inheritance.

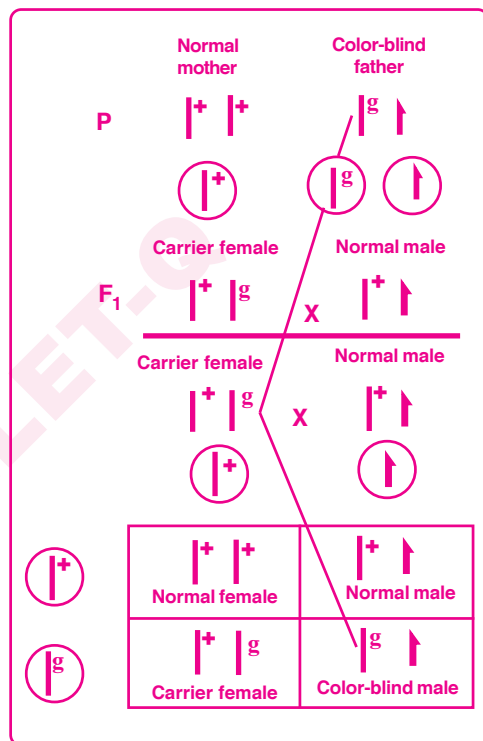
Two best examples of criss-cross inheritance are Colour blindness and Haemophilia.

II) Explanation:

- (1) Every gene whether dominant or recessive is expressed phenotypically.
- (2) Males have only one X chromosome.
- (3) Males are more prone to X-linked recessive gene expression.
- (4) Females have two X chromosome. There are more than 50% of chances of having a dominant gene. So females are less prone to X-linked recessive gene expression.

III) Colour Blindness:

- (1) The retina of eye is made up of rods and cone cells.
- (2) The cone cells are responsible for colour vision.
- (3) A recessive gene present on X chromosome causes colour blindness (Red-green).
- (4) The dominant gene influences normal colour vision.



- (5) When a woman (AAX^CX^C) with normal vision marries a 'colour- blind' man (AAX^{cb}Y), all the daughter will be the carriers. Their Karyotype is (AAX^CX^{cb}) with normal vision. Hence all the sons have normal vision. Their Karyotype is (AAX^CY).
- (6) When the carrier daughter marries a man with normal colour vision, 50% of sons gets colour blindness. All others will have normal vision, of which 50% of daughters are carriers. Here the colour blind character of the parent is inherited by grandson through the carrier daughter.

IV) Other possible inheritances:

- 1) When both parents are colour blind all their children will be colour blind.
- 2) When mother is colour blind and father has normal vision, all their sons inherit colour blindness from mother. All the daughter will be carriers because they get a dominant gene from father and recessive gene from mother.
- 3) When mother is a carrier and father is colour blind, 50% of daughters and 50% of sons get colour blindness.
- 4) So, the X-linked characters are inherited by daughters from father, by sons from their mother.