



PREVIOUS PAPERS**IPE: MAY-2026 (AP)****Time : 3 Hours****JR. BIOLOGY****Max.Marks : 85****PART A - BOTANY****SECTION-A****I. Answer ALL the following questions.****5 × 1 = 5**

1. Smallest living moneran cells that lack a cell wall are
1) Cyanobacteria 2) Protozoans 3) Mycoplasma 4) Bacteria
4. Palmitic acid contains how many carbons?
1) 16 2) 20 3) 15 4) 19
3. Cell furrow forms during cytokinesis of _____ cell.
4. _____ is the major limiting factor for photosynthesis.
5. Glycolysis occurs in which part of the cell?

SECTION-B**II. Answer ALL the following questions****7 × 2 = 14**

6. State two economically important uses of heterotrophic bacteria.
7. How do dicots differ from monocots with respect to venation?
8. What is meant by epipetalous condition? Give an example.
9. What is the significance of vacuole in a plant cell?
10. Give one example for each of amino acids, sugars, nucleotides and fatty acids.
11. Out of the basic raw materials of photosynthesis, what is reduced? What is oxidised?
12. What is meant by bolting? Which hormone causes bolting?

SECTION-C**III. Answer ANY FOUR of the following questions.****4 × 4 = 16**

13. What is meant by homosporous and heterosporous pteridophytes? Give two examples.
14. Explain different regions of root with neat labelled diagram.
15. Differentiate between Rough Endoplasmic Reticulum (RER) and smooth Endoplasmic Reticulum (SER).
16. Though redundantly described as a resting phase, interphase does not really involve rest. Comment.
17. Draw a neat labelled diagram of Chloroplast.
18. Write any four physiological effects of cytokinins in plants.

SECTION-D**IV. Answer ANY ONE of the following questions.****1 × 8 = 8**

19. Describe the internal structure of a Dicot Root with neat labelled diagram.
20. Explain the reactions of Krebs's cycle.

PART B - ZOOLOGY**SECTION-E****I. Answer ALL the following questions.****4 × 1 = 4**

1. The lowest taxonomic category is _____
1) genus 2) family 3) species 4) taxon
2. Air bladder in bony fishes helps in _____
1) buoyancy 2) food collection 3) excretion 4) digestion
3. Erythrocytes are produced in the Bone marrow of adults
4. What is the double walled cup like structure of the nephron?

SECTION-F**II. Answer ALL the following questions****7 × 2 = 14**

5. What are the basic processes in taxonomy?
6. What are the functions of canal system in sponges?
7. Define vital capacity.
8. Name the three layers of blood vessels.
9. Human skull is described as dicondylic skull. Give the reason.
10. What is corpus callosum?
11. What are Islets of Langerhan?

SECTION-G**III. Answer ANY FOUR of the following questions.****4 × 4 = 16**

12. Write eight salient features of the class Amphibia.
13. Draw a neat labeled diagram of the female reproductive system of frog.
14. Explain the process of inspiration and expiration under normal conditions.
15. Describe the structure of a skeletal muscle.
16. Give a brief account of the mechanism of synaptic transmission
17. Write a note on the mechanism of hormone action.

SECTION-H**IV. Answer ANY ONE of the following questions.****1 × 8 = 8**

18. Describe the structure of the heart of man with the help of neat labelled diagram.
19. Explain the physiology of urine formation.

IPE AP MAY - 2026

SOLUTIONS

PART I: BOTANY

SECTION-A

1. Smallest living moneran cells that lack a cell wall are
1) Cyanobacteria 2) Protozoans ✓3) Mycoplasma 4) Bacteria
2. Palmitic acid contains how many carbons?
✓1) 16 2) 20 3) 15 4) 19
3. Cell furrow forms during cytokinesis of Animal cell.
4. CO₂ is the major limiting factor for photosynthesis.

5. Glycolysis occurs in which part of the cell?
A: Cytoplasm

SECTION-B

6. State two economically important uses of heterotrophic bacteria.

A: Uses of Heterotrophic bacteria:

- 1) Making curd from milk (by lactic acid bacteria).
- 2) Production of alcohol, antibiotics, enzymes and amino acids.

7. How do dicots differ from monocots with respect to venation?

A:	Dicots	Monocots
	1) In dicots, reticulate venation is seen. 2) Veinlets are arranged in network manner. Ex: Hibiscus	1) In monocots, parallel venation is seen. 2) Veins are arranged parallelly to each other. Ex: Musa

8. What is meant by epipetalous condition? Give an example.

- A: 1) The attachment of stamens to the petals is called epipetalous condition.
2) Ex: Datura Brinjal.

9. What is the significance of vacuole in a plant cell?

- A: 1) **Osmo regulation** is the major role of vacuole in a plant cell.
2) Vacuolar sap contains water, sap, excretory product and colour pigments.

10. Give one example for each of amino acids, sugars, nucleotides and fatty acids.

- A:**
- | | |
|----------------|---------------------------------------|
| a) Amino acids | Ex: <u>G</u> lycine |
| b) Sugars | Ex: <u>G</u> lucose |
| c) Nucleotide | Ex: <u>A</u> denylic acid |
| d) Fatty acids | Ex: <u>L</u> ecithin, Glycerol |

11. Out of the basic raw materials of photosynthesis, what is reduced? What is oxidised?

A: CO_2 is reduced and H_2O is oxidised in the dark phase of photosynthesis.

12. What is meant by bolting? Which hormone causes bolting?

- A:**
- 1) Bolting:** Elongation of internodes just before flowering is called bolting.
 - Gibberellins are responsible for bolting. **Ex:** Beet, Cabbage

SECTION-C

13. What is meant by homosporous and heterosporous pteridophytes? Give two examples.

A: 1) Homosporous pteridophytes:

These are the plants which produce only **one kind of spores**.

Ex: Psilotum, Lycopodium

2) Heterosporous pteridophytes:

These are the plants which produce **two kinds of spores** on the same plant.

Ex: Selaginella, Salvinia.

14. Explain different regions of root with neat labelled diagram.

A: A typical young root shows 4 regions:

- 1) Root cap
- 2) Region of meristematic activity
- 3) Region of elongation
- 4) Region of maturity

1) Root cap:

- The root is covered at the apex by a thimble-like structure called the root cap.
- It protects the tender apex of the root as it makes its way through the soil.

2) Region of meristematic activity:

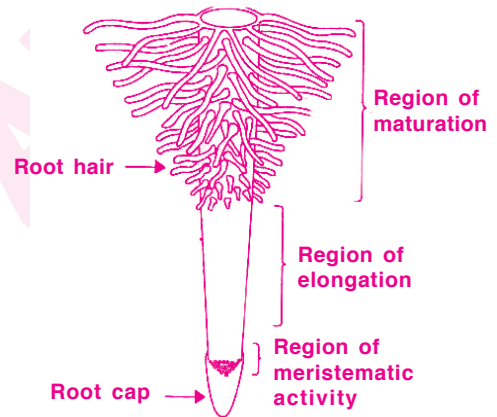
- The cells of this region are very small, thin walled and with dense protoplasm.
- They divide repeatedly to produce daughter cells.

3) Region of elongation:

- The cells proximal to the meristematic region undergo rapid elongation.
- These responsible for the growth of the root in length.

4) Region of maturity:

- From this regions, some of the epidermal cells form very fine delicate thread like structures called root hairs.
- Root hairs absorb water and mineral salts from the soil.



15. Differentiate between Rough Endoplasmic Reticulum (RER) and smooth Endoplasmic Reticulum (SER).

A:	Rough Endoplasmic reticulum (RER)	Smooth Endoplasmic Reticulum (SER)
	1) The ER bearing ribosomes on their surface is called RER.	1) The ER which does not bear ribosomes on their surface is called SER.
	2) RER observed in cells actively involves in protein synthesis and secretion.	2) SER is the site for synthesis of lipids and lipid like steroidal hormones in animal cells.

16. Though redundantly described as a resting phase, interphase does not really involve rest. Comment.

A: Interphase: The state of cell cycle, at which, the nucleus is not in a state of division, is called Inter phase. It is the period of preparation for cell division. This stage occurs between two successive cell divisions.

The inter phase is called resting phase. But during this time, the cell prepares for division by undergoing both cell growth and DNA replication in an orderly manner. The inter phase is divided into 3 sub stages- G_1 phase, S phase and G_2 phase.

1) G_1 phase: This is the phase between mitosis phase and initiation of DNA replication. **During G_1 phase** the cell is **metabolically active** and it grows continuously; but **does not replicate its DNA**.

This G_1 phase includes

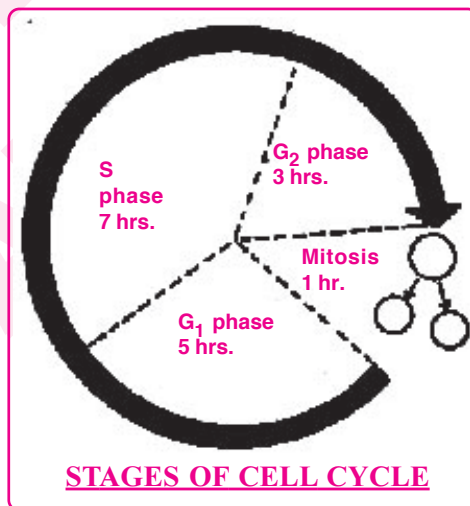
- Increase in the size of the cell.
- Synthesis of RNA and proteins.

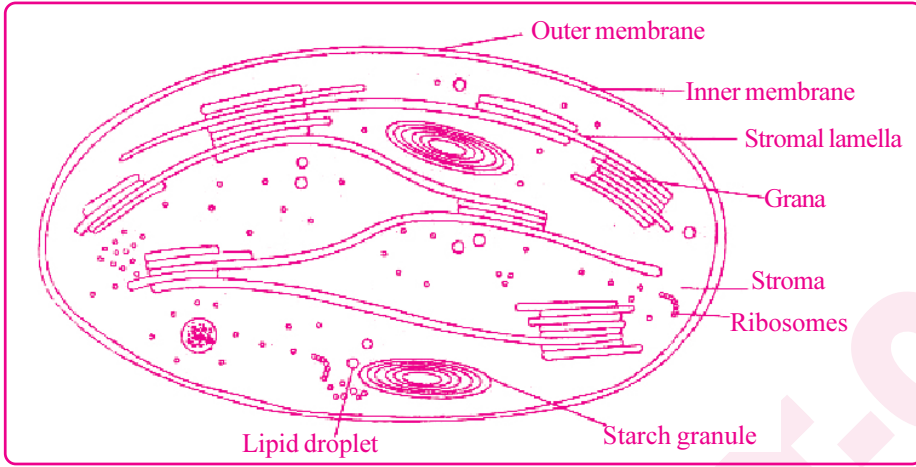
2) S Phase: In this phase, **DNA replication takes place**. During this time the amount of **DNA per cell doubles**. However, there is no increase in the chromosome number.

3) G_2 phase: During **G_2 phase**, the **synthesis of proteins and RNA continues**.

Various cell organelles are newly synthesized.

In view of the above 3 phases, we say interphase does not really involve rest.



17. Draw a neat labelled diagram of Chloroplast.**A:****18. Write any four physiological effects of cytokinins in plants.**

- A:**
- 1) Cytokinins are a class of plant growth hormones that promote cell divisions in roots & shoot tips.
 - 2) They help to produce new leaves, chloroplasts in leaves.
 - 3) They help in lateral shoot growth and adventitious shoot formation.
 - 4) They promote nutrient metabolism which helps the delay of leaf senescence.
 - 5) They help to overcome apical dominance. Thus they promote the growth of lateral branches and help in the bushy growth of the tree.
 - 6) Naturally Cytokinins are synthesised in places where rapid cell division occurs.

Ex: Root tips, shoot buds, young fruits.

SECTION-D

19. Describe the Internal Structure of a Dicot Root with neat labelled diagram.

A: T.S of Dicot Root shows three main parts. They are I) Epidermis II) Cortex III) Stele

I) Epidermis:

- 1) It is the outermost layer
- 2) It is made up of single layered rectangular cells.
- 3) It contains root hairs. They help in absorption of water.
- 4) Cuticle and stomata are absent.
- 5) Epidermis is useful in the protection of inner tissue.

II) Cortex: The Region between epidermis and stele is called cortex. It has three subparts.

1) Exodermis:

- i) It is **2 to 3 layered thick suberised cells**.
- ii) It prevents the exit of water from cortex.

2) Parenchyma (General Cortex):

- i) It is found below the hypodermis and is made up of thin walled parenchyma.
- ii) They enclose a number of glands.

3) Endodermis:

- i) It is the inner most layer of the cortex.
- ii) Cylindrical cells are tightly arranged.
- iii) Endodermis contains '**casparian thickenings**' deposited with **suberin in cell wall**.

III) Stele: Stele is the central conducting cylinder. It has three parts (1) Pericycle (2) Vascular bundles (3) Medulla

1) Pericycle:

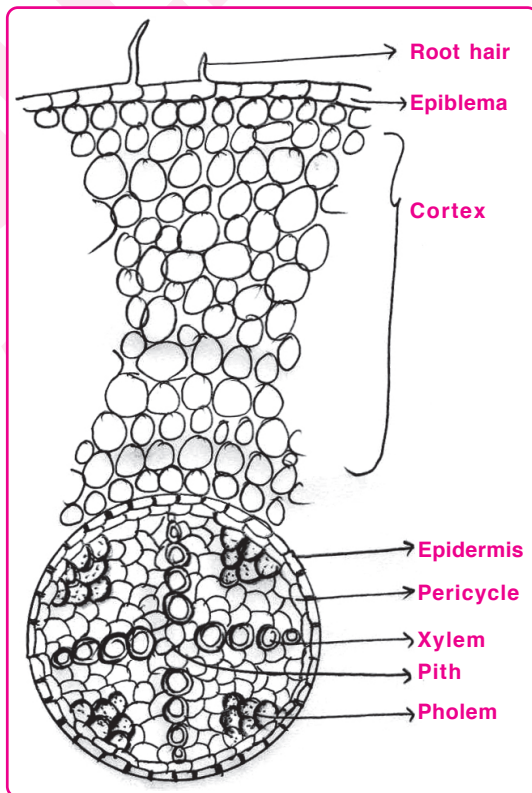
- i) Pericycle is with single layer of cells surrounding the stele.
- ii) * **Secondary growth is observed**.

2) Vascular bundles:

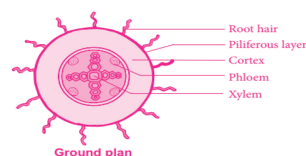
- i) Vascular bundles contain xylem and phloem on separate radii.
- ii) * **Usually 4 xylem bundles alternate with 4 phloem bundles.**
- iii) * This condition is called '**Tetrach**'.
- iv) Xylem transports water. Phloem transports food.

3) Medulla (or) Pith :

- i) * Medulla is small (or) **absent**.
- ii) It helps in the storage of food and water.



TS OF DICOT ROOT

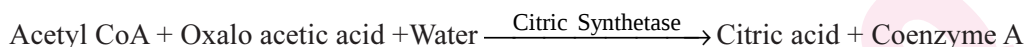


20. Explain the reactions of Krebs cycle.

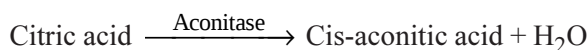
- A:** 1) **Krebs Cycle:** Krebs cycle is a cyclic process which occurs in all aerobic organisms to generate energy. It takes place in mitochondria.
- 2) In Krebs cycle, Acetyl coenzyme (CoA) is oxidised to form CO_2 and H_2O .
Also, ADP is converted into 'energy-rich' ATP.

3) Krebs Cycle- Reaction Steps:

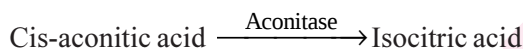
Step 1 (Condensation):



Step 2 (Dehydration):



Step 3 (Hydration):



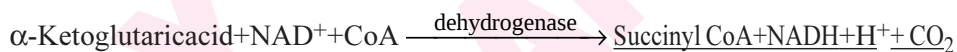
Step 4(Oxidation I):



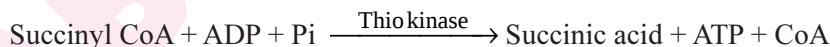
Step 5 (Decarboxylation):



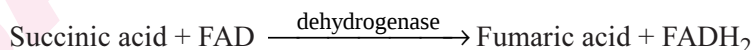
Step 6(Oxidation II):



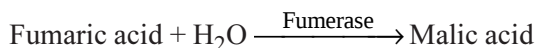
Step 7(Cleavage):



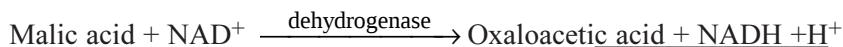
Step 8(Oxidation III):



Step 9(Hydration):



Step 10(Oxidation IV):



PART II : ZOOLOGY**SECTION-E**

21. The lowest taxonomic category is

- 1) genus 2) family ✓3) species 4) taxon

22. Air bladder in bony fishes helps in

- ✓1) buoyancy 2) food collection 3) excretion 4) digestion

23. Erythrocytes are produced in the **Bone marrow** of adults

24. What is the double walled cup like structure of the nephron?

A: Bowman's capsule

SECTION-F

25. What are the basic processes in taxonomy?

A: Characterisation, Identification, Classification and Nomenclature are the 4 basic processes in taxonomy.

26. What are the functions of canal system in sponges?

A: Functions of the canal system in sponges:

- i) Collection of food (nutrition)
- ii) Respiratory exchange of gases (respiration)
- ii) Removal of wastes (excretion).

27. Define vital capacity.

A: 1) **Vital Capacity** is the maximum volume of air a person can **breathe in** after '**forced expiration**'.
2) VC includes TV(tidal volume), ERV(expiratory reserve volume),
IRV(inspiratory reserve volume). Thus, $VC = TV + ERV + IRV$

28. Name the three layers of blood vessels.

A: Three layers of blood vessels are

- 1) Tunica intima (innermost layer) - squamous endothelium.
- 2) Tunica media (middle muscular layer) - smooth and elastic fiber.
- 3) Tunica externa (outer connective tissue layer) - fibrous connective tissue.

29. Human skull is described as dicondylic skull. Give the reason.

A: 1) The occipital bone has **two condyles** on either side of foramen magnum.
2) These two articulate with atlas and hence called dicondylic skull (as in amphibians).

30. What is corpus callosum?

- A:** 1) **Corpus callosum** is a transverse internal connection between two cerebral hemispheres, beneath the cerebral cortex.
- 2) It coordinates the functions of the two cerebral hemispheres.

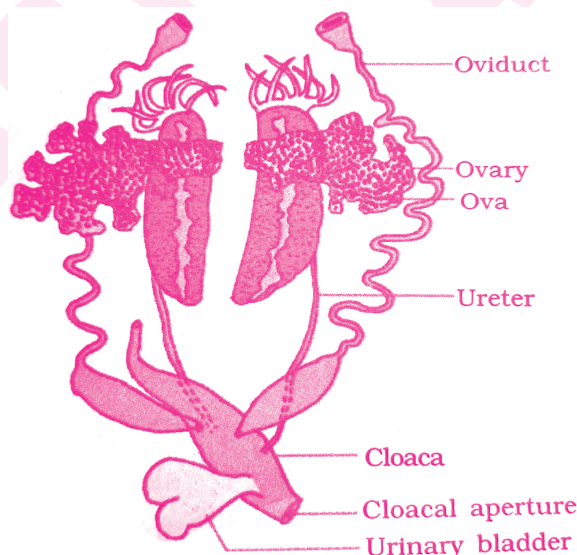
31. What are Islets of Langerhan?

- A:** 1) Islets of Langerhan is endocrine part of pancreas.
- 2) Pancreas consists of 1-2 million Islets of Langerhans.
- 3) It contains alpha cells which secrete glucagon, and beta cells which secrete insulin.

SECTION-G**32. Write eight salient features of the class Amphibia.****A: Salient features of Amphibia:**

[**Amphibia Ex:** Bufo (toad), Rana (frog), Hyla (tree frog), Rhacophorus (flying frog)]

- 1) **Habitat:** They lead dual mode of life on land and in water.
- 2) **Body structure:** The body is divided into distinct head, trunk and tail (present or absent).
- 3) **Skin:** It is moist, glandular and without scales except the members of Apoda.
- 4) **Limbs:** Amphibians are first tetrapods having 2 pairs of limbs.
- 5) **Eyes and Ears:** Eyes have eyelids, a tympanum (eardrum) represents the ear.
- 6) **Glands:** Lacrimal and harderian glands are present in the eyes.
- 7) **Respiration:** Respiration is pulmonary, cutaneous and bucco pharyngeal.
- 8) **Circulatory system :** Heart is three chambered (two auricles & one ventricle)
- 9) **Excretion:** Amphibians are ureotelic. Kidneys are mesonephric
- 10) **Reproduction:** Sexes are separate. Fertilisation is external.
- 11) **Development:** Development is indirect it involves a larval stage (tadpole).

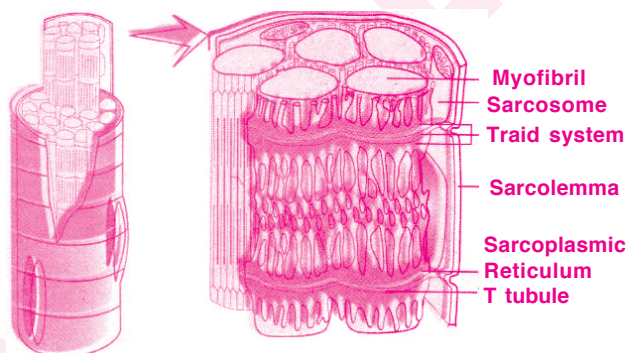
33. Draw a neat labeled diagram of the female reproductive system of frog.**A:****Female Reproductive system of frog**

34. Explain the process of inspiration and expiration under normal conditions.**A: I) Inspiration:**

- 1) **Intake of atmospheric air into the lungs** is called Inspiration. It is an **active process**.
- 2) It takes place by the **contraction of diaphragm muscles**.
- 3) Contraction of external intercostal muscles raise the ribs side ways and increase the thoracic volume in dorso-ventral axis.
- 4) When the ribs and diaphragm are drawn out they pull the pleural membrane attached to lungs.
- 5) Then the pressure inside the lungs decreases than that of the atmosphere.

II) Expiration:

- 1) Sending out air from lungs is called expiration. It is a **passive process**.
- 2) During Expiration, the external intercostal muscles and muscles of diaphragm **relax**.
- 3) Then the volume of the thoracic cavity is reduced.
- 4) The air is forced out through air passages .

35. Describe the structure of a skeletal muscle.**A: Structure of Skeletal Muscle:**

- 1) Skeletal muscles are primarily involved in locomotion and bodily movements.
- 2) The skeletal muscle is made up of muscle bundles or fascicles.
- 3) Skeletal muscle fibre is surrounded by a thin connective tissue sheath, the endomysium.
- 4) Each fascicle contains cylindrical muscle fibres. The fascicles are held together by collagenous connective tissue called fascia.
- 5) Each muscle fibre has an outer sarcolemma, enclosing sarcoplasm.
- 6) There are many peripheral nuclei (syncytium)
- 7) The endoplasmic reticulum is sarcoplasmic reticulum, which stores calcium ions.
- 8) There are large number of parallel myofibrils in sarcoplasm.
- 9) Myofibrils show alternate dark and light bands. So it is called striped (or) striated muscle.
- 10) **Skeletal muscle is usually attached to skeletal structures by tendon.**

36. Give a brief account of the mechanism of synaptic transmission**A: Synaptic transmission:**

- 1) Synapse is a junction between two successive neurons.
- 2) It transmits nerve impulses from one neuron to other neuron.
- 3) Two types of synapses. (i) Electrical synapse (ii) Chemical synapse
 - (i) Electrical synapses are electrically conductive links between two neurons .
 - (ii) In chemical synapses, the membranes of the pre and post-synaptic neurons are separated by a fluid-filled space.
- 4) Chemical messengers called neurotransmitters are involved in the transmission of impulses.
- 5) Neuro transmitters are released from the synaptic vesicles of axon terminals.
- 6) When an impulse (action potential) arrives at the axon terminal, it gets depolarized .
- 7) Calcium ions fuse with the plasma membrane and release their neurotransmitters in the synaptic cleft by **exocytosis**.
- 8) The post synaptic membrane has ligand gated channels.

37. Write a note on the mechanism of hormone action.**A: Mechanism of action of Hormones:**

- 1) Hormones regulate various functions of the body.
- 2) They act on target cells. They are chemical messengers.
- 3) Based on solubility, hormones are of 2 types . They are A) lipid insoluble and B) lipid soluble.

A) Mechanism of lipid insoluble hormone:

- i) Lipid insoluble hormones bind to membrane bound receptors and stimulate G protein.
- ii) G protein further activates adenylate cyclase resulting in the formation of secondary messenger like cAMP which mediate further reactions in a cascade manner.

Ex: Epinephrine.

B) Mechanism of lipid soluble hormone:

- i) Lipid soluble hormones easily diffuse through cell membranes
- ii) They interact with receptors in cytoplasm, forming hormone-receptor complex.

SECTION-H

38. Describe the structure of the heart of man with the help of neat labelled diagram.

A: Structure of the Human heart: Human heart is a hollow muscular, cone shaped and pulsating organ situated between lungs. Its size is about a clenched fist.

Human heart consists of 4 parts:

I) Pericardium II) Heart wall III) External Structure IV) Internal Structure

I) Pericardium: Heart is covered by **double walled pericardium**. There is **pericardial fluid** which reduces friction and allows free movement of the heart.

II) Heart wall: It consists of 3 layers.

(1) Outer epicardium (2) Middle myocardium (3) Inner endocardium.

III) External Structure : Human heart has four chambers.

1) Two small upper chambers are called **atria** (L.A & R.A)

2) Two large lower chambers are called **ventricles** (L.V & R.V)

3) Atria and ventricles are separated by a deep transverse groove called **coronary sulcus**.

IV) Internal structure: 1) Atria 2) Ventricles 3) Nodal tissue 4) Aortic arches.

(1) Atria:

i) Atria are thin walled **blood receiving chambers**. The right one is larger than the left.

ii) The two atria are separated by thin **inter-atrial septum**.

iii) Atria and ventricles are separated by a membrane called atrio -ventricular septum.

vi) Bicuspid valve is in between L.A & L.V.

vii) Tricuspid valve is in between R.A & R.V.

(2) Ventricles :

i) These are thick walled blood 'pumping chambers' (lower chambers)

ii) The two ventricles are separated by an **interventricular septum**.

iii) The wall of the left ventricle is thicker than the right ventricle

iv) The inner surface of the ventricles is raised into muscular ridges called **columnae carneae**.

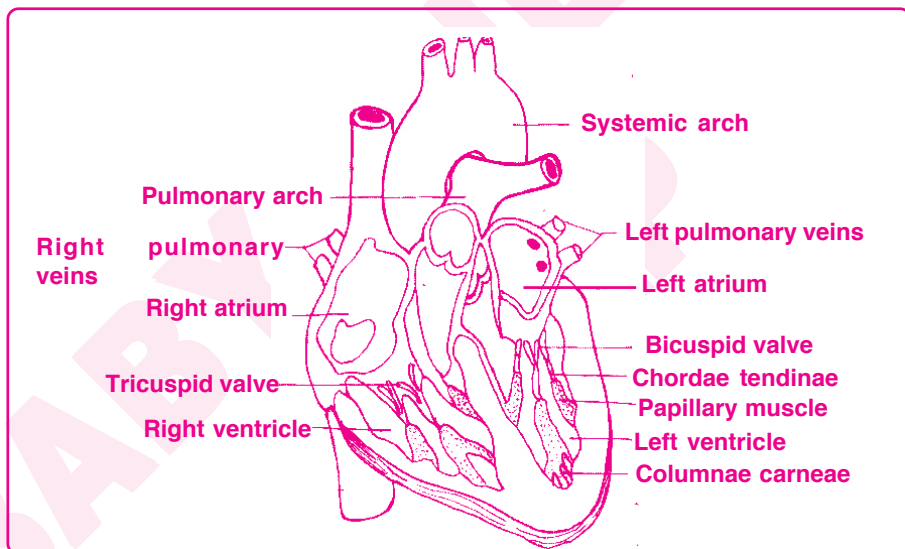
v) Some of these ridges are large and conical, and are called **papillary muscles**.

(3) Nodal tissue (Pacemaker):

- i) It is a **modified heart muscle**. It consists of **two nodes SAN, AVN** and **fibres**.
- ii) **SAN(SinoAtrial Node)** is located in the 'right upper corner of right atrium', (close to the opening of superior venacava.)
- iii) **AVN (AtrioVentricular Node)** is located in the 'lower left corner of the right atrium', (close to the opening of coronary sinus.)
- iv) AVN forms AV bundle or "His" bundle. It is divided into right and left bundle branches.

(4) Aortic arches: There are two aortic arches in man.

- i) **Pulmonary Arch:** It arises from the left anterior angle of the right ventricle. Its opening is guarded by the pulmonary valve and it carries deoxygenated blood to the lungs.
- ii) **Systemic Arch:** It arises from the left ventricle. Its opening is guarded by the aortic valve. It transports oxygenated blood to different parts of the body through its branches.



INTERNAL STRUCTURE OF THE HEART

39. Explain the physiology of urine formation.

A: I) Urine Formation: Kidneys are main excretory organs of human beings. Urea along with water and other dissolved substances are collectively called urine. Three processes of Urine formation:

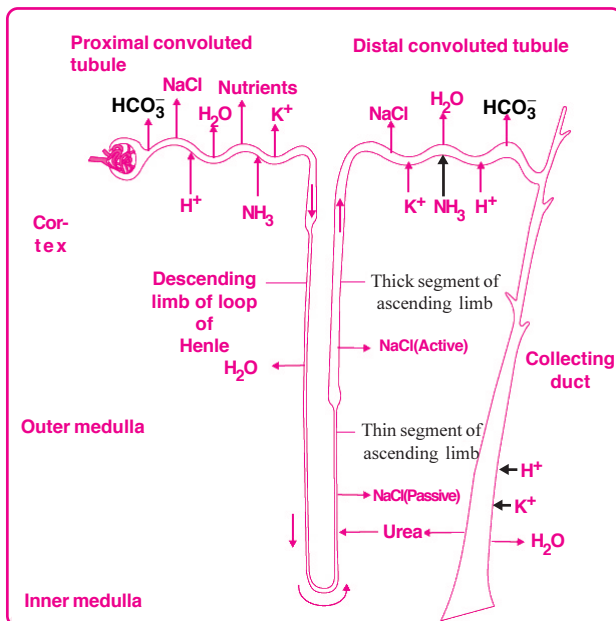
1) Glomerular filtration 2) Selective reabsorption 3) Tubular secretion.

1) Glomerular filtration: Glomerular capillaries along with inner wall of Bowman's capsule form a sieve. The podocytes and slit pores help in this process. **Blood is filtered with a net filtration pressure of 10mm of Hg.** During this process the entire plasma is filtered except proteins and blood cells.

The filtrate is ultrafiltrate or glomerular filtrate or primary urine.

The glomerular filtration rate in a healthy individual is 125ml/ minute.

2) Selective reabsorption: Nearly 99% of primary urine and essential substances are reabsorbed by renal tubules called selective reabsorption. About 85% of primary urine is reabsorbed in a constant unregulated manner called obligatory reabsorption.



REABSORPTION AND SECRETION OF MAJOR SUBSTANCES

3) Tubular secretion: During the formation of urine, the tubular cells secrete substances such as H^+ , K^+ and NH_3 into the filtrate. Tubular secretion is also an important step in the formation of urine, as it helps in the maintenance of ionic and acid base balance of the body fluids.

II) Mechanism of selective reabsorption- Secretion in different parts of nephrons

1) Proximal convoluted tubule: It is lined by cuboidal epithelium with brush border. About 80% electrolytes and water are reabsorbed. Water is absorbed by passive diffusion (osmosis) and Na^+ , glucose, amino acids and other essential substances by active transport. H^+ and NH_3 are secreted. HCO_3^- is absorbed to maintain pH.

2) Henle's loop: Water reabsorbed in descending limb by diffusion. Ascending limb has a thin segment and thick segment. $NaCl$ is reabsorbed passively in thin part and actively in thick part. In Henle's loop, low osmolarity (300) is maintained **towards cortex** and **high osmolarity** (1200) at the **tip in medulla**. The counter flow of blood through vasa recta removes water, $NaCl$ and reabsorbed substances continuously.

3) Distal Convoluted Tubule(DCT): Water is reabsorbed by the action of ADH (Anti diuretic hormone). HCO_3^- is absorbed. H^+ , K^+ and NH_3 are secreted to maintain pH.

4) Collecting Ducts(CD): This segment allows the passage of small amount of urea to keep up its osmolarity. Concentrated urine is released into pelvis. It is **hypertonic** to the plasma of blood.