

Examination Paper, 2019 [M]

Time Allowed: 3 Hours]

[Maximum Marks: 70

General Instructions:

- (i) There are total **27** questions and **four** sections in the question paper. **All** questions are compulsory.
 - (ii) Section **A** contains questions number **1** to **5**, very short answer type questions of **one** mark each.
 - (iii) Section **B** contains questions number **6** to **12**, short answer type-**I** questions of **two** marks each.
 - (iv) Section **C** contains questions number **13** to **24**, short answer type-**II** questions of **three** marks each.
 - (v) Section **D** contains question number **25** to **27**, long answer type questions of **five** marks each.
 - (vi) There is no overall choice. However, an internal choice has been provided in **one** question of **two** marks, **two** questions of **three** marks and **three** questions of **five** marks each. You have to attempt only one of the alternatives in all such questions.
 - (vii) Wherever necessary, the diagram drawn should be neat and properly labelled.
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SECTION — A

- 1. Write two codes of nomenclature of living organisms.**

Ans. Codes of Nomenclature

ICBN: International Code of Botanical Nomenclature.

ICZN: International Code of Zoological Nomenclature.

- 2. What is an 'endarch' arrangement ? Which one, out of the root and stem, shows this arrangement?**

Ans. – When the protoxylem lies towards the centre/pith and the metaxylem lies towards the periphery of the organ, the arrangement of xylem is endarch.

– It is found in stems.

- 3. Iodine turns the starch into blue black colour. Why?**

Ans. Starch forms helical secondary structure and it can hold iodine in the helices; the starch-iodine complex is blue in colour.

4. What do you understand by the term ‘facilitated diffusion’?

Ans. Facilitated diffusion refers to the movement of substances across the membrane with the help of membrane proteins following concentration gradient without energy expenditure.

5. Name the regions of brain, which constitute ‘brain stem’.

Ans. Midbrain and hind brain.

SECTION — B

6. Give any four important characteristics of mycoplasma.

Ans. (i) They lack a cell wall.
(ii) They are the smallest living cells.
(iii) They can survive without oxygen.
(iv) They are pathogenic, i.e. cause diseases in plants and animals.

7. The spread of living pteridophytes is limited and restricted to narrow geographical regions. Why?

Ans. The pteridophytes are restricted to narrow geographical regions because:
(i) The gametophytes require cool, damp, shady places to grow.
(ii) They require water for fertilisation.

8. Some animals of phylum ‘Cnidaria’ show metagenesis. What is it? Give an example of animal that shows metagenesis.

Ans. Metagenesis is the phenomenon of alternation of generations, in cnidarians, i.e., polyps produce medusae asexually and medusae produce polyps sexually.
e.g. *Obelia*.

9. What are exocrine glands? Name the secretions of any two exocrine glands.

Ans. – The glands whose secretions are released through ducts to the site of action, are called exocrine glands, e.g., saliva from salivary glands, digestive enzymes from pancreas.

10. Name the two types of lymphocytes and write one difference between the two.

Ans. The two types of lymphocytes are:
(i) B-lymphocytes
(ii) T-lymphocytes

Differences:

B-lymphocytes	T-lymphocytes
– They undergo maturation in the bone marrow.	– They undergo maturation in the thymus gland.
– They produce antibodies in response to the pathogens.	– They are responsible for cell-mediated immunity and stimulate B-cells to produce antibodies.

14. Give atleast three points of differences between spring wood and autumn wood.

Ans. Differences:

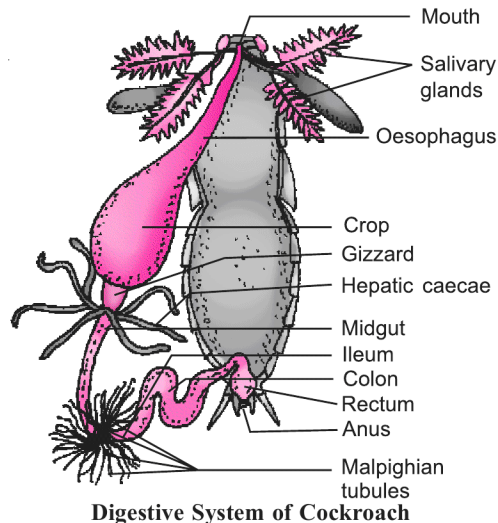
Spring Wood	Autumn Wood
– The wood formed during favourable growth season (spring and summer), is called spring wood.	– The wood formed during unfavourable growth periods (winter and autumn), is called autumn wood.
– The cambium is very active and the secondary xylem vessels are larger in dimension.	– The cambium is less active and the wood produced has vessels of narrow dimension.
– It is lighter in colour.	– It is darker in colour.
– It has a lower density.	– It has a higher density.

15. Draw a diagram of alimentary canal of cockroach and label any six parts in it. (Description is not required)

The alternate choice of this question is for only visually impaired students:

Describe the structure of alimentary canal of cockroach.

Ans.



Digestive System of Cockroach

(any six)

16. Name the scientists who proposed the cell theory. Also list its main postulates.

Ans. – Cell theory was first proposed by Matthias Schleiden and Theodor Schwann; later Rudolf Virchow explained the origin of new cells.

– Its postulates are:

- (i) All living organisms are composed of cell(s) and its/their products.
- (ii) All cells arise from pre-existing cells.

17. Enlist the different types of amino acids based on the number of carboxyl and amino groups in them. Also give one example of each of these amino acids.

Or

Explain a glycosidic, peptide and a phosphodiester bond.

Ans. There are three types of amino acids:

- (i) Acidic amino acids – *e.g.* Glutamic acid
- (ii) Basic amino acids – *e.g.* Lysine
- (iii) Neutral amino acids – *e.g.* Valine

Or

- A glycosidic bond is formed between two carbon atoms of two adjacent monosaccharides.
- A peptide bond is formed between the carboxyl group of one amino acid and the amino group of the next amino acid.
- A phosphodiester bond refers to the bond between a phosphate moiety and the 3' carbon of sugar of one nucleotide on one side and the 5' carbon of the sugar of another nucleotide on the other side.

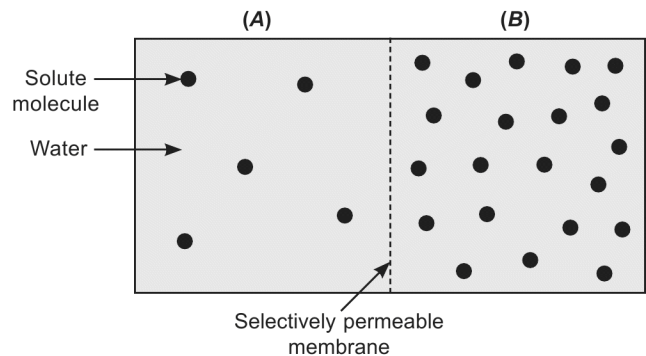
18. Describe briefly the various stages of cell cycle during the interphase preceding mitosis.

Ans. Interphase

- (a) Interphase is the most active stage in the cell cycle, when the cell prepares for the division phase.
- (b) It consists of three sub-stages:
 - (i) **G₁ Phase or Gap-1 Phase**
 - It corresponds to the interval between mitosis (M-phase) and initiation of replication of DNA; the cell grows in size.
 - (ii) **S Phase or Synthetic Phase**
 - It is the period during which DNA replication takes place and the amount of nucleic acid doubles.
 - (iii) **G₂ Phase or Gap-2 Phase**
 - During this phase, more RNAs and proteins are synthesised in preparation for mitosis and also for the growth of cells.

19. Study the given figure in which two chambers, A and B, containing solutions are separated by a semi-permeable membrane:

- (a) Solution of which chamber has a lower water potential?
- (b) Solution of which chamber has a lower solute potential?
- (c) In which direction will osmosis occur?
- (d) Which solution has a higher solute potential?
- (e) At equilibrium which chamber will have lower water potential.
- (f) If one chamber has a ψ of -2000 kPa and the other -1000 kPa, which is the chamber that has the higher ψ ?



- Ans.** (a) Chamber B (b) Chamber B
(c) Chamber A to B (d) Chamber A
(e) No chamber; both will be equal. (f) Chamber with -1000 kPa.

20. Discuss: "The respiratory pathway is an amphibolic pathway."

- Ans.** – Respiration involves breakdown of respiratory substrates; the compounds formed as a result of breakdown enter different pathways for synthesis of various compounds.
- Fatty acids are broken down to acetyl CoA before entering the respiratory pathway, when it is the respiratory substrate.
 - But when the organism requires to synthesize fatty acids, acetyl CoA would be withdrawn from the respiratory pathway.
 - When proteins are the respiratory substrates, amino acids are deaminated to form pyruvic acid which enters the respiratory pathway.
 - Pyruvic acid from respiratory pathway is the raw material for the manufacture of amino acids.
 - Since respiratory pathway involves anabolism as well as catabolism, it is known as amphibolic pathway.

21. What would be expected to happen if:

- (a) GA_3 is applied to rice seedling.
- (b) A rotten fruit get mixed with unripe fruits.
- (c) You forget to add cytokinin to the culture medium.

- Ans.** (a) The rice seedlings would grow tall due to elongation of internodes.
(b) The ripening of fruits will be hastened due to release of ethylene by the rotten fruit.
(c) Roots will be initiated from the callus.

22. Name any three enzymes secreted by pancreas. Specify the substrate and product of each.

- Ans.** Trypsin, lipase and amylase are enzymes secreted by pancreas.
- Trypsin acts on proteins, proteoses and peptones and converts them into shorter peptides.
 - Lipase acts on triglycerides and converts them into diglycerides and monoglycerides along with the release of a fatty acid at every step.
 - Amylase acts on starch and converts it into maltose.

23. Describe the role of haemoglobin in the transport of respiratory gases.

Or

Explain how the counter-current mechanism contributes to concentrate urine in human kidney.

- Ans.** – Haemoglobin is the respiratory pigment present in the erythrocytes; it transports oxygen and carbon dioxide, the respiratory gases.

Transport of oxygen:

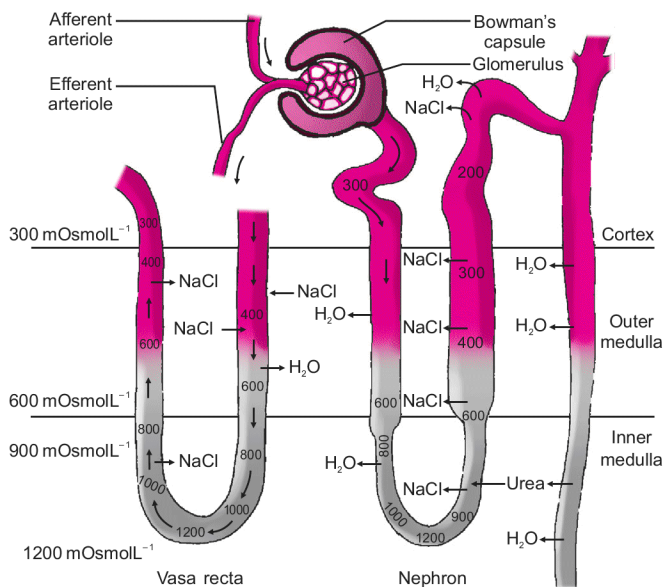
- Oxygen combines with the haemoglobin in a reversible manner to form oxyhaemoglobin; each haemoglobin molecule can carry a maximum of four oxygen molecules.
- 97% of oxygen is carried as oxyhaemoglobin in the blood and every 100 ml of blood can deliver about 5 ml of oxygen.

Transport of carbon dioxide:

- Carbon dioxide combines with the haemoglobin to form carbaminohaemoglobin in the erythrocytes.
- About 20–25 percent of the carbon dioxide is transported as carbaminohaemoglobin and every 100 ml of deoxygenated blood transports about 4 ml of carbon dioxide.

Or

- The flow of filtrate in the two limbs of loop of Henle is in opposite directions and the flow of blood in the two limbs of a *vasa recta* is also in opposite directions and hence forms a counter current system.
- The two factors responsible for increasing the osmolarity towards the medullary interstitium are:
 - (i) The proximity between the loop of Henle and the *vasa recta*.
 - (ii) The counter current systems in them.
- The osmolarity in the cortex is about 300 mOsmolL^{-1} and that in the medulla is about $1200 \text{ mOsmolL}^{-1}$.
- This gradient is maintained by sodium chloride and urea.
- The interstitial gradient of NaCl is maintained by the loop of Henle.
- Urea is added to the interstitial fluid of the medulla by its diffusion from the collecting duct; it re-enters the ascending limb by diffusion.
- The counter-current mechanism thus helps to maintain a concentration gradient between the medullary interstitium and the urinary tubule.
- As the filtrate moves in the collecting duct past the interstitial fluid, water moves out of the tubule by osmosis and urine becomes concentrated.



Concentration of Urine

24. Explain in brief the Nitrogen cycle.

Ans. The nitrogen cycle involves the following steps:

(i) **Nitrogen fixation:**

- It is the process of conversion of atmospheric free nitrogen into ammonia and other nitrogenous compounds.
- It is carried out by soil microbes like *Azotobacter*, *Azospirillum* and *Rhizobium*.
- Lightning and ultraviolet rays provide energy for conversion of nitrogen into oxides of nitrogen.

(ii) **Ammonification:**

- It is the process of decomposition of organic nitrogenous compounds into ammonia.

(iii) **Nitrification:**

- It is the process of converting ammonia first into nitrite (by *Nitrosomonas*, *Nitrococcus*) and then into nitrate (by *Nitrobacter*).

(iv) **Denitrification**

- It is the process of conversion or reduction of nitrates in the soil to free nitrogen.
- It is carried out by bacteria like *Thiobacillus* and *Pseudomonas*.

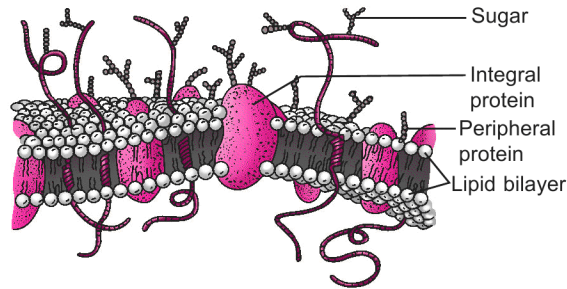
SECTION — D

25. Name the scientist who proposed the fluid mosaic model about the structure of plasma membrane. Describe the structure of plasma membrane according to this model.

Or

Why meiosis is called reduction division? Describe the key events of prophase-I of meiosis-I cell division. Write the significance of meiosis cell division.

- Ans.**
- The fluid mosaic model was proposed by Singer and Nicolson.
 - The cell membrane is made of lipids mainly phosphoglycerides, that are arranged as a bilayer, proteins and carbohydrates.
 - The lipids are arranged within the protein layers with the polar head towards the outer surface and the hydrophobic tails towards the inner surface.
 - The cell membrane also possesses some carbohydrates.
 - The membrane proteins may lie on the surface of membrane (peripheral proteins) or partially or totally buried in the membrane proteins.
 - The ratio of lipids to proteins varies in different types of cells.



Fluid Mosaic Model of Plasma Membrane

Or

Meiosis is called reduction division, because the daughter cells formed after meiosis have only half the number of chromosomes as the parent cell.

Events in Prophase I of meiosis:

- Prophase I has been divided into the following five phases, based on the chromosomal behaviour;
 - (i) Leptotene, (ii) Zygotene, (iii) Pachytene, (iv) Diplotene and (v) Diakinesis
- During leptotene, the compaction of chromosomes continues and the chromosomes become visible under light microscope.
- During zygotene, the homologous chromosomes start pairing, in the process, called synapsis; it is accompanied by the formation of synaptonemal complex and the pair of synapsed homologous chromosomes, is called a bivalent.
- During pachytene, the bivalents appear as tetrads and recombination nodules appear indicating the sites of crossing over.
- Crossing over occurs between non-sister chromatids of homologous chromosomes; the process is catalysed by enzyme, recombinase.
- Diplotene is marked by the dissolution of the synaptonemal complex and the tendency of the members of bivalents to separate except at sites of cross overs, called chiasmata.
- Diakinesis is marked by terminalisation of chiasmata; the chromosomes are fully condensed and the nuclear envelope and nucleolus have disappeared.

Significance of Meiosis

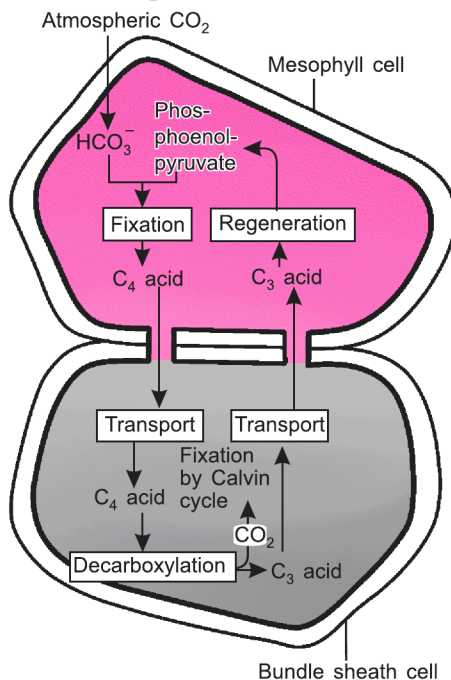
- Meiosis ensures the maintenance of a constant chromosome number, characteristic of a species, through generations.
- The crossing over results in variations of genetic characters in the progeny; variation is necessary for survival of species and it is the raw material for evolution.

26. Name the CO₂ acceptor in the mesophyll cells of a C₄ plant. Explain the synthesis of glucose in such plants.

Or

Explain the major steps in Kreb’s cycle. Why is this cycle also called citric acid cycle?

Ans. Phosphoenol pyruvate (PEP) is the CO₂ acceptor in such plants.



Hatch-Slack Pathway

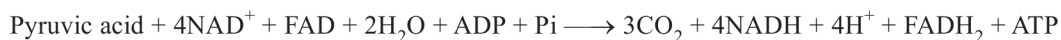
- Phosphoenol pyruvate (PEP) is the primary carbon dioxide acceptor present in the mesophyll cells; the reaction is catalysed by PEP-carboxylase and the first stable product is oxaloacetic acid (OAA) a 4C-compound.
- OAA is converted into malic acid, which is transported to bundle sheath cells and decarboxylated to form pyruvic acid and carbon dioxide.
- The carbon dioxide enters the calvin cycle that is operating in the bundle sheath cells and sugars are formed.

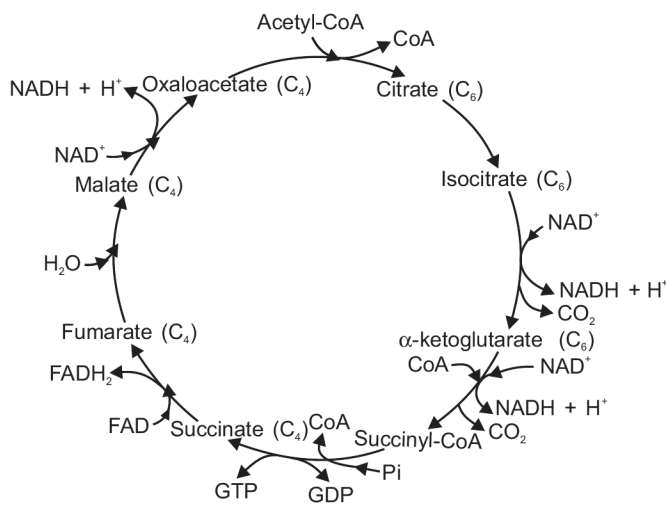
Or

Since the first product of Krebs's cycle is citric acid, it is called citric acid cycle also.

Steps in Citric Acid Cycle

- During this cycle of reactions, 3 molecules of NAD and one molecule of FAD are reduced to NADH and FADH respectively.
- One ATP molecule is produced directly from GTP formed by substrate level phosphorylation.
- The reactions of aerobic oxidation of Pyruvic acid can be summed up as:





Kreb's Cycle

27. Describe the sequence of events which occur in the cardiac cycle in humans. Where and how are the sounds 'lub' and 'dub' produced in the heart during this cycle?

Or

Explain the sliding filament theory of the mechanism of muscle contraction.

Ans. Cardiac cycle

– A cardiac cycle refers to the sequential events in the heart that are cyclically repeated and consists of diastole and systole of both the atria and both the ventricles.

– The events are as follows:

(i) **Joint diastole**

- During this phase, both atria and ventricles are in the relaxed state.
- Blood from pulmonary veins flows into the left atrium and from superior and inferior vena cava into right atrium.
- Since AV valves are open, blood also flows into the respective ventricles from the atria.
- Semilunar valves are closed.

(ii) **Atrial systole**

- Atrial muscles contract and blood flow into ventricles increases by about 30%.
- The ventricles continue to remain in their diastole.

(iii) **Ventricular systole**

- As the action potential is conducted to the ventricles, they start their systole and the atria start their diastole.
- As the pressure inside ventricles increases, the AV valves close to prevent backflow of blood into atria.

- Further increase in ventricular pressure causes the opening of semilunar valves and blood from the left ventricle enters the aorta and that from the right ventricle enters the pulmonary artery.

(iv) **Ventricular diastole**

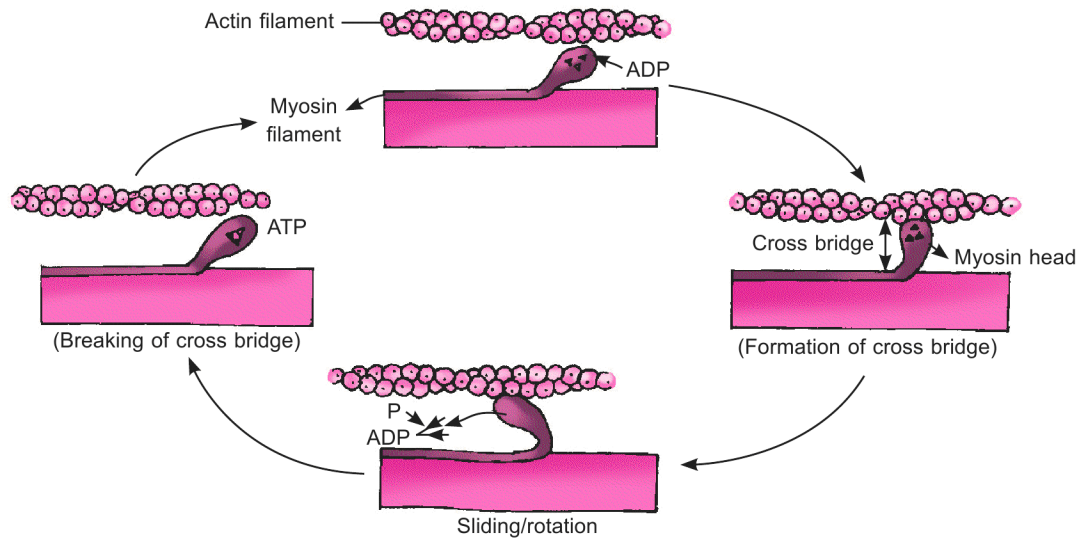
- The ventricles start relaxing and the atria also continue their diastole.
- As the ventricular pressure decreases, the semilunar valves close to prevent the backflow of blood into the ventricles.

The two heart sounds are ‘lub’ and ‘dub’.

- The first heart sound ‘lub’ is produced by the closure of AV-valves at the start of ventricular systole.
- The second heart sound ‘dub’ is produced by the closure of semilunar valves at the start of ventricular diastole.
- The first heart sound lub is of longer duration.

Or

- The sliding filament theory states that contraction of a muscle fibre takes place by the sliding of the thin (actin) filaments over the thick (myosin) filaments.
- When a neural signal reaches the neuromuscular junction and releases the neurotransmitter, acetylcholine, an action potential is generated in the sarcolemma.
- It spreads through the muscle fibre and stimulates the release of calcium ions from the sarcoplasmic reticulum.
- When the calcium ions bind to the troponin on the actin filament, the active site for myosin becomes exposed.
- The myosin head binds to the active site on actin and forms a cross bridge; this utilises energy by hydrolysis of ATP.
- The formation of cross bridge pulls the actin filaments towards the centre of A band.
- Consequently, the ‘Z’ lines attached to the actin filaments are also pulled inwards, resulting in the shortening of the sarcomere and muscle.
- The myosin releases ADP and inorganic phosphate and starts relaxing, but binding of another ATP causes the breaking of the cross bridge and is hydrolysed by the myosin head.
- The cycle of cross bridge formation, sliding of actin filaments and the breaking of the cross bridge, continues till the calcium ions are actively pumped back into the sarcoplasmic reticulum.
- In the absence of calcium ions, the active site for myosin on actin is masked; this causes the actin filaments to slide out of A band and the sarcomere (hence the muscle) comes back to its original length, i.e. the muscle is relaxed.



Stages in Cross Bridge Formation, Rotation of Head and Breaking of Cross Bridge

Examination Paper, 2019 [E]

Time Allowed: 3 Hours]

[Maximum Marks: 70

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 - (vii) Wherever necessary, the diagram drawn should be neat and properly labelled.
-

SECTION — A

1. Which has more number of species: a genus or a family?

Ans. A family.

2. What constitutes the stele in plants?

Ans. In plants, stele is constituted by all the tissues that are on the inner side of the endodermis, i.e., pericycle, vascular bundles and pith.

3. Give an example of protein which has quaternary structure.

Ans. Haemoglobin.

4. Define solute potential. With what symbol is it represented?

Ans. – Solute potential refers to the magnitude by which the water potential is lowered due to dissolution of a solute in it.
– It is represented as Ψ_s .

5. Blind spot in the eye is devoid of the ability of vision. Why is it so?

Ans. Because there is no photoreceptor cell.

SECTION — B

6. List four points of differences between viruses and viroids.

Ans. Differences:

Viroids	Viruses
<ul style="list-style-type: none">– They lack a protein coat.– These are short segments of free RNA, that is infectious.– They are smaller than viruses.– Their RNA is of low molecular weight.	<ul style="list-style-type: none">– They have a protein coat.– Their genetic/infectious material is RNA or DNA.– They are comparatively larger.– Their RNA is of higher molecular weight.

7. Give two examples of heterosporous ferns. Why are they called so?

Ans. – *Selaginella* and *Salvinia* are heterosporous.
– They are called so, because they produce two types of spores, i.e. microspores and megaspores.

8. Write any four characteristics of animals of class 'Aves'.

Ans. (i) Body is covered by feathers and they can fly except a few like ostrich.
(ii) Jaws are modified into beaks and teeth are absent.
(iii) Endoskeleton is bony and bones are pneumatic (with air cavities).
(iv) Forelimbs are modified into wings and covered by feathers; hindlimbs have scales and are modified for walking, perching, swimming, etc.
(v) Digestive tract has two additional chambers, crop and gizzard.
(vi) Heart is four chambered and there is double circulation. (any four)

9. What are glandular epithelium? Give one example of each of two types of glandular epithelium.

Ans. The columnar or aiboidal epithelial cells which are specialised for secretion constitute glandular epithelium

e.g., unicellular – goblet cells in alimentary canal
multicellular – salivary glands.

10. (a) Name the cranial meninges that cover brain.

(b) Write down one function of cerebellum and cerebrum each.

Ans. (a) The cranial meninges consists of three layers:

- (i) the outer pia mater.
- (ii) the middle arachnoid and
- (iii) the inner dura mater.

(b) – The cerebellum integrates the information from semicircular canals of the ear and the auditory system.
– The cerebrum is responsible for memory, communication and intersensory associations.

11. Differentiate between juxtamedullary and cortical nephrons.

Ans. Differences:

Juxtamedullary Nephrons	Cortical Nephrons
<ul style="list-style-type: none">– Their glomeruli are placed close to the inner margin of the cortex.– They have long loops of Henle.– The Henle's loops are found deeper in the medulla.– Vasa rectae are present.	<ul style="list-style-type: none">– Their glomeruli are present in the outer margin of the cortex.– They have short loops of Henle.– The Henle's loops extend only to a short distance in the medulla.– Vasa rectae are absent/very few.

12. List the different types of ribs found in our body. How many pairs of ribs are present in human beings?

Or

Mention the location and significance of thymus gland in human body.

- Ans.** – The types of ribs in a human body:
- (i) True ribs.
 - (ii) Vertebro-chondral ribs.
 - (iii) Floating ribs.
- There are 12 pairs of ribs in a human being.

Or

- Thymus gland is located between the lungs behind the sternum on the ventral side of aorta.
- This gland plays a major role in the development of immune system of the body in the following ways.
 - The thymosins secreted by the thymus has a role in the differentiation of T-lymphocytes, which provide cell-mediated immunity.
 - It also stimulates the production of antibodies, which provide humoral immunity.

SECTION — C

13. State the condition in which the flowers are described as (a) perigynous (b) epigynous and (c) hypogynous.

Give one example of each plant in which these flowers are found.

- Ans.** (a) A flower is perigynous when the gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level; the ovary is half-inferior, e.g. rose, plum, peach.
- (b) A flower is epigynous when the ovary is completely enclosed and fused with the thalamus and all the other parts of the flower arise above the ovary; the ovary is inferior, e.g. cucumber and guava.
- (c) A flower is hypogynous when the gynoecium occupies the highest position and all the other parts of the flower arise below the ovary; the ovary is superior, e.g. mustard, brinjal, etc.

14. Give atleast three points of differences between Heart Wood and Sap Wood.

Ans. Differences:

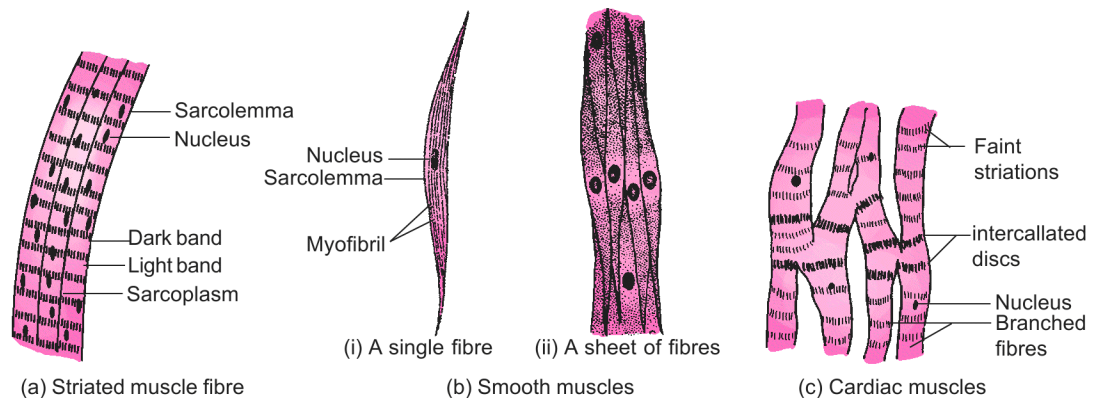
Heart Wood	Sap Wood
– It is the central core of wood formed after a certain years of secondary growth.	– It is the peripheral part of the wood, formed after certain years of secondary growth.
– It is composed of dead cells and darker in colour.	– It is composed of living cells and lighter in colour.
– It has no function in conduction.	– It helps in conduction.
– As it contains extractives (gums, resins, tannins, etc), it is more durable and resistant to attack by microbes and insects.	– As it does not have these extractives, it is less durable and resistant to attack by insects and microbes.

15. Draw labelled diagrams of three types of muscular tissues. (Description is not required)

The alternate choice of this question is for only visually impaired students :

Describe the structure of three types of muscular tissues. Also give one example of each about their location in human body.

Ans.



Muscle Cells

16. Leucoplasts are colourless plastids. Name and mention the storage products of the different types of leucoplasts.

Ans. – Leucoplasts are of three types:

- (i) Amyloplasts are the leucoplasts that store starch.
- (ii) Aleuroplasts are the leucoplasts, which store proteins.
- (iii) Elaioplasts are the leucoplasts, which store lipids.

17. About the structure of DNA molecule, answer the following questions:

- (a) How many hydrogen bonds are formed between (i) Guanine and Cytosine (ii) Adenine and Thymine?
- (b) How many base pairs are present in one turn of the helix of a DNA strand?
- (c) What is the distance between two successive bases in a DNA strand?

Ans. (a) (i) Three, (ii) Two
 (b) Ten base pairs (c) 0.34 nm. or 3.4 Å

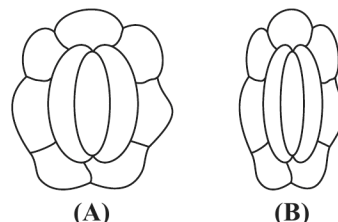
18. Enumerate the key events of telophase of mitosis.

Ans. The key events of telophase are:

- (i) Chromosomes cluster at the opposite poles of the spindle and their identity is lost as discrete bodies as they start uncoiling.
- (ii) Nuclear envelope becomes assembled around the chromosome clusters.
- (iii) Nucleolus, endoplasmic reticulum and golgi complex are reformed.

19. Observe the diagram and answer the following questions:

- (a) In which class of angiosperms you find these types of guard cells?
- (b) Which of the stoma in figure shows higher water content?
- (c) Which element plays an important role in opening and closing of stomata?



- Ans.** (a) In dicot plants. (b) (i) Shows higher water content.
 (c) Potassium.

20. Besides the presence or absence of oxygen, state three differences between aerobic and anaerobic respiration.

Ans. Differences:

Aerobic Respiration	Fermentation
– It is a process in which glucose is completely broken down into carbon dioxide and water.	– It is a process in which glucose is only partially oxidised to some organic compound and carbon dioxide.
– There is a net gain of thirty six molecules of ATP for every molecule of glucose.	– There is a net gain of only two molecules of ATP per molecule of glucose.
– NADH is oxidised on the electron transport chain and the reaction is very vigorous.	– NADH is used for a reduction step or slowly oxidised to NAD ⁺ .

21. Explain the following terms:

3

- (a) Vernalisation
- (b) Photoperiodism
- (c) Differentiation

Or

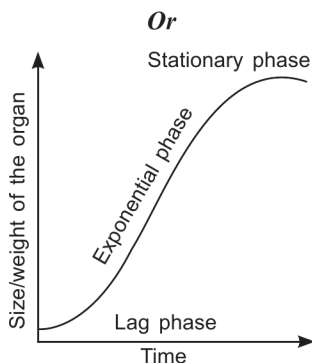
- (a) Draw an idealised sigmoid growth curve showing its three phases, found in many higher plants and plant organs.
- (b) Write a mathematical expression for exponential growth in plants.

The alternate choice of this question is for only visually impaired students :

Name the three phases in the sigmoid growth curve. Mention the characteristics of each phase.

- Ans.** (a) Vernalisation refers to the low temperature treatment given to the seeds/seedlings of certain plants to promote flowering.
- (b) Photoperiodism refers to the response of plants to duration of light/dark periods for flowering.
- (c) Differentiation is the process by which totipotent embryonic or meristematic cells undergo changes in the structure, shape and chemical nature according to the function they are going to perform.

(a)



(b) **Geometrical growth:**

- In geometrical growth, both the cells formed after mitosis continue to divide.
- It is seen in the exponential phase of growth.
- It is expressed as

$$W_1 = W_0 e^{rt}$$

where, W_1 = final weight
 W_0 = initial weight
 r = relative growth rate
 t = time of growth
 e = base of natural logarithm

22. Name one enzyme of gastric juice and one of pancreatic juice that are released as proenzymes in the human alimentary canal. Give the substrate and the end products of each.

- Ans.** – Pepsinogen in gastric juice and trypsinogen in pancreatic juice are the proenzymes.
- Pepsinogen is activated by hydrochloric acid into pepsins that acts on proteins and converts them into peptones and proteoses.
 - Trypsinogen is activated by enterokinase into trypsin, which acts on proteins, peptones and proteoses and converts them into smaller peptides.

23. Describe the role played by diaphragm and intercostal muscles in inspiration.

3

Or

Describe the process of hemodialysis.

- Ans.** – Inspiration is initiated by the contraction of diaphragm, which increases the volume of the thoracic chamber along the antero-posterior axis.
- The contraction of external intercostal muscles lifts the ribs and sternum upwards and increases the volume of the thoracic cavity along the dorso-ventral axis.
 - The overall increase in the thoracic volume causes an increase in the pulmonary volume.
 - This decreases the intra-pulmonary pressure to less than that of the atmospheric pressure and hence, air from outside rushes into the lungs, i.e., inspiration is achieved.

Or

- Blood from the artery of an uremia patient is taken, cooled to 0°C and mixed with an anticoagulant like heparin.
- It is put into the cellophane tubes of the artificial kidney, where cellophane is permeable to micromolecules, but not to macromolecules like plasma protein.
- Outside the cellophane tube is the dialysing fluid, which has the same composition as that of plasma except the nitrogenous molecules like urea, uric acid, creatine, etc.
- Hence, the nitrogenous molecules from within the cellophane tubes flow into the dialysing fluid, following concentration gradient. (dialysis)
- The blood coming out of the artificial kidney is warmed to body temperature, mixed with antiheparin and restored to a vein of the patient.

24. Describe in brief, the process of development of root nodules in leguminous plants.

- Ans.**
- When the root hair of a leguminous plant is infected by *Rhizobium*, it becomes curled or deformed due to the chemicals secreted by the bacterium.
 - The rhizobia enter these deformed root hair and the infection thread carries the bacterial cells to the inner cortex.
 - The bacterial cells get modified into rod-shaped bacteroids and cause the inner cortical cells and the pericycle cells to multiply.
 - Proliferation and growth of these cells lead to the formation of nodules.
 - The mature nodule has also vascular tissues differentiated in it, and they are continuous with those of the root.

SECTION — D

25. (a) Give a brief account about the structure of an interphase nucleus.

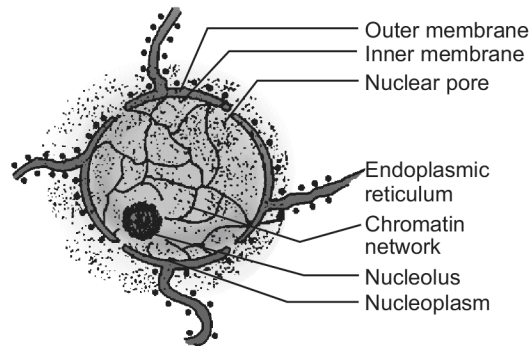
(b) Enlist the types of chromosomes based on the position of centromere.

Or

Prophase-I is the longest phase of meiosis cell division. What significant changes take place during its sub-stages in cell activities. Write the significance of meiosis cell division.

Ans. (a) Nucleus

- A eukaryotic cell has a double-membrane boundary, called nuclear membrane; the space between the two membranes, is called perinuclear space.
- The outer membrane is continuous with the endoplasmic reticulum and bears ribosomes on it.
- The nuclear envelope is interrupted at several places by nuclear pores that are formed by the fusion of its two membranes.
- The interior of the nucleus is filled with the matrix, called nucleoplasm; it contains nucleoli and chromatin.
- The nucleoli are spherical structures, not bounded by any membrane.
- The nucleus of an interphase (non-dividing) cell shows a highly extended and elaborate nucleoprotein fibres, called chromatin; they differentiate into chromosomes in a dividing cell.



Nucleus

- (b) – Centromere is the non-stained region that holds the chromatids together in a chromosome.
- Depending on the position of centromere, the chromosomes are of the following types:
 - (i) Telocentric – the centromere is terminal and so the chromosome has only one arm.
 - (ii) Acrocentric – the centromere is situated closer to one end, making one arm extremely short and the other arm very long.
 - (iii) Submetacentric – the centromere is little away from the centre and so one arm is slightly longer than the other.
 - (iv) Metacentric – the centromere is right in the middle and the two arms of the chromosome are equal in length.

Or

- Prophase I has been divided into the following five phases, based on the chromosomal behaviour; (i) Leptotene, (ii) Zygotene, (iii) Pachytene, (iv) Diplotene and (v) Diakinesis
- During leptotene, the compaction of chromosomes continues and the chromosomes become visible under light microscope.
- During zygotene, the homologous chromosomes start pairing, in the process, called synapsis; it is accompanied by the formation of synaptonemal complex and the pair of synapsed homologous chromosomes, is called a bivalent.
- During pachytene, the bivalents appear as tetrads and recombination nodules appear indicating the sites of crossing over.
- Crossing over occurs between non-sister chromatids of homologous chromosomes; the process is catalysed by enzyme, recombinase.
- Diplotene is marked by the dissolution of the synaptonemal complex and the tendency of the members of bivalents to separate except at sites of cross overs, called chiasmata.
- Diakinesis is marked by terminalisation of chiasmata; the chromosomes are fully condensed and the nuclear envelope and nucleolus have disappeared.
- Meiosis ensures the maintenance of a constant chromosome number, characteristic of a species, through generations.
- The crossing over results in variations of genetic characters in the progeny; variation is necessary for survival of species and it is the raw material for evolution.

26. Name the pentose phosphate that fixes CO₂ in a C₃ plant. Explain Calvin cycle in such plants.

Or

Explain the major steps in citric acid cycle. Where does this process occur in a cell?

Ans. – Ribulose 1, 5 bisphosphate (RuBP) is the CO₂ acceptor in a C₃ plant.

Calvin cycle

– It occurs in the stroma of chloroplasts.

– The three phases of Calvin cycle are as follows:

(i) **Carboxylation**

– Carbon dioxide is accepted by ribulose 1, 5 bisphosphate (RuBP) to form 3-phosphoglyceric acid (PGA), a 3C-compound.

– The reaction is catalysed by Ribulose 1, 5 bisphosphate carboxylase-oxygenase (RuBisCO).

(ii) **Reduction**

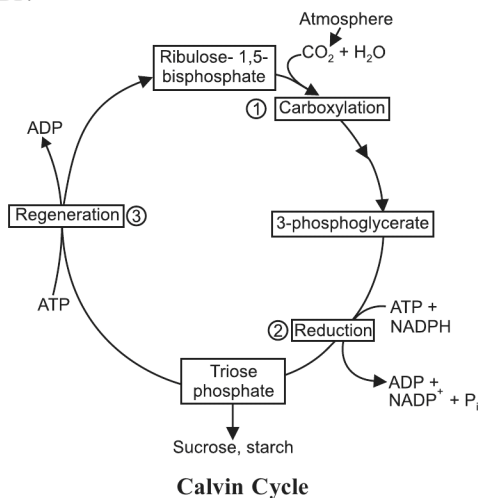
– It is a series of reactions that leads to the formation of glucose.

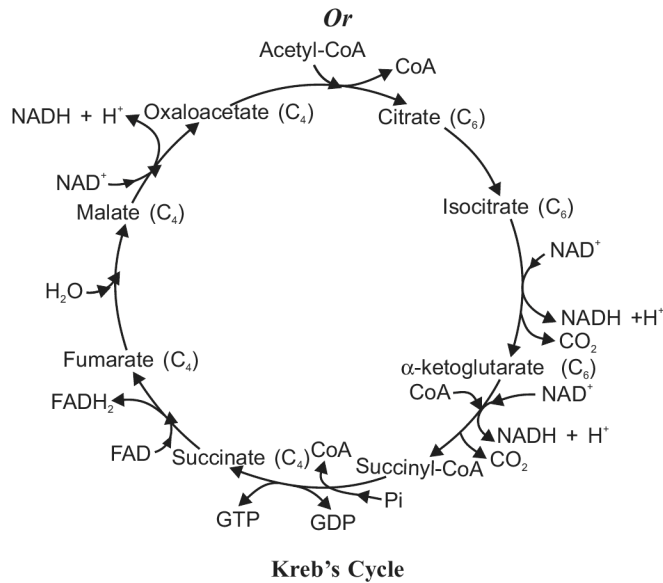
– Two molecules of ATP and two molecules of NADPH are used, respectively for phosphorylation and reduction of one CO₂ molecule.

(iii) **Regeneration of RuBP**

– For the cycle to continue, the primary acceptor of carbon dioxide, i.e., RuBP has to be regenerated.

– In this series of reaction, RuBP is regenerated; it requires one ATP for phosphorylation to form one RuBP.





– It occurs in the mitochondrial matrix.

- 27. (a) Where is sino-atrial node (SAN) located in human heart? Why is SAN called pacemaker of the heart?**
- (b) What is electro-cardiogram? What represents P-wave, QRS complex and T-wave in a standard ECG?**
- (c) What are causes of Angina and Coronary Artery Disease?**

Or

Describe the detailed structure of arc actin fiber and myosin fiber.

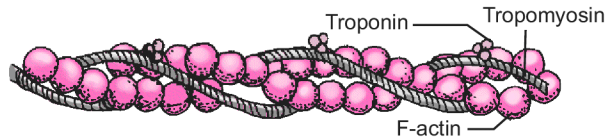
Ans. (a) Sino-atrial node

- It is located in the right upper corner of the right atrium.
 - Since, it initiates and maintains the rhythmic contractile activity of the heart, it is called pacemaker of our heart.
- (b)** – An electrocardiogram is the graphic record of the electrical potential differences produced by the cardiac muscles during a cardiac cycle.
- The P wave represents the depolarisation of atria, which leads to atrial systole.
 - The QRS complex represents the depolarisation of the ventricles that leads to ventricular systole.
 - T wave represents the repolarisation of ventricles.
- (c)** Angina and Coronary Artery Disease occur when not enough oxygen is reaching the heart muscles, i.e., when the blood supply is not enough to the heart muscles.

Or

Actin fibre

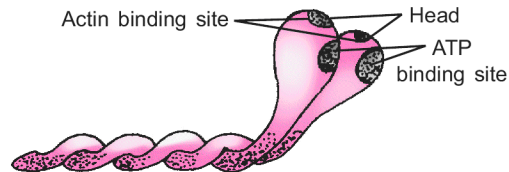
- An actin filament is made of three proteins, namely F actin, tropomyosin and troponin.
- Each actin filament contains two 'F' (filamentous) actins helically wound to each other; each 'F' actin is polymer of 'G' (globular) actins.
- Two filaments of protein, tropomyosin also run close to the 'F' actins along their length.
- Troponin is a complex protein found at regular intervals on the tropomyosin.
- In the resting state, a subunit of troponin masks the binding site for myosin on the actin filament.
-



Actin Filament

Myosin fibre

- The thick myosin filament is a polymer of meromyosins; each meromyosin has two parts - a globular head with a short arm, called heavy meromyosin (HMM) and a tail, called light meromyosin (LMM).
- The HMM component projects outward at regular distance and an angle from each other from the surface of the polymeric myosin and is known as cross arm.
- The globular head functions as enzyme ATPase and has binding sites for ATP and active sites for actin.
-



Myosin

Examination Paper, 2018

[NCT]

Time allowed: 3 hrs.]

[Maximum marks: 70

General Instructions:

- (i) *There are total 26 questions and five sections in the question paper. All questions are compulsory.*
 - (ii) *Section A contains question number 1 to 5 Very Short Answer type questions of one mark each.*
 - (iii) *Section B contains question numbers 6 to 10 Short Answer type I questions of two marks each.*
 - (iv) *Section C contains question numbers 11 to 22 Short Answer type II questions of three marks each.*
 - (v) *Section D contains question number 23, Value Based Question of four marks.*
 - (vi) *Section E contains question numbers 24 to 26 Long Answer type questions of five marks each.*
 - (vii) *There is no overall choice in the question paper; however, an internal choice is provided in one question of two marks, one question of three marks and all three questions of five marks. An examinee is to attempt any one of the questions out of two given in the question paper with the same question number.*
-

SECTION – A

- 1. Write the name of most abundant enzyme in the world. 1**
Ans. Ribulose 1, 5 biphosphate carboxylase oxygenase (RuBisCO).
- 2. Pepsinogen is an inactive enzyme released by the gastric gland of stomach. 1**
(a) How is it activated?
(b) On which nutrient does it act upon?
- Ans.** (a) Pepsinogen is activated by the hydrochloric acid in the gastric juice.
(b) It acts on the proteins.
- 3. What is Cytokinesis? 1**
Ans. Cytokinesis is the process of division of cytoplasm, by which the two daughter nuclei formed by karyokinesis become separated into two daughter cells.

4. Define the term 'Species'. 1

Ans. A species is a group of individual organisms which have fundamental similarities and can interbreed among themselves in nature.

5. To which bone are the ribs ventrally attached to? 1

Ans. Sternum.

SECTION – B

6. Write two characteristic features of Euglenoids. 2

Ans. – Euglenoids are mostly freshwater forms and occur in stagnant water.
– Cell wall is absent, but they have a protein-rich layer, called pellicle, which gives flexibility to the body.
– They have two flagella, one very short and the other long, at the anterior end of the cell.
– They possess photosynthetic pigments that are identical to those of higher plants.

7. Name the main mineralocorticoid in our body. What is its function? 2

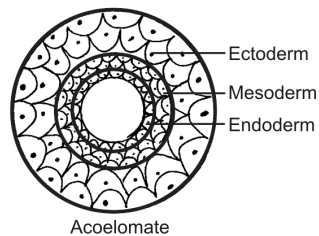
Ans. – Aldosterone is the mineralocorticoid in our body.
– It helps in the maintenance of electrolytes volume of body fluid, osmotic pressure and blood pressure.

8. Both gymnosperms and angiosperms bear seeds. Then why are they classified separately? 2

Ans. – In gymnosperms, the ovules are naked, i.e., they are not enclosed in an ovary; so the seeds are also exposed as fruit is not formed.
– In angiosperms, the ovules are present within the ovary; the ovary develops into a fruit, with the ovules developing into seeds inside.

9. Diagrammatically represent sectional view of triploblastic organisation in animals. 2

Ans.



10. (a) **What is partial pressure of a gas?**
 (b) **Which are the two factors which affect the rate of diffusion of a gas?** 2

- Ans. (a) The pressure contributed by an individual gas in a mixture of gases, is called partial pressure of gas.
 (b) The factors that affect diffusion of a gas include:
 (i) the pressure or concentration gradient.
 (ii) solubility of the gases.
 (iii) thickness of the membranes involved in diffusion. (any two)

OR

- (a) **In old age, people often suffer from stiffness and inflammation in joints. What is this condition called?**
 (b) **What is the cause of osteoporosis?**

- Ans. (a) This condition is called arthritis.
 (b) Decreased level of oestrogen is the cause of osteoporosis.

SECTION – C

11. (a) **Differentiate between apocarpous and syncarpous ovary.**
 (b) **What is a parthenocarpic fruit?**
 (c) **What are pneumatophores?** 3

Ans. (a)	<i>Apocarpous Ovary</i>	<i>Syncarpous Ovary</i>
	– When the gynoecium of a flower has two or more carpels and if the carpels are free from one another, the ovary is described as apocarpous ovary.	– When the ovary of a flower has two or more carpels and if the carpels are fused, the ovary is described as syncarpous ovary.

- (b) A fruit which develops without fertilisation of the ovary, is called a parthenocarpic fruit.
 (c) Pneumatophores are the branches of roots that come above the ground and grow vertically upwards in the plants that grow in marshy or swampy areas.

12. **Describe the steps involved in the formation of root nodules in leguminous plants.** 3

- Ans. – When the root hair of a leguminous plant is infected by *Rhizobium*, it becomes curled or deformed due to the chemicals secreted by the bacterium.
 – The rhizobia enter these deformed root hair and the infection thread carries the bacteria to the inner cortex.

- The bacteria get modified into rod-shaped bacteroids and cause the inner cortical cells and the pericycle cells to multiply.
- Proliferation and growth of these cells lead to the formation of nodules.
- The mature nodule has also vascular tissues differentiated in it, and they are continuous with those of the root.

13. Explain the three types of cell junctions. 3

Ans. The three types of cell junctions are :

- (a) Tight junctions
- (b) Gap junctions
- (c) Adhering junctions

Functions of cell junctions are :

- (a) Tight junctions prevent the leaking of substances across a tissue.
- (b) Gap junctions facilitate the cells to communicate with each other by connecting their cytoplasm.
- (c) Adhering junctions perform cementing of the adjacent cells to keep them together.

14. (a) Differentiate between RER and SER. 3

(b) Why is mitochondria called ‘the power house of the cell’?

Ans. (a)

<i>Rough Endoplasmic Reticulum</i>	<i>Smooth Endoplasmic Reticulum</i>
<ul style="list-style-type: none"> - It has ribosomes on its outer surface. - It is present more in protein/ enzyme-secreting cells. - It is involved in the synthesis and transport of proteins. 	<ul style="list-style-type: none"> - It has no ribosomes attached to it. - It is present more in cells that synthesize lipids and sterols. - It is involved in the synthesis of lipids and steroid hormones.

(b) Mitochondria are called power house of the cell because they are the sites of aerobic respiration and they produce cellular energy in the form of ATP.

15. (a) Explain competitive inhibition along with an example. 3

(b) Name the pyrimidines found in DNA.

Ans. (a) Competitive inhibition: Competitive inhibition is a phenomenon in which an inhibitor of an enzyme closely resembles the substrate of the enzyme in its molecular structure, and competes for the active site of the enzyme with the substrate and inhibits the enzyme action. e.g. inhibition of succinate dehydrogenase by malonate; malonate closely resembles succinate, the substrate of the enzyme.

(b) Cytosine and thymine.

16. Answer the following questions with reference to the anatomy of dicot stem:

- (a) **Type of cells present in the hypodermis.**
- (b) **Why is the endodermis layer referred to as starch sheath?**
- (c) **Why are the vascular bundles present here referred to as ‘open’ and ‘conjoint’?**

3

Ans. (a) Collenchyma

- (b) Since the endodermal cells are rich in starch grains, it is referred to as starch sheath.
- (c) – Since the vascular bundles have cambium and possess the ability to form secondary vascular tissues, they are called ‘open’.
- Since the xylem and phloem are situated along the same radius of the vascular bundle, the bundles are conjoint.

17. Write any three points of difference between mitosis and meiosis.

3

<i>Mitosis</i>	<i>Meiosis</i>
<ul style="list-style-type: none">– Two daughter cells are formed.– The daughter cells receive the same number of chromosomes as the parent cell.– The daughter cells are identical to the parent cell and between themselves.– Synapsis and crossing over do not occur.– Centromere of every chromosome divides and one half of the centromere along with one chromatid (now it is a daughter chromosome) moves towards the pole.	<ul style="list-style-type: none">– Four daughter cells are formed.– The daughter cells receive half the number of chromosomes as the parent cell.– The daughter cells are different among themselves and do not resemble the parent cell.– Synapsis and crossing over are characteristics of prophase I.– One whole chromosome from every homologous pair of chromosomes moves towards one pole, while the other whole chromosome of the pair moves towards the opposite pole during Anaphase I.

(any three)

18. Explain how butter in your food gets digested and is absorbed in the body? 3

- Ans.**
- Digestion of fats is facilitated by the bile salts, which break the larger fat droplets into smaller ones, i.e., emulsification, and thereby increase the surface area for lipase action.
 - Pancreatic lipase acts on triglycerides and progressively converts them into diglycerides and then into monoglycerides, releasing one molecule of fatty acid at every step.

- The intestinal lipase acts on the absorbed diglycerides and triglycerides and breaks them into monoglycerides, fatty acids and glycerol.
- The end products of fat digestion are glycerol, fatty acids and monoglycerides.
- The end products of fat digestion are incorporated into small, spherical, water soluble molecules, called micelles with the help of bile salts and phospholipids.
- The micelles are absorbed into the intestine from where fatty acids, fat-soluble vitamins and glycerol are separated.

OR

Fill in the blanks (i) to (vi) in different columns of the table given below:

Endocrine gland	Hormones	Functions
(a) Ovary	(i)	Support pregnancy
(b) (ii)	Glucagon	Maintains blood glucose level
(c) Pituitary	TSH	(iii)
(d) Thyroid	(iv)	Metabolism of carbohydrate, fat and proteins
(e) (v)	Melatonin	Regulation of diurnal rhythms
(f) Pituitary	Oxytocin	(vi)

- Ans.** (a) (i) Progesterone
 (b) (ii) Pancreas
 (c) (iii) Stimulates the thyroid gland to secrete thyroxine.
 (d) (iv) Thyroxine (tetraiodothyronine)
 (e) (v) Pineal gland
 (f) (vi) Child birth and ejection of milk from mammary glands.

- 19. (a) Define Vernalisation.**
 (b) What are short day plants?
 (c) Name the plant growth regulator which is synthesised by ripening fruits. 3

- Ans.** (a) Vernalisation refers to the cold temperature requirement of certain plants for flowering.
 (b) Short day plants are those plants which require light period less than the critical photoperiod for flowering.
 (c) Ethylene

20. Answer the following questions in respect to cockroach: 3

- (a) What is meant by paurometabolous?
- (b) What is the function of gizzard and malpighian tubules?
- (c) Write scientific name of Cockroach.

Ans. (a) Since development involves nymphal stages, it is called paurometabolous.
(b) – Gizzard helps in grinding the food.
– Malpighian tubules absorb the nitrogenous wastes from the body fluid and convert them into uric acid and sent it into hindgut.
(c) *Periplaneta americana*.

21. (a) Define Respiratory Quotient (RQ). Give RQ of fat and protein. 3
(b) Where does glycolysis occur and what does glucose breakdown into during this process?

Ans. (a) Respiratory quotient is defined as the ratio of the volume of carbon dioxide evolved to the volume of oxygen consumed in respiration.
– RQ of fat is less than one (0.7)
– RQ of protein is less than one (0.9)
(b) – Glycolysis occurs in the cytoplasm of the cell.
– Glucose is broken down into pyruvic acid.

22. (a) Differentiate between apoplast and symplast pathway of water movement in root.
(b) Where are casparian strip found in plants and what are they made up of? 3

Ans. (a)

<i>Apoplast Pathway</i>	<i>Symplast Pathway</i>
– The movement is through cell walls and intercellular spaces.	– Movement involves crossing of membrane and cytoplasm of cells.
– Movement is through mass flow and is faster.	– Movement is slower and is down a concentration gradient.
– Movement in the root cortex is apoplastic.	– Movement in the endodermis and further is symplastic.

(b) They are found in the endodermis of roots.
– They are made of suberin.

SECTION – D

23. Disha is suffering from high blood pressure and her doctor advised her to start medication to control her blood pressure. But she is reluctant to take medicines. Her friend Somya convinces her to take the medicines.

- (a) Mention the normal blood pressure of a healthy person.
- (b) Which organs can be affected due to high bloodpressure? (Name any two)
- (c) Which values do you observe in Somya? (List any two) 4

Ans. (a) The normal blood pressure of a healthy human is 120/80 mm Hg.
(b) Brain and kidney.
(c) Her concern for her friend, value of friendship, patience to convince her friend with her knowledge.

SECTION – E

24. (a) Explain the mechanism of urine formation.

(b) Write the full form of the following:

- (i) GFR
- (ii) ADH 5

Ans. (a) (i) **Glomerular Filtration**

- A protein-free fluid is filtered from the blood of glomerular capillaries into the lumen of Bowman’s capsule.
- About 1200 ml of blood is filtered by the kidneys, per minute.
- The filtration is caused by the blood pressure in the glomerular capillaries.
- The glomerular filtration rate is about 125 ml/minute or 180 litres/day in a healthy human individual.
- The kidneys have a built in mechanism for the regulation of glomerular filtration rate (GFR).

(ii) **Reabsorption**

- Nearly 99% of the filtrate is reabsorbed in the renal tubule by the brush-bordered epithelial cells lining the renal tubule.
- Certain substances like glucose, amino acids, Na^+ ions, Ca^{++} ions and K^+ ions are reabsorbed actively; nitrogenous wastes are reabsorbed passively.
- Water is reabsorbed passively by osmosis.
- Certain other substances like Cl^- ions are absorbed passively.

(iii) **Tubular Secretion**

- It is the process in which certain substances/ions like K^+ , H^+ , and ammonia are directly secreted into the lumen of the nephron.

(b) (i) Glomerular Filtration Rate

(ii) Anti-diuretic hormone

Or

(a) **What is resting membrane potential? Give the role of sodium-potassium pumps in maintaining it. How does resting potential change into action potential?**

(b) **Give one function of the following:**

(i) **Medulla**

(ii) **Hypothalamus**

Ans. (a) The potential difference across the membrane of a resting neuron, is called resting membrane potential.

- When the membrane of a nerve cell carries out a sodium-potassium pump, three Na^+ ions are transported outwards and two K^+ ions inwards.

- The outside becomes positively charged and the interior or axoplasm becomes negatively charged.

(b) (i) The medulla contains centres which control respiration, cardiovascular reflexes and gastric secretions.

(ii) – The hypothalamus contains centres for controlling body temperature, urge for eating and drinking.

- Its neurosecretory cells secrete hormones.

25. Where does the Calvin cycle take place? Describe its three phases. (Draw the cycle also). **5**

Ans. – It occurs in the stroma of chloroplasts.

- These reactions reduce the carbon dioxide into carbohydrates, making use of the ATP and $NADPH_2$ produced in the photochemical reactions.

– The three phases of Calvin cycle are as follows:

(i) **Carboxylation**

- Carbon dioxide is accepted by ribulose 1, 5 biphosphate (RuBP) to form 3-phosphoglyceric acid (PGA), a 3C-compound.

- The reaction is catalysed by Ribulose 1, 5 bisphosphate carboxylase-oxygenase (RuBisCO).

(ii) **Reduction**

- It is a series of reactions that leads to the formation of glucose.
- Two molecules of ATP and two molecules of NADPH are used, respectively for phosphorylation and reduction of one CO₂ molecule.

(iii) **Regeneration of RuBP**

- For the cycle to continue, the primary acceptor of carbon dioxide, *i.e.*, RuBP has to be regenerated.
- In this series of reaction, RuBP is regenerated; it requires one ATP for phosphorylation to form one RuBP.

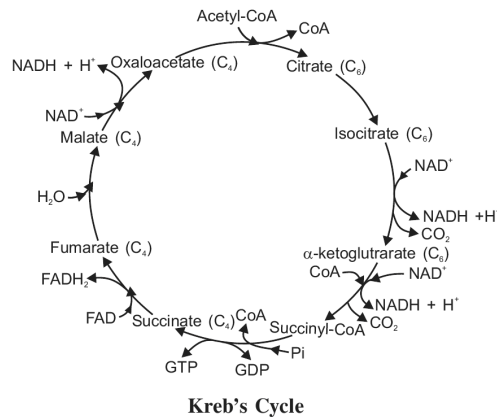
OR

Why is Kreb's cycle also called citric acid cycle? Explain the major steps of the cycle. (Draw the cycle also).

Ans. Kreb's cycle is called citric acid cycle, because the first product of this cycle is citric acid.

Citric Acid Cycle

- The sequence of reactions in citric acid cycle was first followed by Sir Hans Kreb; hence it is also known as Kreb's cycle.



- During this cycle of reactions, 3 molecules of NAD and one molecule of FAD are reduced to NADH and FADH respectively.
- One ATP molecule is produced directly from GTP formed by substrate level phosphorylation.
- The reactions of aerobic oxidation of Pyruvic acid can be summed up as:

$$\text{Pyruvic acid} + 4\text{NAD}^+ + \text{FAD} + 2\text{H}_2\text{O} + \text{ADP} + \text{Pi} \longrightarrow 3\text{CO}_2 + 4\text{NADH} + 4\text{H}^+ + \text{FADH}_2 + \text{ATP}$$

26. (a) Describe the effect of substrate concentration on enzyme activity.

(b) Explain the primary, secondary and tertiary structure of proteins. 5

- Ans. (a) - With the increase in substrate concentration, the velocity of enzyme reaction increases at first.
- But it reaches a maximum velocity (V_{max}) at a particular concentration of the substrate.
 - Beyond this, there is no further increase in the velocity of the reaction, as all the active sites of the enzyme are saturated; the number of active sites on the enzyme is fewer than the number of substrate molecules.

(b) **Primary Structure**

- In the primary structure, the protein exists as a long chain of amino acids, arranged in a particular sequence; such a polypeptide is non-functional.
- The amino acid at the left end is the first amino acid (mostly methionine) and the one at the right end, is the last amino acid of the polypeptide chain.

Secondary Structure

- In the secondary structure of proteins, there is interaction between every fourth amino acid by formation of hydrogen bonds; the polypeptide assumes a helical shape (α -helix) *e.g.*, keratin.
- Only right handed (α -helix) helices are seen.

Tertiary Structure

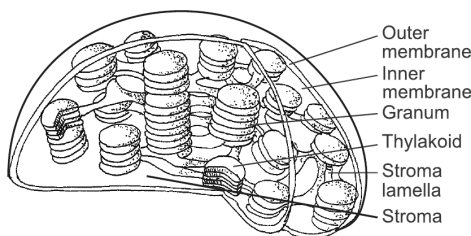
- When a polypeptide chain is folded upon itself like a hollow wollen ball, it is said to be in its tertiary structure.
- This gives a 3-dimensional structure of a protein.
- Tertiary structure of protein is absolutely essential for many biological activities of proteins.

OR

(a) Describe the structure of chloroplast along with its diagram.

(b) What are nuclear pores? State their function.

- Ans. (a)
- Each chloroplast is double-membrane bound, where the inner membrane is relatively less permeable.
 - The interior is filled with a matrix, called stroma.
 - A number of organised, flat membranous sacs, called thylakoids are present in the stroma.
 - Thylakoids may be arranged as stacks/piles of coins called grana or as intergranal thylakoids; the membranes of thylakoids enclose a space, called lumen.
 - The stroma of the chloroplast contains enzymes for photosynthesis, a small circular DNA molecules, RNA molecules and 70 S ribosomes; they are semiautonomous organelles.



- (b)
- Nuclear pores are the openings/pores in the nuclear envelope, formed by the fusion of its two membranes.
 - These pores help in the exchange of materials, especially RNA, proteins, ribosomes, etc. between the cytoplasm and nucleoplasm.