Version No.			

ROLL NUMBER						

Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

BIOLOGY HSSC–I (3rd Set Solution)

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

(1) During the secretion of Insulin from Pancreas, which route is it most likely to take?

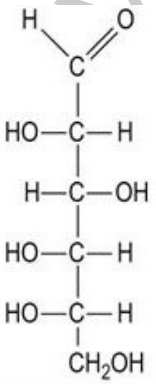
A. Golgi apparatus → RER→ SER →Secretory vesicle ○

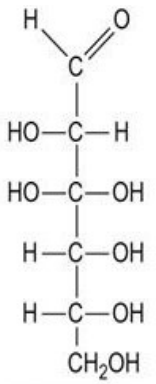
B. RER→SER→ Golgi apparatus→Secretory vesicle ○

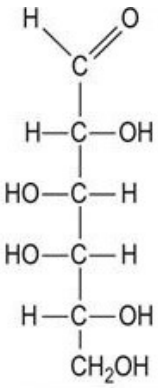
C. RER→ Transport vesicle → Golgi apparatus →Secretory vesicle ●

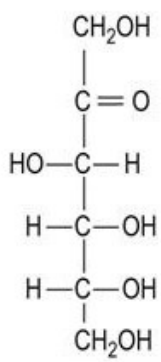
D. Transport vesicle→RER→ Golgi apparatus→Secretory vesicle ○

(2) Which molecule is ketohexose?

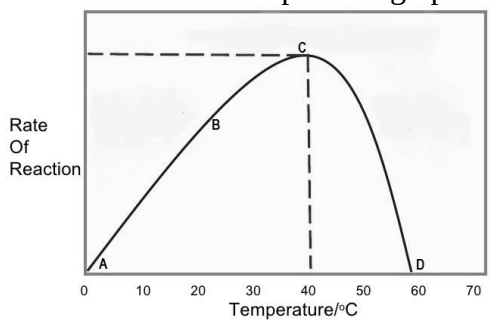
A.  ○

B.  ○

C.  ○

D.  ●

(3) This graph shows effect of temperature on rate of reaction of an enzyme catalysed reaction. Mention the point of graph that shows optimum temperature.



A. ○ B. ○
C. ● D. ○

(4) Why Z scheme temporarily shifts to cyclic pathway during light reaction?

A. Z scheme produces more ATP as compared to NADPH ○
B. Z scheme produces less ATP as compared to NADPH ○
C. Calvin cycle requires more ATP as compared to NADPH ●
D. Calvin cycle requires less ATP as compared to NADPH ○

(5) Transmission of Viral hepatitis is through different routes. Identify the correct option among the following.

	Via Blood only	Via Blood and body fluids	Via Faecal Oral route	
A.	Hepatitis A and E	Hepatitis B and D	Hepatitis C	○
B.	Hepatitis C	Hepatitis B and D	Hepatitis A and E	●
C.	Hepatitis A and E	Hepatitis C	Hepatitis B and D	○
D.	Hepatitis B and D	Hepatitis A and E	Hepatitis C	○

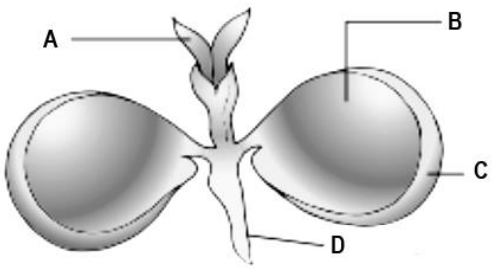
(6) We have 1 billion bacteria per square centimetre of our skin. Why we have so many bacteria on our skin?

A. To produce acne, eczema and pimples on the skin ○
B. To limit the growth of pathogens by colonization resistance ●
C. To provide essential minerals and nutrients to the body ○
D. To help in decomposition after the death of a person ○

(7) The filaments of some fungi are coenocytic, which means they:

A. Are not differentiated into organs ○
B. Are composed of distinct cells ○
C. Do not have cross walls ●
D. Have mushroom like appearance ○

(8) The diagram shows a dicot seed opened. Select the part that is impenetrable and prevents germ growth.



A. ○ B. ○
C. ● D. ○

(9) All organ systems are less developed in parasitic flat worms **EXCEPT**:

A. Circulatory system ○ B. Digestive system ○

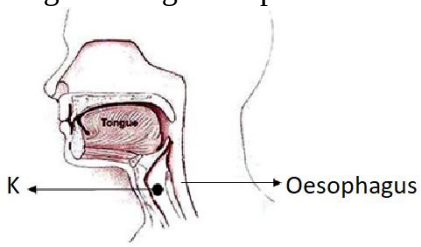
C. Reproductive system ● D. Respiratory system ○

(10) Water potential (Ψ_w), solute potential (Ψ_s) and pressure potential (Ψ_p) are interrelated with each other. If Ψ_w=-1500 KPa and Ψ_s= -2100 KPa, then Ψ_p will be:

A. 3600 KPa ○ B. -3600 KPa ○

C. -600 KPa ○ D. 600 KPa ●

(11) The given diagram represents the entry of food particle "K" in trachea.



Which one of the following reason could be responsible for the entry of particle "K" into larynx instead of oesophagus?

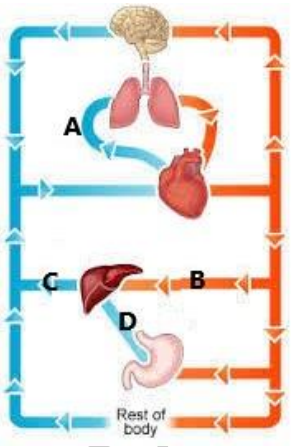
A. Waves of contraction and relaxation of skeletal muscles ○

B. Upward movement of soft palate ○

C. Failure of larynx to move upward closing glottis ●

D. Failure of lubrication activity of oral cavity ○

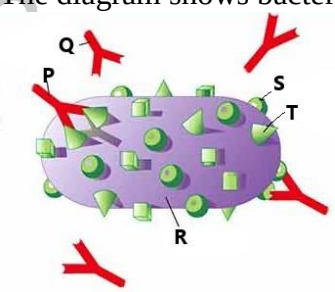
(12) The diagram shows flow of blood in various parts of body. Identify the portal vein.



A. ○ B. ○

C. ○ D. ●

(13) The diagram shows bacteria surrounded by antibodies. Which parts are antigens?



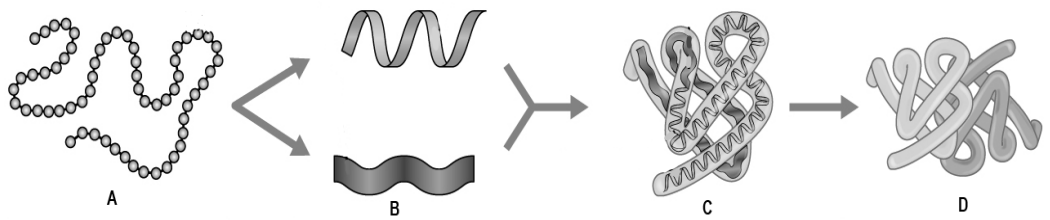
A. P and Q ○ B. S and T ●

C. P, Q and R ○ D. R, S and T ○

(14) "P" are organelles produced in a rounded structure "Q" found in nucleus of eukaryotic cells and then pass through "R" into cytoplasm to provide site for synthesis of "S".
What does "R" indicate in the above statement?

A.	Nuclear pore	●	B.	Ribosome	○
C.	Cell membrane	○	D.	RNA	○

(15) The diagram shows four levels of protein structure. Select the level that depends on disulphide bridges for stability.



A.		○	B.		○
C.		●	D.		○

(16) The process of chemiosmotic phosphorylation depends on proton pumps. Pick the row that shows the components of ETC that pump H^+ to generate ATP.

	NADH dehydrogenase complex	FADH dehydrogenase complex	Coenzyme Q	Cytochrome reductase complex	Cytochrome c	Cytochrome oxidase complex
A.	✓	x	✓	✓	x	✓
B.	X	✓	x	X	✓	X
C.	✓	X	x	✓	X	✓
D.	x	✓	✓	x	✓	X

A.		○	B.		○
C.		●	D.		○

(17) Ascent of sap depends on four factors according to TACT theory. Choose the pair of factors that depend on hydrogen bonding of water?

A.	Cohesion and Adhesion	●
B.	Transpiration and Adhesion	○
C.	Cohesion and Tension	○
D.	Transpiration and Tension	○

Federal Board HSSC-I Examination
Biology Model Question Paper
(Curriculum 2006)

Time allowed: 2.35 hours Total Marks: 68

Note: Answer any fourteen parts from Section 'B' and attempt any two questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q.2 Attempt any **FOURTEEN** parts from the following. All parts carry equal marks.

i. Why lysosomes are called suicidal bags?

Answer: Lysosomes contain strong hydrolytic enzymes. Autolysis is the self digestion of a cell by releasing the contents of lysosomes within the cell when they burst. In this programmed cell death, the broken parts of the cell are engulfed by other cells. In such circumstances lysosomes have been named as suicidal bags. Autolysis is a normal event in some differentiation process of development and may occur throughout a tissue. e.g reabsorption of tadpole tail during metamorphosis. Autolysis also occurs in muscles, which are not exercised.

ii. Compare eukaryotic and prokaryotic flagellum for the following aspects.

a. Composition b. Ultra – structure c. Basal body

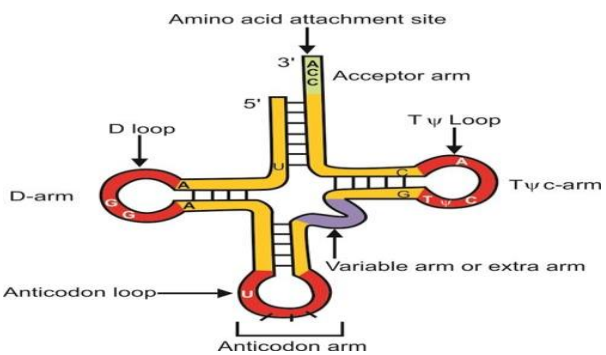
Answer:

Features	Prokaryotic flagella	Eukaryotic flagella
Composition	Flagellin	Tubulin
Ultra – structure	The long helical filament of flagella is composed of many subunits of a single protein, flagellin, arranged in several intertwined chains.	9 duplets of microtubules in a cylindrical array around 2 singlet microtubules (axoneme).
Basal body	The basal body is anchored in the cytoplasmic membrane and cell wall. It consists of a central rod that passes through a series of rings arranged in one pair of discs(Gram positive bacteria) or two pairs of rotating discs (Gram negative bacteria)	Basal bodies are structurally identical to centrioles. (Cylindrical array of 9 triplets of microtubules)

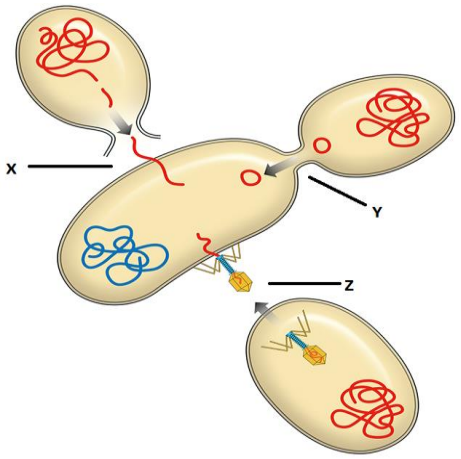
iii. Why hydrophobic exclusion property of water is important for protoplasm?

Answer: Hydrophobic exclusion is the reduction of the contact area between water and hydrophobic substances which are placed in water. e.g. if you place few drops of oil on the surface of water solution, the oil droplets will tend to coalesce into single drop. Biologically hydrophobic exclusion plays key roles in maintaining the integrity of lipid bilayer membranes.

iv. Draw the cloverleaf model of tRNA with proper labels.



v. Following diagram show the different methods of parasexuality in Bacteria.



Correctly name and introduce the methods of parasexuality represented by X, Y and Z in the diagram.

Answer:
X=Transformation: Transformation is the uptake of genetic material from the environment by bacterial cells.
Y=Conjugation: During conjugation, genetic material is transferred from a donor bacterium to a recipient bacterium through direct contact.
Z=Transduction: Transduction occurs when foreign DNA is introduced into bacterial cells via a third party i.e. bacteriophage.

vi. What do you know about feedback inhibition in relation to enzyme action?

Answer: The activity of an enzyme is inhibited by its own product, it is called feedback inhibition. This is a type of reversible non competitive inhibition.
This phenomenon is a part of normal regulatory mechanism and usually happens during the regulation of metabolic pathways.
e.g. the amino acid aspartate becomes the amino acid threonine by a sequence of five enzymatic reactions. When threonine, the end product of this pathway is present in excess, it binds to an allosteric site on enzyme 1 on this pathway and then the active site is no longer able to bind aspartate.
When all the threonine is consumed in cellular events, the threonine molecule which is attached to the allosteric site is also removed, and the pathway resumes its activity once again.

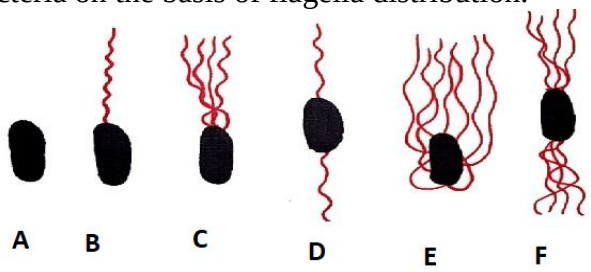
vii. How it was proved that oxygen liberated during photosynthesis comes from water, not carbon dioxide?

Answer: In 1930 Van Niel hypothesized that plants split water as a source of hydrogen and the oxygen is released as a byproduct.
Niel's hypothesis was confirmed during 1940's when first isotope of (O^{18}) was used in biological research.
In first experiment water was made of O^{18}.The water tagged O^{18} was added to an algal suspension. The oxygen evolved during photosynthesis was found to be radioactive. It was separated and identified.
In another experiment carbon dioxide with tagged O^{18} was added. The oxygen evolved contained none of the isotopes. Thus the source of oxygen was proved to be water.

Experiment 1: $6CO_2 + 12\ H_2O^{18} \text{----------} > C_6H_{12}O_6 + 6H_2O + 6O^{18}{}_2$

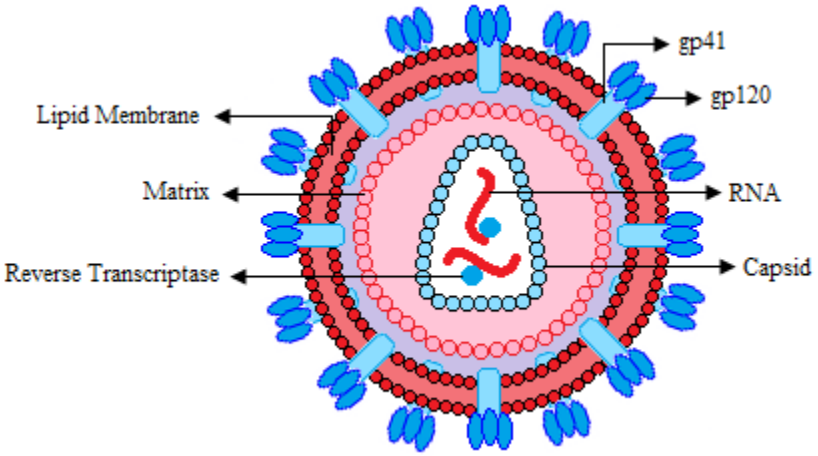
Experiment 2: $6CO^{18}{}_2 + 12H_2O \text{----------} > C_6H_{12}\ O^{18}{}_6 + 6H_2O + 6O_2$

viii. In the following diagram, some types of bacteria are shown. Use correct terminology for each of these bacteria on the basis of flagella distribution.



Answer: A=Atrichous (non motile) B=Monopolar monotrichous C=Lophotrichous D=Bipolar monotrichous E=Peritrichous F=Amphilophotrichous

ix. Draw a labelled diagram of HIV.



x. Define:

a. Glycolysis b. Trichome c. Sarcinae

Answer: A. Glycolysis: The stepwise enzymatic breakdown of hexose (glucose) into two molecules of pyruvate (3-carbon compound) with the release of energy as ATP and NADH in cytoplasm is called glycolysis.
B. Trichome: The individual chain of cells (like beads in a string) in a filament of cyanobacteria is called trichome.
C. Sarcinae: As a result of three planes of cell divisions (first vertical then again vertical but at right angle to the first and then horizontal) in coccus bacteria a cube like groups of eight is produced called sarcina.

xi. How lipids and protein absorption occurs in small intestine of man?

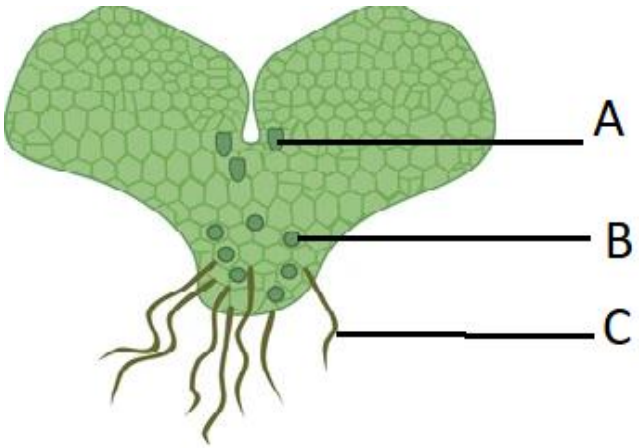
Answer: **Absorption of Lipids:** The product of digestion of lipids are free fatty acids and glycerol that are absorbed by epithelial cells, here they combine to form fats in these cells. These fats then combine with cholesterol and protein to form small globules called chylomicrons. The chylomicrons leave the epithelial cells and enter the lacteals of lymphatic system within the villi. They are carried through the lymphatic system into large veins that return blood to heart.
Absorption of Protein: After digestion individual amino acids are absorbed in epithelial cells of villi and enter in the hepatic portal system, which transport them to the liver. The amino acids may be modified in the liver or released into the bloodstream and distributed throughout the body for assimilation.

xii. Why Kingdom Protista is considered a polyphyletic group?

Answer: The protest kingdom is a polyphyletic group because protests do not share a single common ancestor. This hypothesis is based upon the variations exhibited by them in size, body

structure, ways of obtaining nutrients, mode of life, habitat, methods of reproduction and means of locomotion.

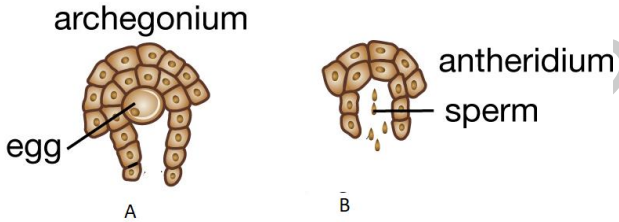
xiii. Following is the diagram of prothallus of a fern.



a. Correctly name the parts labelled as A, B and C
b. Draw the microscopically enlarged view of structures shown as A and B
c. Which phase of life cycle is shown in this diagram?

Answer: a. A=Archegonia B=Antheridia C=Rhizoids

b.



c. Gametophyte

xiv. How single veined leaves evolved in plants?

Answer: Lycopods were the first plants that developed true leaves. Two hypothesis have been proposed to explain their origin.

1. Out growth hypothesis: According to this single veined leaf originated as simple outgrowth from the naked branches of the primitive plant. The outgrowths had no vascular tissues. With the increase in size vascular tissues were needed for the transportation of food, water and support. Thus vascular supply was extended from main vascular bundle of stem giving rise to a single veined leaf.

2. Reduction Hypothesis: The early vascular plants had leafless branches. These branches were gradually reduced in size. Thus by simplification and reduction in size and flattening of leafless branches the microphyllous leaves were evolved.

xv. Compare Protostomes and Deuterostomes for the following features:

a. Cleavage b. Fate of blastophore c. Coelom formation

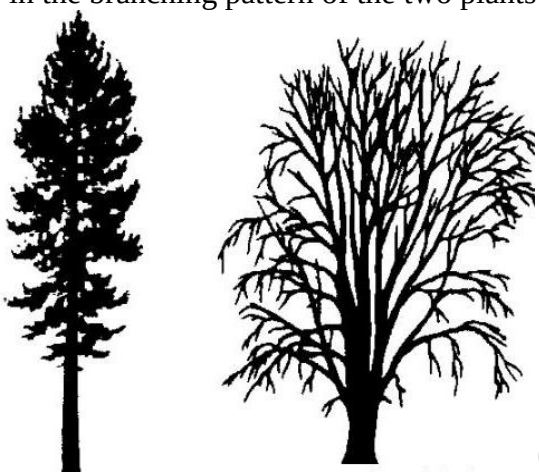
Answer:

Features	Protostoes	Deuterostomes
a. Cleavage	spiral and determinate cleavage	radial and indeterminate cleavage
b. Fate of blastopore	the blastopore develops into a mouth	the blastopores develops into anus
c. Coelom formation	The solid mesoderm masses split to develop coelom in a protostome. This splitting process is known as Schizocoelous.	The archenteron fold develops coelom in a deuterostome in the form of a pair of primitive gut's mesodermal pouches. The process is known as Enterocoelous.

xvi. Applying 10 kg ammonium nitrate per acre of land to a tomato crop give maximum yield. In light of your knowledge of tonicity, what would you predict if 1000 kg of ammonium nitrate is given to the same crop per acre?

Answer: 1000 kg is 100 times higher amount of the fertilizer as compared to 10 kg. Adding this much amount of fertilizer with increase the concentration of soil solution by 100 times making it highly hypertonic. In this condition the tomato plant root cells will lose water by exosmosis resulting in plasmolysis of cells and finally wilting of the plants. It may even lead to death due to severe dehydration. Thus the use of synthetic fertilizers beyond maximum limit harm the crops.

xvii. Difference in the branching pattern of the two plants is due to a growth correlation.



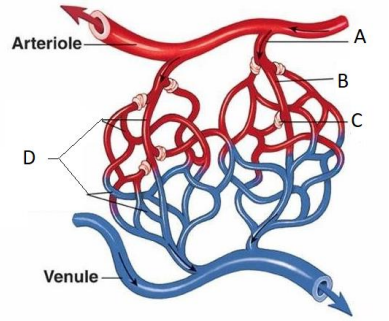
Explain the mechanism of the correlation responsible for this pattern of plant growth.

Answer: Apical dominance: Apical dominance occurs when the shoot apex inhibits the growth of lateral buds so that the plant may grow vertically. A strong apical dominance results in a plant with less branching while a weak apical dominance results in much branching and a bushy plant appearance.Typically, the end of a shoot contains an apical bud, which is the location where shoot growth occurs. The apical bud produces a plant hormone, auxin that inhibits growth of the lateral buds further down on the stem towards the axillary bud. Auxin is predominantly produced in the growing shoot apex and is transported throughout the plant via the phloem and diffuses into lateral buds which prevent elongation. When the apical bud is removed, the lowered IAA concentration allows the lateral buds to grow and produce new shoots, which compete to become the lead growth.

xviii. Complete the following table related to digestion in human beings following the pattern in row 1:

	Digestive juice	**Source**	**Substance acted upon**	**Products of digestion**
1	**Salivary amylase**	Salivary gland	starch	maltose
2	**Pepsin**	Chief cells	Protein	Peptide chains
3	**Erepsin**	Jejunum and ileum lining	Peptides	Amino acids
4	**Bile**	Liver and gall bladder	Fats	Emulsions of fats droplets

xix. In the following figure a capillary network at tissue level is shown.



a. Give correct names to the parts labelled as A, B, C and D.
b. Through which structure in the diagram blood mainly flow in a metabolically inactive tissue?
c. What is the functional role of structures "C" in the diagram?

Answer: a. A=Metarteriole B=Thoroughfare channel C=Precapillary sphincters D= Capillaries

b. B=Thoroughfare channel

c. "C" in the diagram are precapillary sphincters. The cyclic opening and closing of these precapillary sphincters is called vasomotion. The degree of opening of the sphincters depends on metabolic activity of the surrounding tissue and thus they regulate the flow of blood into the capillaries of a tissue according to needs.

xx. What is your understanding about heart attack?

Answer: Blockage of blood vessel in the heart by an embolus or thrombus causes necrosis of heart muscles. This is called heart attack or myocardial infarction. A blood clot may completely block a coronary artery or atherosclerosis may reach a critical level causing massive damage to heart muscle. All of a sudden the person feels a heavy squeezing ache or discomfort in the center of the chest. The pain may radiate to shoulder, arm, neck or jaw. Sweating, nausea, shortness of breath and dizziness are the symptoms of heart attack. When heart muscle dies, they are not replaced because cardiac muscle does not divide.

SECTION – C (Marks 26)

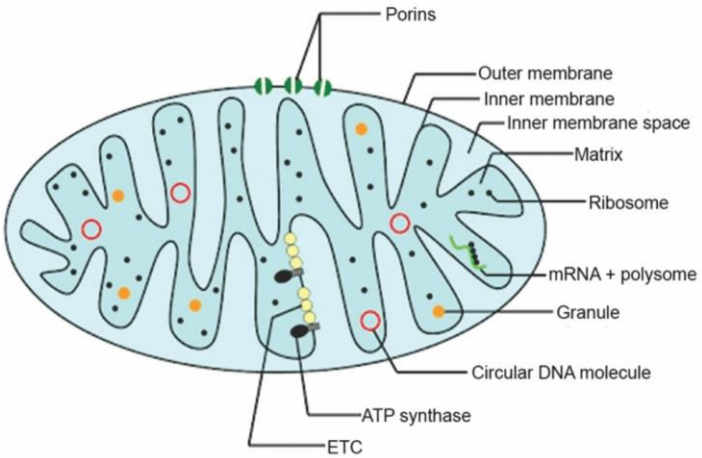
Note: Attempt any TWO questions. All questions carry equal marks. (2×13 = 26)

Q.3 a. Describe two double membrane organelles of eukaryotic cells that are the centers of two vital bioenergetic reactions. **(4+4)**

Answer:

Mitochondria

Mitochondria (singular: *mitochondrion*) are present in all eukaryotic cells. Some cells have a single large mitochondrion, but more often a cell has hundreds or even thousands of mitochondria; the number correlates with the cell's level of metabolic activity. For example, cells that move or contract have proportionally more mitochondria per volume than less active cells. Mitochondria are capable to divide themselves (self-replicating) in order to increase their number. They divide by fission.



Mitochondria are cylindrical or rod shaped structures. They are enclosed by double membrane, the outer **membrane** and the **inner membrane**. The outer membrane is smooth and somewhat like a sieve due to presence of porins. These are special proteins responsible for the transport of molecules across the membrane. Porins allow free passage of various molecules into the inter-membrane space. The inner membrane is selectively permeable and folded inwards. The folds are called cristae which serve to increase the surface area. The inner surface of cristae has granular structures called F0-F1 particles. These particles are actually ATP synthase enzymes. In addition, several other complexes are also found in inner mitochondrial membrane, which serve as electron carriers in electron transport chain. The inner membrane divides the mitochondrion into two internal compartments. The first is the **intermembrane space**, the narrow region between the inner and outer membranes. The second compartment, the **mitochondrial matrix**, is enclosed by the inner membrane. Mitochondrial matrix is a jelly like material that contains a small circular DNA, all kinds of RNA, ribosomes (70S) and enzymes. The presence of these components indicates that mitochondria have their own genetic system. It means, the protein, which are required by mitochondria are synthesized by their own metabolic machinery.

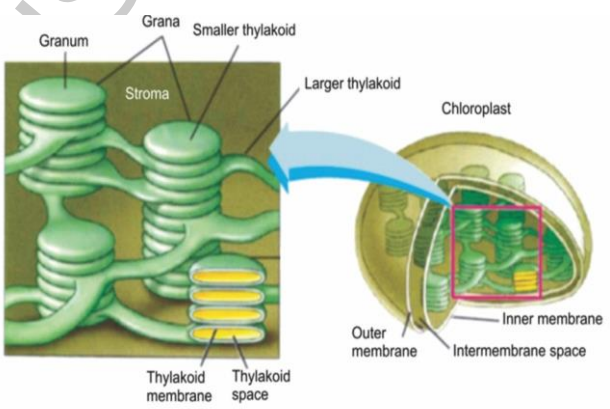
Mitochondria are the sites of cellular respiration, the metabolic process that uses oxygen to generate ATP by extracting energy from sugars, fats, and other organic compounds. Enzymes in the matrix catalyze some of the steps of cellular respiration like Krebs cycle. Other proteins that function in ATP generation through electron transport chain are found into the inner membrane.

Structure and functions of chloroplast:

Chloroplast is a discoid structure which consists of three parts i.e., envelope, stroma and thylakoids. Each chloroplast is bounded by a smooth double membrane (envelope). The outer membrane like mitochondria contains porins and therefore freely permeable to small molecules. The inner membrane is semipermeable and rich in protein. Between the outer and inner membrane there is intermembrane space.

The ground mass of chloroplast is called stroma. It is the colourless proteinaceous substance which like mitochondrial matrix also contains a small circular DNA, all kinds of RNA, ribosomes (70S) and various enzymes. The stroma contains a system of chlorophyll bearing double membrane, flattened sac-like structures called thylakoids. There are two types of thylakoids: smaller thylakoids and the larger thylakoids. **Smaller thylakoids** are disc like sacs which are piled over one another like stack of coins. Each stack of smaller thylakoids is called granum (plural: *grana*). Each granum consists of 25-50 thylakoids and there are about 40 - 60 grana found in each chloroplast. Photosynthetic pigments are also found in the membranes of smaller thylakoids. **Larger thylakoids** connect the grana with each other and are also called intergrana. These membranes are colourless as they do not have pigments.

Chloroplast is the site of photosynthesis in a plant cell. The first phase of photosynthesis is light dependent reaction in which sunlight is captured and transformed into ATP. This phase takes place in grana region of chloroplast. The second phase of photosynthesis is light independent



reaction (dark reaction) in which CO_2 is reduced to make carbohydrates. The enzymes for this activity are found in stroma region of chloroplast.

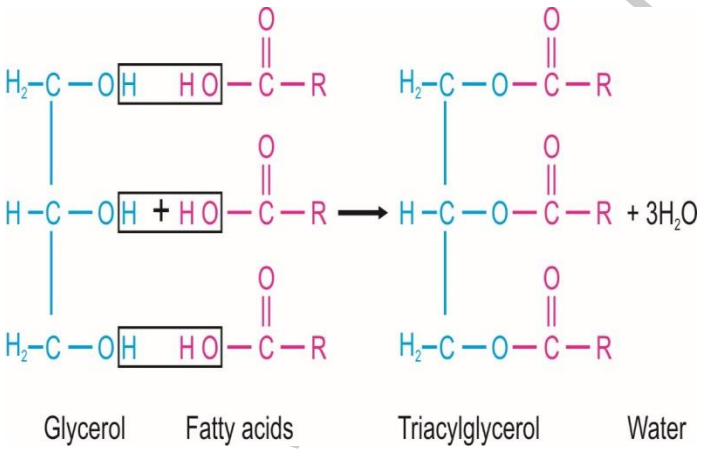
b. Explain the chemical nature and functions of acyl glycerols. **(05)**

Answer:

Acylglycerol

The most abundant lipids in living things are acylglycerol. Chemically, acylglycerols can be defined as esters of glycerol and fatty acids. An ester is the compound produced as the result of a chemical reaction of an alcohol with acid and a water molecule is released such a reaction is called esterification.

Glycerol is a trihydroxy alcohol which contains three carbons, each bears an OH group. A fatty acid is a type of organic acid containing one carboxylic acid group attached to a hydrocarbon. Fatty acids contain even number of carbons from 2 to 30. Each fatty acid is represented as R-COOH, where R is a hydrocarbon tail. When a glycerol molecule combines chemically with one fatty acid, a monoacylglycerol (monoglyceride) is formed. When two fatty acids combine with a glycerol a diacylglycerol (diglyceride) is formed and when three fatty acids combine with one glycerol molecule a triacylglycerol (triglyceride) is formed. Triacylglycerols are also called neutral lipid as all three OH groups of glycerol are occupied by fatty acids and no charge bearing OH group is left.



Properties and types of fatty acids

About 30 different fatty acids are found. Fatty acids vary in length. Acetic acid (2C) and butyric acid (4C) are simplest fatty acid, whereas palmitic acid (16C) and stearic acid (18C) are most common fatty acids. Some properties of fatty acid are increased with an increase in number of carbon atoms, such as melting point, solubility in organic solvent and hydrophobic nature. Fatty acids are either saturated or unsaturated. Fatty acids in which all of the internal carbon atoms possess hydrogen side groups are said to be saturated fatty acids because they contain the maximum number of hydrogen atoms that are possible, e.g., palmitic acid. Saturated fatty acids tend to be solid at room temperature (higher melting point) and are more common in animal lipids (fats).

Unsaturated fatty acids have one or more pairs of carbon atoms joined by a double bond. They therefore are not fully saturated with hydrogen, e.g., oleic acid. Unsaturated fatty acids are liquid at room temperature (lower melting point) and are more common in plant lipids (oils). Triglycerides containing hydrocarbon chains melt at a low temperature. This is useful for living things.

Q.4 a. How C_4 plants compensate for the energy loss due to photorespiration under high temperature regime. **(04)**

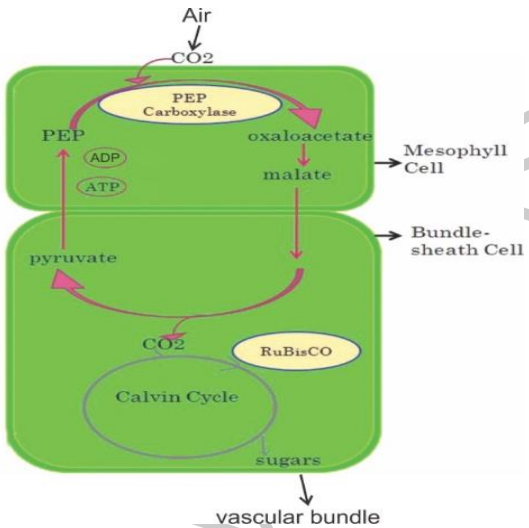
Answer:

C_4 photosynthesis: An adaptation to the problem of photorespiration

Some plants which grow in tropical climate have an adaptation to the problem of photorespiration. They have an additional metabolic pathway in light independent phase of photosynthesis beside Calvin cycle. This metabolic pathway is called Hatch-Slack cycle of C_4 pathway in which phosphoenol pyruvate (PEP) carboxylase is used instead of RuBisCO to fix CO_2 to phosphoenol pyruvate (a C_3 molecule), and the result is oxaloacetate, a C_4 molecule. It takes place in cytoplasm of mesophyll cells.

$$PEP + CO_2 \xrightarrow{\text{PEPcarboxylase}} \text{Oxaloacetate}$$

As the first product of CO_2 fixation is a 4-carbon compound oxaloacetate, so the plants are called C_4 plants e.g., maize, sugarcane, sorghum, etc. Oxaloacetate is then transported to the chloroplasts of mesophyll cells. It is then converted to another 4-C compound, the malate, with the help of NADH, produced in the photochemical phase. The malate is then transported



to the chloroplasts of bundle sheath cells. Here malate is converted to pyruvate (C_3) with the release of CO_2. Thus concentration of CO_2 increases in the bundle sheath cells. These cells contain enzymes of Calvin cycle. Because of high concentration of CO_2, RubisCO participates in Calvin cycle and not in photorespiration. Sugar formed in Calvin cycle is transported into the phloem. Pyruvate generated in the bundle sheath cells re-enters mesophyll cells and regenerates phosphoenol pyruvate (PEP) by consuming one ATP.

b. Define and explain the role of two types of phagocytes in second line of defense. **(04)**

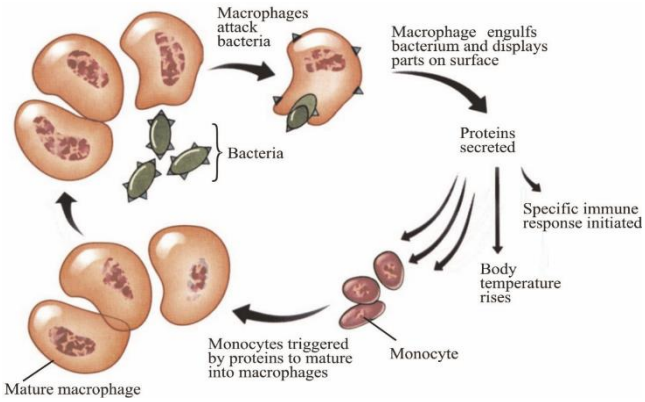
Answer:

There are white blood cells in the body called phagocytes. A phagocyte is a cell that destroys other abnormal body cells (cancerous cells) or invaded microorganisms by engulfing. This process is called phagocytosis. Two types of blood cells are phagocytes: macrophages and neutrophils.

Macrophages

Macrophages are derived from monocytes or the monocytes that leave the blood are called macrophages. Monocytes are formed in bone marrow. From bone marrow, through blood, macrophages are transported to the areas of the body where they are needed. Macrophages are generally found in the organs such as the lungs, liver, spleen, kidney and lymph nodes, rather than remaining in the blood. In these organs, they patrol within the free spaces among the cells and provide protection by trapping and destroying microorganisms

entering the tissue. As macrophages interact with microbes, they not only engulf and destroy



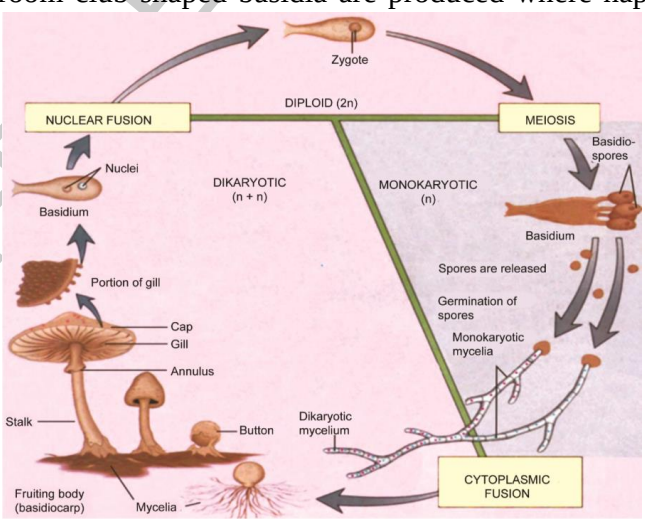
them; they also display some parts of microbes on their surface so that other body cells may also be informed. The macrophages also secrete many different proteins when they perform phagocytosis of the microbes. Some of these proteins trigger the maturation of monocytes into macrophages, thereby increasing their numbers. Another protein interleukin-I signals the brain to raise the body temperature, producing fever. Some other proteins also stimulate the specific immune response.

Neutrophils

These belong to the granulocyte type of WBCs. They are highly short-lived and highly mobile as they squeeze between cells of capillary walls and can enter parts of tissue where other cells would not be able to enter otherwise. They move like *Amoeba* forming pseudopodia. They proceed rapidly to infected area to perform their duty and they often die after a single phagocytic event. Neutrophils also release lysosomal enzymes and certain chemicals that kill microorganisms and cause inflammation.

c. Draw and explain the life cycle of a typical mushroom (like *Agaricus*). **(05)**

Answer: Life cycle of a mushroom (Agaricus) Life cycle start by the germination of characteristic haploid sexual spores of this fungus, called basidiospores. Each basidiospore has the potential to give rise to a new primary mycelium that consists of monokaryotic hyphae. The mycelium of Mushroom (*Agaricus*), consists of mass of white, branched, thread like hyphae that occur mostly below ground. A hyphae of a primary mycelium encounters another monokaryotic (n) hyphae of a different mating type and the two hyphae fuse. However the two haploid nuclei remain separated from each other. In this way a secondary mycelium with a **dikaryotic** (n + n) hyphae is produced, in which each cell contains two haploid nuclei. The n + n hyphae of the secondary mycelium grow and form compact mass, called buttons, along the mycelium. Each button grows into a fruiting body known as mushroom. A mushroom, which consists of a stalk and a cap, is called basidiocarp. The lower surface of the cap usually consists of many thin perpendicular plates called gills that radiate from the stalk to the edge of the cap. On the gills of the mushroom club shaped basidia are produced where haploid nuclei of the dikaryotic cells fuse to



form diploid zygotes. Meiosis then takes place forming four haploid nuclei that move into finger like projections forming basidiospore, which are released later.

Q.5 a. List the distinguishing features of phylum echinodermata giving relevant examples. **(04)**

Answer:

General characteristics of phylum echinodermata: They are free living; some are attached to the substratum. The echinoderms are exclusively marine. Most are found at the bottom along the shorelines in shallow seas.

Body is covered by delicate epidermis. The echinoderms are triploblastic coelomates and exhibit radial symmetry in adult. Echinoderms have an endoskeleton consisting of a spine bearing calcium rich plates. The spines, which stick out through the delicate skin, account for their name. The mouth is on the oral side and anus is on the aboral side. There is a central disc from which arms radiate. The body may be flattened like biscuit, (cake urchin), star-shaped with short arm (starfish) globular (sea urchin), star-shaped with long arms (brittle star) or elongated (sea cucumber). Coelom consists of canals and spaces, and one of which forms water vascular system Organs of locomotion are the tube feet. These are present along the edges of grooves present in the arms.

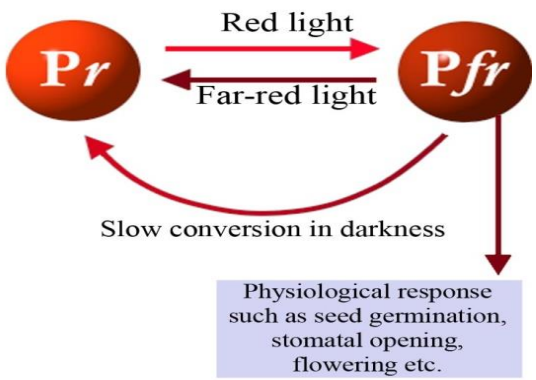
The sexes are separate. The fertilization is external. The larvae such as bipinnaria and brachiolaria are complex and exhibit bilateral symmetry, autotomy and regeneration. The regeneration is shown by the adult and larval stages. The examples are starfish, sea cucumber, sea lily, brittle star and sea urchin.

b. Explain the role of phytochromes in photoperiodic response. **(04)**

Answer:

Interconversion and action of phytochromes

Phytochrome is a blue green leaf pigment that alternately exists in two forms: Pr (Phytochrome red) absorbs red light (of 660 nm wave length) and is converted to Pfr Pfr (Phytochrome far-red) absorbs far-red light (of 730 nm wave length) and is converted to Pr Direct sunlight contains more red light than far-red light; therefore Pfr is present more in plants during the day. Far-red light are invisible heat radiations that are present in both day and night, but conversion of Pfr to Pr occurs mainly at night. The rate of this conversion (Pfr to Pr) provides a biological clock to the plants to determine the length of their night.



A short day plant requires a low ratio of Pfr to Pr. A night longer than critical length results in accumulation of Pr so the Pfr to Pr ratio becomes low. On the other hand a long day plant requires a high ratio of Pfr to Pr. A night shorter than critical length results in less formation of Pr so the Pfr to Pr ratio becomes high.

c. Explain the structure of human heart with the help of a diagram. **(05)**

Answer:

Structure of Human Heart

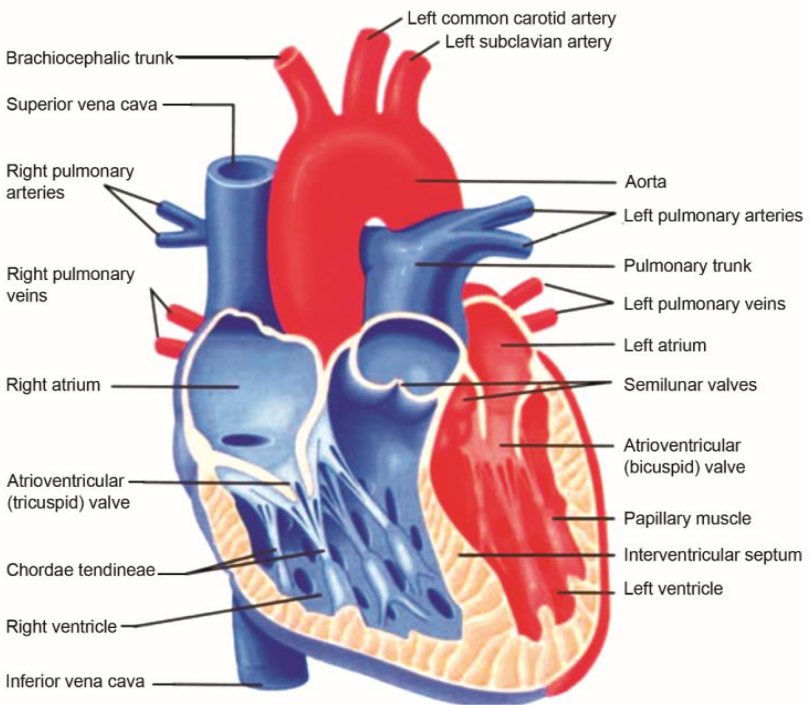
The heart is located in the thoracic cavity between the lungs. The pericardium is a closed sac that surrounds heart. It consists of two parts; the outer part and inner part. The outer part consists of inelastic white fibrous tissue. The inner part is made up of two membranes. The inner membrane is attached to the heart and the outer one is attached to the fibrous tissue. Pericardial fluid is secreted between them and reduces the friction between the heart wall and surrounding tissues when the heart is beating. The inelastic nature of the pericardium as whole prevents the heart from being overstretched or overfilled with blood.

The heart consists of four chambers: two atria (meaning, entrance chamber) and two ventricles (meaning, belly). The atria lie above the ventricles. The heart wall is composed of the three layers of tissue: The epicardium, the myocardium, and the endocardium. The epicardium is a thin serous membrane comprising of the smooth outer surface of the heart. The thick middle layer of the heart, the myocardium, is composed of cardiac muscle cells. The smooth inner surface of the heart chambers is the endocardium, which consists of simple squamous epithelium over a layer of connective tissue. The heart valves are formed by a fold of the endocardium, making a double layer of endocardium with connective tissue in between.

The thickness of the walls of each chamber is different: The atria have comparatively thin walls as they only have to force blood into the ventricles and this does not require much power. On the other hand, the ventricles have to force blood out of the heart hence they have relatively thick walls, especially the left ventricle which has to pump blood around the whole body. The right ventricle has thinner walls than the left ventricle in a ratio of 1:3, it pumps blood to the lungs, which are at a short distance from the heart.

The right atrium receives the superior vena cava, the inferior vena cava, and the coronary sinus (the coronary sinus is an additional opening into the right atrium that receives venous blood from the myocardium of the heart itself). The left atrium receives the four pulmonary veins. The two atria are separated from each other by the interatrial septum. The atria open into the ventricles through atrioventricular canals. The right ventricle opens into the pulmonary trunk, and the left ventricle opens into the aorta. The two ventricles are separated from each other by the interventricular septum.

An atrioventricular valve is on each atrioventricular canal and is composed of cusps, or flaps. The atrioventricular valve between the right atrium and the right ventricle has three cusps



and is called the tricuspid valve. The atrioventricular valve between the left atrium and left ventricle has two cusps and is therefore called the bicuspid or mitral valve. Each ventricle contains cone-shaped muscular pillars called papillary muscles. These muscles are attached by thin, strong connective tissue strings called chordae tendineae to the cusps of the atrioventricular valves. The papillary muscles contract when the ventricles contract and prevent the valves from opening into the atria by pulling on the chordae tendineae attached to the valve cusps. The aorta and pulmonary trunk possess aortic and pulmonary semilunar.

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