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Answer Sheet No. \_\_\_\_\_

Sign. of Candidate \_\_\_\_\_

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## BIOLOGY HSSC-I (2<sup>nd</sup> 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) The disease caused by viroid is:

A. Hepatitis A

☐

B. Hepatitis D

☒

C. Hepatitis E

☐

D. Hepatitis B

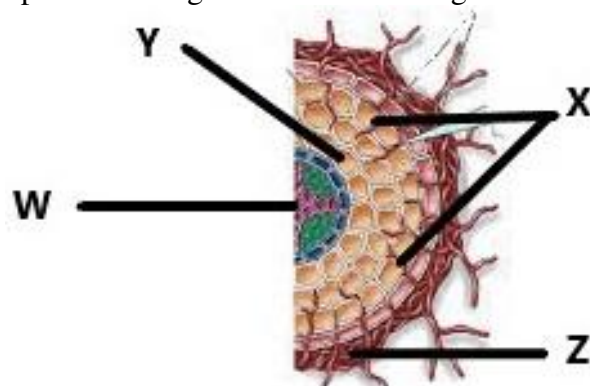
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(2) Identify the actin protein on the basis of following features

|   | Shape       | Nature    | Solubility                  |
|---|-------------|-----------|-----------------------------|
| A | Filamentous | Inelastic | Soluble in aqueous medium   |
| B | Globular    | Inelastic | Soluble in aqueous medium   |
| C | Filamentous | Elastic   | Insoluble in aqueous medium |
| D | Globular    | Elastic   | Insoluble in aqueous medium |

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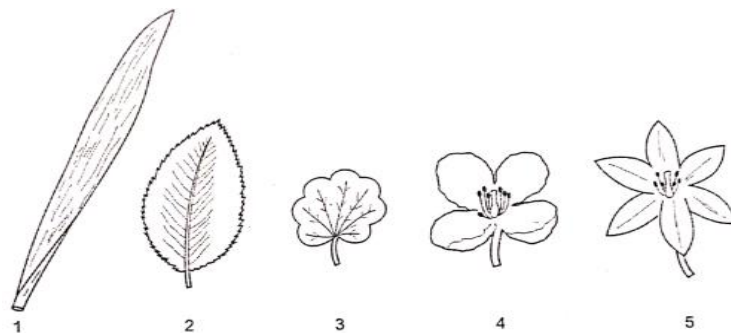
(3) Figure shown is section of plant root invaded with Ectomycorrhizae. Choose the option showing the correct labelling



|   | W      | X                      | Y                      | Z                      |
|---|--------|------------------------|------------------------|------------------------|
| A | Phloem | Cortex                 | Fungal hyphae          | Ectomycorrhizal sheath |
| B | Xylem  | Fungal hyphae          | Ectomycorrhizal sheath | Cortex                 |
| C | Phloem | Ectomycorrhizal sheath | Cortex                 | Fungal hyphae          |
| D | Xylem  | Fungal hyphae          | Cortex                 | Ectomycorrhizal sheath |

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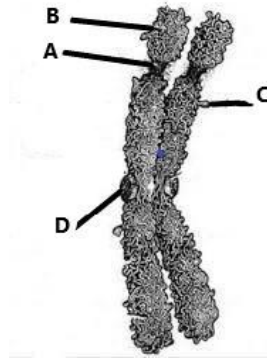
- (4) Guess the technique used to separate the chloroplast and mitochondria:  
 A. Chromatography ☐ B. Spectrophotometry ☐  
 C. Electrophoresis ☐ D. Differential centrifugation ☒
- (5) In C<sub>4</sub> pathway the first compound produced consisting of four carbons after fixation of carbon dioxide is  
 A. Succinate ☐ B. Oxaloacetate ☒  
 C. Malate ☐ D. Fumarate ☐
- (6)  $\text{CO}_2 + 2\text{H}_2\text{S} \longrightarrow (\text{CH}_2\text{O})_n + \text{H}_2\text{O} + 2\text{S}$   
 Indicate the type of bacteria in which the above reaction takes place?  
 A. Chemoautotrophic ☐ B. Parasitic ☐  
 C. Saprotrophic ☐ D. Photoautotrophic ☒
- (7) Choose the incorrect pair:  
 A. Nematode/ Pseudocoelom ☐  
 B. Platyhelminthes/ Metamorphosis ☒  
 C. Mollusca/ Trocophore larva ☐  
 D. Reptile/ Amniote ☐
- (8) Identify the characters of birds:
- |   | Syrinx | Semisolid urine | Urinary bladder | Sinus venosus |
|---|--------|-----------------|-----------------|---------------|
| A | ✓      | ✓               | ✓               | ✗             |
| B | ✓      | ✗               | ✓               | ✓             |
| C | ✓      | ✓               | ✗               | ✗             |
| D | ✓      | ✗               | ✗               | ✓             |
- (9) Identify the tissue on the basis of following characteristics
- |      |  |
|------|--|
| i.   | Extracellular deposition at corners            |
| ii.  | Mechanical tissue                              |
| iii. | Provides support to herbaceous parts of plants |
| iv.  | No role in secondary growth                    |
| v.   | Living cells                                   |
- A. Sclerenchyma ☐ B. Collenchyma ☒  
 C. Xylem ☐ D. Epidermis ☐
- (10) Select the one which is **NOT** the function of liver:  
 A. Albumin synthesis ☐ B. Vitamin A synthesis ☐  
 C. RBC destruction ☐ D. Biotin synthesis ☒
- (11) Seed remain dormant in plants facing stress conditions due to the release of:  
 A. Auxin ☐ B. Cytokinins ☐  
 C. Gibberellins ☐ D. Absciscic acid ☒
- (12) Diagram shows leaves and flowers of different plants.



Which are from monocotyledons?

- A. 1 & 5 ☒ B. 3 & 4 ☐  
 C. 2 & 4 ☐ D. 2 & 5 ☐

- (13) The given figure represents the pair of chromosomes. Choose the structure responsible for giving rise to nucleoli during interphase:

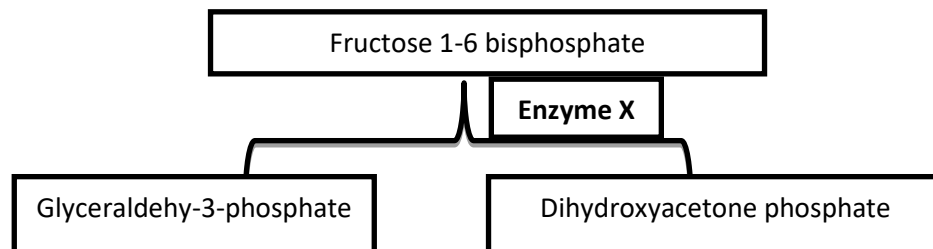


- A. ☒ B. ☐  
C. ☐ D. ☐

- (14) If hair protein is composed of 6 amino acids. Select the possible numbers of nucleotide in mRNA specific for this protein:

- A. 12 ☐ B. 18 ☒  
C. 24 ☐ D. 9 ☐

- (15) The following reaction taking place in presence of enzyme X without utilizing the water, is of glycolysis. The group to which the enzyme X belongs is



- A. Oxidoreductase ☐ B. Hydrolase ☐  
C. Transferase ☐ D. Lyases ☒

- (16) The cardiac pacemaker in a patient fails to function properly. The doctor finds that an artificial pacemaker needs to be implanted in him. It is likely that electrodes of pacemaker will be implanted at the site of:

- A. Atrioventricular bundle ☐ B. Purkinji fibers ☐  
C. Sinoatrial node ☒ D. Atrioventricular node ☐

- (17) What will happen when a child is vaccinated against tuberculosis?

|   | Type of immunity | Production of antibody |
|---|------------------|------------------------|
| A | Active           | No                     |
| B | Active           | Yes                    |
| C | Passive          | No                     |
| D | Passive          | Yes                    |

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

Time allowed: 2.35 hours

Total Marks: 68

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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.

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**SECTION – B (Marks 42)**

**Q.2** Attempt any **FOURTEEN** parts from the following. All parts carry equal marks.  
(14 × 3 = 42)

- i. Write down the role of any three plasma membrane proteins.

Answer:

Role of three types of proteins of plasma membrane can be as follows:

**1) Channel and Carrier Proteins:**

These proteins are involved in the movement of molecules across the membrane either by simply allowing them to diffuse across it or by attaching to the molecules to help them to move across.

**2) Enzymes:**

Some proteins of plasma membrane act as enzymes e.g adenylate cyclase converts ATP into cAMP.

**3) Antigens:**

Some act as antigens, helping cells to recognize other cells e.g foreign substances are recognized and attacked by WBCs.

- ii. Justify the endospore formation in bacteria to withstand unfavorable conditions.

Answer:

An endospore is a dormant, tough, and non-reproductive structure produced by some bacteria. Endospore formation is usually triggered by a lack of nutrients. It is resistant to high temperature. The spore develops within the vegetative cell inside the cell wall.

- The original cell form a copy of its chromosome and surrounds it with tough wall forming the endospore.
  - Water is removed from the endospore. The metabolism inside it stops. The rest of the original cell disintegrates.
  - The endospore germinates when their environmental conditions become favorable
- iii. How bacteriophage get absorbed and penetrated into its host cell? Summarize the steps.

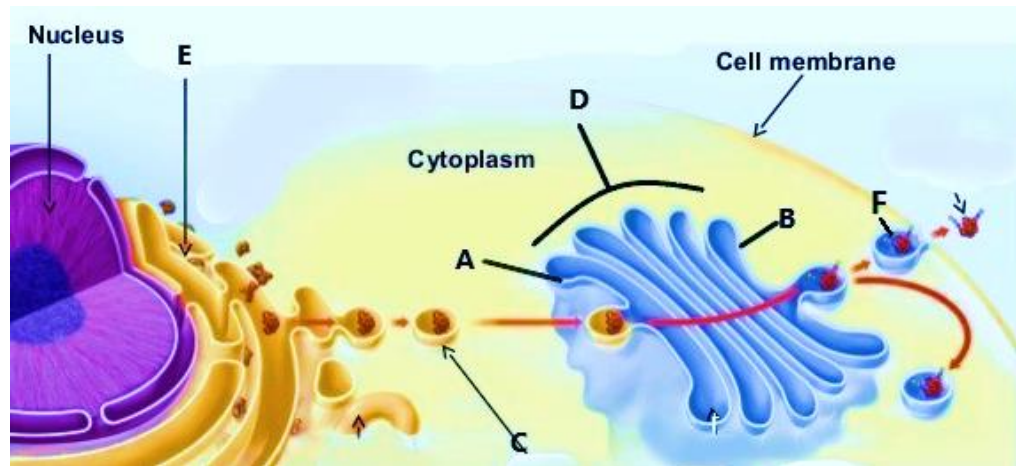
Answer:

Bacteriophage gets absorbed and penetrated into host cell through infection process

**1) Adsorption:** In this step the phage attaches to the specific receptors on the bacterial cell through its tail fibers and tail pins.

**2)Penetration:** After binding, the contractile sheath contracts, releasing lysozyme to digest portion of bacterial envelope. Then the hollow tube is pushed through the envelope, this is known as penetration.

iv. In the following figure a part of cell is shown.



a. Name the labelled sides A and B of Golgi apparatus. Identify C and F as well. (1)

Answer:

A= Cis face, B= Trans face, C= (protein containing) transport vesicles from endoplasmic reticulum, F= transport vesicles (Modified product) from Golgi complex.

b. Why A and B are named so? (1)

Answer:

A( cis /forming face) is so named as at this side of Golgi complex new cisternae are constantly being formed whereas B(trans/ maturing face) is so named as here cisternae are constantly broken down into vesicles again.

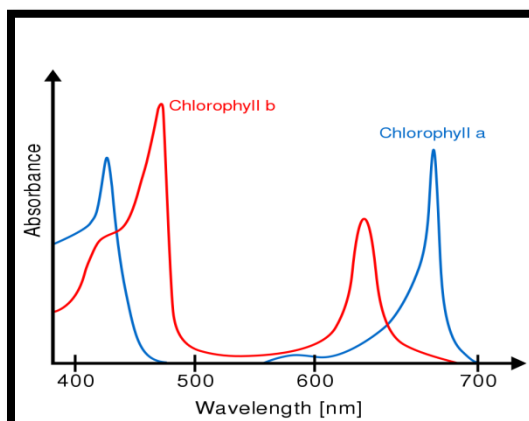
c. Predict the fate of C and F by relating the functioning of both organelles. (1)

Answer:

C is a vesicle containing protein emerging from endoplasmic reticulum which is sent to Golgi complex where it is modified into a secretory vesicle that is F which is then sent out of the cell by exocytosis.

v. Sketch and compare the absorption spectra of chlorophyll a and b. (1+2)

Answer:



Answer:

- ✓ **Chlorophyll a** absorbs violet and orange light the most. Chlorophyll a absorbs light mostly 430nm (blue) and 660nm (red) wavelength of light.
- ✓ **Chlorophyll b** absorbs mostly 470 nm (blue) and 650 nm (orange red) wavelength of light.
- ✓ They do not absorb light of other wavelengths like green and yellow colour.

vi. Compare the evolutionary adaptations of the given phyla: (0.5×6=3)

| S# | Characteristics | Annelida | Echinodermata | Arthropoda |
|----|-----------------|----------|---------------|------------|
| a  | Excretion       |          |               |            |
| b  | Transport       |          |               |            |

Answer:

| S# | Characteristics | Annelida                        | Echinodermata                 | Arthropoda               |
|----|-----------------|---------------------------------|-------------------------------|--------------------------|
| a  | Excretion       | Ciliated organs nephridia       | Excretory organs absent       | Malpighian tubules       |
| b  | Transport       | Closed blood circulatory system | Reduced blood vascular system | Dorsal contractile heart |

vii. (a) The diagram shows a marine animal. Look carefully at the animal and classify according to (1)



|   |                       |  |
|---|-----------------------|--|
| A | Number of germ layers |  |
| B | Type of body symmetry |  |

Answer:

|          |                              |  |
|----------|------------------------------|--|
| <b>A</b> | <b>Number of germ layers</b> | Two germ layers ectoderm and endoderm /(Diploblastic animal) |
| <b>B</b> | <b>Type of body symmetry</b> | Radial symmetry  |

(b) Describe the unifying feature which distinguishes the metatheria and eutheria? (2)

Answer: **METATHERIA:** Unifying feature is the presence of abdominal pouch called Marsupium. Newly born young ones are immature. Mother feeds the young ones and carries them in pouch till they are matured enough.

**EUTHERIA:** Placenta is their unifying feature which is an organ for exchange of materials between maternal blood and fetal blood as development takes place inside the body of mother.

viii. Distinctive characteristics of two plant groups are given below. Identify these groups of plants. Also describe two more characteristics of each group?

a. Forked green stem with no leaves (0.5+1)

Answer:

Plant group is Psilopsida.

1. Sporangia present at the tips of branches.
2. Bear underground stem called rhizome.

b. Circinate venation

(0.5+1)

Answer:

Plant group is Pteropsida (Fern)

1. Sporangia are attached to leaves or fronds.
2. Sporophytic and gametophytic generations are independent to each other.

ix. How the evolution of pollen tube took place? Explain its importance. (3)

Answer:

The evolution of pollen tube parallels the evolution of seeds. The egg produced inside an ovule is very well protected in the sporangium. It is so well protected that flagellated sperm would not have the slightest chance of ever reaching an egg. This obstacle has been overcome by the development of pollen tubes. Once the pollen grain reaches the cone or flower, it germinates. The germinated pollen grain is a tiny male gametophyte. It produces along pollen tube, which grows to the ovule and then digests its way through the protecting layers to the enclosed egg.

x. Complete the following table related to diseases (0.5×6=3)

| S# | Disease        | Cause                                 | Symptom |
|----|----------------|---------------------------------------|---------|
| a  |                | Begomo virus                          |         |
| b  | Food poisoning |                                       |         |
| c  |                | Deposition of cholesterol in arteries |         |

Answer:

| S# | Disease                    | Cause  | Symptom   |
|----|----------------------------|--|---|
| a  | <b>Cotton curl disease</b> | Begomo virus   | Deep downward cupping of the young leaves                                     |
| b  | <b>Food poisoning</b>      | Toxins produced by Salmonella and Campylobacter (only one) | Diarrhea, vomiting and abdominal pain (only one)                              |
| c  | <b>Atherosclerosis</b>     | Deposition of cholesterol in arteries                      | Hyper cholesterolemia, smoking, hypertension and diabetes mellitus (only one) |

xi. How the fluctuation in blood pressure is regulated by baroreceptors? Discuss their role. (1.5+1.5)

Answer:

There are two main types of baroreceptors:

### 1) High pressure arterial baroreceptors:

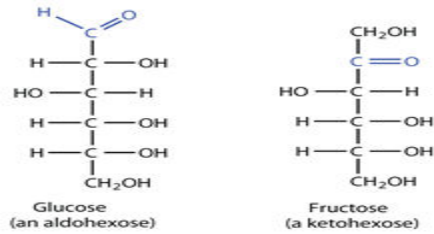
Increase in blood pressure is detected by these receptors which in turn stimulate parasympathetic nerves leading to vasodilation throughout body causing decrease in blood pressure and slow heart rate. The opposite situation stimulates sympathetic nerves which in turn lead to vasoconstriction throughout body causing increase in blood pressure.

### 2) Low volume baroreceptors:

By detecting decrease in blood pressure these receptors send message to hypothalamus, causing vasoconstriction throughout body leading to decrease in heart rate, water retention by kidneys and increase in blood pressure to reach normal level.

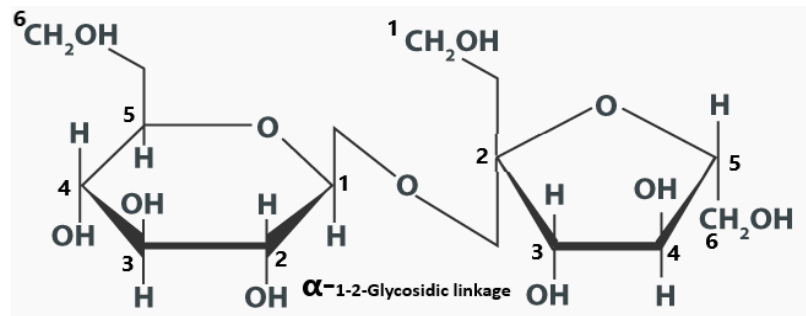


- xii. You are given structural formula of glucose and fructose. Make ring structure of sucrose with help of these.



Answer:

The linkage between alpha glucose and beta fructose is  $\alpha$  1-2 glycosidic linkage in a sucrose molecule



- xiii. Some members of protists show unique features. Identify the group of protists on the basis of given hints. (6×0.5=3)

| S# | Features              | Group | S# | Features           | Group |
|----|-----------------------|-------|----|--------------------|-------|
| A  | Macro and micronuclei |       | D  | Pseudopodia        |       |
| B  | Sleeping sickness     |       | E  | Parasitic protozoa |       |
| C  | Red tide              |       | F  | White rusts        |       |

Answer:

| S# | Features                     | Group           | S# | Features                  | Group                 |
|----|------------------------------|-----------------|----|---------------------------|-----------------------|
| A  | <b>Macro and micronuclei</b> | ciliates        | D  | <b>Pseudopodia</b>        | sarcodina             |
| B  | <b>Sleeping sickness</b>     | zooflagellates  | E  | <b>Parasitic protozoa</b> | sporozoa              |
| C  | <b>Red tide</b>              | dinoflagellates | F  | <b>White rusts</b>        | Oomycota (Water mold) |

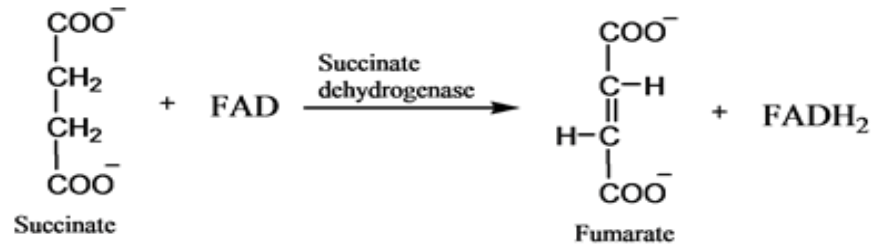
- xiv. Temperature usually drops to below freezing point in northern areas during winter. Which physiological adaptations would enable the plant to survive in that stressful condition?

Answer:

- Plant increase the proportion of unsaturated fatty acids which help membrane to maintain structure at low temperature and crystal formation is inhibited.
- To prevent crystallization in cytoplasm changes in solute composition occur so cytosol becomes super cool without ice formation, although ice crystal may form in cell wall.



- xv. (a) In the following reaction succinate is converted to fumarate in presence of succinate dehydrogenase. How the reaction will take place if we add melonate in the given reaction? (1.5)



Answer:

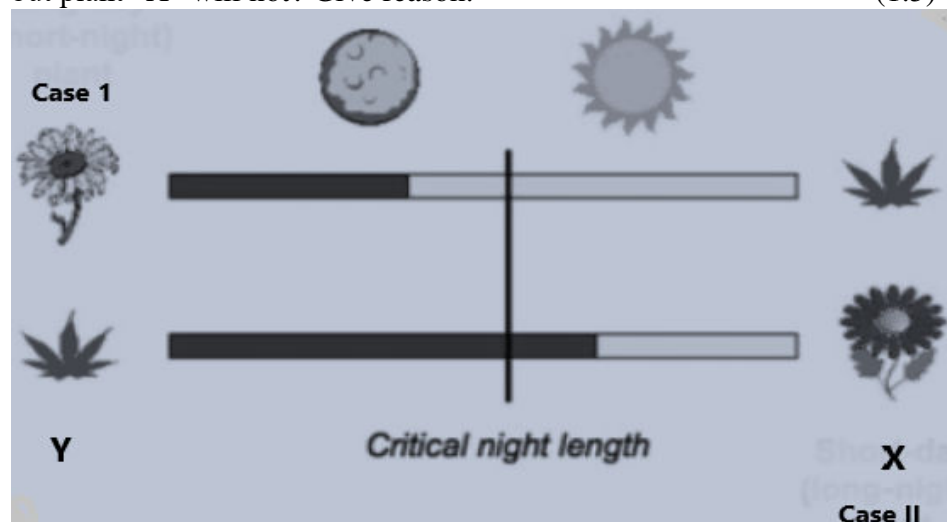
When melonate is added it acts as a competitive inhibitor and competes with the substrate and attaches itself to the active site of the enzyme thus preventing succinate from binding to the enzyme and as a result no product is formed i.e fumarate.

- (b) If the concentration of succinate will be 50 times more than the melonate, will the product be formed or not? Give reason. (1.5)

Answer:

Succinate and melonate will compete with each other and if the concentration of succinate is 50 times more than melonate then it will suppress melonate and will get bind to the enzyme to form product.

- xvi. a) If dark period is interrupted with flash of red light, Plant “Y” will flower but plant “X” will not? Give reason. (1.5)



Answer:

**Plant X is short day plant.**

**Short day plants** are also called long night plants. Short day plants require low ratio of Pfr to Pr for flowering. By interrupting dark period with red light, this required low ratio will be disturbed, in this way flowering will be inhibited.

**Plant Y is long day plant.**

Long day plants are also called short night plants. Long day plants require high ratio of Pfr to Pr for flowering when exposed to red light, Pr will again start to convert into Pfr by absorbing red light. In this way enough Pfr would be left till the end of night promoting flowering

- b) In case II if dark period is interrupted with flash of red light and after a time interval by far red light, what would be the effect on plant “X”? Give reason. (1.5)

Answer:

Because by absorbing far red light Pfr will again be converted to Pr. Till the end of night no Pfr would be left. Ratio of Pfr to Pr would be low so flowering will take place.

- xvii. (a) A woman is diagnosed with tumor at early stage. Investigate the mechanism the cell of immune system will use to kill the cancerous cell? (2)

Answer:

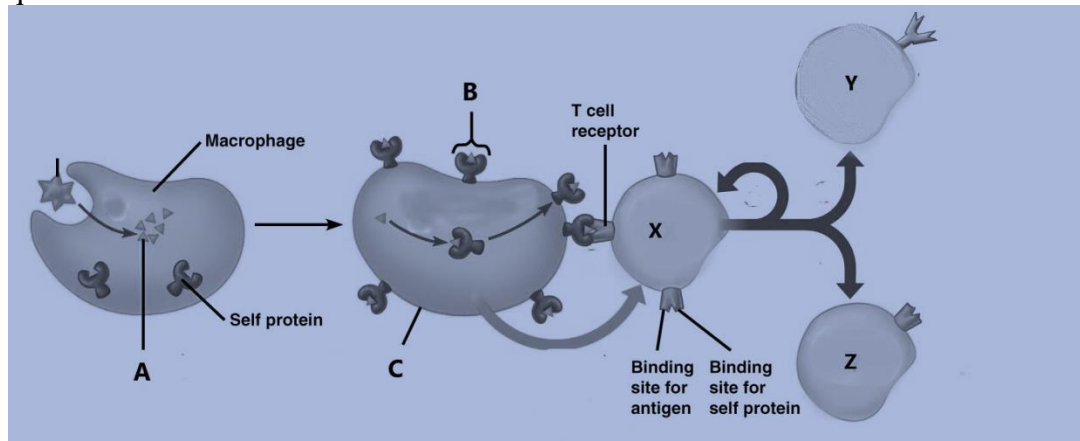
Upon detecting the cancerous cell, macrophages release interleukin-1 which activates NK/cytotoxic T-cells. These cells release protein perforin which punches holes into the membranes of cancerous cells, allowing granzymes (apoptotic proteases) to diffuse into the cell and thus the cell dies by apoptosis at the very early stage of tumor.

- (b) How oil glands within the epidermis inhibit the growth and also kill microorganisms? (1)

Answer:

Oil glands secrete sebum which contains natural antibiotics such as lactic acid which is capable of killing bacteria and microbes.

- xviii. Keeping in mind the cell mediated immune response. Answer the following questions



- a. Identify the structures A,B & C. (1.5)

Answer:

A=antigen from microbe, B=self-non self complex, C=antigen presenting cell.

- b. Recognize the cell responsible for producing antibody? (0.5)

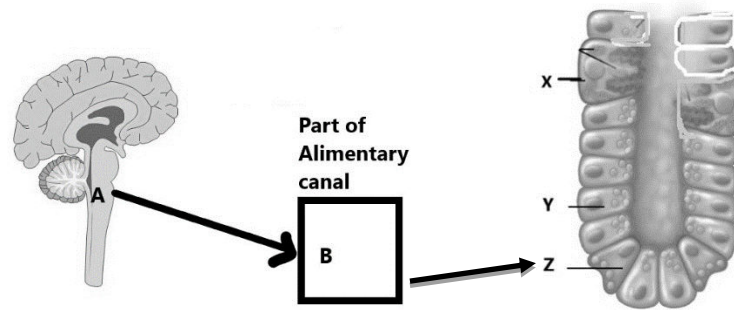
Answer: Y= B-cell is responsible for producing antibodies.

- c. How the role of Y and Z is different from each other? (1)

Answer:

|   |   |
|---|---|
| Y cell---B cell   | Z cell—Cytotoxic T cell                           |
| B cells produce antibodies thus producing humoral immune response | Kills pathogen by secreting perforin or cytotoxin |

- xix. The diagram shows the relation between our nervous and digestive system.



- a. Identify the parts A, B, X and Y. (1)

Answer:

A= Medulla, B= Stomach, X= Parietal cells, Y=Chief cells

- b. After being stimulated by sight of food what would be the effect of part A on part B. (1)

Answer:

Medulla influences the stomach's secretions by producing acetylcholine which stimulates chief, parietal and endocrine cells of stomach.

- c. Evaluate the effect of part Z secretion on X. (1)

Answer:

Z= (Endocrine cells) release gastrin which stimulates X=Parietal cells to release Hydrochloric acid

- xx. Trace the path through which lymph becomes the part of circulatory system. (3)

Answer:

All the lymph is collected by lymphatic system and returned back to circulatory system at subclavian vein.

**The thoracic duct** drains the lower limbs, abdomen, the left thorax, the left upper extremity, and the left side of the head and neck. The duct ends by entering the left subclavian vein.

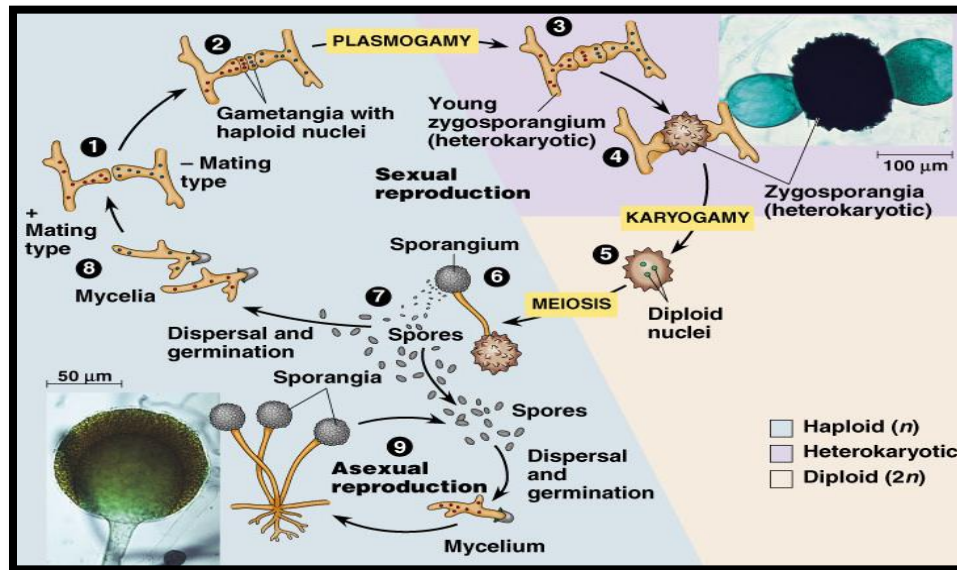
The **right lymphatic duct** is much short and smaller in diameter than the thoracic duct. It drains the right thorax, right upper limb, and right side of the head and neck and opens into the right subclavian vein.

## SECTION – C (Marks 26)

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

- Q.3 a. Draw and explain the life cycle of Zygomycota? (2+5)

Answer:



Asexual reproduction takes place by conidia or spores e.g. *Rhizopus nigricans*. It is known as black bread molds. It is a mass of mycelium. Asexual reproduction in *Rhizopus* takes place by the sporangia containing spores. Sexual reproduction takes place by conjugation.

#### Conjugation:

When hyphae (stolon) of opposite mating types meet, hormones are produced that cause the tips of the hyphae to come together and form gametangia, structures that produce gametes. These structures become separated from rest of the mycelium by the formation of septa. Plus and minus nuclei then fuse to form a diploid nucleus, the zygote. The zygote develops into a zygospore.

#### Zygospore.

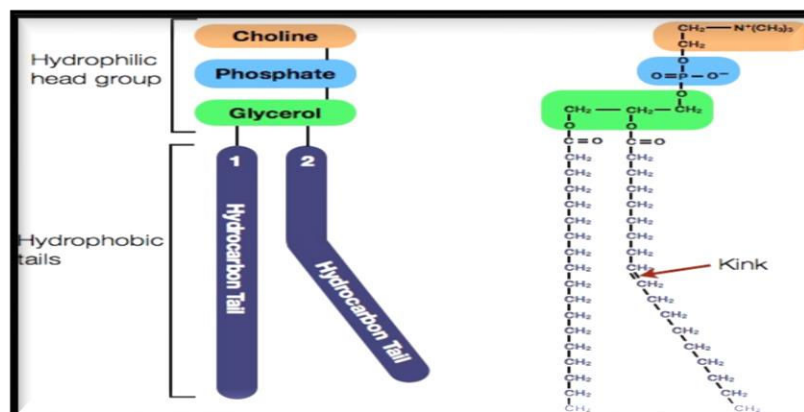
The wall of the zygospore is thick and resistant to unfavourable conditions. The division or phylum name refers to the zygospore. Zygospores germinate under favourable conditions and divide by meiosis. The wall of the zygospore splits and hyphae grows upward. The tip of the hypha develops into a sporangium.

#### Sporangium.

The sporangium contains many nuclei. The wall of the sporangium ruptures and the spores are liberated. Each spore grows into a new plus or minus strain of mycelium. Thus the lifecycle of *Rhizopus* is continued.

- b. Lipids are major constituents of fluid matrix of cell. Draw chemical structure and describe the properties of major membrane lipid? (1+5)

Answer:



**Phospholipids are major membrane lipids.**

Phospholipids are derived from phosphatidic acid. A phospholipid is formed when phosphatidic acid combines with one of the four organic compounds such as choline (a nitrogenous base), ethanolamine (an amino alcohol), inositol (an amino alcohol) and serine (an amino acid).

A phosphatidic acid contains a glycerol, two fatty acids esterified with first and second OH groups of glycerol and a phosphate group esterified with third OH group of glycerol

Most common phospholipid is phosphatidylcholine also called lecithin in which choline is attached to phosphate group of phosphatidic acid.

One end of the phospholipid molecule having phosphate group and additional compound is hydrophilic which is polar and soluble in water. The other end having fatty acid side chain is hydrophobic which is non polar and insoluble in water. These phospholipids are major constituents of lipid bilayer of cell membrane

- Q.4 a. Describe the structure of villus. Relate it with absorption of fats present in your diet. (2+2=4)

Answer:

**Structure of villus**

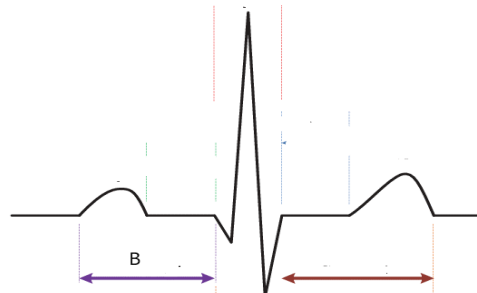
The ileum is the major site of nutrient absorption.

- I. It has tiny finger like projections of the mucosa called villi, which are 0.5 -1.5 mm in length. Each villus is covered by simple columnar epithelium having a blood capillary network and a lymph capillary called a lacteal.
- II. The structural features increase the surface area of small intestine and makes it the largest part of the alimentary canal. Villi and microvilli further increase surface area for absorption to reach the blood or lymph and nutrient molecule must pass through an epithelial cell of the intestinal lining and through a cell lining the blood capillaries or lymph vessels.

**Absorption of lipids:**

- I. After fatty acids and glycerol are absorbed by the epithelial cells, they are converted into fats which are then mixed with proteins and cholesterol into small globules chylomicrons.
- II. These are transported by exocytosis into lacteals. Lymph carrying these globules drains out large veins which drain blood into heart.

- b. Answer the questions related to ECG



- i. Label and explain P wave. (1)

Answer: P wave is produced by depolarization of atria.

- ii. Predict the situation of ventricle during P wave. (0.5)

Answer: During P wave ventricles are in diastolic condition.

iii. Identify Part B in graph. What does it indicate? (1)

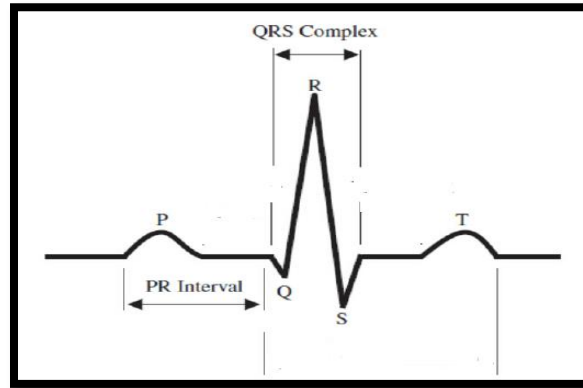
Answer: P-R interval, time period from the start of P wave to the beginning of QRS complex, indicating time required for atrial contraction.

iv. Label part of ECG representing the ejection of blood from ventricle. (0.5)

Answer: QRS complex.

v. Label and explain T wave. (1)

Answer: T wave = ventricular repolarization.



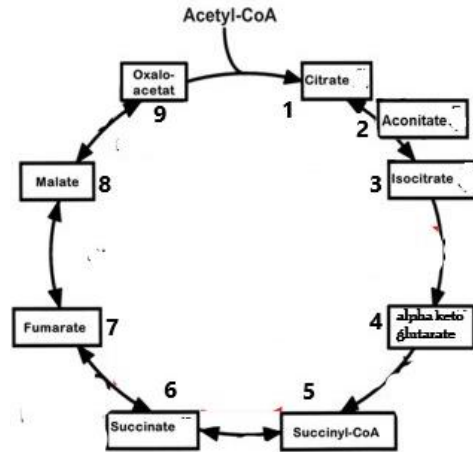
c. How would you relate the opening and closing of stomata with potassium ion? Explain. (5)

Answer:

- I. According to this theory, the start of photosynthetic activity in the morning when plant is exposed to light causes a decrease in level of  $\text{CO}_2$  in the guard cells.
- II. Low level of  $\text{CO}_2$  stimulates the influx of  $\text{K}^+$  ions into the guard cells from the surrounding epidermal cells by active transport.
- III. At the same time malic acid is ionized into malate ions and  $\text{H}^+$  ions due to the exposure of blue light.
- IV. The accumulation of  $\text{H}^+$  ions causes decrease in pH of guard cell, which are then pumped to surrounding epidermal cells in order to maintain the pH of guard cells, incoming  $\text{K}^+$  ions are combined with malate ions to form potassium malate which is highly soluble in water thus decreases the water potential of the guard cells.
- V. In this way water begins to move from surrounding epidermal cells to guard cells. The entry of water into the guard cells make them turgid and thus, stomata are opened.
- VI. In the evening, the photosynthetic activity is stopped and level of  $\text{CO}_2$  rises in guard cells.
- VII. High level of  $\text{CO}_2$  stimulates the efflux of  $\text{K}^+$  ions from the guard cells into the surrounding epidermal cells by active transport.
- VIII. At the same time, malic acid is reformed by the combination of malate ions  $\text{H}^+$  ions as there is no exposure of blue light now.
- IX. Due to the absence of potassium malate, the water potential of the guard cells are increased. In this way, water begins to move from surrounding epidermal cells from guard cells.
- X. The loss of water from guard cells makes them flaccid and thus, stomata are closed.



- Q.5 a. Identify and analyse the steps of oxidative decarboxylation and substrate level phosphorylation in the given Krebs's cycle (3)



Answer:

**Oxidative Decarboxylation:**

**STEP-4:** oxidative decarboxylation takes place and isocitrate (removal of electrons and hydrogen is termed as oxidation while decarboxylation is removal of carbonyl group in form of  $\text{CO}_2$ .) is changed to alpha keto glutarate along with formation of NADH.

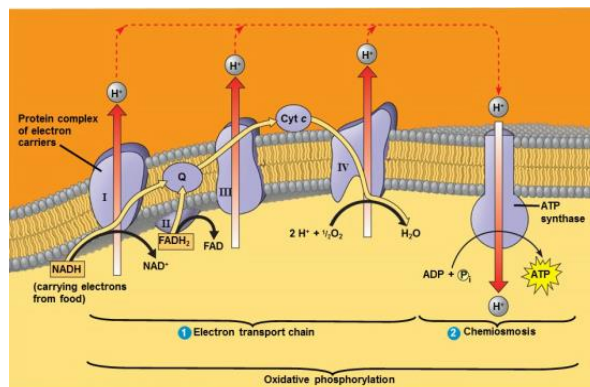
**STEP-5:** Alpha keto glutarate undergoes oxidative decarboxylation and NADH is formed, then it combines with coenzyme A to form succinyl Co-A

**Substrate level Phosphorylation:**

**STEP-6:** removal of coenzyme A from the succinyl Co-A results in the formation of succinate, releasing massive amount of energy which is used to combine  $\text{P}_i$  with GDP to form GTP. GTP reacts with ADP to form ATP and is again converted to GDP.

- b. How the reduced co-enzymes once produced in mitochondrial matrix are involved in ATP synthesis? Construct and outline the mechanism. (2+4)

Answer:



**Oxidative phosphorylation** is the synthesis of ATP molecules with the help of energy liberated during oxidation of reduced co-enzymes ( $\text{NADH}$ ,  $\text{FADH}_2$ ) produced in respiration. The enzyme required for this synthesis is called ATP synthetase.

**ATP synthetase.**

It is located in the inner mitochondrial membrane. It consists of two parts i.e.,  $\text{F}_0$  and  $\text{F}_1$ .  $\text{F}_0$  is embedded in the membrane and involves in the movement of protons from intermembrane space to mitochondrial matrix.  $\text{F}_1$  is a head like part which is projected from the surface of membrane towards matrix. It catalyzes ATP synthesis by the combination of ADP and  $\text{P}_i$ . ATP-synthetase becomes active in ATP formation only

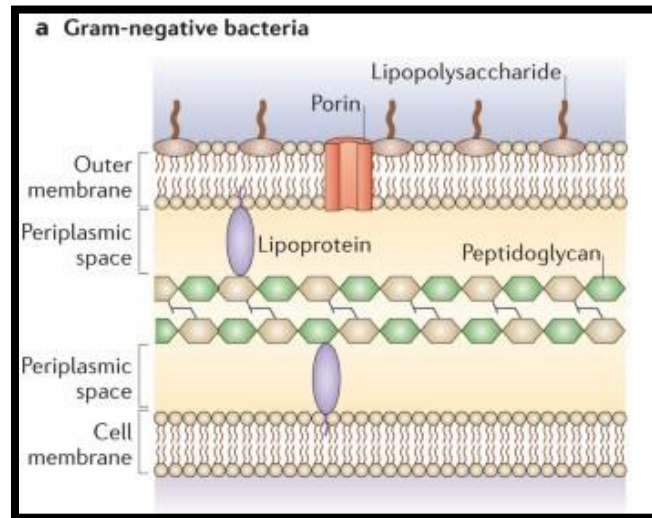


when a proton gradient having higher concentration of  $H^+$  or protons on the  $F_o$  side as compared to  $F_1$  side is established.

The flow of protons through the  $F_o$  channel induces  $F_1$  particles to function as ATP-synthetase. This produces ATP. Oxidation of one molecule of NADH produces 3 ATP molecules while a similar oxidation of  $FADH_2$  forms 2 ATP molecules. The theory of ATP production by this mechanism is called chemiosmosis.

- c. Gram negative bacteria are resistant to antibiotics. Justify the statement by sketching and elaborating the characteristics of its cell wall. (1+3)

Answer:



**Cell wall:** Cell wall is the part of bacterial envelop. It is situated outer to the cell membrane. It is composed of an inner layer of peptidoglycan and an outer lipoprotein membrane (found only in Gram negative bacteria). The peptidoglycan provides structural support and maintains the characteristic shape of the cell.

1. The peptidoglycan layer thicker in Gram-negative bacteria.
2. The Gram-negative has a complex outer layer consisting of lipopolysaccharide and lipoprotein.
3. The Gram-negative cell wall also contains a protein, the porins in outer membrane which act like pores for particular molecules.
4. Lying between the peptidoglycan layer of cell wall and the cell membrane in Gram-negative bacteria is the, periplasmic space which is the site of enzymes (that degrade antibiotics).
5. Pilus is present only in Gram negative bacteria. They allow bacterial cell to adhere to tissue and can help the bacterial cell resist attack from immune system cells in the human body.

\* \* \* \* \*