

Class XI Session 2025-26
Subject - Biology
Sample Question Paper - 2

Time Allowed: 3 hours

Maximum Marks: 70

General Instructions:

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

- | | | |
|----|--|---|
| 1. | Which is the most common respiratory substrate? | [1] |
| | a) Amino acids | b) Carbohydrates |
| | c) Organic acids | d) Fats |
| 2. | During anaphase-I of meiosis: | [1] |
| | a) Sister chromatids separate | b) Non-sister chromatids separate |
| | c) Non-homologous chromosomes separate | d) Homologous chromosomes separate |
| 3. | Largest organelles in the cell are: | [1] |
| | a) Mitochondria in animal cell and chloroplast in plant cell | b) Centrioles in animals and plastids in plant cell |
| | c) Lysosomes | d) Golgi bodies |
| 4. | In dicot stems, the cells of cambium present between the primary xylem and primary phloem are: | [1] |
| | a) Interfascicular cambium | b) Intrafascicular cambium |
| | c) Vascular cambium | d) Medullary cells |
| 5. | The expansion of ICBN is: | [1] |
| | a) Indian Code of Botanical Nomenclature | b) International Class of Botanical Nomenclature |
| | c) International Code of Botanical Nomenclature | d) Indian Class of Botanical Nomenclature |

- a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
- c) A is true but R is false. d) A is false but R is true.

16. **Assertion (A):** Liver fluke has undergone great modification to adapt itself with the parasite life. [1]

Reason (R): The modification in liver fluke is to suit its existence as an endoparasite in the bile duct of sheep.

- a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
- c) A is true but R is false. d) A is false but R is true.

Section B

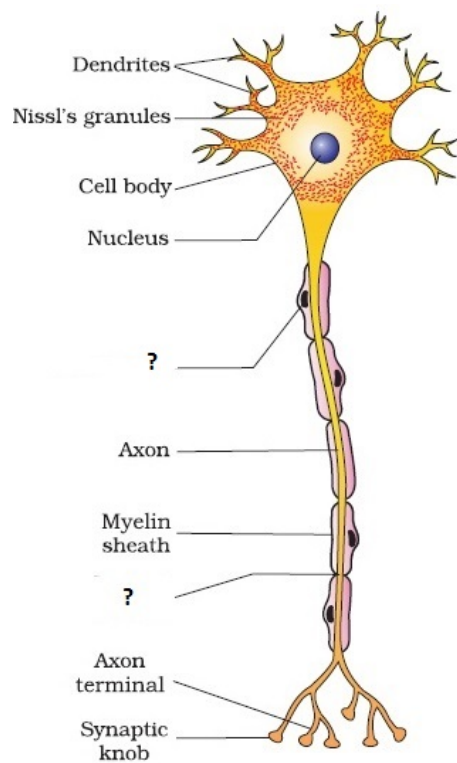
17. What observable features in Trypanosoma would make you classify it under kingdom-Protista? [2]
18. What are the components of stomata? [2]
19. Differentiate between peduncle and pedicel. [2]
20. Define the following terms and give their location? [2]
- i. Purkinje fibre
- ii. Bundle of His
21. Distinguish between lizards and snakes. [2]

OR

Give the unique features of nematodes.

Section C

22. Why do we believe chloroplast and mitochondria to be semi-autonomous organelle? [3]
23. Find examples where the four daughter cells from meiosis are equal in size and where they are found unequal in size. [3]
24. Write short notes on [3]
- i. atrial natriuretic factor
- ii. erythropoietin.
25. The arrangements of ovules within the ovary is known as placentation. What does the term placenta refer to? [3]
- Name and draw various types of placentations in the flower as seen in T.S. or V.S.
26. The energy yield in term of ATP is higher in aerobic respiration than during anaerobic respiration. Why is there anaerobic respiration even in organisms that live in aerobic condition like human beings and angiosperms? [3]
27. Examine the following diagram and answer the following questions: [3]



- i. What forms the myelinated sheath around the axon? Do these cells are also found in non-myelinated nerve cells?
- ii. What is this gap between two adjacent myelin sheath around axon called?
- iii. Where does non-myelinated nerve cells are found?

OR

Describe the structure of Brain.

28. Differentiate between Green algae and Brown algae.

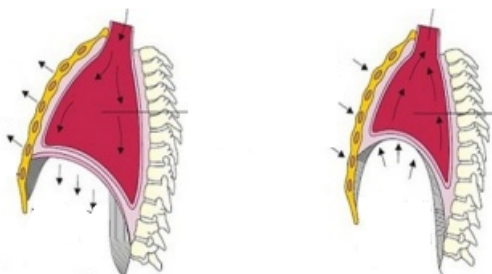
[3]

Section D

29. **Read the following text carefully and answer the questions that follow:**

[4]

In human beings, the lungs are situated in the thoracic chamber which is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs, and on the lower side by the dome-shaped diaphragm. The anatomical setup of the lungs in the thorax is such that any change in the volume of the thoracic cavity will be reflected in the lung (pulmonary) cavity. Such an arrangement is essential for breathing. Breathing involves two stages - inspiration and expiration. During inspiration, the atmospheric air is drawn in and during expiration, the alveolar air is released out.



- i. Observe the image mention conclusions for the image shown. (1)
- ii. What happens to the ribs and diaphragm during exhalation? (1)
- iii. What term is used for the volume of air inspired or expired during normal respiration? (2)

OR

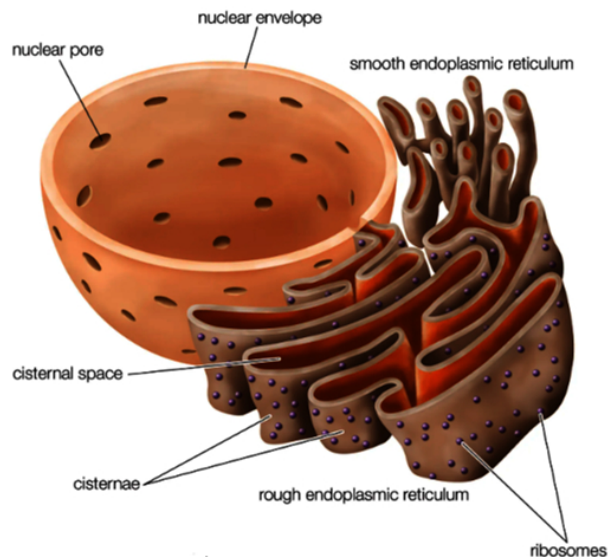
What is residual volume with reference to breathing? (2)

30. Read the following text carefully and answer the questions that follow:

[4]

Electron microscopic studies of eukaryotic cells reveal the presence of a network or reticulum of tiny tubular structures scattered in the cytoplasm that is called the endoplasmic reticulum (ER). The endoplasmic reticulum (ER) is a large network of membrane-bound tubes and sheets which look like long tubules or round or oblong bags (vesicles). The endomembrane system include endoplasmic reticulum (ER), Golgi complex, lysosomes and vacuoles. Since the functions of the mitochondria, chloroplast and peroxisomes are not coordinated with the above components, these are not considered as part of the endomembrane system.

Endoplasmic reticulum



- Observed given figure and mention what is rough endoplasmic reticulum? (1)
- Is RER actively involved in protein synthesis? (1)
- What is the function of smooth endoplasmic reticulum? (2)

OR

Which cell organelle divides the intracellular? (2)

Section E

31. Describe the structure of skeletal muscle.

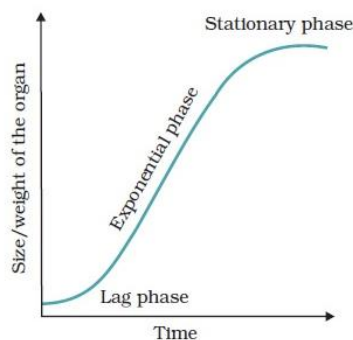
[5]

OR

Discuss the role of Ca^{2+} ions in muscle contraction. Draw neat sketches to illustrate your answer.

32. With reference to the diagram answer the following questions:

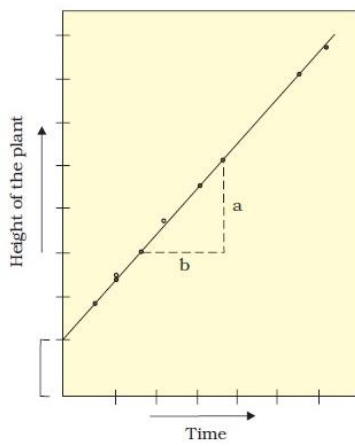
[5]



- Which type of growth is represented by the above curve? Define it.
- What is the significance of efficiency index in the above-mentioned type of growth?
- How will the limited nutrient supply affect it?

OR

With reference to the diagram answer the following questions:



- i. Which type of growth is represented above?
 - ii. Give the mathematical expression for the above-mentioned type of growth.
 - iii. What r stands for? Define it.
33. What are factors which affect action of enzyme? What is lock and key model and induced fit model in respect of enzyme action? [5]

OR

Give a detail explanation of structure of protein.

Solution

Section A

1.
(b) Carbohydrates
Explanation:
The compounds that are oxidized during this process are known as respiratory substrates. Usually, carbohydrates are oxidized to release energy, but proteins, fats, and even organic acids can be used as respiratory substances in some plants.
2.
(d) Homologous chromosomes separate
Explanation:
Homologous chromosomes of each pair separate rather than the chromatids of a chromosome. As a result, half of the chromosomes go to each pole. So real reduction of the number of chromosomes occurs here.
3. **(a)** Mitochondria in animal cell and chloroplast in plant cell
Explanation:
Mitochondria is the largest cell organelles in animal cell and chloroplast is the largest cell organelles in a plant cell.
4. **(b)** Intrafascicular cambium
Explanation:
Intrafascicular Cambium is primary meristem. It develops from the procambium of the stem apex. It is located inside the open vascular bundles, between phloem and xylem patches.
5. **(c)** International Code of Botanical Nomenclature
Explanation:
The scientific names are based on agreed principles and criteria, which are provided in the International Code for Botanical Nomenclature (ICBN). Hence, the correct option is the International code of botanical nomenclature.
6. **(a)** Ringworm
Explanation:
Ringworm, also known as dermatophytosis or tinea, is a fungal infection of the skin. The name “ringworm” is a misnomer since the infection is caused by a fungus, not a worm. Ringworm infection can affect both humans and animals.
7. **(b)** 1-2 months
Explanation:
The life-span is the time period from birth to death of an organism. The life-span of honey bee drone is 1-2 months only. Queen has the longest life span in all three kinds of honey bees.
8. **(b)** Epidermis
Explanation:
Epiblema is found in root as single outermost layer through which root hairs arises.
9. **(b)** 20.83%
Explanation:



Filtration fraction is the ratio of glomerular filtration rate (GFR) to the renal plasma flow (RPF). GFR of a normal human is 120 ml/min. so,

$$\text{FF} = \frac{\text{GFR}}{\text{RPF}} \times 100$$
$$= \frac{120}{600} \times 100 = 20\%.$$

10. **(a)** Four haploid cells

Explanation:

Four haploid cells are formed at the end of meiosis II. It is the reductional division resulting in a halving of chromosome number in daughter cells.

- 11.

- (d)** Mycelium

Explanation:

The body of the filamentous fungus is known as mycelium, which is a thread-like structure. Mycelium produces hyphae and sporogenous cells to produce spores.

12. **(a)** Will decrease

Explanation:

Number of common characters is maximum among members of a particular species. On the other hand, number of common characters is minimum among members of a particular kingdom.

- 13.

- (d)** A is false but R is true.

Explanation:

The root is typically a non-green underground cylindrical structure forming the descending axis of the plant which gives rise to endogenous branches and does not possess nodes, leaves or buds. The presence of nodes and internode is the characteristic feature of stems.

- 14.

- (b)** Both A and R are true but R is not the correct explanation of A.

Explanation:

Long branches of Pinus gradually become shorter towards the apex. Hence, the pine tree has a conical or pyramidal appearance. Long branches bear short branches and older portions of long branches display the scars of fallen short branches.

- 15.

- (c)** A is true but R is false.

Explanation:

Genus Panthera, comprising lion, tiger, leopard is put along with genus, Felis in the family Felidae on the basis of their morphological and reproductive characters while Families like Convolvulaceae, Solanaceae are included in the order Polymoniales mainly based on the floral characters.

16. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Liver fluke has to change its morphologic, as well as physiological characteristics to adapt itself within the host body. The adaptations are -

- i. Enzyme-resistant outer thick tegument.
- ii. Locomotory organs are absent.
- iii. Oral sucker, acetabulum and spines of body wall serve for the attachment with the host's body.
- iv. Alimentary canal ill-developed.
- v. Adults lack circulatory, respiratory and sensory organ.
- vi. The reproductive system is lightly developed.

Section B

17. Observable features in Trypanosoma are as follows:

- i. Unicellular, flagellum with basal granules.
 - ii. Well-developed nucleus like eukaryotes.
 - iii. Reproduces asexually.
 - iv. Reserved food material is in the form of granules.
18. Stomatal opening, guard cells and companion cells.
19. **Peduncle** is the axis of inflorescence which generally bears a number of flowers.

Pedicel is the stalk of the flower which bears a single flower.

20. i. The conducting fibres which relay the contraction impulses from AV node to the walls of ventricles are called Purkinje fibres. They are present in the ventricular musculature.
- ii. The Purkinje fibres along with left and right bundles are known as Bundle of His. The Bundle of His is present in the ventricular musculature.

21.	Lizards	Snakes
	Two pairs of limbs are present	Limbs are absent.
	Scales are of uniform size.	Scales are differentiated into plates and shields.
	Eyelids are movable.	Eyelids are immovable.
	The nictitating membrane is present.	Absent.
	The tongue is not bifid.	It is protrusible and bifid.
	The urinary bladder is present.	It is absent.
	Jawbones are fixed.	These are movable.

OR

Unique features of Nematodes :

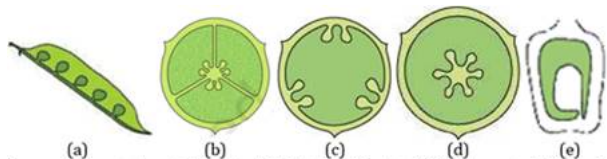
- i. Syncytial epidermis.
- ii. Pseudocoel without mesodermal lining.
- iii. Intestine non-muscular but formed of endoderm alone.
- iv. Sexual dimorphism is quite clear.

Section C

22. Since chloroplast can manufacture some proteins, by the help of its DNA and the ribosomes. New chloroplasts arise by division of preexisting chloroplast or division of their **precursor proplastids**.

Since mitochondria are self-perpetuating **semiautonomous** bodies. They possess ribosomes and DNA of their own and synthesize some proteins. They arise by **division of preexisting mitochondria**.

23.
 - During microsporogenesis in flowering plants the four daughter cells formed are equal in size.
 - On the other hand, during megasporogenesis the four daughter cells formed are unequal in size.
 - This can be seen in many other organisms also during the formation of male and female gametes. Meiosis usually leads to formation of equal sized male gametes and unequal sized daughter cells during the formation of female gametes.
24. i. **Atrial Natriuretic Factor:** A very important peptide hormone known as Atrial Natriuretic Factor (ANF) is secreted by the atrial walls of our heart when blood pressure is increased. Its secretion causes dilation of blood vessels thereby reducing the blood pressure.
- ii. **Erythropoietin:** A peptide hormone called erythropoietin is produced by the juxtaglomerular cells of the kidney. This hormone stimulates the formation of RBC, i.e., erythropoiesis. It is done by activating increased erythropoiesis in haemopoietic tissues.
25. Placenta is flattened, cushion-like tissue on which one or more ovules are attached. It supplies nutrients to the developing embryo.



Types of placentation: (a) Marginal (b) Axile (c) Parietal (d) Free central (e) Basal

26. The anaerobic respiration occurs even in organisms that live in aerobic condition like human beings and angiosperms under conditions of oxygen scarcity that happens in the muscle tissue. Under intense use, muscles demand too much energy (ATP) and consume much more oxygen to produce that energy.

This high consumption leads to oxygen scarcity and the muscle cells begin to make lactic acid by anaerobic respiration trying to fulfil their energetic needs.

Similarly, yeast cells under deficient conditions carry out anaerobic respiration.

27. i. Schwann cell. Yes, these cells are also found in unmyelinated nerve cell.
 ii. The node of Ranvier.
 iii. Unmyelinated nerve cells are found in the autonomous and somatic neural system.

OR

Structure of brain. The human brain is well protected by the skull. Inside the skull, the brain is covered by cranial meninges consisting of an outer layer called dura mater, a very thin middle layer called arachnoid and an inner layer (which is in contact with the brain tissue) called pia mater. The brain can be divided into three major parts.

(i) Forebrain (ii) Midbrain and (iii) Hindbrain

28. Green Algae	Brown Algae
It belongs to Chlorophyta.	It belongs to Phaeophyta.
Chlorophyll a + b present.	Chlorophyll a + c present.
Reserve food material is starch.	Reserve food material is Laminarian starch.
Unicellular to multicellular and may be motile or flagellated.	Filamentous and heterotrichous, multicellular forms.
β -carotene and carotenoids are other pigments present in algae e.g., Spirogyra, Chlamydomonas.	Fucoxanthin and special carotenoids are present in brown algae. e.g., Fucus and Sargassum.

Section D

29. i. • The movement of air into and out of the lungs is carried out by creating a pressure gradient.
 • The diaphragm and a specialised set of muscles help in generation of pressure gradients.
 ii. During exhalation, the ribs move down and inward and the diaphragm moves up. This movement increases the space in our chest cavity and the air is pushed out.
 iii. Volume of air inspired or expired during normal respiration is called tidal volume.

OR

Residual volume (RV) refers to the volume of air that still remains within the lungs after a forcible expiration. The average value of residual volume in a normal healthy adult human is between 1100 to 1200 ml.

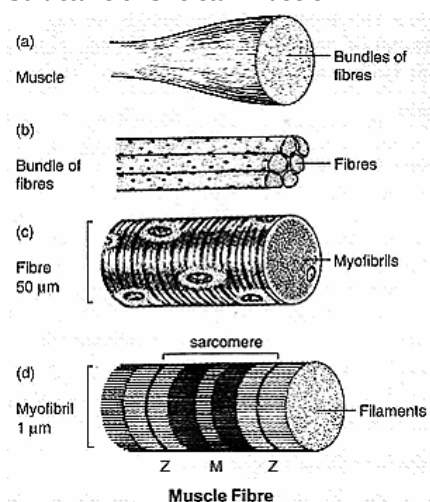
30. i. Rough endoplasmic reticulum has the ribosomes studded in its outer surface which are there to secrete proteins in a cell. Hence, giving it an unsmooth structure and termed it as the rough endoplasmic reticulum.
 ii. Yes, RER is frequently observed in the cells actively involved in protein synthesis and secretion.
 iii. The smooth endoplasmic reticulum is the major site for synthesis of lipids.

OR

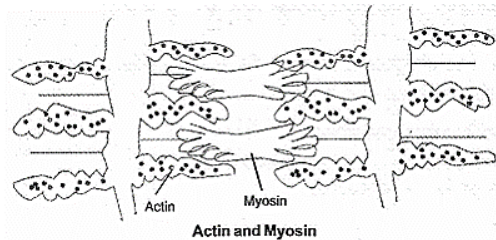
ER divides the intracellular space into two distinct compartments, i.e., luminal (inside ER) and extraluminal (cytoplasm) compartments.

Section E

31. Structure of Skeletal Muscle



- Each organized skeletal muscle is made of a number of muscle bundles or fascicles held together by a common collagenous connective tissue layer called fascia. Each muscle bundle contains a number of muscle fibres.
- Each muscle fibre is lined by the plasma membrane called sarcolemma enclosing the sarcoplasm. Muscle fibre is a syncytium as the sarcoplasm contains many nuclei.
- The endoplasmic reticulum, i.e., sarcoplasmic reticulum of the muscle fibres is the storehouse of calcium ions.
- A characteristic feature of the muscle fibre is the presence of a large number of parallelly arranged filaments in the sarcoplasm called myofilaments or myofibrils. Each myofibril has alternate dark and light bands on it.
- The striated appearance is due to the distribution pattern of two important proteins - Actin and Myosin. The light bands contain actin and are called I-band or Isotropic band., whereas the dark band called 'A' or Anisotropic band contains myosin. Both the proteins are arranged as rod-like structures, parallel to each other and also to the longitudinal axis of the myofibrils.

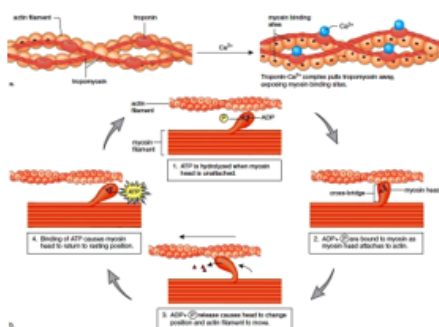


- Actin filaments are thinner as compared to the myosin filaments, hence are commonly called thin and thick filaments respectively.
- In the centre of each 'I' band is an elastic fibre called 'Z' line which bisects it. The thin filaments are firmly attached to the 'Z' line.
- The thick filaments in the 'A' band are also held together in the middle of this band by a thin fibrous membrane called 'M' line. The 'A' and 'I' bands are arranged alternately throughout the length of the myofibrils.
- The portion of the myofibril between two successive 'Z' lines is considered as the functional unit of contraction and is called a sarcomere.
- In a resting state, the edges of thin filaments on either side of the thick filaments partially overlap the free ends of the thick filaments leaving the central part of the thick filaments. This central part of thick filament, not overlapped by thin filaments is called the 'H' zone.

OR

Mechanism of muscle contraction is best explained by the sliding filament theory which states that contraction of a muscle fibre takes place by the sliding of the thin filaments over the thick filaments. Muscle contraction is initiated by a signal sent by the central nervous system (CNS) via a motor neuron.

Muscle contraction is initiated by a neural signal, which after reaching neuromuscular junction or motor endplate releases a neurotransmitter, as a result, an action potential in the sarcolemma is generated. Action potential spreads through muscle fibre and causes the release of calcium ions into the sarcoplasm. An increase in Ca^{2+} level leads to the binding of calcium with a subunit of troponin on actin filaments and thereby removes the masking of active sites for myosin. Utilising the energy from ATP hydrolysis, the myosin head now binds to the exposed active site on actin to form a cross-bridge. This pulls the attached actin filaments towards the centre of 'A' band. The 'Z' line attached to these actions are also pulled inwards thereby causing shortening of the sarcomere, i.e., contraction.



A new ATP binds to myosin head and the cross-bridge is broken. The ATP is again hydrolyzed by the myosin head and the cycle of cross-bridge formation and breakage is repeated causing further sliding. The process continues till the Ca^{++} ions are pumped back to the sarcoplasmic cisternae resulting in masking of actin filaments and breakage of all cross-bridges. This causes the return of 'Z' lines along with filaments back to their original position, i.e., relaxation.

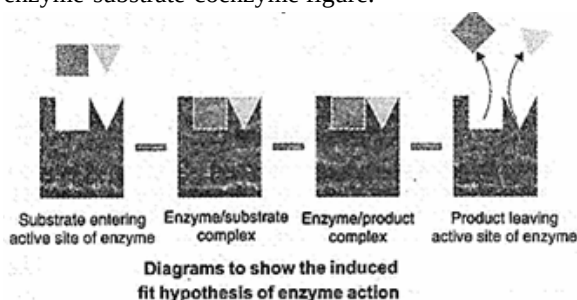
32. i. It represents the Geometrical growth in the plant. In Geometrical growth, initial growth is slow(lag phase), and it increases thereafter at an exponential rate(log phase).
- ii. Efficiency index of a plant is a measure of the ability of a plant to produce new plant material.
- iii. With limited nutrient supply, the growth slows down leading to a stationary phase.

OR

- i. Arithmetic growth is represented in the above diagram.
- ii. $L_t = L_0 + rt$
- iii. r stands for growth rate. The increased growth per unit time is termed as growth rate.

33. Factors Affecting Enzymatic Action

- i. **Temperature and pH:** Enzymes generally function over a narrow range of temperature and pH. Each enzyme shows its highest activity at a particular temperature and pH called the optimum temperature and optimum pH. Activity declines both below and above the optimum value. Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.
- ii. **Concentration of Substrate:** With the increase in substrate concentration, the velocity of the enzymatic reaction rises at first. The reaction ultimately reaches a maximum velocity (V_{max}) which is not exceeded by any further rise in the concentration of the substrate. This is because the enzyme molecules are fewer than the substrate molecules and after saturation of these molecules, there are no free enzyme molecule to bind with the additional substrate molecules.
- iii. **Effect of Inhibitor:** The activity of an enzyme is also sensitive to the presence of specific chemicals that bind to the enzyme. When the binding of the chemical shuts off enzyme activity, the process is called inhibition and the chemical is called an inhibitor. When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as a competitive inhibitor. Due to its close structural similarity with the substrate, the inhibitor competes with the substrate for the substrate binding site of the enzyme. Consequently, the substrate cannot bind and as a result, the enzyme action declines, e.g., inhibition of succinic dehydrogenase by malonate which closely resembles the substrate succinate in structure. Such competitive inhibitors are often used in the control of bacterial pathogens.
- iv. **"Lock and Key" Model:** The model was suggested by Emil Fischer in 1894 Both the enzyme and the substrate possess specific complementary geometric shapes that fit exactly into one another. This is often referred to as "the lock and key" model. However, while this model explains enzyme specificity, it fails to explain the stabilization of the transition state that enzymes achieve. The "lock and key" model has proven inaccurate, and the induced fit model is the most currently accepted enzyme-substrate-coenzyme figure.



- v. **Induced fit Model:** In 1958, Daniel Koshland suggested a modification to the lock and key model: since enzymes are rather flexible structures, the active site is continually reshaped by interactions with the substrate as the substrate interacts with the enzyme. As a result, the substrate does not simply bind to a rigid active site the amino acid side chains which make up the active site are moulded into the precise positions that enable the enzyme to perform its catalytic function. In some cases, such as glycosidases, the substrate molecule also changes shape slightly as it enters the active site. The active site continues to change until the substrate is completely bound, at which point the final shape and charge are determined.

OR

Structure of protein

Primary Structure . The sequence of amino acids i.e., the positional information in a protein is called the primary structure of a protein. A protein is imagined as a line, the left end represented by the first amino acid and the right end represented by the last amino acid. The first amino acid is also called as N-terminal amino acid. The last amino acid is called the C-terminal amino acid. A protein thread does not exist throughout as an extended rigid rod.

Secondary Structure. Regularly repeating local structures stabilized by hydrogen bonds. The most common examples are the alpha helix, beta sheet and turns. Because secondary structures are local, many regions of different secondary structures can be present in the same protein molecule.

Tertiary structure. The overall shape of a single protein molecule-- the spatial relationship of the secondary structures to one another represents tertiary structure. Tertiary structure is generally stabilized by non-local interactions, most commonly the formation of a hydrophobic core, but also through salt bridges, hydrogen bonds, disulfide linkages and even post-translational modifications. The term "tertiary structure" is often used as synonymous with the term fold. The Tertiary structure is what controls the basic function of the protein.

Quaternary Structure. Some proteins are an assembly of more than one polypeptide chain or subunits. The manner in which these individual folded polypeptides or subunits are arranged with respect to each other (e.g. linear string of spheres, spheres arranged one upon each other in the form of a cube or plate etc.) is the architecture of a protein otherwise called the quaternary structure of a proteins.

