

# 09

## Biomolecules

### TOPIC 1

#### Carbohydrates

- 01** Which of the following are not secondary metabolites in plants? [NEET 2021]

- (a) Morphine, codeine
- (b) Amino acids, glucose
- (c) Vinblastine, curcumin
- (d) Rubber, gums

**Ans. (b)**

Primary metabolites are compounds that are directly involved in the growth and development of a plant like amino acids and sugars (glucose). Primary metabolites prominently function growth, development and reproduction of cell. Secondary metabolites are compounds produced in other metabolic pathways that, although important, are not essential for the functioning of the plant.

- 02** Floridean starch has structure similar to [NEET (Sep.) 2020]

- (a) amylopectin and glycogen
- (b) mannitol and algin
- (c) laminarin and cellulose
- (d) starch and cellulose

**Ans. (a)**

Floridean starch has structure similar to amylopectin and glycogen as both are made from  $\alpha$ -D glucose monomers. The key difference between amylopectin and glycogen is, amylopectin is a soluble form of starch, while glycogen is an insoluble form of starch.

- 03** Which two functional groups are characteristic of sugars? [NEET 2018]

- (a) Carbonyl and phosphate
- (b) Carbonyl and methyl

- (c) Hydroxyl and methyl
- (d) Carbonyl and hydroxyl

**Ans. (d)**

**Sugars** are chemically carbohydrates. They are polyhydroxy aldehydes, ketoses and their condensation products. Aldoses bear a terminal aldehyde or  $\text{—CHO}$  group while ketoses have an internal ketone or  $\text{—CO}$  group. Thus, they possess two functional groups, i.e. carbonyl and hydroxyl.

- 04** The chitinous exoskeleton of arthropods is formed by the polymerisation of [CBSE AIPMT 2015]

- (a) keratin sulphate and chondroitin sulphate
- (b) D-glucosamine
- (c) N-acetyl glucosamine
- (d) lipoglycans

**Ans. (b)**

The chitinous exoskeleton of arthropods is formed by the polymerisation of N-acetyl glucosamine, which is a derivative of glucose. It is also a characteristic component of the cell wall of fungi, the radulae of molluscs and the beaks and internal shells of cephalopods, including squid and octopuses.

- 05** Which one of the following is a non-reducing carbohydrate? [CBSE AIPMT 2014]

- (a) Maltose
- (b) Sucrose
- (c) Lactose
- (d) Ribose 5-phosphate

**Ans. (b)**

Sucrose is a disaccharide of glucose and fructose. It is a non-reducing sugar as it does not contain any free anomeric carbon atom. Maltose is a disaccharide

of 2 glucose units. Its first glucose residue cannot undergo oxidation, whereas, second residue can undergo oxidation because it has a reactive free anomeric carbon atom. Hence, it is a reducing sugar.

Lactose and ribose-5-phosphate are also reducing in nature due to the presence of a free ketonic or aldehyde group.

- 06** Macromolecule chitin is [NEET 2013]

- (a) nitrogen containing polysaccharide
- (b) phosphorus containing polysaccharide
- (c) sulphur containing polysaccharide
- (d) simple polysaccharide

**Ans. (a)**

Macromolecule chitin is a complex polysaccharide containing amino sugars and chemically modified sugars, (e.g. glucosamine, N-acetyl galactosamine, etc). Polysaccharides are long carbohydrate molecules of monosaccharide units joined together by glycosidic bonds. They have a general formula  $\text{C}_x(\text{H}_2\text{O})_y$ . Chitin is the main component of the cell wall of fungi, the exoskeletons of arthropods, insects and radulae of molluscs, etc.

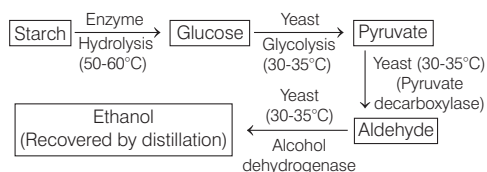
- 07** Which one of the following pairs is wrongly matched? [CBSE AIPMT 2009]

- (a) Detergents — Lipase
- (b) Alcohol — Nitrogenase
- (c) Fruit juice — Pectinase
- (d) Textile — Amylase

**Ans. (b)**

The wrongly matched pair is 'b' because alcohol (ethyl alcohol) can be produced by fermentation of any carbohydrate, containing a fermentable sugar.

The development of synthetic alcohol follows following reaction



- 08** About 98 per cent of the mass of every living organism is composed of just six elements including carbon, hydrogen, nitrogen, oxygen and
- [CBSE AIPMT 2007]

- (a) phosphorus and sulphur  
 (b) sulphur and magnesium  
 (c) magnesium and sodium  
 (d) calcium and phosphorus

**Ans. (a)**

About 98% of the mass of every living organism including bacterium and human beings is composed of just six elements, i.e. Carbon (C), Hydrogen (H), Nitrogen (N), Oxygen (O), Phosphorus (P) and Sulphur (S). Charagaff (1950) suggested that despite wide compositional variations exhibited by different types of DNA the total amount of purines equaled the total amount of pyrimidines ( $A + G = T + C$ ).

- 09** Which of the following is a reducing sugar?
- [CBSE AIPMT 2002]

- (a) Galactose  
 (b) Gluconic acid  
 (c)  $\beta$ -methyl galactoside  
 (d) Sucrose

**Ans. (a)**

Glucose, fructose, mannose, galactose are hexose monosaccharides. The monosaccharides have free aldehyde or ketone group which can reduce  $\text{Cu}^{2+}$  to Cu. Therefore, these are called reducing sugars.

- 10** Most abundant organic compound on earth is
- [CBSE AIPMT 2001, 04]
- (a) protein (b) cellulose  
 (c) lipids (d) steroids

**Ans. (b)**

Cellulose is fibrous polysaccharide that forms the structural component of plant cell wall, some primitive fungi and tunic of ascidians. Cellulose is the most abundant organic substance on earth. It can be digested by only a few microbes present in the gut of ruminants and white ants.

- 11** Lactose is composed of
- [CBSE AIPMT 1998]

- (a) glucose+glucose  
 (b) glucose+fructose  
 (c) fructose+galactose  
 (d) glucose+galactose

**Ans. (d)**

Lactose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ) is a disaccharide found in mammalian milk. It comprises of galactose and glucose units which are linked together by  $\beta$ , 1-4 glycosidic bonds. It is a reducing sugar.

- 12** Cellulose, the most important constituent of plant cell wall is made of
- [CBSE AIPMT 1998]

- (a) unbranched chain of glucose molecules linked by  $\alpha$  1, 4-glycosidic bond  
 (b) branched chain of glucose molecules linked by  $\beta$  1, 4-glycosidic bond in straight chain and  $\alpha$ , 1, 6-glycosidic bond at the site of branching  
 (c) unbranched chain of glucose molecules linked by  $\beta$  1, 4-glycosidic bond  
 (d) branched chain of glucose molecules linked by  $\alpha$  1, 6-glycosidic bond at the site of branching

**Ans. (c)**

Cellulose ( $\text{C}_6\text{H}_{10}\text{O}_5$ )<sub>n</sub> is the most abundant organic polymer. It is a polysaccharide and consists of long unbranched chains of glucose residues linked by  $\beta$ , 1-4 glycosidic bonds. In plants, cellulose is formed from sugar. It serves as building material in the formation of cell wall.

- 13** In which one of the following groups, all the three are examples of polysaccharides?
- [CBSE AIPMT 1996]

- (a) Starch, glycogen, cellulose  
 (b) Sucrose, maltose, glucose  
 (c) Glucose, fructose, lactose  
 (d) Galactose, starch, sucrose

**Ans. (a)**

Starch and glycogen are storage polysaccharide and cellulose is a structural polysaccharide. Starch has straight chain of 1,4  $\alpha$ -D pyranose glucose units and side chains or amylopectin part of 2-200 thousand glucose units that are attached to

straight chains by 1,6  $\alpha$ -D glycosidic bonds.

Glycogen is long chain branched polymer of 5-300 thousand glucose units, straight chain linked by  $\alpha$ -D 1-4 glycosidic bonds and side chains through  $\alpha$ -D 1  $\rightarrow$  6 glycosidic bonds.

**Cellulose**, a fibrous polysaccharide has a linear chain of 6-10 thousand 1  $\rightarrow$  4 linked  $\beta$ -pyranose glucose chain.

- 14** Glycogen is a polymer of
- [CBSE AIPMT 1992]

- (a) galactose (b) glucose  
 (c) fructose (d) sucrose

**Ans. (b)**

A glycogen molecule is a long highly branched chain of about 30000 to 100000  $\alpha$ -D glucose units joined by glycosidic bonds. It is storage form of glucose, popularly called animal starch. It provides energy to animals, fungi and bacteria.

- 15** Living cell contains 60-75% water. Water present in human body is
- [CBSE AIPMT 1992]

- (a) 60-65%  
 (b) 50-55%  
 (c) 75-80%  
 (d) 65-70%

**Ans. (d)**

In humans, about two-third of body is formed of water. About 65-70% of human body is water, of these about 55% (20-22 L) is confined to cells as intracellular water.

## TOPIC 2 Proteins

- 16** Which one of the following is the most abundant protein in the animals?
- [NEET (Sep.) 2020]

- (a) Collagen  
 (b) Lectin  
 (c) Insulin  
 (d) Haemoglobin

**Ans. (a)**

Collagen is the most abundant protein in animal world and RuBisCO is the most abundant protein in the whole of the biosphere because it is present in every plant that undergoes photosynthesis and molecular synthesis through the Calvin cycle.

**17** Identify the substances having glycosidic bond and peptide bond, respectively in their structure.

[NEET (Sep.) 2020]

- (a) Glycerol, trypsin  
 (b) Cellulose, lecithin  
 (c) Inulin, insulin  
 (d) Chitin, cholesterol

**Ans. (c)**

Inulin is a fructan (polysaccharide of fructose). Adjacent fructose units are linked through glycosidic bond. Insulin is a protein composed of 51 amino acids. Adjacent amino acids are attached through peptide bond.

**18** Identify the basic amino acid from the following. [NEET (Sep.) 2020]

- (a) Glutamic acid (b) Lysine  
 (c) Valine (d) Tyrosine

**Ans. (b)**

Option (b) is correct as lysine is a basic amino acid because its side chain contains nitrogen and resembles ammonia, which is a base. Valine is a neutral amino acid, glutamic acid is an acidic amino acid, while tyrosine is an aromatic amino acid.

**19** "Ramachandran plot" is used to confirm the structure of

[NEET (Odisha) 2019]

- (a) RNA (b) proteins  
 (c) triacylglycerides (d) DNA

**Ans. (b)**

'Ramachandran plot' is used to confirm the structure of proteins. Ramachandran plot is a plot of the angles-phi ( $\phi$ ) and psi ( $\psi$ ) of amino acids found in a peptide chain. This plot was developed by GN Ramachandran, an Indian Scientist in 1963.

**20** Which of the following is an amino acid derived hormone? [NEET 2018]

- (a) Estradiol (b) Ecdysone  
 (c) Epinephrine (d) Estriol

**Ans. (c)**

Among the following, epinephrine is an amino acid derived hormone. It is a catecholamine which is produced in the chromaffin cells of adrenal medulla from amino acids tyrosine. On the other hand, estradiol and estriol are steroid hormones that are involved in the regulation of estrous and menstrual cycles.

Ecdysone is also a steroid hormone that controls moulting in insects.

**21** Which of the following is the least likely to be involved in stabilising the three-dimensional folding of most proteins?

[NEET 2016, Phase II]

- (a) Hydrogen bonds  
 (b) Electrostatic interaction  
 (c) Hydrophobic interaction  
 (d) Ester bonds

**Ans. (d)**

Ester bonds are the least likely to be involved in stabilising the 3D folding of most proteins. A long protein chain gets folded upon itself like a hollow woolen ball, giving rise to a tertiary structure (3D) structure.

This structure is stabilised by several types of bonds, i.e. hydrogen bonds, ionic bonds, Vander waal's interactions, covalent bonds and hydrophobic bonds.

Ester bond is formed between sugar and phosphate in a nucleotide and is not involved in stability of a polypeptide chain. Thus, option (d) is correct.

**22** Which one is the most abundant protein in the animal world?

[CBSE AIPMT 2012]

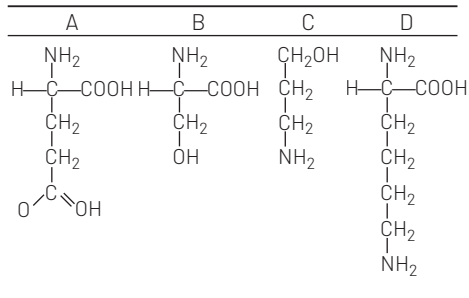
- (a) Trypsin  
 (b) Haemoglobin  
 (c) Collagen  
 (d) Insulin

**Ans. (c)**

Collagen is the most abundant protein (structural protein) in the animal world while Ribulose Bisphosphate Carboxylase Oxygenase (RuBisCO) is the most abundant protein in the whole of the plant world.

**23** Which one out of A-D given below correctly represents the structural formula of the basic amino acid?

[CBSE AIPMT 2012]



- (a) C (b) D  
 (c) A (d) B

**Ans. (c)**

Structure D represents basic amino acid lysine whereas structure A represents glutamic acid (acidic amino acid) and structure B represents alcoholic amino acid serine.

**24** Which of the following is the simplest amino acid?

[CBSE AIPMT 2005]

- (a) Alanine (b) Asparagine  
 (c) Glycine (d) Tyrosine

**Ans. (c)**

Proteins are polymers of amino acids in which amino acids are joined by peptide bonds. Glycine is the simplest amino acid.

**25** Collagen is [CBSE AIPMT 2002]

- (a) fibrous protein  
 (b) globular protein  
 (c) lipid  
 (d) carbohydrate

**Ans. (a)**

Collagen is a major fibrous protein of connective tissue, occurring as white fibres produced by fibroblast.

**26** Which is an essential amino acid?

[CBSE AIPMT 2000]

- (a) Serine (b) Aspartic acid  
 (c) Glycine (d) Phenylalanine

**Ans. (d)**

For human beings, eight amino acids are essential: Leucine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. So, these are known as essential amino acids. Cannot be synthesised in animal body.

**27** Conjugated proteins containing carbohydrates as prosthetic group are known as [CBSE AIPMT 2000]

- (a) chromoproteins  
 (b) glycoproteins  
 (c) lipoproteins  
 (d) nucleoproteins

**Ans. (b)**

**Glycoproteins** (mucoproteins) are conjugated proteins having a simple or complex sugar (galactose) residue at their N-terminal end. Glycoprotein is found in egg white, mucin, antibody IgG, cell membrane, saliva, synovial fluid, heparin. Lipoproteins contain lipids and nucleoproteins contain nucleic acid as the prosthetic group.

**28** What is common among amylase, rennin and trypsin?  
[CBSE AIPMT 1997]

- (a) These are all proteins
- (b) These are proteolytic enzymes
- (c) These are produced in stomach
- (d) These act at a pH lower than 7

**Ans. (a)**

All three are proteins enzymes amylase, rennin and trypsin acts respectively on the substrates starch, lactose and protein. Amylase acts at an optimum pH—6.8-7, rennin at pH-2 and trypsin at an optimum pH—8.5.

**29** Most diverse macromolecules, found in the cell both physically and chemically are [CBSE AIPMT 1996]

- (a) proteins
- (b) carbohydrates
- (c) nucleic acids
- (d) lipids

**Ans. (a)**

Proteins are the most diverse among organic compounds. Among the biomolecules, proteins constitute 9-12%, fat 1-3%, carbohydrates 1-2%, minerals 1-3%, nucleic acids 2% and water 60-75%.

**30** The pyrenoids are made up of  
[CBSE AIPMT 1995]

- (a) proteinaceous centre and starchy sheath
- (b) core of protein surrounded by fatty sheath
- (c) core of starch surrounded by sheath of protein
- (d) core of nucleic acid surrounded by protein sheath

**Ans. (a)**

Pyrenoids consist of dense proteinaceous area surrounded by starchy sheath. These are unique to chloroplast of algae and are associated in polymerising sugars into reserve polymers (starch).

**31** Amino acids are produced from  
[CBSE AIPMT 1992]

- (a) proteins
- (b) fatty acids
- (c) essential oils
- (d)  $\alpha$ -keto acids

**Ans. (d)**

Amino acids are smallest structural units of proteins. Plants and some microorganisms can synthesise these amino acids from inorganic nitrogen/ $\alpha$ -keto acids by reductive amination and transamination. Amino acids besides bearing a carboxyl group, possess an amino group attached to  $\alpha$ -carbon, hence, called as  $\alpha$ -amino acids.

## TOPIC 3 Lipids

**32** Following are the statements with reference to lipids.  
[NEET 2021]

- I. Lipids having only single bonds are called unsaturated fatty acids.
- II. Lecithin is a phospholipid.
- III. Trihydroxy propane is glycerol.
- IV. Palmitic acid has 20 carbon atoms including carboxyl carbon.
- V. Arachidonic acid has 16 carbon atoms.

Choose the correct answer from the options given below

- (a) I and III
- (b) III and IV
- (c) II and III
- (d) II and V

**Ans. (c)**

Statements I, IV and V are incorrect, while II and III are correct.

The incorrect statements can be corrected as

Lipid having only single bonds are called saturated fatty acids.

Palmitic acid has 16 carbon atoms including carboxyl carbon.

Arachidonic acid has 20 carbon atoms.

**33** Which of the following are not polymeric ?  
[NEET 2017]

- (a) Nucleic acid
- (b) Proteins
- (c) Polysaccharides
- (d) Lipids

**Ans. (d)**

Among the given options except lipids all are polymers. These are formed by the polymerisation of monomers. The basic unit of lipid are fatty acids and glycerol molecules that do not form repetitive chains. Instead they form triglycerides from three fatty acids and one glycerol molecules.

**34** A typical fat molecule is made up of  
[NEET 2016, Phase I]

- (a) One glycerol and three fatty acid molecules
- (b) One glycerol and one fatty acid molecule

(c) Three glycerol and three fatty acid molecules

(d) Three glycerol molecules and one fatty acid molecule

**Ans. (a)**

A typical fat molecule is triglyceride formed by esterification of one glycerol and three fatty acid molecules. The three fatty acids can be of same type or different depending on the type of the fat molecules.

**35** A phosphoglyceride is always made up of  
[NEET 2013]

- (a) only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
- (b) only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
- (c) a saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
- (d) a saturated or unsaturated fatty acid esterified to a phosphate group, which is also attached to a glycerol molecule

**Ans. (c)**

A fat is formed of two kinds of smaller molecules, i.e. glycerol and fatty acids. In making a fat free fatty acid molecules join to glycerol by an ester linkage. A fatty acid has a long carbon skeleton, usually 16 or 18 carbon atoms in length. If there are no double bonds between carbon atoms composing the chain, then as many hydrogen atoms as possible are bonded to the carbon skeleton. This is called saturated fatty acid. Unsaturated fatty acid has one or more double bonds. Phosphoglycerides are esters of two fatty acids, phosphoric acid and a trifunctional alcohol glycerol. The fatty acids are attached to the glycerol at the 1 and 2 position on glycerol through ester bonds.

**36** Which one of the following is not a constituent of cell membrane?  
[CBSE AIPMT 2007]

- (a) Cholesterol
- (b) Glycolipids
- (c) Proline
- (d) Phospholipids

**Ans. (c)**

The lipids of cell membrane are of three types namely phospholipids, glycolipids and sterols. The sterol found in the membrane may be cholesterol (animals), phytosterol (plants) or ergosterol (microorganisms). Cell membrane is made up of lipid+protein (60%) and carbohydrates (2-10%). Proline is an amino acid.

- 37** Lipids are insoluble in water because lipid molecules are  
[CBSE AIPMT 2002]
- (a) hydrophilic (b) hydrophobic  
(c) neutral (d) Zwitter ions

**Ans. (b)**

**Bloor** (1943) first time used the term 'lipid'. These are the compounds of C, H, O but the ratio of H and O is more than 2 : 1 that is the ratio of oxygen is lesser as compared to carbohydrates. Lipids are insoluble in water but soluble in non-polar solvents such as benzene, chloroform, etc. Common lipid occurring in a cell is phospholipid. It contains a hydrophilic (polar) head and a hydrophobic (non-polar) tail.

- 38** Which steroid is used for transformation?  
[CBSE AIPMT 2002]
- (a) Cortisol  
(b) Cholesterol  
(c) Testosterone  
(d) Progesterone

**Ans. (b)**

Cholesterol forms a major component of animal cell membranes liposomes (artificially created spheres surrounded by a phospholipid bilayer like a membrane) which are used for transformation (transgenics).

- 39** Spoilage of oil can be detected by which fatty acid?  
[CBSE AIPMT 2001]
- (a) Oleic acid (b) Linolenic acid  
(c) Linoleic acid (d) Erucic acid

**Ans. (d)**

Erucic acid occurs as glycerides in vegetable oils. It is a monounsaturated omega-9-fatty acid. It is found in rapeseed, mustard seed and wallflower seed.

## TOPIC 4 Nucleic Acids

- 40** Match the List-I with List-II.  
[NEET 2021]

List-I	List-II
A. Protein	1. C=C double bonds
B. Unsaturated fatty acid	2. Phosphodiester bonds
C. Nucleic acid	3. Glycosidic bonds
D. Polysaccharide	4. Peptide bonds

Choose the correct answer from the options given below.

- A B C D  
(a) 4 1 2 3  
(b) 1 4 3 2  
(c) 2 1 4 3  
(d) 4 3 1 2

**Ans. (a)**

(A)-(4), (B)-(1), (C)-(2), (D)-(3)

Proteins are polypeptides, they are linear chain of amino acids linked by peptide bond.

Unsaturated fatty acids are carbon chains containing one or more double bonds with terminal carboxylic acid.

The two sugar molecules of nucleic acids are linked together via phosphodiester bond.

Polysaccharides are long chain of sugar molecules joined with a covalent bond, i.e. glycosidic linkage.

- 41** Match the items in Column I with those in Column II.  
[NEET (Oct.) 2020]

Column I	Column II
A. Aquaporin	(i) Amide
B. Asparagine	(ii) Polysaccharide
C. Abscisic acid	(iii) Polypeptide
D. Chitin	(iv) Carotenoids

Select the correct option.

- A B C D  
(a) (iii) (i) (iv) (ii)  
(b) (ii) (iii) (iv) (i)  
(c) (ii) (i) (iv) (iii)  
(d) (iii) (i) (ii) (iv)

**Ans. (a)**

Option (a) is correct match which is as follows

Chemically, aquaporins are major intrinsic proteins that form pores in the membranes of cell. Asparagine is beta-amide derivative of aspartic acid.

Abscisic acid is an apo-carotenoid.

Chitin is a heteropolysaccharide consisting of two types of monosaccharide monomers.

- 42** DNA precipitation out of a mixture of biomolecules can be achieved by treatment with  
[NEET (National) 2019]

- (a) chilled ethanol  
(b) methanol at room temperature  
(c) chilled chloroform  
(d) isopropanol

**Ans. (a)**

Chilled ethanol is used to precipitate DNA out of a mixture of biomolecules. Low temperature protects the DNA by slowing down the activity of enzymes that could break it apart and ethanol helps in the quick precipitation of DNA.

- 43** Which one of the following statements is wrong?  
[NEET 2016, Phase I]

- (a) Cellulose is a polysaccharide  
(b) Uracil is a pyrimidine  
(c) Glycine is a sulphur containing amino acid  
(d) Sucrose is a disaccharide

**Ans. (c)**

Glycine is the simplest amino acid in which functional group 'R' is replaced by hydrogen atom (H).

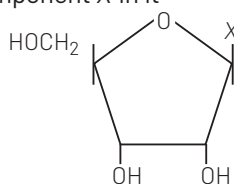
- 44** Which of the following biomolecules does have a phosphodiester bond?  
[CBSE AIPMT 2015]

- (a) Fatty acids in a diglyceride  
(b) Monosaccharides in a polysaccharide  
(c) Amino acids in a polypeptide  
(d) Nucleic acids in a nucleotide

**Ans. (d)**

Phosphodiester bond is responsible for linking nucleotides in nucleic acid (DNA and RNA).

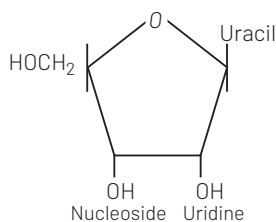
- 45** Given below is the diagrammatic representation of one of the categories of small molecular weight organic compounds in the living tissues. Identify the category shown and the one blank component X in it



[CBSE AIPMT 2012]

- |                 |                 |
|-----------------|-----------------|
| Category        | Component       |
| (a) Cholesterol | – Guanine       |
| (b) Amino acid  | – $\text{NH}_2$ |
| (c) Nucleotide  | – Adenine       |
| (d) Nucleoside  | – Uracil        |

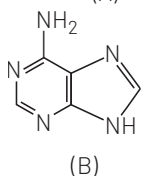
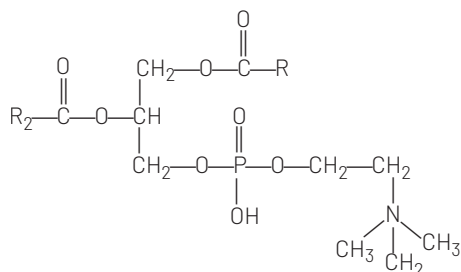
**Ans. (d)**



Nucleoside is made up of ribose sugar and nitrogenous base only. Uracil forms nucleoside with only ribose sugar. So, the option with category nucleoside component uracil is correct.

- 46** Which one of the following structural formula of two organic compounds is correctly identified along with its related function?

[CBSE AIPMT 2011]



- |       |                       |  |
|-------|-----------------------|--|
| (a) A | – Triglyceride- major | – Source of energy                         |
| (b) B | – Uracil              | – A component of DNA                       |
| (c) A | – Lecithin            | – A component of cell membrane             |
| (d) B | – Adenine             | – A nucleotide that makes up nucleic acids |

**Ans. (c)**

Lecithin is a phospholipid composed of choline and inositol. It is found in all living cells as a major component of cell membrane.

- 47** Which one of the following is the correct matching of three items and their grouping category?

[CBSE AIPMT 2009]

Items	Group
(a) Malleus, incus, cochlea	– Ear ossicles
(b) Ilium, ischium, pubis	– Coxal bones of pelvic girdle
(c) Actin, myosin, rhodopsin	– Muscle proteins
(d) Cytosine, uracil, thymine	– Pyrimidines

**Ans. (d)**

There are total five nitrogenous bases found in nucleic acids. Out of these **adenine, guanine** (purines) and **cytosine, thymine** (pyrimidines) are present in DNA, while RNA contains **uracil** in place of **thymine** (both pyrimidines) along with rest 3 similar to DNA.

- 48** Which one of the following pairs of nitrogenous bases of nucleic acids, is wrongly matched with the category mentioned against it?

[CBSE AIPMT 2008]

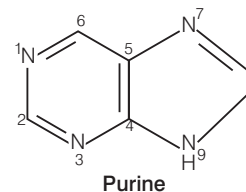
- |                      |               |
|----------------------|---------------|
| (a) Thymine, Uracil  | – Pyrimidines |
| (b) Uracil, Cytosine | – Pyrimidines |
| (c) Guanine, Adenine | – Purines     |
| (d) Adenine, Thymine | – Purines     |

**Ans. (d)**

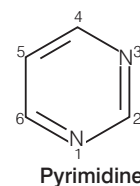
DNA and RNA the principal genetic materials of living organisms are chemically called nucleic acids.

These are polymers of nucleotides. Each nucleotide is composed of phosphoric acid, pentose sugar and nitrogenous base. The nitrogenous bases are of two types, i.e. purine and pyrimidines.

Purines are heterocyclic and two rings, e.g. adenine, guanine.



Pyrimidines are single ring compound, e.g. thymine, cytosine, uracil.



- 49** In the DNA molecule

[CBSE AIPMT 2008]

- |  |
|--|
| (a) the total amount of purine nucleotides and pyrimidine nucleotides is not always equal      |
| (b) there are two strands which run parallel in the 5' → 3' direction                          |
| (c) the proportion of adenine in relation to thymine varies with the organism                  |
| (d) there are two strands which run antiparallel one in 5' → 3' direction and other in 3' → 5' |

**Ans. (d)**

In DNA molecule the adjacent deoxyribonucleotides are joined in a chain by phosphodiester bridges or bonds, which link the 5' carbon of deoxyribose of one mononucleotide unit with 3' carbon of deoxyribose of next mononucleotide unit.

According to **Watson and Crick** DNA molecule consists of two such polynucleotide chains wrapped helically around each other, with the sugar phosphate chain on the outside and purine and pyrimidine on the inside of helix.

The two strands run antiparallel, i.e. one strand has phosphodiester linkage in 3' → 5' direction while other strand has phosphodiester linkage in 5' → 3' direction.

**Chargaff** (1950) suggested that despite wide compositional variations exhibited by different types of DNA the total amount of purines equaled the total amount of pyrimidines ( $A + G = T + C$ ).

- 50** The two polynucleotide chains in DNA are **[CBSE AIPMT 2007]**  
 (a) parallel (b) discontinuous (c) antiparallel (d) semiconservative

**Ans. (c)**

In 1953 **James Watson** and **Francis Crick** suggested that in a DNA molecule there are two polynucleotide chains arranged antiparallel or in opposite directions.

- 51** One turn of the helix in a B-form DNA is approximately **[CBSE AIPMT 2006]**  
 (a) 0.34 nm (b) 3.4 nm (c) 2 nm (d) 20 nm

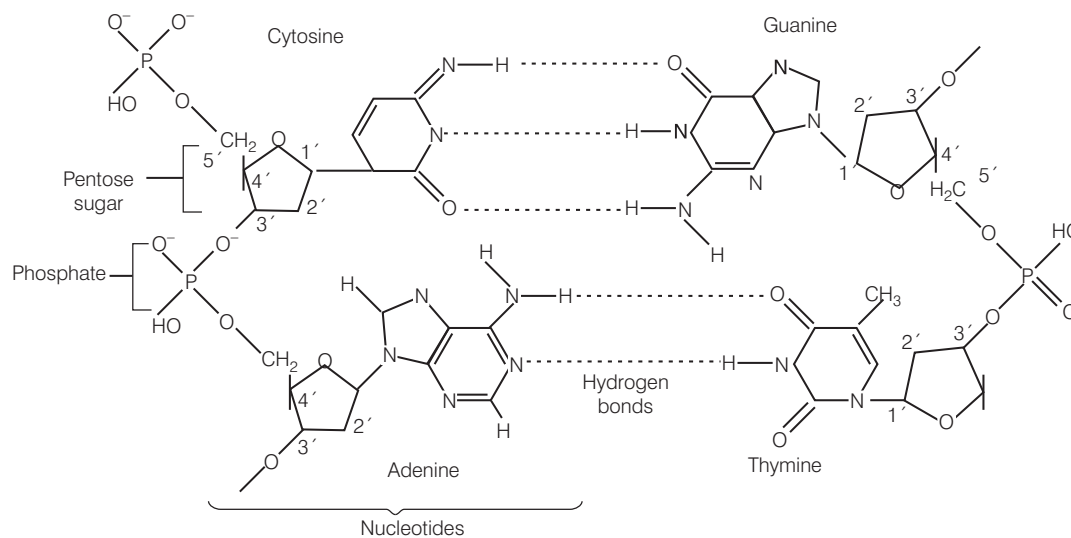
**Ans. (b)**

B-DNA is helical structure with 20Å diameter and the distance between the two base pairs is 3.4Å and there are 10 base pairs in each turn or pitch (one round). Hence, one turn of the helix is approximately 34Å or 3.4 nm ( $10\text{Å} = 1.0\text{ nm}$ ). Z-DNA (in comparison to B-DNA) is left handed double helical structure in which double helix winds to left in zig-zag pattern (instead of right, like B-DNA).

- 52** Nucleotides are building blocks of nucleic acids. Each nucleotide is a composite molecule formed by **[CBSE AIPMT 2005, 1991]**  
 (a) base-sugar-phosphate (b) base-sugar-OH (c) (base-sugar-phosphate)<sub>n</sub> (d) sugar-phosphate

**Ans. (a)**

Nucleotides are the building blocks of nucleic acids (DNA and RNA). A single nucleotide is composed of a phosphate molecule, a five carbon sugar (either ribose or deoxyribose) and a purine (adenine or guanine) or a pyrimidine (thymine or cytosine or uracil) nitrogenous base.

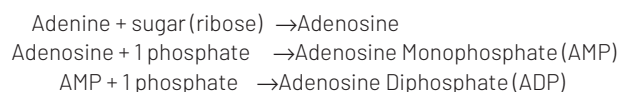
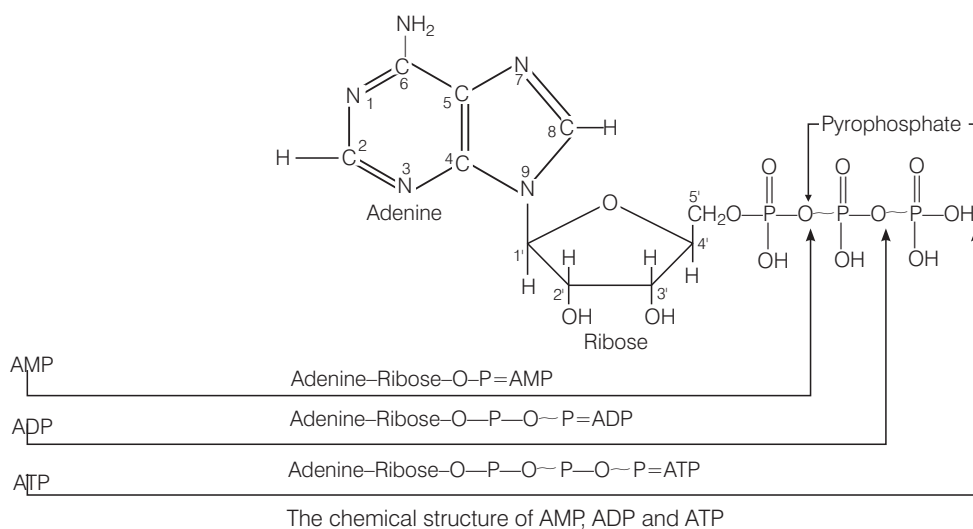


Chemical structures of base pairs and sugar phosphate chains

- 53** ATP is a **[CBSE AIPMT 2000]**  
 (a) nucleotide (b) nucleosome  
 (c) nucleoside (d) purine

**Ans. (a)**

A nucleotide contains (a) a 5-C sugar (b) a phosphate molecule (c) a nitrogenous base. ATP is also a nucleotide. It also has a 5-C sugar (ribose), 3 phosphate molecules and a nitrogenous base (adenine).



- 54** Which one of the following amino acids is an essential part of human diet ? [CBSE AIPMT 2000]  
 (a) Glycine (b) Phenylalanine (c) Serine (d) Aspartic acid

**Ans. (b)**

For human beings, eight amino acids are essential. These are leucine, isoleucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine.

- 55** Radioactive thymidine when added to the medium surrounding living mammalian cells gets incorporated into the newly synthesised DNA. Which of the following types of chromatin is expected to become radioactive if cells are exposed radioactive thymidine as soon as they enter the S-phase? [CBSE AIPMT 1998]  
 (a) Heterochromatin (b) Euchromatin (c) Both (a) and (b)  
 (d) Neither (a) nor (b) but only the nucleolus

**Ans. (b)**

In the beginning of S-phase, DNA replication occurs. DNA replication can occur in diffuse/less tightly coiled euchromatin. So active DNA stains light in colour when stained with acetocarmine and feulgen reagent in comparison to heterochromatin.

- 56** DNA synthesis can be specifically measured by estimating the incorporation of radio labelled [CBSE AIPMT 1997]  
 (a) uracil (b) adenine (c) thymidine (d) deoxyribose sugar

**Ans. (c)**

DNA consists of deoxyribose sugar, phosphate molecules and nitrogenous bases—adenine, guanine, cytosine and thymine, whereas RNA consists of ribose sugar, phosphate molecules and nitrogenous bases—adenine, guanine, cytosine and uracil.

Thus, estimating the incorporation of radiolabelled thymine can measure DNA synthesis and radiolabelled uracil can measure RNA synthesis, as all other nitrogenous bases are similar in both DNA and RNA.

- 57** The nitrogenous organic base purine occurring in RNA is [CBSE AIPMT 1996]  
 (a) cytosine (b) thymine (c) guanine (d) uracil

**Ans. (c)**

Purines are 9-membered double ring nitrogen bases which possess nitrogen at 1, 3, 7 and 9 positions, e.g. adenine (A), guanine (G). These purines are present in both DNA and RNA.

- 58** Two free ribonucleotide units are interlinked with [CBSE AIPMT 1995]  
 (a) peptide bond (b) covalent bond (c) hydrogen bond (d) phosphodiester bond

**Ans. (d)**

The bonds that exist between the phosphate group of one nucleotide and hydroxyl group of sugar (ribose or deoxyribose) of the adjacent nucleotide is known as phosphodiester bond.



**59** Which is wrong about nucleic acids? [CBSE AIPMT 1993]

- (a) DNA is single stranded in some viruses
- (b) RNA is double stranded occasionally
- (c) Length of one helix is 45 Å in B-DNA
- (d) One turn of Z-DNA has 12 bases

**Ans. (c)**

Length of one helix or the pitch per turn of helix is 34 Å in B-DNA, 25 Å in A-DNA and 46 Å in Z-model of DNA. In Z-DNA sugar moieties are seen in opposite direction. So the 3-5 diester bond forms zig-zag structure in Z-DNA.

**60** Adenine is [CBSE AIPMT 1992]

- (a) purine (b) pyrimidine
- (c) nucleoside (d) nucleotide

**Ans. (a)**

Nitrogen bases are of two types-purines and pyrimidines. Purines are 9 membered double ring nitrogen bases which possess nitrogen at 1, 3, 7 and 9 positions, e.g. adenine (A), guanine (G). Pyrimidines are 6-membered nitrogen bases that contain nitrogen at 1 and 3 positions, e.g. cytosine (C), thymine (T), uracil (U).

**61** Which is distributed more widely in a cell? [CBSE AIPMT 1992]

- (a) DNA (b) RNA
- (c) Chloroplasts (d) Spherosomes

**Ans. (b)**

Ribonucleic Acid (RNA) is a single chain polyribonucleotide which functions as carrier of coded genetic information from DNA to cytoplasm, and takes part in protein and enzyme synthesis. RNA is more common and abundant than DNA. There are six types of RNAs-ribosomal (most abundant), transfer RNA (15% to total RNA), messenger RNA (2-5%), small sized nuclear RNA, small cytoplasmic RNA, and genetic RNA (in viruses called riboviruses).

**62** The basic unit of nucleic acid is [CBSE AIPMT 1991]

- (a) pentose sugar (b) nucleoid
- (c) nucleoside (d) nucleotide

**Ans. (d)**

Nucleic acids (DNA and RNA) are linear mixed polymers of **nucleotides**, so also called polynucleotides. Nucleic acids were first discovered

by **Miescher** (1868-69) as nuclein and named nucleic acid by **Altmann** (1889). They are formed of C, H, O, N and P comprising nitrogenous heterocyclic bases viz purines or pyrimidines, pentose sugar and phosphoric acid.

**63** DNA is composed of repeating units of [CBSE AIPMT 1991]

- (a) ribonucleosides
- (b) deoxyribonucleosides
- (c) ribonucleotides
- (d) deoxyribonucleotides

**Ans. (d)**

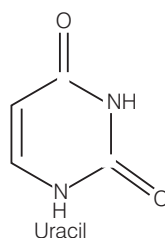
Nucleic acids are repeating units of nucleotides, DNA is formed of the repeating units of deoxyribonucleotides and RNA is a mixed polymer chain of ribonucleotides.

**64** In RNA, thymine is replaced by [CBSE AIPMT 1991]

- (a) adenine
- (b) guanine
- (c) cytosine
- (d) uracil

**Ans. (d)**

Uracil forms nucleoside with only ribose sugar while thymine forms the same with only deoxyribose sugar. Other nitrogen bases (i.e. adenine, guanine, cytosine) produce nucleosides with both sugars.



**65** RNA does not possess [CBSE AIPMT 1988]

- (a) uracil (b) thymine
- (c) adenine (d) cytosine

**Ans. (b)**

Ribonucleic Acid (RNA) contains pyrimidine bases-cytosine and uracil and purine bases-adenine and guanine. Thymine is the pyrimidine base present only in DNA and uracil is present only in RNA, though other nitrogenous bases remain the same in both DNA and RNA.

**66** In double helix of DNA, the two DNA strands are [CBSE AIPMT 1988]

- (a) coiled around a common axis
- (b) coiled around each other
- (c) coiled differently
- (d) coiled over protein sheath

**Ans. (a)**

Deoxyribo Nucleic Acid (DNA) is helically coiled macromolecule, made up of two antiparallel polydeoxyribonucleotide chains held together by hydrogen bonds.

The chains are interlocked and are coiled around a common axis. DNA has a diameter of 20 Å. One turn of spiral has a distance of 34 Å containing 10 nucleotides in each turn.

## TOPIC 5 Enzymes

**67** Match the following columns. [NEET (Sep.) 2020]

Column I	Column II
A. Inhibitor of catalytic activity	1. Ricin
B. Possess peptide bonds	2. Malonate
C. Cell wall material in fungi	3. Chitin
D. Secondary metabolite	4. Collagen

Choose the correct option.

- (a) 3 1 4 2
- (b) 3 4 1 2
- (c) 2 3 1 4
- (d) 2 4 3 1

**Ans. (d)**

Option (d) is the correct. It can be explained as follows.

Malonate is the competitive inhibitor of catalytic activity of succinic dehydrogenase. Collagen is proteinaceous in nature and possesses peptide bonds.

Chitin is a homopolymer present in the cell wall of fungi and exoskeleton of arthropods.

Abrin and ricin are toxins, secondary metabolites.

**68** Prosthetic groups differ from coenzymes in that  
[NEET (Odisha) 2019]

- (a) they require metal ions for their activity
- (b) they (prosthetic groups) are tightly bound to apoenzymes
- (c) their association with apoenzymes is transient
- (d) they can serve as cofactors in a number of enzyme catalysed reactions

**Ans. (b)**

Prosthetic groups are organic compounds and are distinguished from other cofactors in that they are tightly bound to the apoenzyme. For example, in peroxidase and catalase, which catalyse the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme.

**69** Which of the following is a commercial blood cholesterol lowering agent?  
[NEET (National) 2019]

- (a) Statin
- (b) Streptokinase
- (c) Lipases
- (d) Cyclosporin A

**Ans. (a)**

Statins are commercial blood cholesterol lowering agent as they competitively inhibit the enzymes involved in cholesterol synthesis. They are obtained from a yeast, *Monascus purpureus*.

Streptokinase is a thrombolytic agent which is used to treat pulmonary embolism and myocardial infarction.

Lipases help to digest fat molecules while cyclosporin A is an immunosuppressant.

**70** Consider the following statement  
[NEET (National) 2019]

- (A) Coenzyme or metal ion that is tightly bound to enzyme protein is called prosthetic group.
  - (B) A complete catalytic active enzyme with its bound prosthetic group is called apoenzyme. Select the correct option.
- (a) (A) is true but (B) is false
  - (b) Both (A) and (B) are false
  - (c) (A) is false but (B) is true
  - (d) Both (A) and (B) are true

**Ans. (a)**

Statement A is true but B is false. Correct information about statement B is as follows.

A complete catalytic, active enzyme with its bound prosthetic group is called holoenzyme. An apoenzyme is an inactive enzyme which gets activated by the binding of an organic or inorganic cofactor.

**71** Select the correct match  
[NEET 2018]

- (a) TH Morgan - Transduction
- (b)  $F_2 \times$  Recessive parent - Dihybrid cross
- (c) Ribozyme - Nucleic acid
- (d) G Mendel - Transformation

**Ans. (c)**

**Ribozymes** are RNA molecules having enzymatic activity, i.e. they are capable of catalysing specific biochemical reactions. Hence, they are nucleic acids with enzymatic function.

**TH Morgan** is known as the 'Father of Experimental Genetics'. He worked on linkage, crossing over, linkage maps, etc.

In dihybrid cross, two allelic pairs are used for crossing.

**Mendel** is considered as the 'Father of Genetics'. He proposed the laws of inheritance.

**72** Which one of the following statements is correct, with reference to enzymes? [NEET 2017]

- (a) Apoenzyme = Holoenzyme + Coenzyme
- (b) Holoenzyme = Apoenzyme + Coenzyme
- (c) Coenzyme = Apoenzyme + Holoenzyme
- (d) Holoenzyme = Coenzyme + Cofactor

**Ans. (b)**

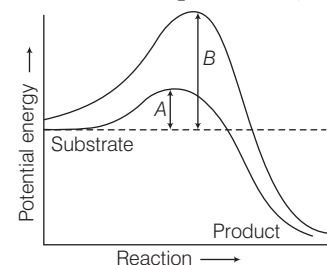
**Holoenzyme** It is a conjugate catalytically active enzyme together with its coenzyme.

**Apoenzyme** The protein part of catabolically active enzyme is called apoenzyme.

**Coenzyme** Some enzymes require additional organic or metallo-organic molecules for their activity. These molecules are called coenzyme.

So, holoenzyme is apoenzyme together with coenzyme hence option (b) is correct.

**73** Which of the following describes the given graph correctly?  
[NEET 2016, Phase II]



- (a) Endothermic reaction with energy A in the presence of enzyme and B in the absence of enzyme
- (b) Exothermic reaction with energy A in the presence of enzyme and B in the absence of enzyme
- (c) Endothermic reaction with energy A in the absence of enzyme and B in the presence of enzyme
- (d) Exothermic reaction with energy A in the absence of enzyme and B in the presence of enzyme

**Ans. (b)**

The graph shows the exothermic reaction A in the presence of enzyme as it lowers down the activation energy substantially.

The B graph shows this reaction in the absence of enzyme when activation energy is quite high. Thus, option (b) is correct.

**74** A non-proteinaceous enzyme is  
[NEET 2016, Phase II]

- (a) lysozyme
- (b) ribozyme
- (c) ligase
- (d) deoxyribonuclease

**Ans. (b)**

Ribozyme is a form of ribosomal RNA (23 SrRNA) which acts as a catalyst in splicing of RNA during protein synthesis. It is the only non-protein enzyme known so far, rest all the enzymes are proteinaceous. Hence, option (b) is correct.

**75** Select the option which is not correct with respect to enzyme action.  
[CBSE AIPMT 2014]

- (a) Substrate binds with enzyme as its active site
- (b) Addition of lot of succinate does not reverse the inhibition of succinic dehydrogenase by malonate

- (c) A non-competitive inhibitor binds the enzyme at a site distinct from that which binds the substrate  
 (d) Malonate is a competitive inhibitor of succinic dehydrogenase

**Ans. (b)**

Option (b) is incorrect with respect to enzyme action because addition of a lot of succinate reverse the inhibition of succinic dehydrogenase by malonate. Inhibition of succinic dehydrogenase by malonate is an example of competitive inhibition.

Competitive inhibition occurs when enzyme and inhibitor both have more or less similar structure and are present in higher concentration.

Thus, both enzyme and inhibitor compete for the active site of enzyme resulting in the decrease of the enzymatic activity.

- 76** Transition state structure of the substrate formed during an enzymatic reaction is

- (a) transient but stable [NEET 2013]  
 (b) permanent but unstable  
 (c) transient and unstable  
 (d) permanent and stable

**Ans. (c)**

The substrate binds to the enzyme at its active site forming an enzyme substrate complex. This complex formation is a transient and unstable phenomenon. Very soon, the product is released from the active site. It is the fact that all other intermediate structural states are unstable. Stability is related to energy status of the molecule or the structure.

- 77** The essential chemical components of many coenzymes are [NEET 2013]

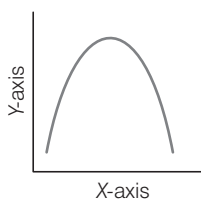
- (a) proteins  
 (b) nucleic acids  
 (c) carbohydrates  
 (d) vitamins

**Ans. (d)**

Essential chemical components of many coenzymes are vitamins, e.g. coenzyme Nicotinamide Adenine Dinucleotide (NAD) and NADP contain the vitamin niacin. Proteins, nucleic acids and carbohydrates are not enzymatic biomolecules.

- 78** The curve given below shows enzymatic activity with relation to three conditions (pH, temperature and substrate concentration). [CBSE AIPMT 2011]

What do the two axis (X and Y) represent?



	X-axis	Y-axis
(a)	Temperature	– Enzyme activity
(b)	Substrate concentration	– Enzymatic activity
(c)	Enzymatic activity	– Temperature
(d)	Enzymatic activity	– pH

**Ans. (a)**

X-axis represents temperature and Y-axis represent enzyme activity. All enzyme act at an optimum temperature, above and below this temperature, the enzyme activity declines.

- 79** Modern detergents contain enzyme preparation of [CBSE AIPMT 2008]

- (a) acidophiles  
 (b) alkaliphiles  
 (c) thermoacidophiles  
 (d) thermophiles

**Ans. (b)**

Modern detergents contains enzyme preparation of alkaliphiles. Detergents represent the largest industrial application of enzymes amounting to 25–30% of total sales of enzyme.

The enzymes used in detergents must be cost effective, safe to use and be able to perform the task in the presence of anionic and non-ionic detergents, soaps, oxidants, etc at pH between 8–10.5%.

The chief enzymes used are proteases,  $\alpha$ -amylase and sometimes cellulase.

- 80** A competitive inhibitor of succinic dehydrogenase is [CBSE AIPMT 2008]

- (a) malonate  
 (b) oxaloacetate  
 (c)  $\alpha$ -ketoglutarate  
 (d) malate

**Ans. (a)**

Succinic dehydrogenase oxidised the succinate to fumarate. Malonate, an analogue of succinate, which is a strong competitive inhibitor of succinate dehydrogenase and therefore, blocks the activity of citric acid cycle in eukaryotes.

In Krebs' cycle the reversible hydration of fumarate to malate is catalysed by fumarase enzyme.

- 81** An organic substance bound to an enzyme and essential for its activity is called [CBSE AIPMT 2006]

- (a) holoenzyme (b) apoenzyme  
 (c) isoenzyme (d) coenzyme

**Ans. (d)**

**Coenzyme** is an organic non-protein molecule that associates with an enzyme molecule in catalysing biochemical reactions. It usually participates in the substrate enzyme interaction by donating or accepting certain chemical groups.

**Holoenzyme** is a complex comprising of enzyme molecule and its cofactor. The enzyme is catalytically active in this state.

**Apoenzyme** is an inactive enzyme that must associate with a specific cofactor molecule in order to function.

**Isoenzyme** or **isozyme** is one of the several forms of an enzyme that catalyse the same reaction but differ from each other in such properties as substrate affinity and maximum rates of enzyme substrate reaction.

- 82** An enzyme that can stimulate germination of barley seeds is [CBSE AIPMT 2006]

- (a)  $\alpha$ -amylase (b) lipase  
 (c) protease (d) invertase

**Ans. (a)**

Barley seeds are rich in carbohydrate (starch). The starch is hydrolysed by  $\alpha$ -amylase to monosaccharides unit at the time of germination of seeds.

- 83** Which one of the following hydrolyses internal phosphodiester bonds in a polynucleotide chain?  
[CBSE AIPMT 2005]
- (a) Lipase (b) Protease  
(c) Endonuclease (d) Exonuclease

**Ans. (c)**

DNase (deoxyribonuclease) or simply nuclease is an enzyme which breaks down DNA by hydrolysis of the phosphodiester bonds of its sugar-phosphate back bone. Depending on the position of hydrolysing phosphodiester bonds, nucleases are of two types :

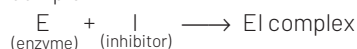
- (i) Endonucleases  
(ii) Exonucleases

Endonucleases hydrolyse internal phosphodiester bonds in a polynucleotide chain (i.e. DNA). While exonucleases hydrolyse terminal phosphodiester bonds in a polynucleotide chain (i.e. DNA).

- 84** Which of the following statements regarding enzyme inhibition is correct?  
[CBSE AIPMT 2005]
- (a) Competitive inhibition is seen when a substrate competes with an enzyme for binding to an inhibitor protein  
(b) Competitive inhibition is seen when the substrate and the inhibitor compete for the active site on the enzyme  
(c) Non-competitive inhibition of an enzyme can be overcome by adding large amount of substrate  
(d) Non-competitive inhibitors often bind to the enzyme irreversibly

**Ans. (b)**

A competitive inhibitor competes with substrate molecule for occupying the active site of an enzyme. These inhibitors have structural resemblance with substrate molecules due to which they easily bind with active site of an enzyme and form an enzyme-inhibitor complex.



- 85** Enzymes, vitamins and hormones can be classified into a single category of biological chemicals, because all of these  
[CBSE AIPMT 2005]
- (a) help in regulating metabolism

- (b) are exclusively synthesised in the body of a living organism as at present  
(c) are conjugated proteins  
(d) enhance oxidative metabolism

**Ans. (a)**

Enzymes, vitamins and hormones are classified into a single category of biological chemical because all these help in regulation of metabolism. Enzyme is a proteinaceous catalyst produced by a cell and responsible for the high rate and specificity of one or more intercellular or intracellular biochemical reactions. Vitamin is an organic substance which generally synthesised by plants (exception vitamin-D). Absence of a vitamin from the diet for sufficient time gives symptoms of a resulting deficiency disease. Hormones are chemical messengers which on secretion bring about a specific and adaptive physiological response.

- 86** The catalytic efficiency of two different enzymes can be compared by the  
[CBSE AIPMT 2005]
- (a) formation of the product  
(b) pH optimum value  
(c)  $K_m$  value  
(d) molecular size of the enzyme

**Ans. (c)**

$K_m$ , **Michaelis-Menten constant** is defined as substrate concentration at which reaction velocity of enzyme catalysed reaction ( $V_0$ ) is half of the maximum velocity of this reaction ( $V_{max}$ ), (i.e.  $K_m = \frac{1}{2} V_{max}$ ).  $K_m$  can vary greatly from enzyme to enzyme and even for the different substrates of the same enzyme.

- 87** The major role of minor elements inside living organisms is to act as  
[CBSE AIPMT 2003]
- (a) binder of cell structure  
(b) cofactors of enzymes  
(c) building blocks of important amino acids  
(d) constituent of hormones

**Ans. (b)**

Though trace elements are required for various uses, most of these have a significant role in enzyme activities (e.g. zinc activates carboxylases, carbonic anhydrase and various dehydrogenases).

- 88** Hydrolytic enzymes which act at low pH are called as  
[CBSE AIPMT 2002]
- (a) proteases (b)  $\alpha$ -amylases  
(c) hydrolases (d) peroxidases

**Ans. (c)**

Lysosomes are the reservoirs of acid hydrolases showing optimum activity at pH 5.0 maintained within the lysosome. These include proteases, nucleases, glycosidases, lipase, etc. Among these protease act a very low pH, i.e. 2.

- 89** Cytochrome is  
[CBSE AIPMT 2001]
- (a) metallo flavoprotein  
(b) Fe containing porphyrin pigment  
(c) glycoprotein  
(d) lipid

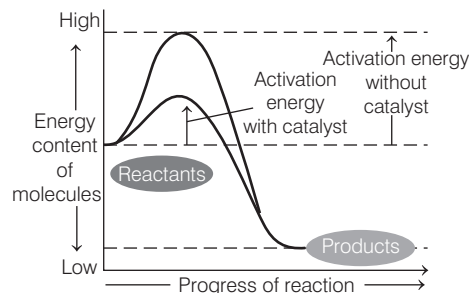
**Ans. (b)**

Cytochrome is the respiratory pigment. It is composed of protein, iron and porphyrin ring. It functions as an enzyme in the respiratory chain. Unlike haemoglobin the metal atom in the porphyrin ring must change it's valency for the molecule to function. Cytochromes are basically located in inner mitochondrial membranes and thylakoids of chloroplasts.

- 90** Enzymes enhance the rate of reaction by  
[CBSE AIPMT 2000]
- (a) forming a reactant-product complex  
(b) changing the equilibrium point of the reaction  
(c) combining with the product as soon as it is formed  
(d) lowering the activation energy of the reaction

**Ans. (d)**

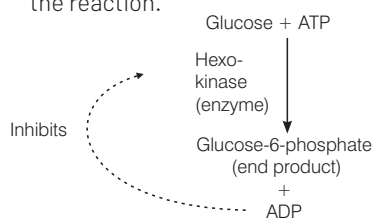
Enzymes enhance the rate of a reaction by just lowering the activation energy (the energy required for substances to react and get converted into product) of a reaction.



- 91** Feedback inhibition of an enzymatic reaction is caused by  
 (a) end product [CBSE AIPMT 2000]  
 (b) substrate  
 (c) enzyme  
 (d) rise in temperature

**Ans. (a)**

In feedback inhibition, the product of an enzyme-catalysed reaction accumulates and acts as inhibitor of the reaction.

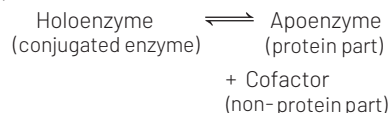


- 92** Cofactor (coenzyme) is a part of holoenzyme it is [CBSE AIPMT 1997]  
 (a) loosely attached inorganic part  
 (b) accessory non-protein substance attached firmly  
 (c) loosely attached organic part  
 (d) None of the above

**Ans. (c)**

Coenzyme/cofactors are organic substances (often vitamins) which are loosely attached with apoenzymes. A holoenzyme is a conjugated enzyme.

It has a proteinaceous part called **apoenzyme** and a non-proteinaceous part called **cofactor**.



Cofactor is very necessary for the activity of holoenzyme.

Cofactors can be separated from enzyme by dialysis. Cofactors may be inorganic (i.e. metal activators) or organic (i.e. coenzymes and prosthetic group).

- 93** An enzyme brings about [CBSE AIPMT 1993]

- (a) decrease in reaction time  
 (b) increase in reaction time  
 (c) increase in activation energy  
 (d) reduction in activation energy

**Ans. (d)**

Enzymes act by reducing the amount of activation energy. The binding energy is the source of energy used by enzyme to lower the activation energy of reaction.

Activation energy is the minimum energy required from outside to overcome the energy barrier of reactants. Enzymes lower energy of activation by two ways—bringing reactants molecules together, and developing strain in bonds of reactants.

- 94** Enzymes having slightly different molecular structure but performing identical activity are

[CBSE AIPMT 1991]

- (a) homoenzymes (b) isoenzymes  
 (c) apoenzymes (d) coenzymes

**Ans. (b)**

Isoenzymes (analogous enzymes) are multiple molecular forms of same enzyme with same substrate activity and found in the same organism. These enzymes are formed by different genes, have different  $K_m$  constants for their substrates and operate at different pH. About 100 enzymes are known to have isoenzymes, e.g. LDH (Lacto-Dehydrogenase acting on pyruvate to form lactate) has 5 isoenzymes in man,  $\alpha$ -amylase in wheat has 16 isoenzymes.

- 95** Which of the following is not a part of enzyme but it activates the enzyme? [CBSE AIPMT 1989]

- (a) K (b) C  
 (c) N (d) Si

**Ans. (a)**

Potassium ( $K^+$ ) is an essential element, loosely held to the apoenzyme part of the enzyme.  $K^+$  is an inorganic cofactor (metal activator) of enzyme pyruvate kinase.