

MULTIPLE CHOICE QUESTIONS

1. It is said that the elemental composition of living organisms and that of inanimate objects (like earth's crust) are similar in the sense that all the major elements are present in both. Then what would be the difference between these two groups? Choose the correct answer from among the following:

- a. Living organisms have more gold in them than inanimate objects**
- b. Living organisms have more water in their body than inanimate objects**
- c. Living organisms have more carbon, oxygen and hydrogen per unit mass than inanimate objects.**
- d. Living organisms have more calcium in them than inanimate objects.**

Solution:

Option (c) is the answer.

2. Many elements are found in living organisms either free or the form of compounds. Which of the following is not found in living organisms?

- a. Silicon**
- b. Magnesium**
- c. Iron**
- d. Sodium**

Solution:

Option (a) is the answer.

3. Aminoacids have both an amino group and a carboxyl group in their structure. Which one of the following is an amino acid?

- a. Formic acid**
- b. Glycerol**
- c. Glycolic Acid**
- d. Glycine**

Solution:

Option (d) is the answer.

4. An amino acid under certain conditions has both positive and negative charges simultaneously in the same molecule. Such a form of amino acid is called

- a. Acidic form**
- b. Basic form**
- c. Aromatic form**
- d. Zwitterionic form**

Solution:

Option (d) is the answer.

5. Sugars are technically called carbohydrates, referring to the fact that

their formulae are only multiple of $C(H_2O)$. Hexoses, therefore, have six carbons, twelve hydrogens and six oxygen atoms. Glucose is a hexose. Choose from among the following another hexose.

- a. Fructose
- b. Erythrose
- c. Ribulose
- d. Ribose

Solution:

Option (a) is the answer.

6. When you take cells or tissue pieces and grind them with an acid in a mortar and pestle, all the small biomolecules dissolve in the acid. Proteins, polysaccharides and nucleic acids are insoluble in mineral acid and get precipitated. The acid-soluble compounds include amino acids, nucleosides, small sugars etc. When one adds a phosphate group to a nucleoside, one gets another acid-soluble biomolecule called

- a. Nitrogen base
- b. Adenine
- c. Sugar phosphate
- d. Nucleotide

Solution:

Option (d) is the answer.

7. When we homogenise any tissue in acid the acid-soluble pool represents

- a. Cytoplasm
- b. Cell membrane
- c. Nucleus
- d. Mitochondria

Solution:

Option (a) is the answer.

8. The most abundant component of living organisms is

- a. Protein
- b. Water
- c. Sugar
- d. Nucleic acid

Solution:

Option (b) is the answer.

9. A homopolymer has only one type of building block called monomer repeated 'n' number of times. A heteropolymer has more than one type of monomer. Proteins are heteropolymers usually made of

- a. 20 types of monomers
- b. 40 types of monomers
- c. 30 types of monomers

d. only one type of monomer

Solution:

Option (a) is the answer

10. Proteins perform many physiological functions. For example, some functions as enzymes. Which of the following represents an additional function that some proteins discharge?

- a. Antibiotics**
- b. Pigment conferring colour to skin**
- c. Pigments making colours of flowers**
- d. Hormones**

Solution:

Option (d) is the answer.

11. Glycogen is a homopolymer made of

- a. Glucose units**
- b. Galactose units**
- c. Ribose units**
- d. Aminoacids**

Solution:

Option (a) is the answer.

12. The number of 'ends' in a glycogen molecule would be

- a. Equal to the number of branches plus one**
- b. Equal to the number of branch points**
- c. One**
- d. Two, one on the left side and another on the right side**

Solution:

Option (d) is the answer.

13. The primary structure of a protein molecule has

- a. Two ends**
- b. One end**
- c. Three ends**
- d. No ends**

Solution:

Option (a) is the answer.

14. Enzymes are biocatalysts. They catalyse biochemical reactions. In general, they reduce the activation energy of reactions. Many Physico-chemical processes are enzyme-mediated. Which of the following reactions is not enzyme-mediated in the biological system?

- a. Dissolving CO₂ in water**
- b. Untwining the two strands of DNA**
- c. Hydrolysis of sucrose**
- d. Formation of peptide bond**

Solution:

Option (a) is the answer.

VERY SHORT ANSWER TYPE QUESTIONS

1. Medicines are either man-made (i.e., synthetic) or obtained from living organisms like plants, bacteria, animals etc. and hence the latter are called natural products. Sometimes natural products are chemically altered by man to reduce toxicity or side effects. Write against each of the following whether they were initially obtained as a natural product or as a synthetic chemical.

- a. Penicillin _____
- b. Sulfonamide _____
- c. Vitamin C _____
- d. Growth Hormone _____

Solution:

- A. Penicillin- Natural product (obtained from fungus *P. notatum*)
- B. sulphonamide- Synthetic product
- C. Vitamin C- Natural product
- D. Growth Hormone- Natural product

2. Select an appropriate chemical bond among ester bond, glycosidic bond, peptide bond and hydrogen bond and write against each of the following.

- a. Polysaccharide _____
- b. Protein _____
- c. Fat _____
- d. Water _____

Solution:

- a. Polysaccharides – Glycosidic bond, formed by elimination of water molecule.
- b. Protein- peptide bond, it is the $-\text{CO}-\text{NH}-$ BOND formed by elimination of water molecules.
- c. Fats- ester bond, derived from an acid (organic or inorganic) in which at least one $-\text{OH}$ (hydroxyl) group is replaced by an $-\text{O}-\text{alkyl}$ (alkoxy) group
- d. Water- H-bond, formed between the hydrogen of one water molecule and oxygen of the other water molecule.

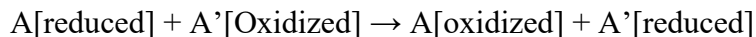
3. Write the name of anyone amino acid, sugar, nucleotide and fatty acid.

Solution:

- Amino acid- Glycine
- Sugar- Glucose
- Nucleotide- Adenosine
- Fatty acid- Oleic acid

4. The reaction given below is catalysed by oxidoreductase between two substrates A and A', complete the reaction. A reduced + A' oxidized

Solution:



5. How are prosthetic groups different from co-factors?

Solution:

Cofactors are the non proteinous, may be organic or inorganic constituent of the enzyme. The prosthetic group belongs to organic cofactors, remains tightly bound with apoenzymes.

6. Glycine and Alanine are different with respect to one substituent on the α -carbon. What are the other common substituent groups?

Solution:

-COOH, -NH₂, and -H are the common substituents.

7. Starch, Cellulose, Glycogen, Chitin are polysaccharides found among the following. Choose the one appropriate and write against each.

Cotton fibre _____

Exoskeleton of cockroach _____

Liver _____

Peeled potato _____

Solution:

Cotton fibre- cellulose [more than 90%].

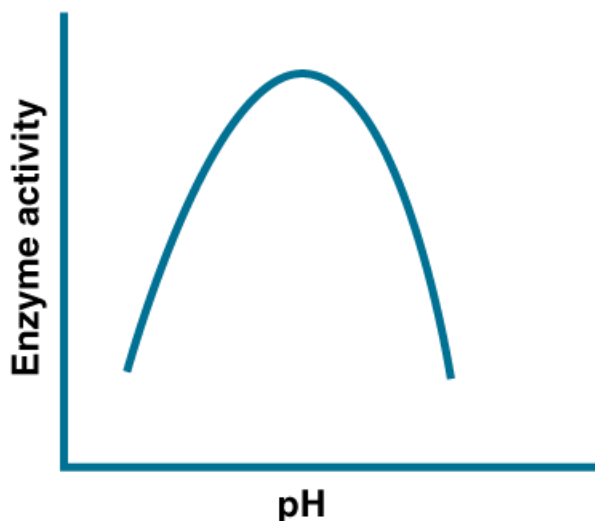
The exoskeleton of cockroach- chitin

Liver- glycogen

Peeled potato- starch

SHORT ANSWER TYPE QUESTIONS

1. Enzymes are proteins. Proteins are long chains of amino acids linked to each other by peptide bonds. Amino acids have many functional groups in their structure. These functional groups are, many of them at least, ionisable. As they are weak acids and bases in chemical nature, this ionization is influenced by the pH of the solution. For many enzymes, activity is influenced by the surrounding pH. This is depicted in the curve below, explain briefly.



Solution:

The dependence of enzyme on pH is due to the presence of charged amino acid at its active site, variation causes changes in charge of amino acid. The enzymatic activity decreases when pH is less than the optimum pH.

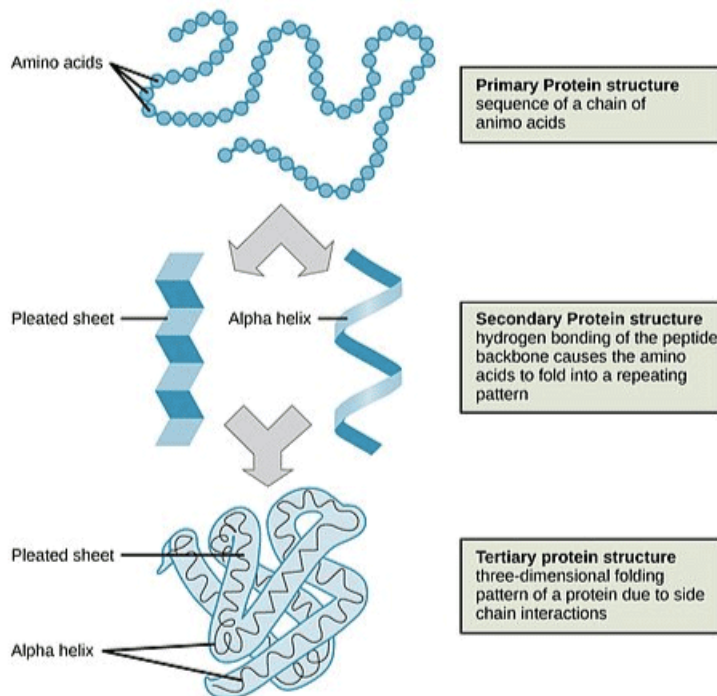
2. Is rubber a primary metabolite or a secondary metabolite? Write four sentences about rubber.

Solution:

Rubber is secondary metabolite because the of its unknown function in plants physiology
It is obtained from plant as exude which is sticky
Rubber is used for synthesizing tyre, eraser etc.

3. Schematically represent primary, secondary and tertiary structures of a hypothetical polymer say for example a protein

Solution:



4. Nucleic acids exhibit secondary structure, justify with example.

Solution:

DNA and RNA are known to exist in the form of a helix. DNA forms double helix and RNA forms a single-stranded helical form. As helix is considered to be a secondary structure, therefore, nucleic acids exist in secondary structure.

5. Comment on the statement “living state is a non-equilibrium steady-state to be able to perform work”.

Solution:

In a biological system, metabolic reactions always remain on and influx and efflux of metabolites take place constantly, hence it can be said that living state is a non-equilibrium steady state which can perform work.

LONG ANSWER TYPE QUESTIONS

1. Formation of the enzyme-substrate complex (ES) is the first step in catalysed reactions.

Describe the other steps until the formation of the product.

Solution:

1. In the first step, the substrate binds to the active site of the enzyme which fits into the active site
2. The binding of the substrate will help the enzyme to alter its shape and will fit more tightly
3. The active site of the enzyme breaks the chemical bond of the substrate thus forming a new enzyme product
4. The product will be released by the enzymes in the reaction and the free enzyme is ready to bind the substrate of another molecule and once again run through the catalytic cycle.

2. What are the different classes of enzymes? Explain any two with the type of reaction they catalyse.

Solution:

There are different classes of enzymes. They are Oxidoreductase, Transferase, Hydrolase, Lysates, Isomerase, ligases.

a) Oxidoreductase:

These are the enzymes which help in simultaneous oxidation and reduction of two substrates.

$S_{\text{reduced}} + S'_{\text{reduced}} \rightarrow S_{\text{oxidized}} + S'_{\text{oxidized}}$

b) Hydrolases:

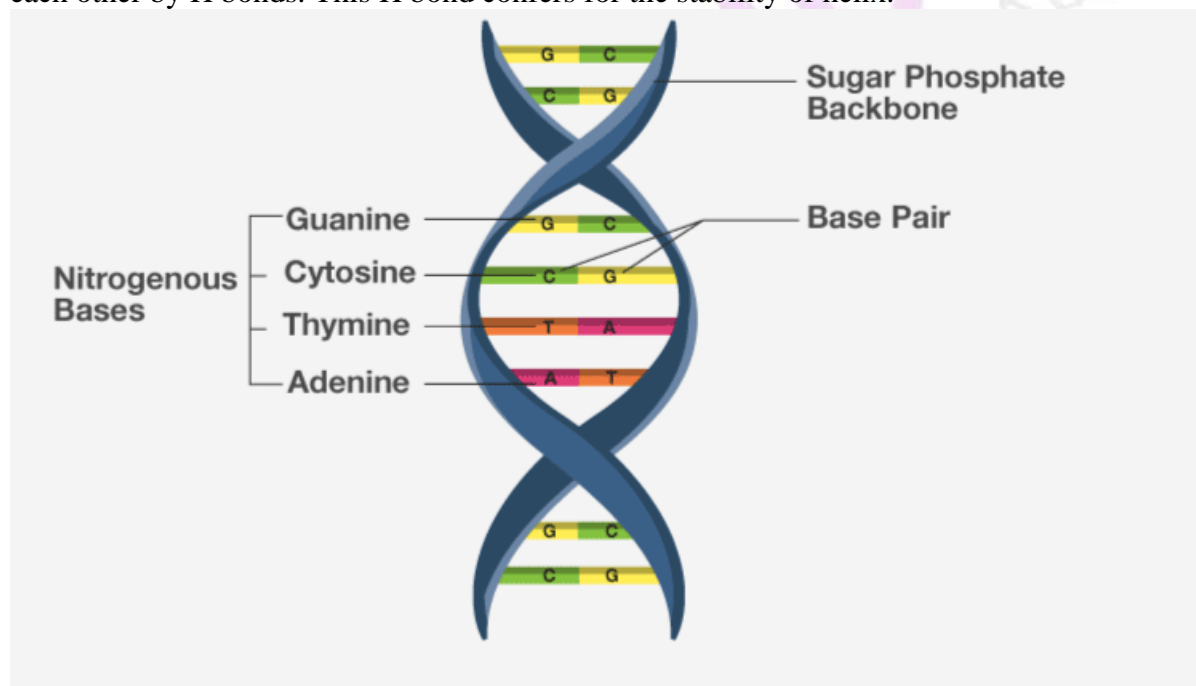
These enzymes facilitate the hydrolysis of a molecule.

$\text{Sucrose} \rightarrow \text{Glucose} + \text{Fructose}$

3. Nucleic acids exhibit secondary structure. Describe through Watson Crick Model.

Solution:

DNA is made up of two polypeptide chains, arranged in a double helix. The backbone is of sugar-phosphate while the nitrogenous bases are present on the inner side. These nitrogenous bases pairs to each other by H bonds. This H bond confers for the stability of helix.

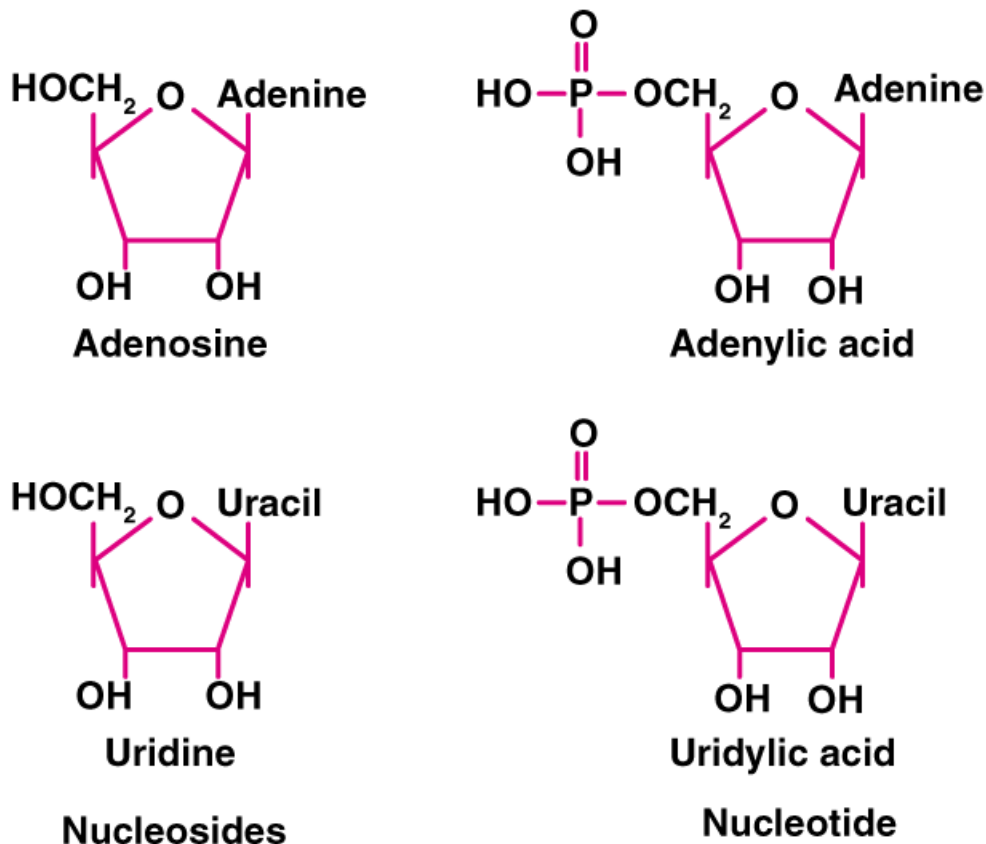


4. What is the difference between a nucleotide and nucleoside? Give two examples of each with their structure.

Solution:

Nucleotides are the monomers of nucleic acid and are formed of nucleoside and phosphate group.

Whereas nucleosides are the constituent of nucleotides. Adenosine, guanosine, thymidine, uridine and cytidine are nucleosides. Adenylic acid, thymidylic acid, guanylic acid, uridylic acid and cacodylic acid are nucleotides.



5. Describe various forms of lipid with a few examples.

Solution:

Lipids are classified into three categories:

Simple lipids, compound lipids and derivatives.

Simple lipids are the esters of fatty acids eg: Triglycerol, fats and wax

Compound lipids are with an additional group other than fats and alcohols. An example is phospholipids, glycolipids

When lipids consist of hydrocarbon ring and the long chain of hydrocarbons they are called derivatives
Examples of Steroids, Cholesterol.