

Chap 2 (Biological Molecules) F.Sc 1st Year Biology

Notes

Chapter 2: Biological Molecules

(Short Questions Answers)

Cellulose is digested by the herbivores but not by humans. Why?

In the herbivores (cow, buffalo etc.,) it is digested because of microorganisms (bacteria, yeasts, protozoa) in their digestive tract. These microorganisms secrete an enzyme called cellulase for its digestion. It is not digested in the human digestive tract as it lacks cellulase secreting organisms.

What are lipids?

The lipids are a heterogeneous group of compounds related to fatty acids. They are insoluble in water but soluble in organic solvents such as ether, alcohol, chloroform and benzene. Lipids include fats, oils, waxes, cholesterol, and related compounds.

Why lipids store double the amount of energy as compared to the same amount of any carbohydrate?

Because of higher proportion of C-H bonds and very low proportion of oxygen, lipids store double the amount of energy as compared to the same amount of any carbohydrate.

What are different classes of lipids? OR classify lipids.

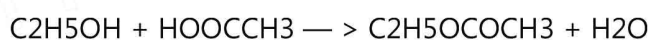
Lipids have been classified as acylglycerols, waxes; phospholipids. Sphingolipids, glycolipids and terpenoid – lipids including carotenoids and steroids.

What are acylglycerols?

Chemically; acylglycerols can be defined as esters of fatty acids and alcohol. Acylglycerols are composed of glycerol and fatty acids. The most widely spread acylglycerol is triacyl glycerol, also called triglycerides or neutral lipids.

What is an ester? Express it with an equation.

An ester is a compound produced as a result of a chemical reaction of an alcohol with an acid and a water molecule is released.



Differentiate between saturated and unsaturated fatty acids. Give examples.

The fatty acids which contain no double bond are called saturated fatty acids e.g., acetic acid, butyric acid, palmitic acid while those which have up to 6 double bonds are called unsaturated fatty acids e.g., Oleic Acid.

How fatty acids of animals differ from those of plants?

In animals the fatty acids are straight chains, while in plants these may be branched or ringed. 59. Compare the solubility and melting points of palmitic and butyric acids. Ans: Palmitic acid (C16) is much more soluble in organic solvent than butyric acid (CA). The melting point of palmitic acid is 63.1°C as against -8°C for butyric acid.

Give examples of fibrous proteins.

Examples are silk fibre (from silk worm, and spiders web), myosin (in muscle cells) fibrin (of blood clot), keratin (of nails and hair), and collagen (in connective tissues of skin, bones, ligaments etc.).

Give the characters of globular proteins, or What are globular proteins?

- These are spherical or ellipsoidal due to multiple folding of polypeptide chains.
- Tertiary structure is most important in them.
- They are soluble in aqueous media such as salt solution, solution of acids or bases, or aqueous alcohol.
- They can be crystallized
- They disorganize with changes in the physical and physiological environment.

Give examples of globular proteins.

Examples are enzymes, antibodies, hormones and haemoglobin.

From which cells nucleic acids were isolated?

Nucleic acids were first isolated in 1870 by an Austrian physician Friedrich Miescher from the nuclei of pus cells.

Why nucleic acids are give that name?

Due to their isolation from nuclei and their acidic nature, they were named re nucleic acids.

How many types of nucleic acids are there?

Nucleic acids are of two types, deoxyribonucleic acid or DNA and ribonucleic acid or RNA.

What is the effect of room temperature on fats?

Fats containing unsaturated fatty acids are usually liquid at room temperature and are said to be oils. Fats containing saturated fatty acids are solids. Animal fats are solid at room temperature, whereas most of the plant fats are liquid.

What is the specific gravity of fats and oils?

Fats and oils have a specific gravity of about 0.8.

What is the chemical nature or composition of waxes? or what are waxes?

Chemically, waxes are mixtures of long chain alkanes (with odd number of carbons ranging from C₂₅ to C₃₅) and alcohols, ketones and esters of long chain fatty acids.

What is the chemical nature of phospholipids?

Phospholipids are derivatives of phosphatidic acid, which are composed of glycerol, fatty acids and phosphoric acid.

Name the nitrogenous bases, which are important components of phospholipids.

Nitrogenous bases such as choline, ethanolamine and serine are important components of phospholipids.

Where are phospholipids found?

They are widespread in bacteria, animal and plant cells and are frequently associated with membranes.

What are terpenoids? Give examples.

Terpenoids are lipids which are made up of simple repeating units, isoprenoid units. This unit by condensation in different ways gives rise to compounds such as rubber, carotenoids, steroids, terpenes etc.

What are the most abundant organic compounds to be found in cells?

Proteins are the most abundant organic compounds to be found in cells and comprise over 50% of their total dry weight.

What are proteins?

Proteins are polymers of amino acids, the compounds containing carbon, nitrogen, oxygen and hydrogen.

Give any two functions of proteins.

Carriers: Some proteins (e.g., hemoglobin) work as carriers and transport specific substances such as oxygen, lipids, metal ions, etc.

Defend body: Some proteins, called antibodies, defend the body against pathogens.

What is the number of amino acids in proteins?

The number of amino acids varies from a few to 3000 or even more in different proteins.

How many types of amino acids occur in cells and how many are found in proteins?

About 170 types of amino acids occur in cells and tissues. Of these, about 25 are constituents of proteins. Most of the proteins are however made of 20 types of amino acids.

How RNA molecules occur?

The RNA molecules occur as single strand, which may be folded back on to itself, to give double helical characteristics.

Whether RNA molecules occur as single strand or double strand?

The RNA molecules occur as single strand, which may be folded back on to itself, to give double helical characteristics.

What is transcription?

It is the process by which RNA is synthesized from DNA.

How many types of RNAs are there? or Name different types of RNA molecules.

There are three types of RNA which are: messenger RNA (mRNA), transfer RNA (tRNA), and ribosomal RNA (rRNA).

Where RNAs are synthesized?

All the three types of RNAs are synthesized from DNA in the nucleus and then are moved out in the cytoplasm to perform their specific functions.

What is the function of mRNA? or define mRNA?

It takes the genetic message from the DNA of the nucleus to the ribosomes in the cytoplasm to form particular proteins.

What is the length of mRNA?

mRNA consists of a single strand whose length depends upon the size of the gene as well as the protein for which it is taking the message. For example for a protein molecule of 1,000 amino acids, mRNA will have the length of 3,000 nucleotides.

What is the percentage of different types of RNAs in the cell?

mRNA is about 3 to 4% of the total RNA in the cell. tRNA comprises about 10 to 20% of the cellular RNA. rRNA may be up to 80% of the total RNA.

What is the length of tRNA?

Transfer RNA molecules are small, each with a chain length of 75 to 90 nucleotides.

What is alpha carbon in amino acids?

All the amino acids have an amino group (-NH₂) and a carboxyl group (COOH) attached to the same carbon atom, also known as alpha carbon.

What is the general formula of amino acids?

They have the general formula as R (amino group) H₂N-CCOOH (carboxyl group) alpha carbon.

How glycylalanine is formed? or How peptide bond is formed?

Glycylalanine is formed when amino acid glycine combines with amino acid alanine. The linkage between the hydroxyl group of carboxyl group of one amino acid and the hydrogen of amino group of another amino acid release H₂O and C – N link to form peptide bond. Thus a dipeptide, glycylalanine, is formed.

How the specific properties of a protein are determined?

The specific properties of each protein are determined by the number and the specific sequence of amino acids in a molecule, and also depend upon the shape which the molecule assumes as the chain folds into its final, compact form

What did F. Sanger conclude about insulin?

Sanger concluded that insulin is composed of 51 amino acids in two chains. One of the chains had 21 amino acids and the other had 30. amino acids and they were held together by disulphide bridges

What is the composition of haemoglobin? or How many amino acid chains are present in haemoglobin? Also give number of amino acids in each chain.

Haemoglobin is composed of four chains two alpha and two beta chains. Each alpha chain contains 141 amino acids, while each beta chain contains 146 amino acids.

How the size of a protein is determined?

The size of a protein molecule is determined by the type of amino acids and the number of amino acids comprising that particular protein molecule.

How many proteins are present in human body?

There are over 10,000 proteins in the human body which are composed of unique and specific arrangements of 20 types of amino acids.

Why the arrangement of amino acids in a protein molecule is highly specific for its proper functioning.

It is because if any amino acid is not in its normal place, the protein fails to carry on its normal function. For example in the sickle cell haemoglobin only one of the 574 amino acids do not occupy the normal place and the haemoglobin fails to carry any or sufficient oxygen, hence leading to death of the patient.

What are the two main types of secondary structure of proteins?

- **α-helix:** It involves a spiral formation of the basic polypeptide chain.
- **β-pleated sheet:** It is formed by the folding back of the polypeptides.

How tertiary structure of protein is maintained?

It is maintained by three types of bonds, namely ionic, hydrogen, and disulfide (-S-S-).

Give an example of quaternary structure of protein.

Haemoglobin, the oxygen-carrying protein of red blood cells, has a quaternary structure.

Why it is very difficult to classify proteins?

Due to complexity of structure and diversity in their function, it is very difficult to classify proteins.

Classify proteins according to their structure.

- Fibrous proteins
- Globular proteins

Give the characters of fibrous proteins.

- They consist of molecules having one or more polypeptide chains in the joint form of fibrils. Secondary structure is most important in them.
- They are insoluble in water
- They are non-crystalline
- They are elastic in nature.

Where does DNA occur in cell?

DNA occurs in chromosomes, in the nuclei of the cells and in much lesser amounts in mitochondria and chloroplasts.

Where RNA is present in the cell?

RNA is present in the nucleolus, in the ribosomes, in the cytosol and in smaller amounts in other parts of the cells..

What are nucleic acids? Or Nucleic acids are polymers of units of which component?

The nucleic acids are polymers of units called nucleotides. DNA is made up of deoxyribonucleotides, while RNA is composed of ribonucleotides.

What are the subunits of a typical nucleotide?

Each nucleotide is made of three subunits:

- a 5-carbon monosaccharide (a pentose sugar)
- a nitrogen-containing base
- a phosphoric acid

What pentose sugar is found in nucleotides? (OR How ribonucleotide and deoxyribonucleotide differ in having pentose sugar?)

Pentose sugar in ribonucleotide is ribose, while in deoxyribonucleotide it is deoxyribose (one oxygen removed from OH group at carbon number

What nitrogenous bases are present in nucleic acids?

Nitrogenous bases are of two types:

- single-ringed pyrimidines
- double-ringed purines

Pyrimidines are cytosine (abbreviated as C), Thymine (abbreviated as T), and uracil (U).
Purines are adenine (A) and guanine (G).

What is the position of attachment of nitrogenous base and phosphoric acid to pentose sugar in a typical nucleotide?

In a typical nucleotide the nitrogenous base is attached to position 1 of pentose sugar, while phosphoric acid is attached to carbon at position 3 of pentose sugar.

Differentiate between nucleoside and nucleotide.

The compound formed by combination of a base and a pentose sugar is called nucleoside while a nucleoside and a phosphoric acid combine to form a nucleotide.

Name a nucleotide used as an energy currency by the cell.

ATP is the nucleotide used as an energy currency by the cell.

What kinds of nucleotides DNA is made up of?

It is made of four kinds of nucleotides namely, d-adenosine monophosphate (d-AMP, adenylic acid), d-guanosine monophosphate (d-GMP, also known as d-guanylic acid); d-Cytidine monophosphate (d-CMP, also known as de cytidylic acid) and d-thymidine monophosphate (d-TMP, also known as d thymidylic acid).

What is polynucleotide chain?

The nucleotides are united with one another through phosphodiester linkages in a specific sequence to form long chains known as polynucleotide chains.

What is NAD?

Nicotinamide adenine dinucleotide, abbreviated as NAD, is an example of dinucleotide. It is an important coenzyme in several oxidation-reduction reactions in the cells.

What is the amount of DNA in a cell?

The amount of DNA is fixed for a particular species, as it depends upon the number of chromosomes. The amount of DNA in germ cells (sperms and ova) is one half to that of somatic cells (skin, muscle, bone cells etc.)