

Q- Definitions, Classification, types, characteristics and Examples of carbohydrates, proteins and fats.

Carbohydrates:-

Definition :- Carbohydrates are the human body's key source of energy. Carbohydrates are organic compounds, these comprise of only carbon, hydrogen and oxygen.

⇒ The hydrogen: oxygen ratio is usually 2:1.

⇒ Carbohydrates are also known as saccharides, which means sugar.

Classification:-

Carbohydrates are classified into simple carbohydrates and complex carbohydrates:

1- Simple carbohydrates:- (Monosaccharides)

These are simplest sugars and can not be hydrolyzed.

⇒ The general formula is $C_n(H_2O)_n$.

⇒ Examples of simple carbohydrates:-

1- Monosaccharides. (sugars)

2- Oligosaccharides. (sugars)

⇒ Monosaccharides or simple ^{Carbohydrates} sugars are sub-divided into trioses, tetrose, pentose

hexose, heptose etc.
Examples of Monosaccharides:-

Examples of monosaccharides are glucose, fructose, erythrulose, ribulose etc.

* Glucose:- The immediate source of energy for cellular respiration and blood sugar.

* Galactose:- A sugar in milk and yogurt.

* Fructose:- A sugar found in honey.

Oligosaccharides/oligosaccharoses:-

Oligosaccharides are compound sugars that yield 2 to 10 molecules of the same or different monosaccharides on hydrolysis.

Disaccharides:-

Oligosaccharides yielding 2 molecules of monosaccharides on hydrolysis is known as disaccharides.

Trisaccharides:- The ones yielding 3 or 4 monosaccharides on hydrolysis are known as trisaccharides and tetrasaccharides respectively and so on.

⇒ Common Disaccharides:- Three common disaccharides are:

⇒ Sucrose:- common table sugar = glucose + fructose

→ Lactose :- Major sugar in milk =
glucose + galactose.

→ Maltose +
Production of starch digestion.
= glucose + glucose.

Poly saccharides :- (Non-sugars)

Polysaccharides are compound sugars and yield more than 10 molecules of monosaccharides on hydrolysis.

→ They are further classified depending on the type of molecules produced as a result of hydrolysis.

→ They maybe homo poly saccharides i.e monosaccharides of same type.

→ Or they maybe hetero polysaccharides i.e monosaccharides of different type.

Examples of Homo poly saccharides :-

- * Starch.
- * Glycogen.
- * Cellulose.
- * Pectin.

Examples of hetero poly saccharides :-

- * Hyaluronic acid.
- * Chondroitin.

Types of carbohydrates :-

* On the basis of health :-

- 1- Healthy and Unhealthy Carbohydrates.
- 2- ~~B~~ Good and Bad Carbohydrates
- 3- Slow and Fast carbohydrates.

* On the basis of Number of Molecules.

- 1- Simple carbohydrates.
- 2- Complex carbohydrates.
- 3- ~~Fibrous~~ carbohydrates.

* On the basis of Fibrous content :-

* Fibrous Carbohydrates.

Fiber :-

Parts of plants that can't be digested.

⇒ They help in the process of digestion.

Characteristics of Carbohydrates :-

- ⇒ Carbohydrates ^{of low molecular weight} are Sweet in taste.
- ⇒ Sweetness of sugar depends on molecular weight.
- ⇒ So polysaccharides are not sweet and also called Non-sugar.
- ⇒ Example of non-sugar carbohydrates is ~~starch~~ starch.
- ⇒ ~~Carbohydrates~~ ^{certain polysaccharides} are Soluble in water.
- ⇒ Carbohydrates are white solids.
- ⇒ Carbohydrates are sparingly soluble in organic liquids.

Functional Groups of Carbohydrates :-

functional groups of carbohydrates are:

- 1- Aldehyde group. (CHO)
- 2- Ketone group. (R-C-R)

Aldose sugar:-

⇒ carbohydrates which contain aldehyde group is called as aldose sugar.

Ketose sugar:-

⇒ carbohydrates which contain ketone group is called as ketose sugar.

Sources of carbohydrates:-

Carbohydrates are the natural compounds and their basic source is plants.

⇒ The chief source of carbohydrates is the cereals.

Other sources of carbohydrates:-

- i- Vegetables: e.g. potato, carrot, beets etc.
- ii- Legumes: e.g. peanut, lentil etc.
- iii- Fruits: both sweet and non-sweet fruits provide carbohydrates.

Examples of carbohydrates:

- | | | |
|-------------|----------|-----------|
| * Starch:- | * Rice | * Glucose |
| * Cellulose | * Lentil | * Sucrose |
| * Glycogen | * Bread | * Pasta |
| * Galactose | * Grams | * Corn |
| * Maltose | * Oats | * Fiber |
| * Fructose | * Beans | |

Protiens:-

Protiens are the chief-builders of the body. They are made up of Carbon, Hydrogen, oxygen and nitrogen.

Normal Protiem requirement of an adult is 1g/kg of the body weight.

- The protiens are polymers made of monomers called the amino acids.
- Our body is capable of manufacturing some amino acids, others must be obtained from our food.

Classification :-

Classification of protiens based on Structure of protiens:-

There are four structural level of organization to describe the protiens.

Primary structure of protiens:-

Primary structure of protein exist as long chain of amino acid arranged in a particular sequence. they are non-functional proteins.

Secondary structure of proteins:-

The polypeptide chain is coiled into a spiral or helix to have a three dimensional structure, where the amino acids interact by the formation of hydrogen bonds.

Ex:- keratin, silk fiber etc.

Tertiary structure of proteins:-

The tertiary structure of a protein refers to the overall three-dimensional arrangement of its polypeptide chain in space.

Ex- Globulins of blood.

Quaternary structure of proteins:-

When a protein is an assembly of more than one polypeptide or subunits of its own, this is said to be the quaternary structure of protein.

Ex- Hemoglobin and insulin.

Classification of proteins on the basis of Biological functions:

Proteins can be grouped on their metabolic functions they perform.

Enzymatic Proteins:

They are the most varied and highly specialized proteins with catalytic activity.

Ex- Urease, catalase etc.

Structural Proteins:-

These proteins aid in strengthening or protecting

biological structures.

Ex:- collagen, elastin, Keratin etc.

Transport or Carrier Proteins:-

These proteins help in transport of ions or molecules in the body.

Ex:- myoglobin, haemoglobin.

Nutrient and Storage Proteins:-

These proteins provide nutrition to growing embryos and store ions.

Types of Proteins:-

There are seven types of proteins:

- 1- Antibodies.
- 2- Contractile protein
- 3- Enzymes
- 4- Hormonal proteins
- 5- Structural proteins.
- 6- Storage proteins
- 7- Transport proteins.

Characteristics of Proteins:-

- * They are soluble in water.
- * They do not coagulate by heat.
- * They are highly basic because most basic amino acids are present in them.

- * Due to its basic nature, it reacts with mineral acid and ~~nucleic~~ nucleic acid and forms its salt.
- * Proteins are polypeptide structures consisting of one or more long chains of amino acid residues.
- * They carry out a wide variety of organism functions, including DNA replication, transporting molecules, catalyzing metabolic reactions and providing structural support to cells.

Examples of proteins:-

- * Spider silk
- * Hemoglobin
- * Keratin in nail and hair.
- * Actin and myosin in muscle fibers.
- * Hormones like insulin and thyroxine.
- * Immunoglobulins in defense.
- * Amylase, Lipase, pepsin, trypsin are digestive enzymes.

LIPIDS:- (Fats and oil)

Definition:-

Lipids are naturally occurring organic compounds known as oils and fats.

Lipids are fatty, waxy or oily compounds that are soluble in organic solvents and insoluble in polar solvents such

as water.

Classification of Lipids:-

Lipids are classified into four groups:

1- Simple Lipids:-

Simple lipids are made up of fatty acid and alcohol.

Examples of Simple lipids,

1- Triglycerol or triglycerides (TAG)

⇒ TAG are the esters of fatty acids with glycerol.

⇒ TAG are neutral fat.

⇒ The fat we eat is TAG.

⇒ Fat in liquid state is called oil.
(groundnut oil, corn oil etc).

2- Waxes:-

⇒ Waxes are esters of fatty acids with HMW monohydric long chain alcohol.

HMW ⇒ High molecular weight.

⇒ Waxes are not important in human metabolism.

⇒ They are widely used in pharmaceutical and cosmetic industries.

2- Compound lipids:-

Compound lipids are made

up of fatty acids, alcohol and additional groups.

Examples of compound lipid:-

- 1- Phospholipids.
- 2- Glycolipids
- 3- Lipoproteins.

3- Derived lipids:-

Derived lipids are obtained on hydrolysis of simple and compound lipids.

Examples:-

- 1- Fatty acids.
- 2- Steroids.
- 3- Eicosanoids.
- 4- Ketone bodies.

4- Miscellaneous lipids:-

They possess characteristics of lipids.

- Ex:-
- * Squalene.
 - * Carotenoids.

Types of lipids:-

Fats can be classified into saturated, trans fats and unsaturated.

1- Saturated fat:- Saturated fat is

Solid at room temperature, which is why it is also known as "Solid fat".
⇒ It is mostly in animal foods, such as milk, cheese and meat.

2- Trans fats:-

This is a fat that has been changed by a process called hydrogenation. This process increases the shelf life of fat and makes the fat harder at room temperature.

⇒ Trans fats are present in processed foods, snack foods such as chips and crackers;

⇒ Trans fat are also present in cookies.

⇒ Foods made with shortening and partially hydrogenated oils contains trans fat.

3- Unsaturated fat:-

unsaturated fat is liquid at room temperature.

⇒ It is mostly in oils from plants.

⇒ Monounsaturated fat and polyunsaturated fat are types of unsaturated fat.

Characteristics of lipids:-

1- Lipids are relatively insoluble in water.

2- They are soluble in non-polar organic solvents like ether, chloroform, and methanol.

- 3 - Lipids have high energy content and are metabolized to release calories.
- 4 - Lipids also act as electrical insulators they insulate nerve axons.
- 5 - plant fats are unsaturated and are liquid at room temperature.
- 6 - The melting point of fats depends on length of chain of the constituent fatty acid and the degree of unsaturation.
- 7 - Fats contain saturated fatty acids. They are solid at room temperature. Example is animal fat.

Examples of lipids:-

- 1 - Phospholipids
- 2 - Waxes
- 3 - Triglycerides
- 4 - Fats and oils
- 5 - Sterol
- 6 - Fatty acids
- 7 - Cholesterol
- 8 - Saturated fat
- 9 - Glycerolipids
- 10 - Sphingolipids
- 11 - Steroids
- 12 - Cell membrane structural component.