CARBOHYDRATES

The carbohydrates, often termed as sugars, are the "staff of life" for the organisms. Carbohydrates contain carbon, hydrogen and oxygen in the ratio of 1:2:1 Hydrogen and oxygen are combined in the same ratio as in the water (H_2O).

Definition:

"Optically active polyhydroxy aldehydes or ketone or the compounds which produce units of such type on hydrolysis."

Formula:

Carbohydrates are represented by formula as $C_x(H_2O)_y$.

Uses of Carbohydrates:-

They are used as an energy source or storage form and they are used as a structural component. Carbohydrates can be used as an energy source because most cells can convert simple carbohydrates into energy that

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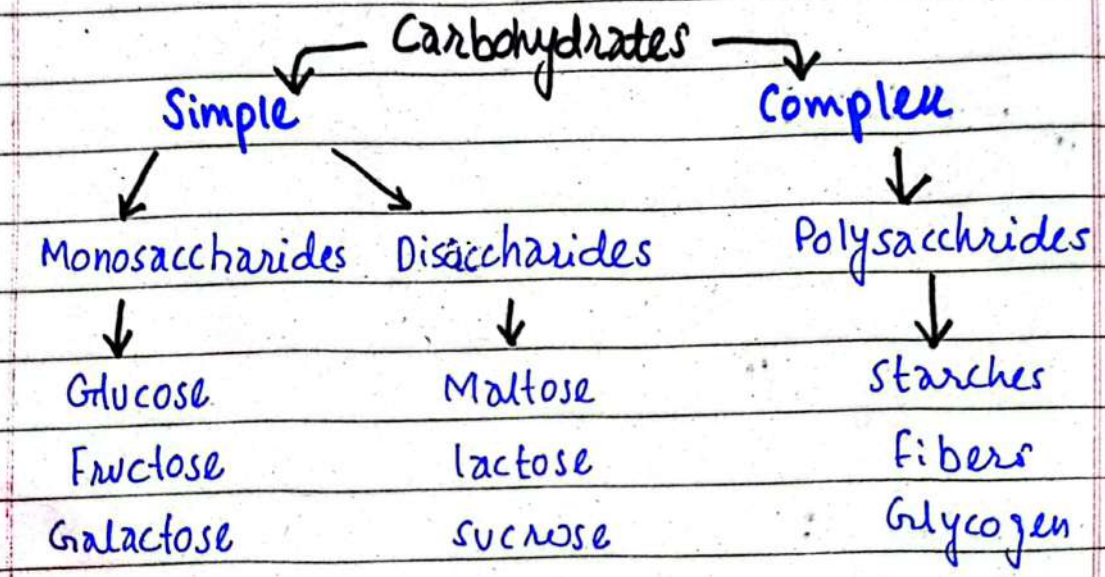
can be harnessed by the cell. Living things also use carbohydrates as a means of storage for future use. Larger carbohydrates molecules can also be used by living organisms to construct physical structures. In plants and bacteria carbohydrates are the main component of the cell wall.



Classification of carbohydrates:-

a. Monosaccharide:-

The simplest carbohydrates are the monosaccharides. The two most common monosaccharides are glucose and fructose. Monosacchrides are the fundamental units, or building blocks that make up are others carbohydrates. Monosaccharides

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typically have a chain of carbon atoms linked together called a "**carbon backbone**". The number of carbon atoms in chain is the way biochemists classify monosacchrides. There are 3 groups of monosacchrides. Trioses are monosacchrides that have a 3-carbon backbone. They are also called 3-carbon sugars. Sugars with a 5-carbon backbone are known as pentose called 5-carbon sugar. 6-carbon sugars are known as hexoses. Differences are based on the number of carbon atom. All three carbon sugars have same chemical formula $C_3H_6O_3$. 5-carbon sugars all have $C_{15}H_{10}O_5$ for their formula. 6-carbon sugars all $C_{16}H_{12}O_6$.

- **Glucose:-** Glucose (blood sugar) is the most abundant monosacchride in the human body. Glucose is a 6-carbon sugar. It is the chemical "fuel" that is carried in the blood stream to tissues as an energy source for metabolism. other carbohydrates that are absorbed by the human body must be converted to glucose before the body

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can break it down for energy.

• **Fructose:-**

Fructose is the most abundant carbohydrates in fruits. Honey is a 1:1 mixture of glucose and fructose. Although glucose and fructose share the same molecular formula, their structures and properties are different. Many soft drinks and fruit drinks are sweetened with "high fructose corn syrup". Ribose and deoxyribose are both Pentose sugars. They are the sugars found in the nucleotides that form nucleic acid. Ribose is found in RNA and deoxyribose is found in DNA.

(b) **Disaccharides:-**

when two monosaccharides are bonded together, a disaccharide is formed. The process of linking the two monosaccharides together removes a hydrogen atom and an oxygen bonded to a hydrogen (-OH). This process is called dehydration synthesis because the atoms removed from the sugar bonds to form water. Thesa are 3 common disaccharides, lactose, sucrose, and maltose. Disaccharides, like

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monosaccharides, are soluble in water, but they are too big to pass through the cell membrane by diffusion.

- **Lactose:-**

lactose is a disaccharide composed of a glucose and galactose molecule bonded together. Lactose (called "milk sugar") constitutes about 4-5% of cow's milk. A specific enzyme called lactase is required for the digestion of lactose. The enzymes breaks the bonds connecting the two monosaccharides. People who lack this enzyme are said to be "lactose intolerant" they cannot digest milk or milk products like ice-cream, cheese, or yougurt.

- **Sucrose:-**

Sucrose, or table sugar, is a disaccharide composed of glucose and a fructose monosaccharide joined together. It is harvested from sugar can or sugar beets and is also called sugar can. It is widely used refined sugar in atypically western diet. Broken down in the small intestines during digestion to give the

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smaller mono-saccharides that are able to pass into the blood and through cell membranes into cells.

Maltose:-

Maltose, or malt sugar, is a disaccharide that is composed of two glucose molecule maltose is sugar used in malted milk shakes and malted milk candis. Maltose is found primarily in plants, particularly in seeds that are sprouting. These sprouting seeds are taking larger carbohydrates and breaking them into maltose. Brewers and distillers used sprouted barley seeds and extract the maltose to brew beers and make spirits, whiskey, bourbon, or scotch.

(c) **Polysaccharides:-**

Polysaccharides are the most abundant carbohydrates in nature. They serve as reserve food and energy storage. Polysaccharides are composed of hundreds or thousands of mono-saccharide unit bonded together. The monosaccharide building blocks are bonded together just like disaccharide

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are except instead of just linking two monosaccharides are continuously link creating a long chain of a monosaccharide units. Three polysaccharides are the most significant to living organisms. They are starch, glycogen, and cellulose.

- **starch:-** starch is the most important source of carbohydrates in the human diet. starch is formed in plants. starchis commonly found in seeds where it serves as a storage form of carbohydrates. As a seed sprouts the cells in the young plant convert starch molecules into disacchalides and then glucose that can be used as energy for the growing plant. Amylose is a component of starch that consists of starch that consists of many glucose molecules that are linked together.

- **Glycogen:-** Glycogen, often called animal starch, is the storage form of carbohydrate in animals. Almost all animals cell contain some glycogen.

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to provide energy for the cells functions. However, glycogen is most abundant in liver cells and muscle cells. when exercising or fasting cells will draw upon these reserves to obtain glucose needed to continue functioning.

- **cellulose:-** Cellulose is a carbohydrates found only in plants. cellulose is the structural component of plant cell walls; It is the most abundant of all carbohydrates in plants. cotton and paper are close to 95% cellulose. Wood is about 50% cellulose. Humans cannot digest cellulose found in plants. Herbivores like cows, sheep, and deer have an enzymes called cellulase that allows their digestive system to break the chemical bonds in cellulose release the smaller monosaccharides.

⇒ Characteristics of carbohydrates:-

1 → Carbohydrates are the most abundant biomolecules on Earth.

2 → Carbohydrate is
- Produced by the conversion of more

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than 100 billion metrictions of CO_2 and H_2O in photosynthesis.

- a major dietary stable and its oxidation is central in energy yielding pathway in living cell
- structural and protective elements in the cell walls of the bacteria and plants and in the connective tissues of animals.
- lubricate skeletal joints and patricipate in recognization and adhesion between cells as glycoconjugates.

(2) Protein:-

The name protein is derived from "Proteios" meaning prime importance

Definition:-

Any class of nitrogenous organic compounds that have large molecules composed of one or more long chains of amino acids and are an essential part of all living organisms, especially as structural component of body tissues such as muscle, hair etc and as enzymes and antibodies.

"A Protein found in wheat."

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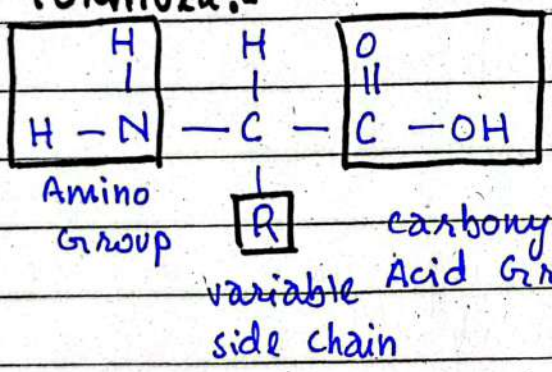
Characteristics:-

- They are polymer of Amino acids
- Proteins are colorless and tasteless.
- The solubility of proteins depends upon the PH
- They are high molecular weight biomolecules
- They are 10,000 different kinds of Proteins in human body.
- They contain the elements, carbon, Hydrogen, Oxygen and nitrogen
- They may also contain phosphorus, Iron, copper Iodine, sulphur and Zinc.

Formula:-



(a) classification of Proteins:-

- **Based on Physical - chemical properties:-**

• Simple Protein:-

These proteins are made of only one type of amino acid, as structural

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component. On decomposition with acids, they liberate constituent amino acids. They are mostly globular type of Proteins. Examples are albumin, globulin, collagen etc. They are the most abundant protein in animal kingdom.

- **compound or conjugated Proteins:-**
The protein, which is attached to some non-protein groups. Examples are phospho-protein, lipo-protein etc.

- **Derived Proteins:-**
Those proteins, which are derived from simple or conjugated proteins from the actions of heat, enzyme or chemical agents. For example: Proteoses, enzymes peptones, oligo peptides etc.

- Based on the structure of Proteins:-

- **Primary Protein:-**
Primary structure of protein is the linear sequence of amino acids that make up the polypeptide chain.

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- **Secondary Protein:-**
The linear, unfolded structure of polypeptide chain assumes helical shape to produce the secondary structure. The secondary structure refers to the regular folding pattern of twists and kinds of the polypeptide chain.

- **Tertiary protein:-**
Tertiary structure of proteins is the three dimensional structure formed by the bending and twisting of the polypeptide chain. the linear sequence of polypeptide chain is folded into compact globular.

(3) Fats / Lipids:-
"Lipids" word is derived from "Lipos" means fat. primary building blocks of lipids are fatty Acids, Glycerol and sterols.

definition:-
Any of a class of organic compounds that are fatty acids and their derivatives and are insoluble in water but soluble in organic solvents. They include many

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natural oils, waxes and steroids.

Classification:-

- **Simple Lipids:-**
These are compounds of fatty acids with glycerol. For example; common fats and oils.

- **Compounds Lipids:-**
These are compounds of fatty acids with glycerol and possess additional groups also. for example:- Phospholids (Phosphoric Acid), Glycolids (carbohydrates), lipoprotein.

- **Derived Lipids:-**
These are the substances derived from simple and compound lipids by hydrolysis. Examples are sterols, vitamin D and Terpenes.

characteristics:-

- They are most heterogenous group of substances.
- They are insoluble in water soluble in organic compounds like ether, alcohol chloroform, benzene etc.

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- soluble in organic compounds like ether, alcohol chloroform, benzene etc.

- Fats, oils and steroids are most important lipids found in nature.

- They are poor conductor of heat and electricity.

- They not only occupy the human diet but also used as a raw material in manufacturings of soap, detergents, varnishes, paints, polishes, cosmetics and pharmaceuticals.