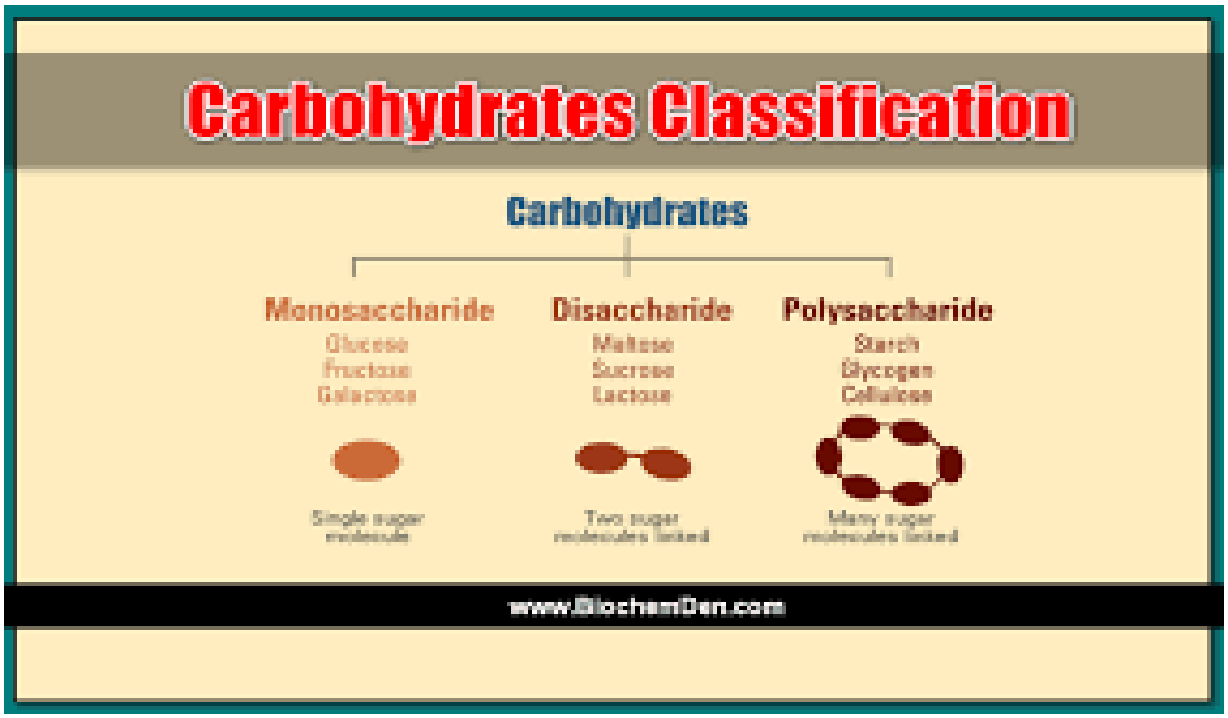
Carbohydrates:-

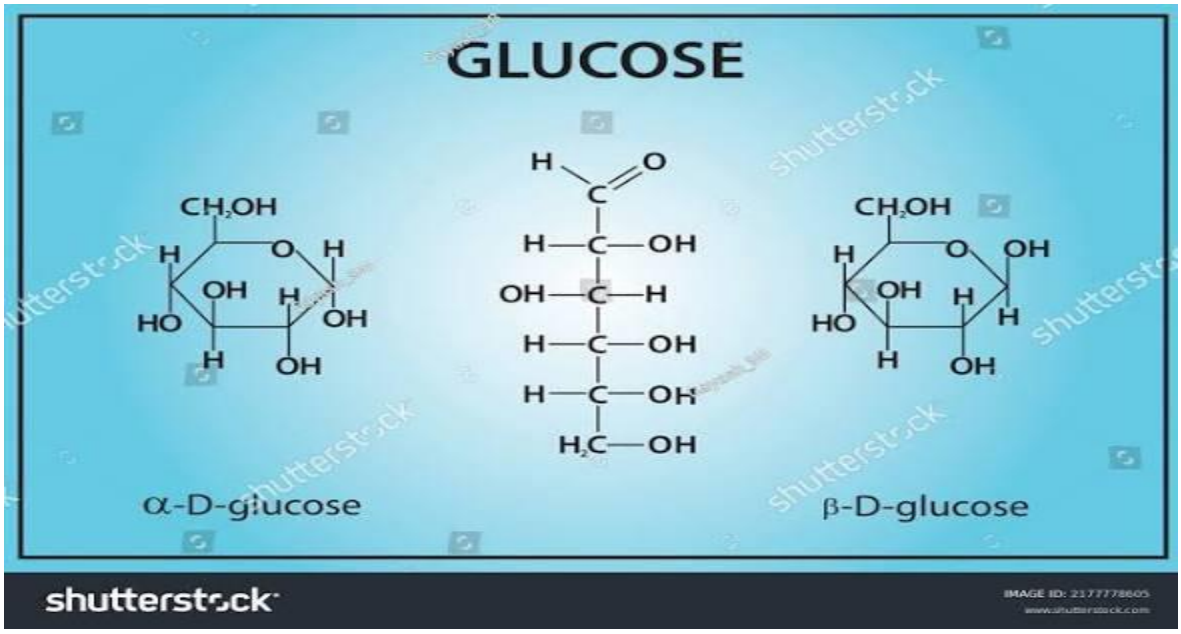
- Carbohydrates are organic compounds made up of carbon, hydrogen, and oxygen atoms, usually with a hydrogen to oxygen atom ratio of 2:1.
- They are one of the main types of nutrients and the most important source of energy for many organisms.



- SIMPLE CARBOHYDRATES: • Simple carbohydrates are organic compounds composed of one or two sugar molecules, known as monosaccharides and disaccharides.
- These carbohydrates are relatively small in size and are characterized by their quick digestion and absorption in the body, leading to rapid increases in blood sugar levels.

- There are two types of simple carbohydrates:

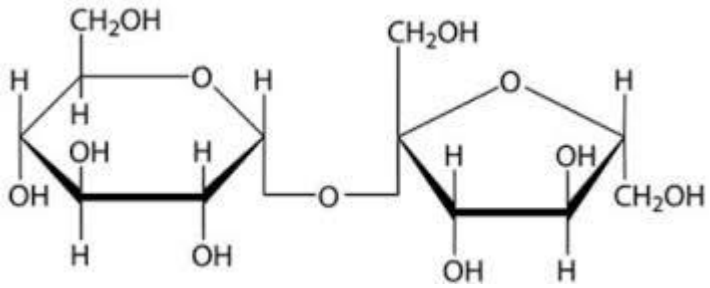
  a) Monosaccharides: These are the simplest form of carbohydrates, consisting of single sugar molecules. Examples include glucose, fructose, and galactose.



Physical Properties: -

Solubility: Highly soluble in water due to hydrophilic nature.
• Taste: Generally sweet.
• State: Solid at room temperature.
• Crystalline Structure: Most are crystalline in nature. Chemical Properties:
• Reducing Sugar: They act as reducing agents (e.g., glucose).
• Isomerism: Exhibit structural isomerism (e.g., glucose and fructose).
• Ring Structure Formation: Exist in cyclic structures in aqueous solutions.

b) Disaccharides: These consist of two monosaccharide molecules linked together. Common disaccharides include sucrose (table sugar), lactose (found in milk), and maltose.



Physical Properties:-

Solubility: Generally soluble in water.
• Taste: Typically, sweet, varying in intensity.
• Physical Form: Solid at room temperature, often crystalline.
• Optical Activity: Rotate plane-polarized light; specific rotation depends on structure. Chemical Properties:
• Glycosidic Bond Formation: Consist of two monosaccharides joined by a glycosidic bond.
• Hydrolysis: Can be broken down into their monosaccharide units by hydrolysis.
• Reducing and Non-Reducing Types: Some act as reducing sugars (e.g., maltose), while others like sucrose do not.

Reactivity:-

Less reactive than monosaccharides due to the involvement of their carbonyl group in glycosidic bond.

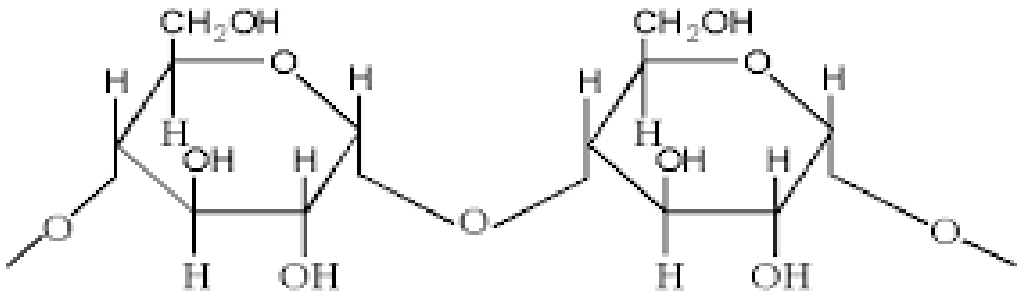
• Mutarotation: Exhibit mutarotation upon hydrolysis.
• Chemical Stability: More stable than monosaccharides but can participate in chemical reactions like Maillard browning.

- **COMPLEX CARBOHYDRATES: •**

Complex carbohydrates are organic compounds composed of multiple sugar molecules (monosaccharides) linked together in long chains.

• These chains can vary in length and complexity, and they are also known as polysaccharides.

• This gradual release of energy makes complex carbohydrates an important source of sustained energy for the body. Polysaccharides: These are complex carbohydrates made up of long chains of monosaccharide units. They include starches, glycogen (the storage form of glucose in animals),
and dietary fibers like cellulose.



Starch

Physical Properties: •

Solubility: Generally insoluble or less soluble in water. • Taste: Typically, not sweet. • State: Solid, often amorphous or fibrous. • Molecular Weight: High molecular weight due to long polymer chains.

Chemical Properties:

• Glycosidic Bonds: Long chains of monosaccharides connected by glycosidic bonds.
• Structural Diversity: Vary in length, branching, and types of monosaccharides.
• Hydrolysis: Can be hydrolyzed to simpler sugars, often requiring specific enzymes.
• Non-Reducing Nature: Usually do not have free aldehyde or ketone groups. • Biological Functions: Serve as energy stores (e.g., starch, glycogen) and structural components (e.g., cellulose, chitin).
• Chemical Reactions: Less reactive than mono- and disaccharides; involved in biochemical processes like energy storage and structural support.

FUNCTIONS OF CARBOHYDRATES: -

Carbohydrates play several crucial roles, functioning as key sources of energy, structural components, and in cell signaling.

1. Energy Source: •

Carbohydrates are the body's primary and preferred source of energy.

They are broken down into glucose, which is used by cells for energy through a process called cellular respiration.
• Glucose can be used immediately or stored as glycogen in the liver and muscles for later use.

2. Structural Components: •

Certain carbohydrates are integral structural components of cells and tissues. • For example, cellulose, a polysaccharide found in plant cell walls, provides structural support.
• In humans and animals, glycosaminoglycans (such as chondroitin and hyaluronic acid) are important for the structure and function of connective tissues and cartilage.

3. Cell Signaling and Recognition:

Carbohydrates are involved in cell signaling and cellular recognition processes.
• Glycoproteins and glycolipids, which are carbohydrates attached to proteins and lipids, are present on the cell surface and play a role in cell-to-cell communication and immune responses.
• These structures are critical in processes like immune cell recognition and the targeting of cells by viruses and bacteria.

4. Source of Dietary Fiber:

• Certain carbohydrates, like fiber, are not digestible by human enzymes but play a crucial role in maintaining gut health.
• Fiber aids in digestion, helps regulate blood sugar levels, and supports a healthy gut microbiome.

5. Energy Storage:
• In plants, carbohydrates are stored as starch, which can be broken down into glucose for energy during periods of low photosynthesis
. • In animals, as mentioned earlier, excess glucose is stored as glycogen. 6. Precursors for Other Biochemical Substances:
• Carbohydrates can be converted into other essential substances, such as amino acids and fatty acids.
• They also contribute to the synthesis of nucleotides, which are the building blocks of DNA and RNA.