

**D.PHARM 2<sup>ND</sup> YEAR**

# **BIOCHEMISTRY**

## **CARBOHYDRATES**

**(PART-1)**

**2026-27**



4 KCal/g.

# Carbohydrates

↓  
carbon

→ Most abundant Biomole  
→ sugar, fibres, starch.

→ hydrates of Carbon 1:2:1

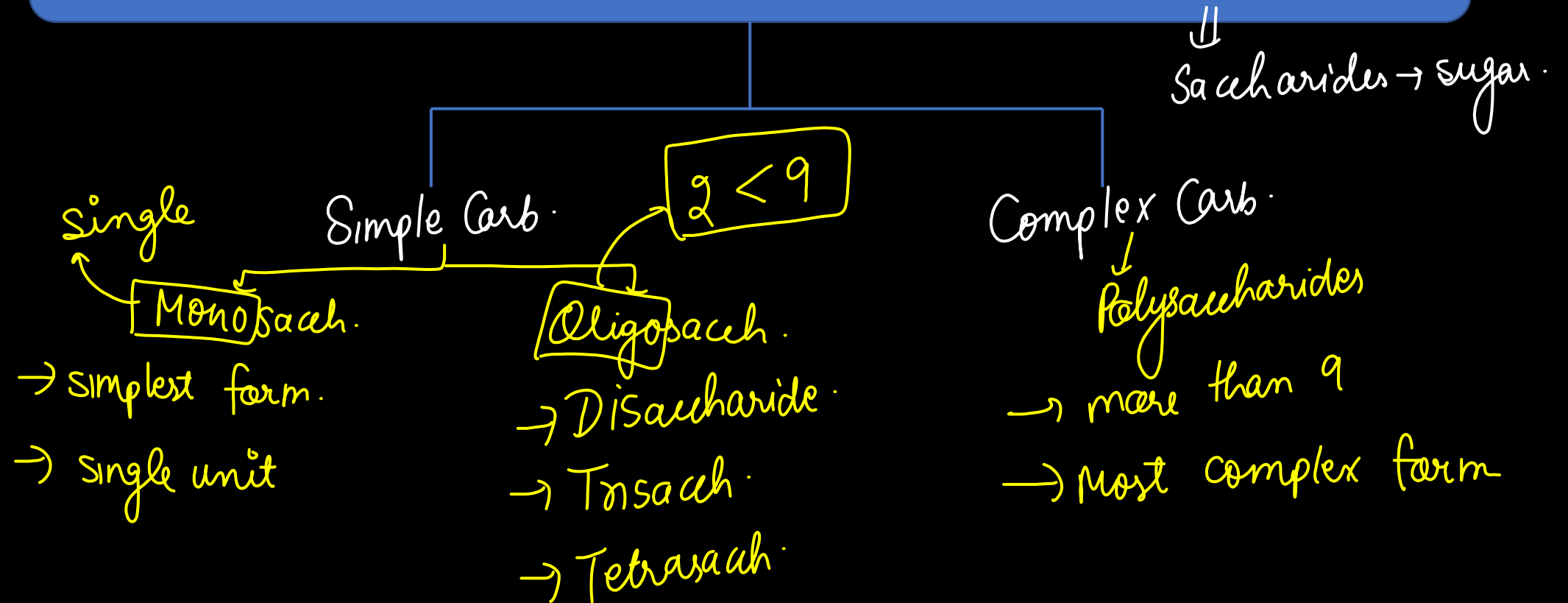
→ generally organic (C, H, O). molecules.

→ general formula →  $[C_n(H_{2O})_n]$   $n = \text{no of C atoms.}$

# glucose →  $n = 6$  →  $C_6H_{12}O_6$

Ribose →  $n = 5$  →  $C_5H_{10}O_5$

# Classification of Carbohydrates



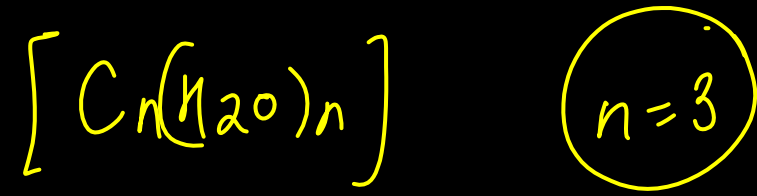
# Monosaccharides

→ single  
Sugar.

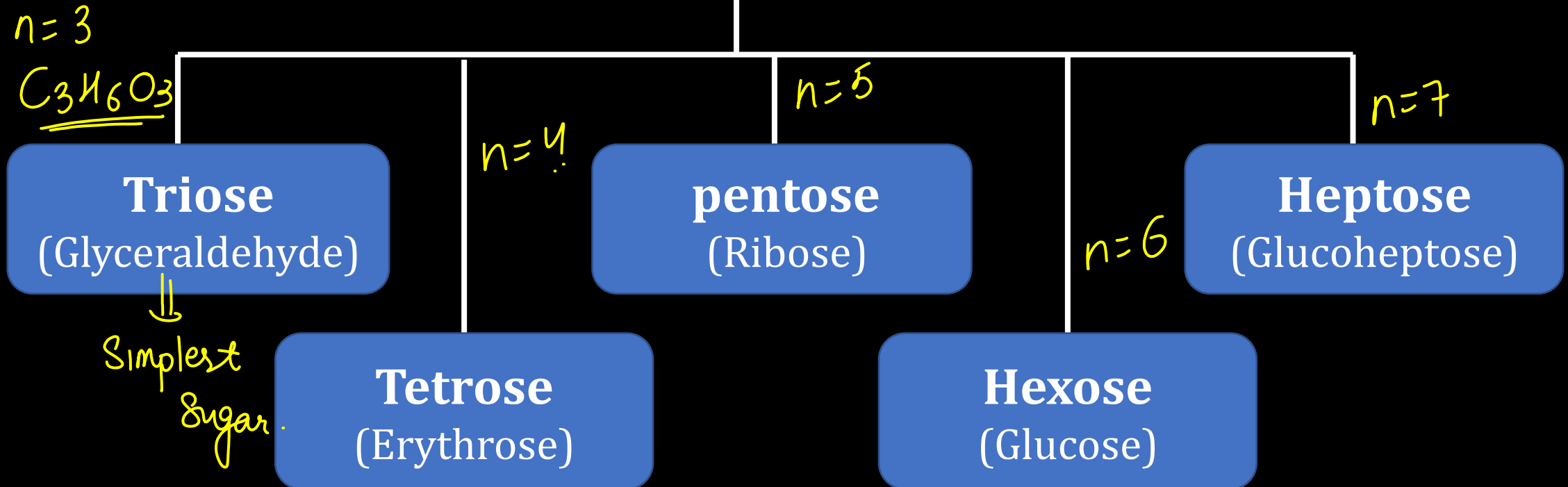
↪ दूध ✗

→ Aldose → Aldehyde group  
 → Ketose → ketone group.

- Cannot be hydrolyzed further.
- If a monosaccharide contains an aldehyde group then it is called aldose.
- If it contains a keto group then it is called a ketose.
- Examples of monosaccharides include **glucose mannose, galactose, fructose, etc.**



- Monosaccharides may be further classified depending on the number of carbon atoms:



# Monosaccharides



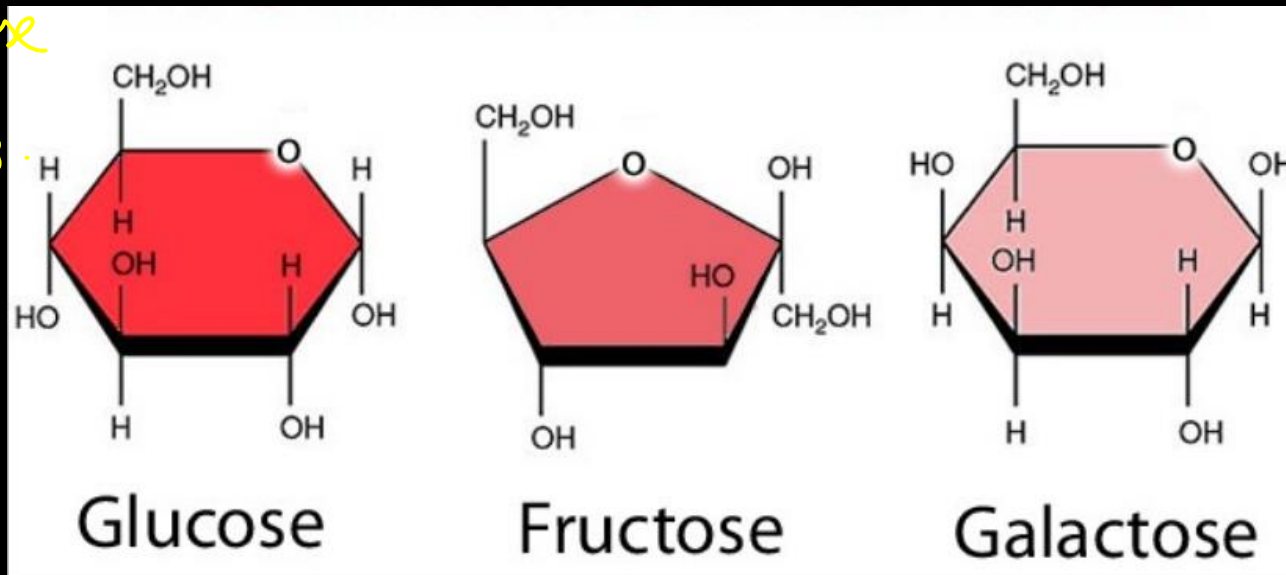
Glucose

Fructose

Galactose

epimers  
↓  
glu & galactose  
are C<sub>4</sub> epimers.

C<sub>1</sub> & C<sub>n</sub>  
↓  
exactly  
opp.





1) Maltose  $\rightarrow$  glu + glu.  
 $\downarrow$

connected by  
glycosidic  
linkage.

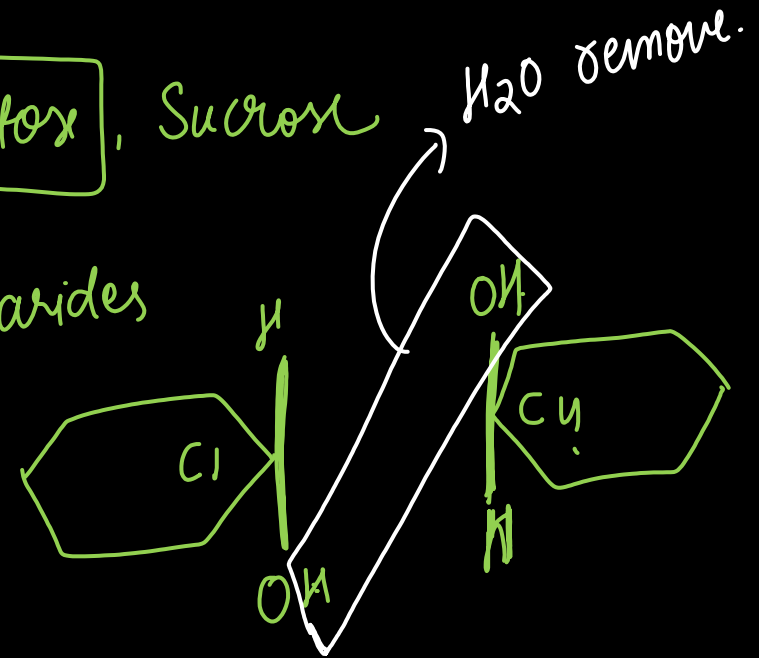
# Oligosaccharides

$\rightarrow$  more than 2 and less than 9 monosaccharides  
are present

1) Disaccharides  $\rightarrow$  Lactose, Maltose, Sucrose

2) Trisaccharides  $\rightarrow$  3 monosaccharides

$\downarrow$   
Raffinose



connected by  
glycosidic

| Type            | Example   | Composition                      |
|-----------------|-----------|----------------------------------|
| Disaccharide    | Sucrose   | Glucose + Fructose               |
| 2 Mono.         | Lactose   | Glucose + Galactose              |
| 3 Mono.         | Maltose   | Glucose + Glucose                |
| Trisaccharide   | Raffinose | Galactose + Glucose + Fructose   |
| 4 Monosach.     | Stachyose | 2 Galactose + Glucose + Fructose |
| Tetrasaccharide |           |                                  |

# Disaccharides

- **Disaccharides** are carbohydrates that consist of **two monosaccharide units** linked by a **glycosidic bond**.
- On **hydrolysis**, they yield **two monosaccharides**.

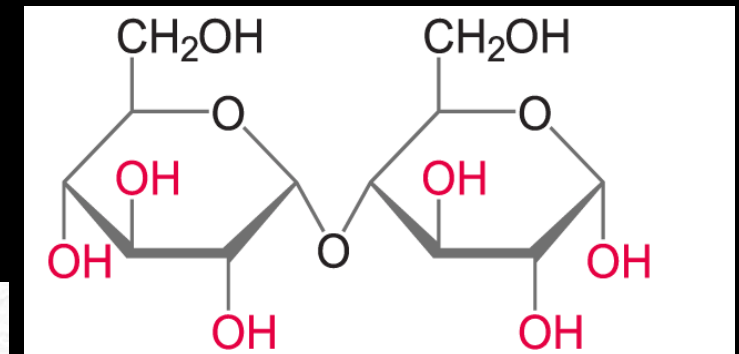
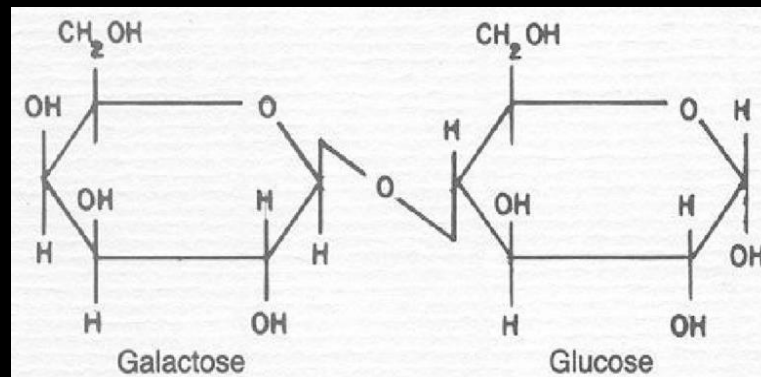
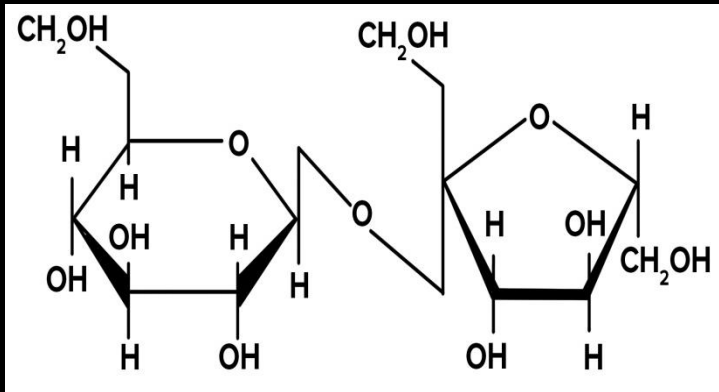
| <b>Disaccharide</b> | <b>Constituent Monosaccharides</b> |
|---------------------|------------------------------------|
| Sucrose             | Glucose + Fructose                 |
| Lactose             | Glucose + Galactose                |
| Maltose             | Glucose + Glucose                  |

# Disaccharides

Sucrose

Lactose

Maltose



# Polysaccharides

More than 9 monosaccharides.

↓  
Most complex form of

- A **polysaccharide** is a **complex carbohydrate** composed of **more than 10 monosaccharide units** linked together by **glycosidic bonds**. *Carbohydrates*
- They are often **insoluble** in water and serve as **storage** or **structural** molecules in living organisms.

| Name                                      | Monomer             | Source/Function                                       |
|-------------------------------------------|---------------------|-------------------------------------------------------|
| Starch → h                                | Glucose             | Found in plants; energy storage                       |
| Glycogen → animal starch.                 | Glucose             | Found in animals; energy storage in liver and muscles |
| Structural Poly. → Homopoly.<br>Cellulose | Glucose             | Found in plant cell walls; structural role            |
| Chitin                                    | N-acetylglucosamine | Found in exoskeleton of arthropods and fungal walls   |

→ Stored form of Carb. in plants.  
 → Amylose → linear structure  
 → Amylopectin → Branched structure  
 → Monomeric unit → fructose.  
 → cockroach.

| Polysaccharide | Constituent Monosaccharide(s) | Type of Glycosidic Bond                                                |
|----------------|-------------------------------|------------------------------------------------------------------------|
| Starch         | $\alpha$ -D-Glucose           | $\alpha(1\rightarrow4)$ and $\alpha(1\rightarrow6)$                    |
| Amylose        | $\alpha$ -D-Glucose           | $\alpha(1\rightarrow4)$                                                |
| Amylopectin    | $\alpha$ -D-Glucose           | $\alpha(1\rightarrow4)$ and $\alpha(1\rightarrow6)$                    |
| Glycogen       | $\alpha$ -D-Glucose           | $\alpha(1\rightarrow4)$ and $\alpha(1\rightarrow6)$<br>(more branched) |
| Cellulose      | $\beta$ -D-Glucose            | $\beta(1\rightarrow4)$                                                 |
| Chitin         | N-Acetyl-D-glucosamine        | $\beta(1\rightarrow4)$                                                 |



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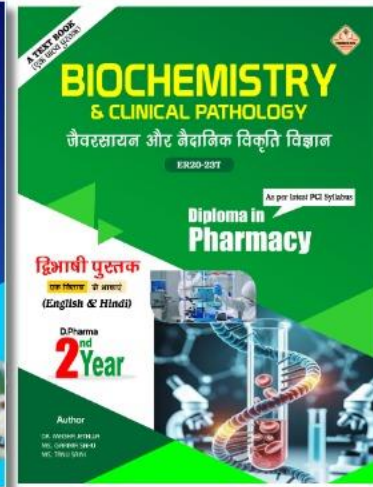
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