

Plant Physiology



Function of plant parts

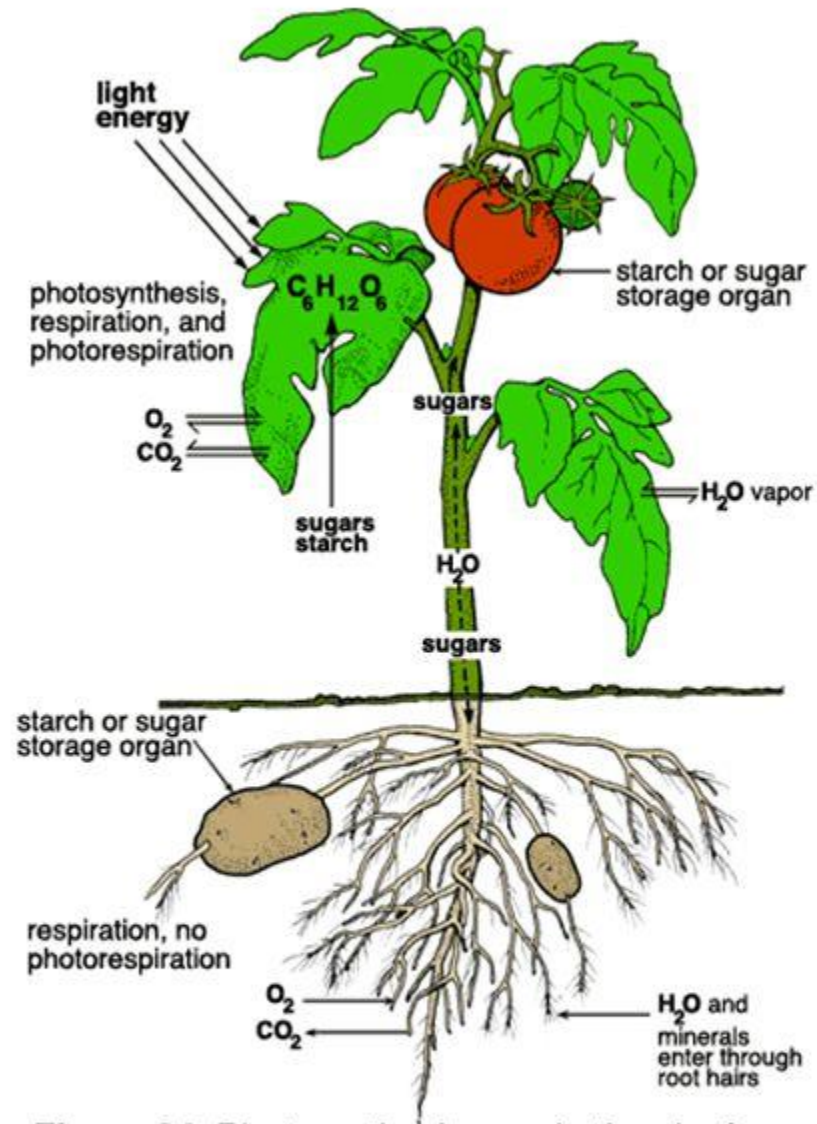
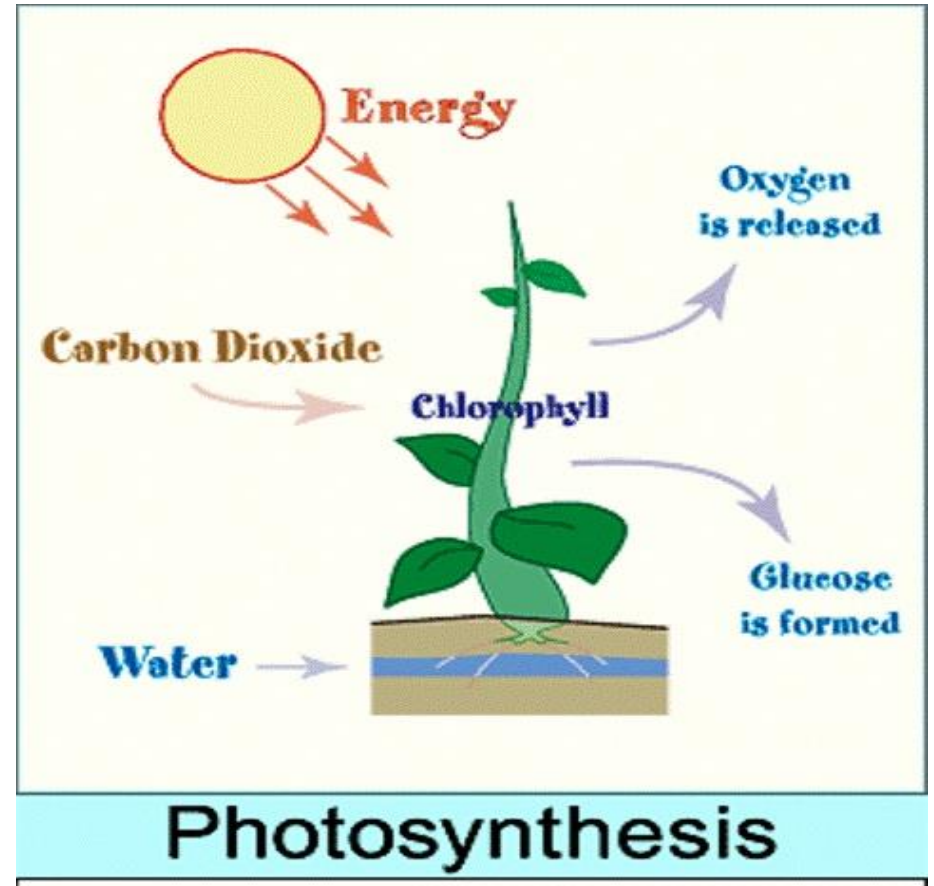


Figure 24. Photosynthesis, respiration, leaf water exchange, and translocation of sugar (photosynthate) in a plant.


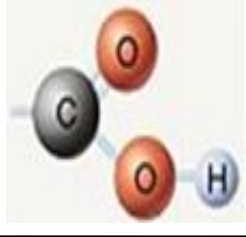

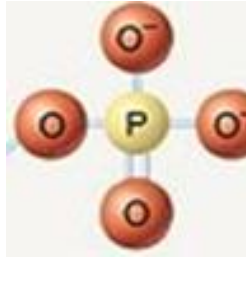


- Plant Physiology is the study of how plant function.
- It is the study of the processes involved in plant growth and plant behaviour .
- It includes the examination of the internal mechanisms by which the plant carries on its many complex synthetic processes and the way in which these processes are integrated.

Biological Molecules

- Organic molecules of living organisms consists of a carbon backbone to which groups of atoms, called functional groups, are attached.
- These functional groups determine the characteristics, solubility and chemical reactivity of the molecules.

Important functional group of biological molecules

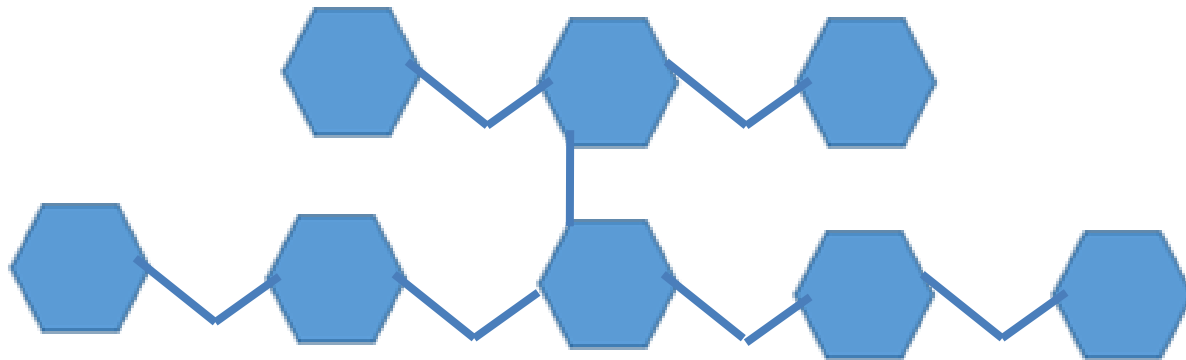
Functional group	Formula	Ball structure model
Amino	NH_2	
Carboxyl	COOH	
Hydroxyl	OH	
Phosphate	PO_4	

Synthesizing Organic Molecules

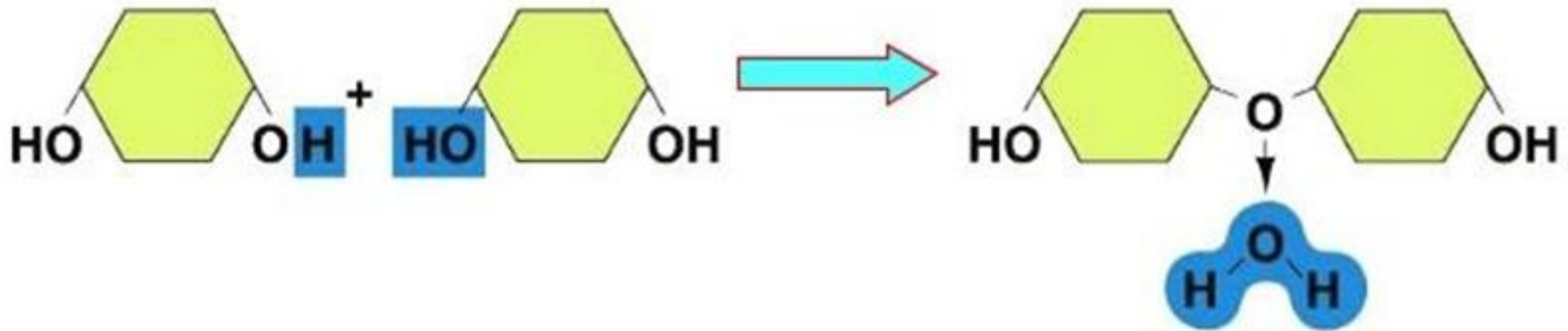
- Small molecules (e.g. amino acids) are used as **subunits** or monomers with which to synthesize larger molecules (e.g. proteins), the polymers.
- Living organisms synthesize long organic molecules through **condensation reactions**, so called because a hydrogen removed from one subunit and a hydroxyl removed from a second subunit “condense” to form a molecule of water as the subunits are joined by a covalent bond.
- The reverse reaction, called **hydrolysis**, uses water to break the molecule into individual subunits again.

Synthesis and breakdown of organic molecules

- a. A typical organic molecule is composed of similar or identical subunits linked together.



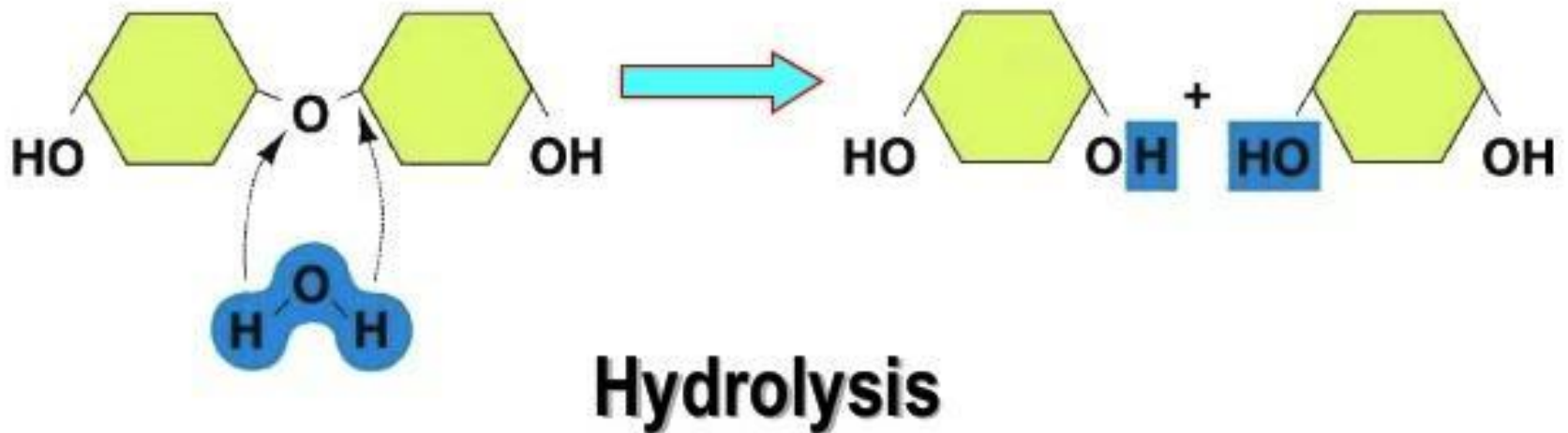
- b. In a condensation reaction, two subunits are joined by a covalent bond. Simultaneously, a hydroxyl group is removed from one subunit and combines with a hydrogen removed from a second subunit to form water.



condensation

c. Hydrolysis is the **reverse of condensation**.

Hydrogen and hydroxyl from water are added to the subunits as the large organic molecule is broken apart into its subunits.



The Principal Types Of Biological Molecules

- Nearly all biological molecules fall into one of four categories : carbohydrates, lipids, proteins and nucleic acids.

Carbohydrates

- All carbohydrates are either small water - soluble sugars (glucose, fructose) or chains made by stringing sugar subunits together (starch, cellulose, glycogen).
- The general formula for carbohydrates is $(\text{CH}_2\text{O})_n$.

Carbohydrate Table



Monosaccharide	Disaccharide	Polysaccharide
Glucose	Maltose	Starch
Fructose	Sucrose	Glycogen
Galactose	Lactose	Cellulose



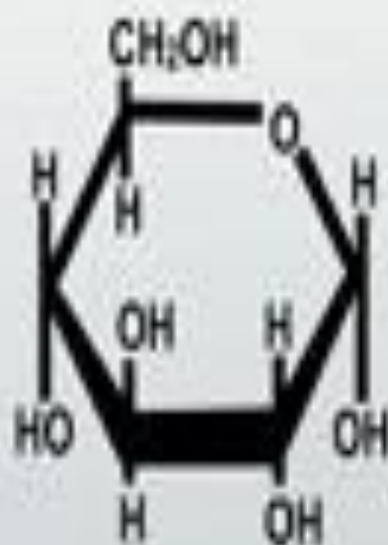
Monosaccharides

- A carbohydrate consisting of one sugar molecule is a monosaccharide.
- The most important monosaccharide is glucose.
- It has six carbons, hence has the chemical formula $(\text{CH}_2\text{O})_6$ or $\text{C}_6\text{H}_{12}\text{O}_6$.
- Glucose has a key role in short term energy storage and nearly all the chemical reactions that produce energy for living organisms.

Monosaccharides

simple sugars

mono
one



saccharide
sugar

Monosaccharides



**Molasses
(Glucose)**



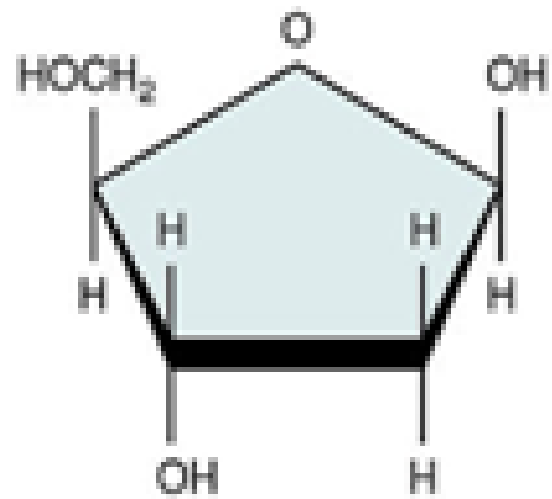
**Cherries
(Fructose)**



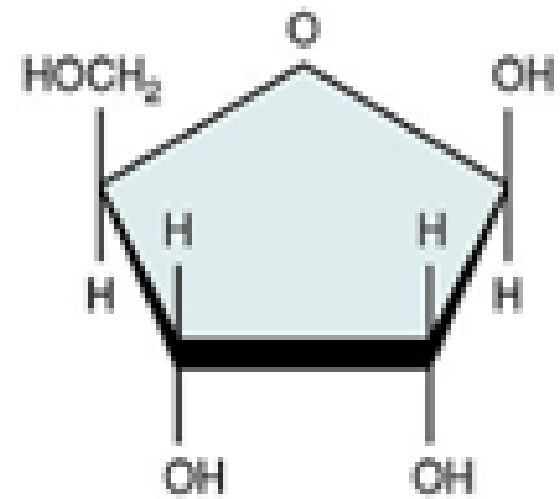
**Yogurt
(Galactose)**

- Other monosaccharides with **six carbon** atoms are **fructose** (the “corn sugar” of the food industry), **galactose** and **mannose**.
- **Ribose** and **deoxyribose**, with **five carbon** atoms, are parts of the genetic molecules of RNA and DNA respectively.
Other five carbon sugars are **xylose** and **arabinose**.





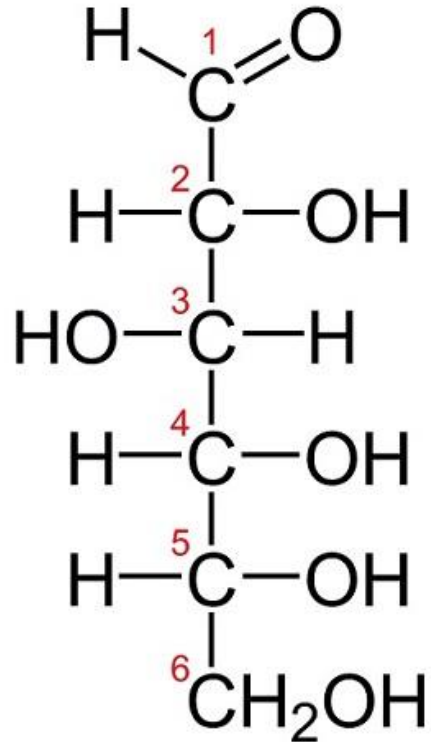
Deoxyribose



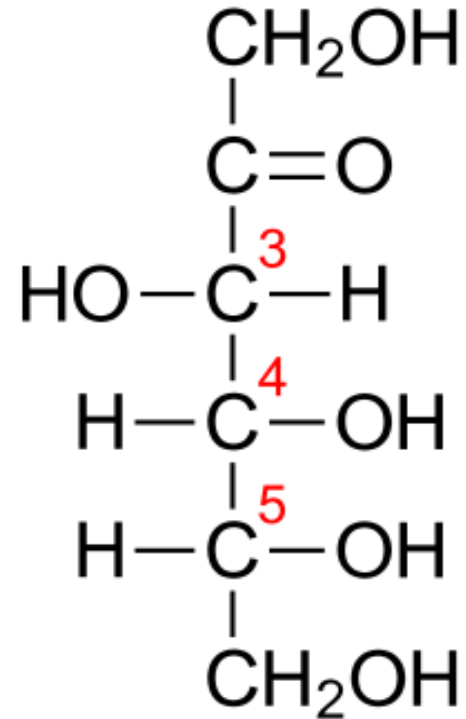
Ribose

(b) Pentoses

Hexose sugars

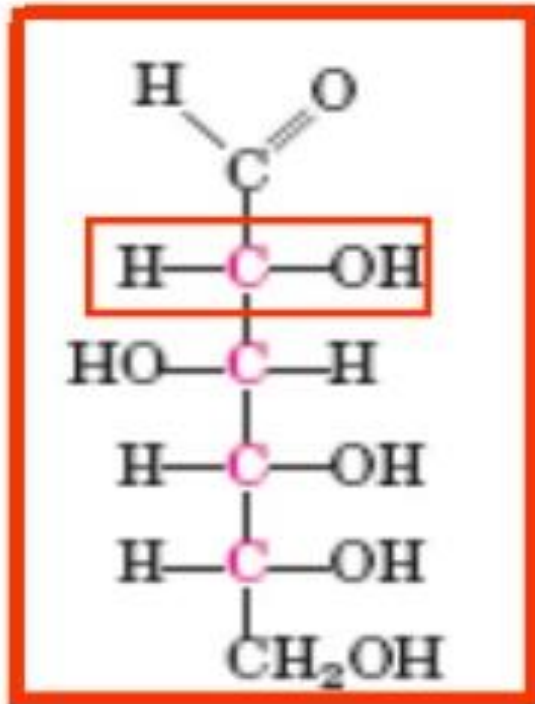


D-Glucose

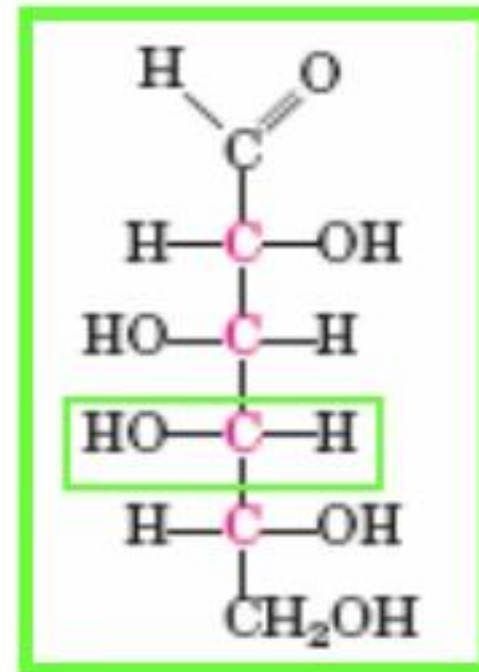


D-Fructose

Hexose sugars

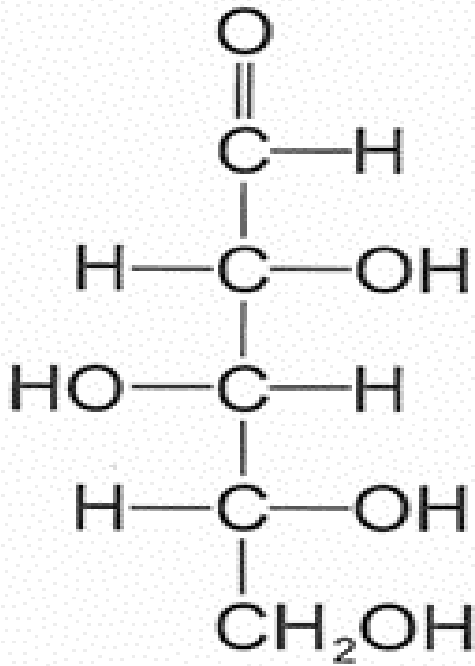


D- mannose

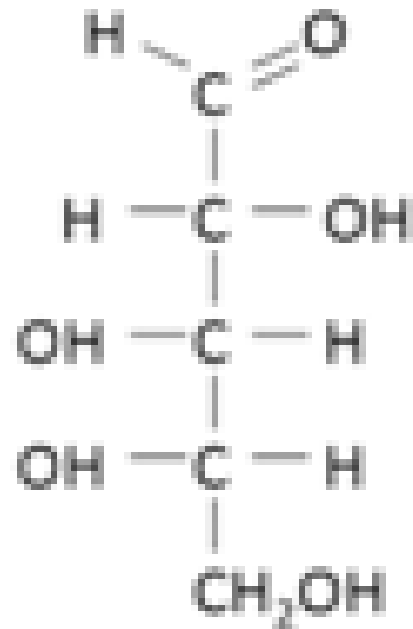


D- galactose

Pentose sugars

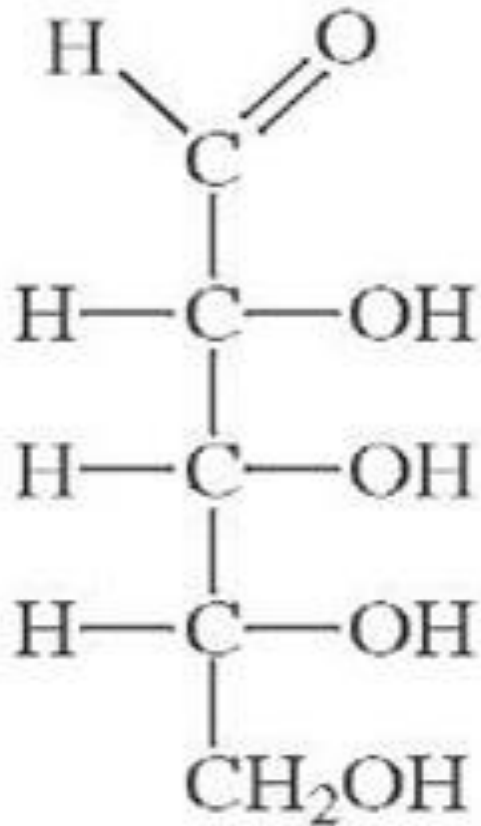


D-xylose

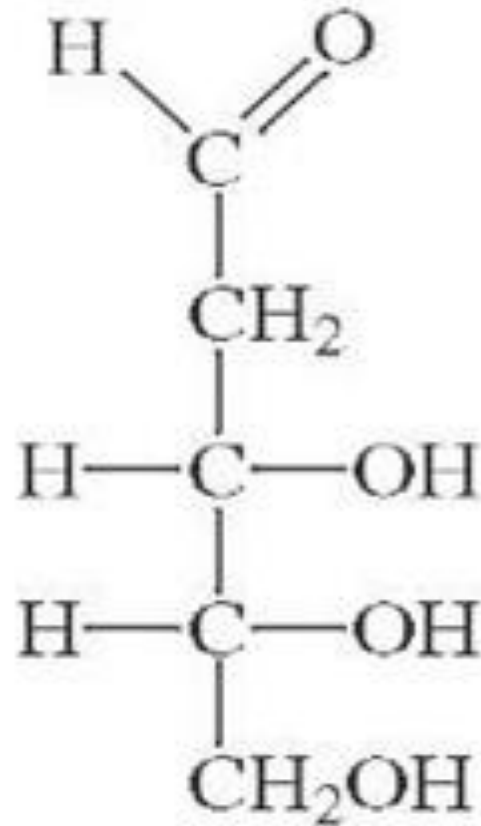


L-arabinose

Pentose sugars



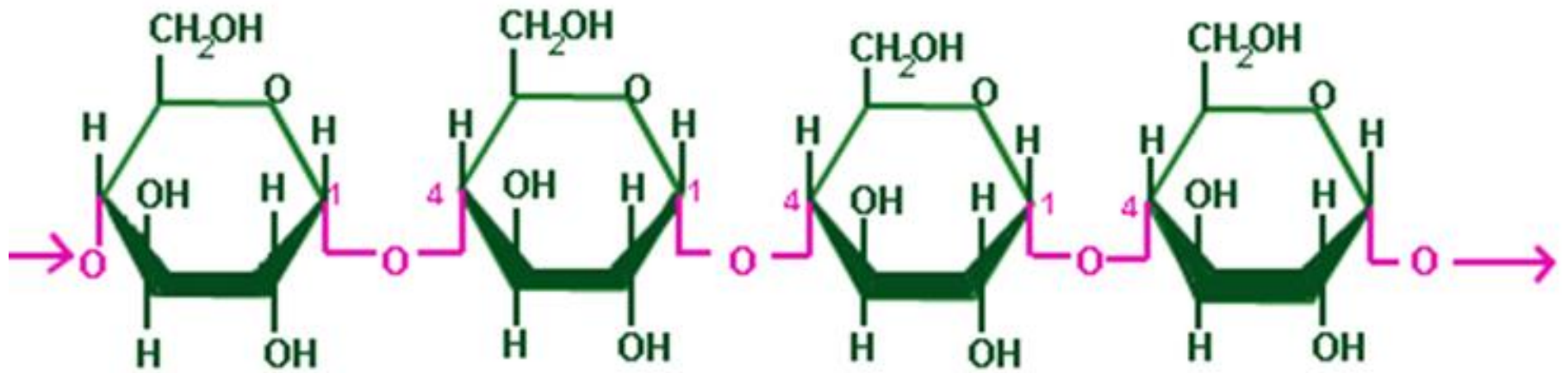
D-Ribose



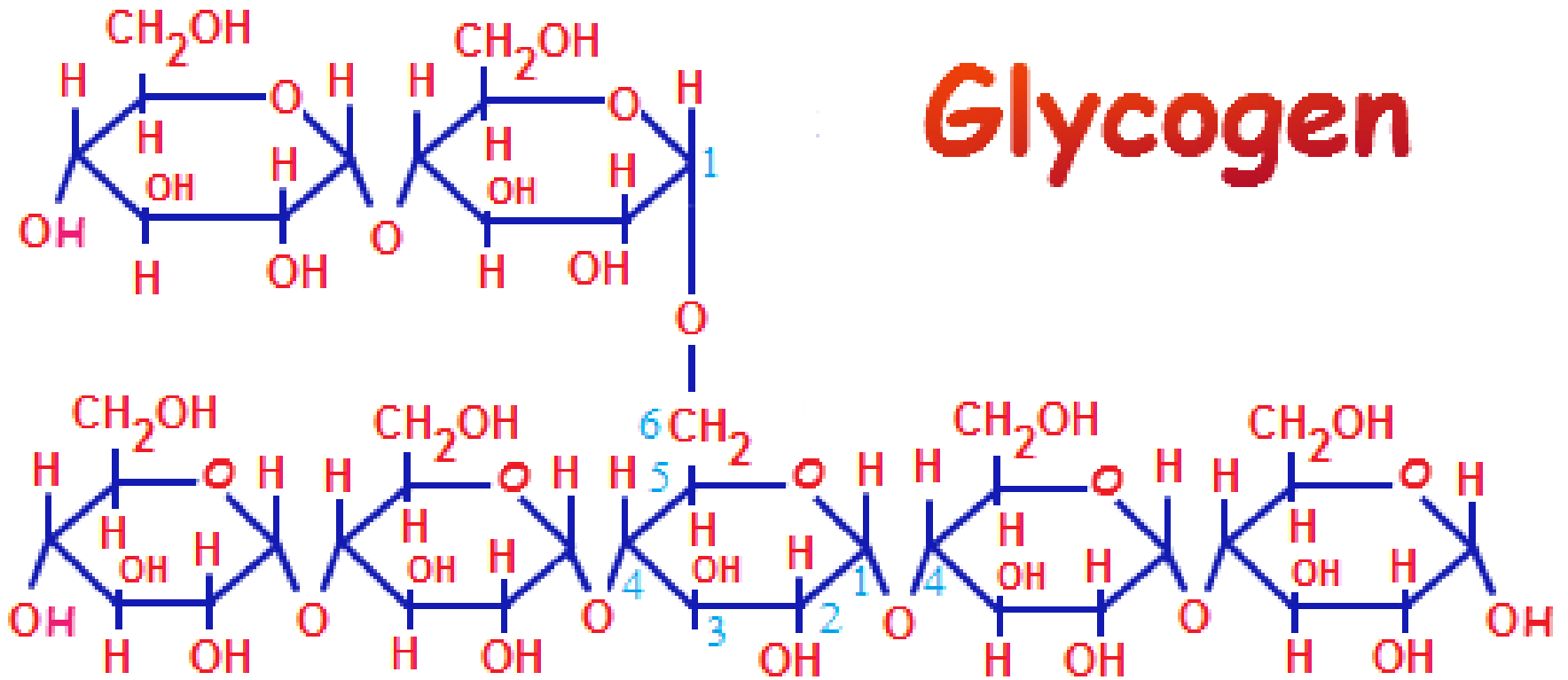
2-Deoxy-D-ribose

- The open chain structure shown above applies to solutions of these substances.
- In their derivatives , e.g.. starch, and glycogen, sugars occur in a ring or cyclic structure.
- The ring may be six – membered (pyranose) as in glucose or five – membered (furanose) as in fructose.

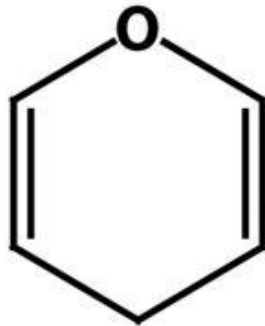
Starch



Glycogen



Pyranose and Furanose forms

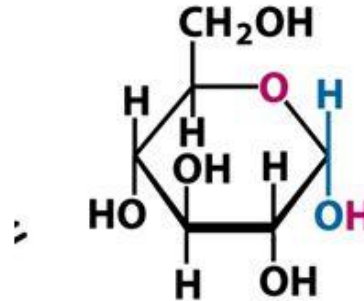


Pyran



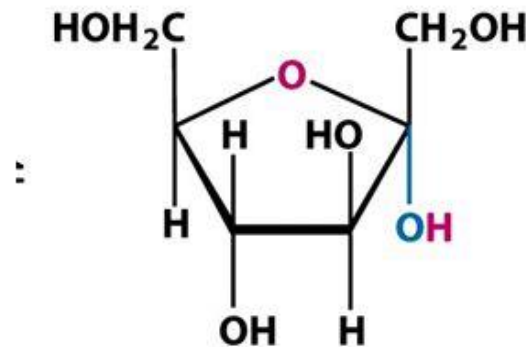
Furan

Unnumbered figure pg 306c
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α-D-Glucopyranose

Hemiacetal,
Haworth
structure



α-D-Fructofuranose
(a cyclic form of fructose)

Hemiketal,
Haworth
structure

THANK YOU