

19/10/2018

# BIOLOGY

Tuesday

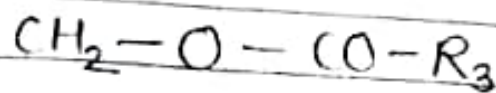
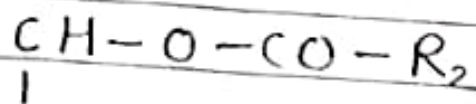
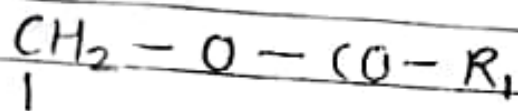
Q: What are lipids? Give an account of general classification of lipids?

- Ans:
- Fats (or lipids) are fatty acid esters of alcohols and related substances, which are insoluble in water but get dissolved in a number of non-polar organic solvents such as benzene, ether, acetone, chloroform etc.
  - They are of three types viz. simple compound, & derived lipids. Simple lipids are esters of fatty acids and alcohols with no additional groups, such as true fats, waxes, cutin and suberin.
  - Compound lipids or fats have additional group besides fatty acid and alcohols, such as phospholipids, glyco-lipids, sulpholipids etc.

Simple Lipids: (1) True fats: - They are triglycerides which are formed by esterification of three molecules of fatty acids with one molecule of trihydric alcohol glycerol.

- The three fatty acids may be similar (eg. tripalmitin) or dissimilar (eg. butter).

General formula:-



where  $R-CO-$  is derived from the fatty acid. at each esterification a molecule of water is given out.

- If a true fat is hydrolysed, ester linkage break down and the two components of the fat are regenerated.
- Hydrolysis by mean of alkalies is called 'saponification' as it yields salts of fatty acid or 'soaps'.
- The soap action of the fatty acid is due to the presence of an extremely polar water soluble end of an otherwise extremely non-polar water insoluble substance.
- True fats chiefly serve as reserve food. They are stored in the cell inside sphaerosomes, elaioplasts or oil bodies.

#### (2) waxes:-

- wax is a soft hydrophobic mixture of long chain carbon compound including alcoholic esters of fatty acids which are poor in oxygen and have a melting point between  $36-100^{\circ}C$ .
- waxes differ from true fats in having fatty acid esters of long chain monohydric alcohols. Free alcohols, free hydroxy fatty acids, sterols, and other fat-like substance may also occur in waxes.
- wax found on the upper surface of floating leaves prevents wetting and submergence of the leaves. wax found on the surface of aerial parts is useful in reducing insulation and transpiration.



Complex Lipids

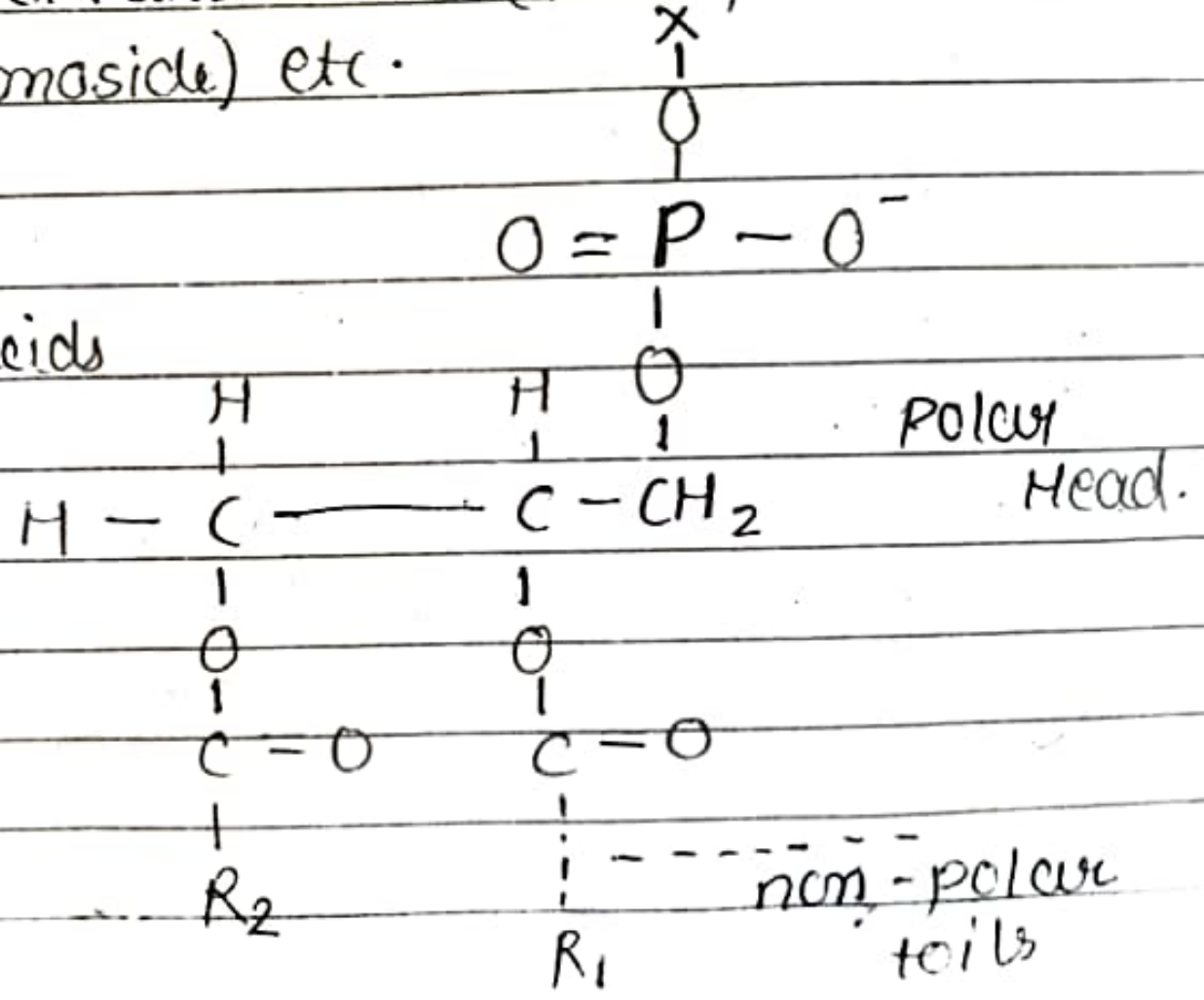
in the wall of the cork and endodermal cells.

### Phospholipids:-

II Compound Lipids

They are triglycerides, where one fatty acid is replaced by phosphoric acid linked to choline (in lecithin), ethanolamine (in cephalin) or inositol (in inoside) etc.

$R_1, R_2$ : fatty acids  
 $X$ : polar group.



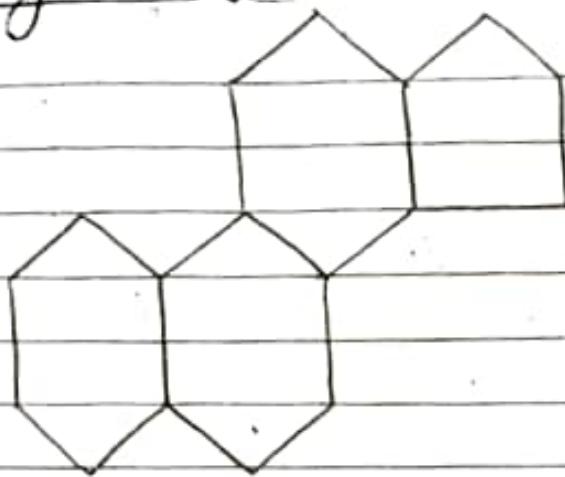
## STERIODS AND STEROLS

The complex lipids which are unsaponifiable include the biochemically important class, the steroids. They fall in the category of isoprenoid lipids along with carotenes & bile acids.

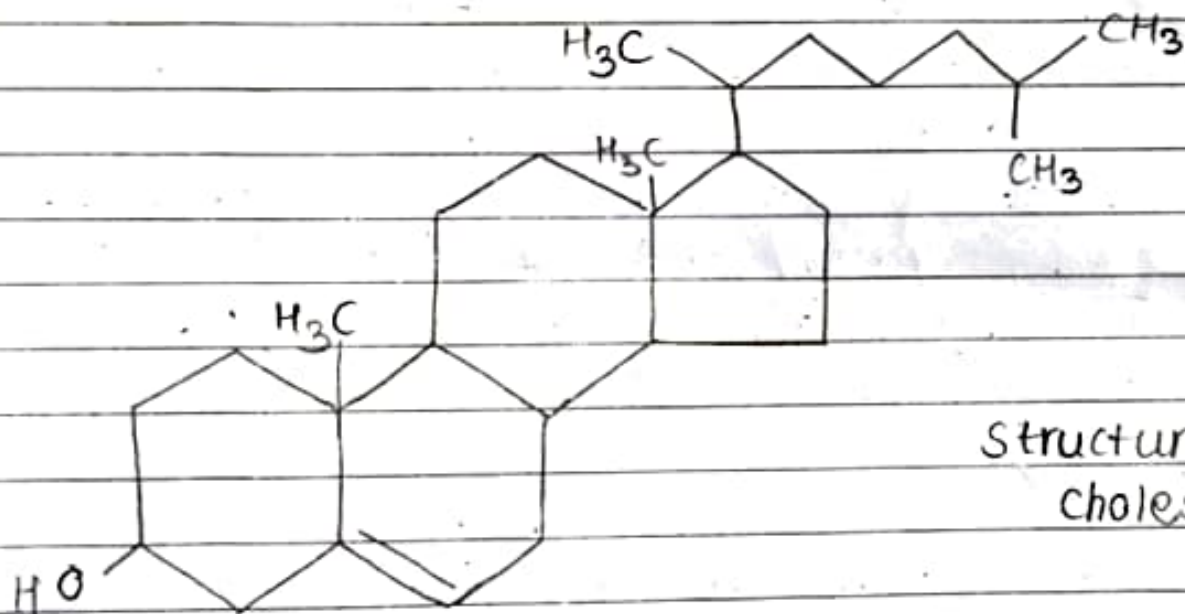
- They are tetracyclic crystallisable alcohols of high molecular weight eg. cholesterol, cortisone, testosterone, ergosterol
- Cholesterol is important metabolically in human beings and plants where it occurs.

Diagrams (lipids) → Derived lipids :

14



Basic structure of steroids.



Structure of  
cholesterol.



Q3. write a note on function of lipids & the carbohydrates?

Ans:

Function of Fats & Lipids:-

(viii) Steroids act as hormones eg. Testosterone

- i. They serve as food reserve in both plants & animals. Their oxidation yields energy for growth.
- ii. They function as concentrated food because as compared to carbohydrates, they yield more than twice as much energy per unit weight.
- iii. In seeds and spores, they help in thermal insulation, protection from ultra violet radiation.
- iv. Vitamin A, D, E and K are soluble in fats. Therefore they function as a transportable energy supply.
- v. In animal, fats form an insulating layer below the skin for protection against low temperature.
- vi. Several plants fats are edible. So are animal fats present in milk.
- vii. Soap is manufactured from plants fats (previously from animal fat).

(ix) They are component of cell membranes (phospholipids)  
(x) Vitamin D is synthesized from Ergosterol on exposure to sunlight (a steroid)

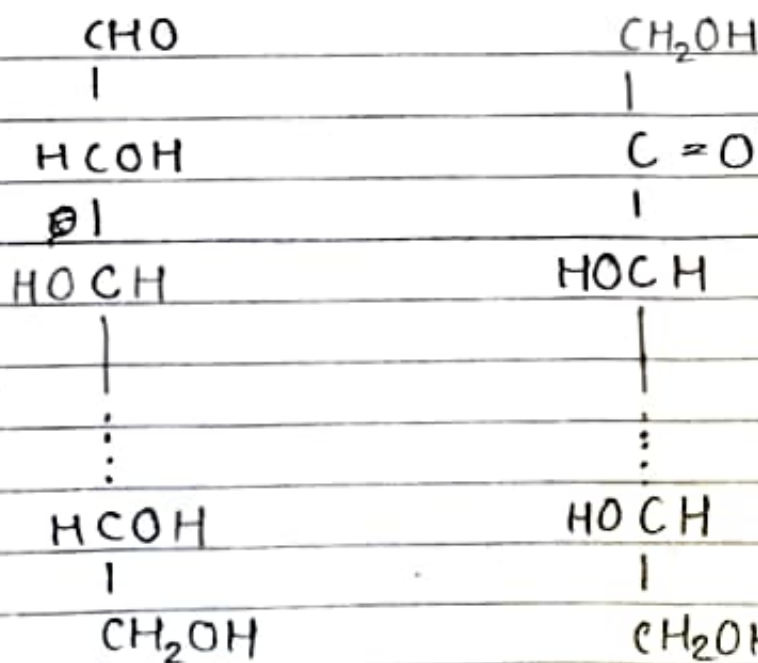
III. Derived Lipids  $\rightarrow$  Steroids, etc. Sterols. (after carbohydrates)

Q. what are carbohydrates? Give an account of general classification of carbohydrates?

Ans. i. The term 'carbohydrate' is derived from the French term 'hydrated de carbon' which means that it is a hydrate of carbon or  $C_n H_{2n} O_n$ .

ii. All carbohydrates are basically polyhydroxy compounds which fall into two broad categories i.e. 'aldoses' & 'ketoses'.

iii. An aldose, possess an aldehyde group ( $-CHO$ ) in the terminal position; while a ketone has a ketone group ( $>C=O$ ) in the subterminal position.



ALDOSE

KETOSE



iii Carbohydrates are commonly differentiated into 'sugar' and 'polysaccharides'.

Technically, carbohydrates are generally classified into three forms viz. monosaccharides, oligosaccharides & polysaccharides.

(soluble in water)

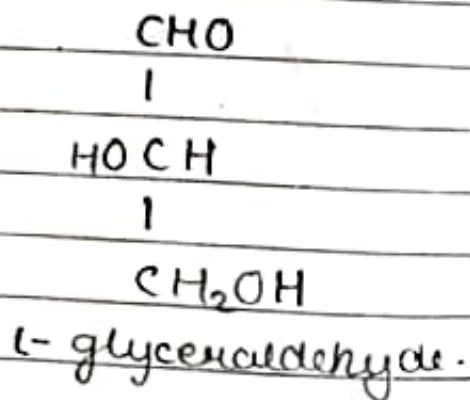
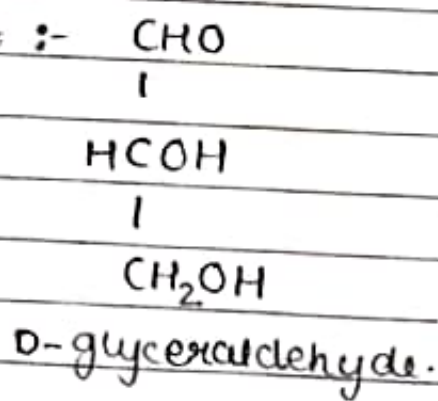
(A) MONOSACCHARIDES:- (Sweet in taste) (Crystalline)

• They are carbohydrate monomers or simple sugar which cannot be hydrolysed to yield smaller and simple carbohydrates, and are building blocks for polysaccharides.

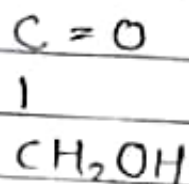
(i) Trioses:-

They are the simplest of the monosaccharides or sugar, which possess three carbons with a general formula  $C_3H_6O_3$ .

ALDOSE :-



KETOSE :-

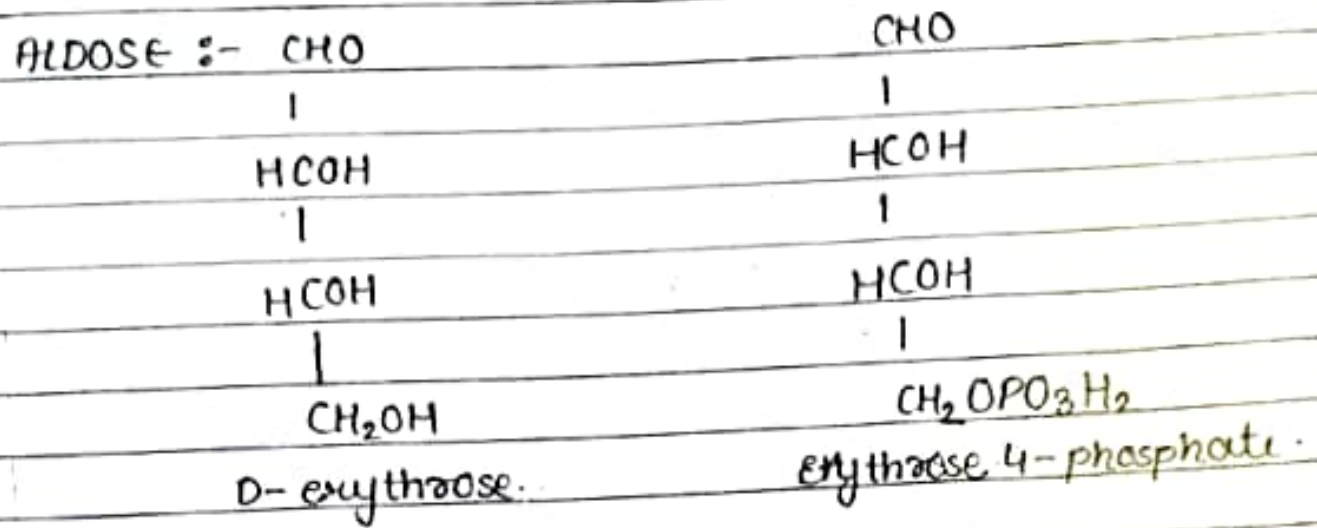


Dihydroxyacetone.

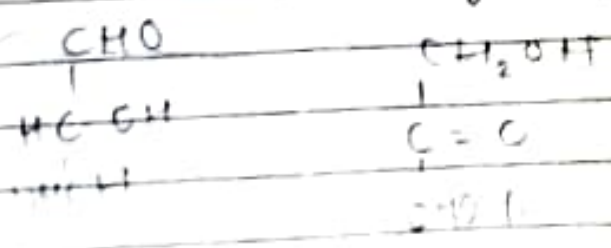
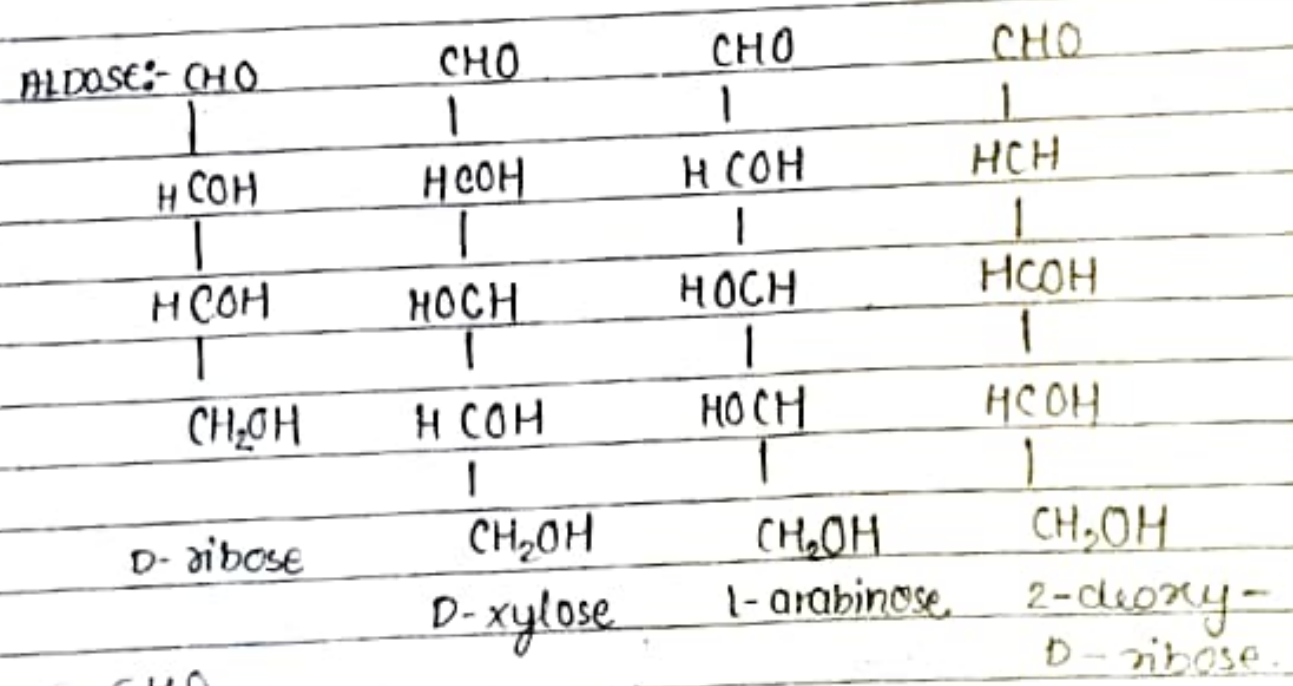
Both of them are imp. intermediates of respiration & photosynthesis pathways.



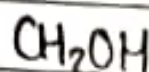
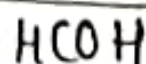
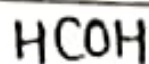
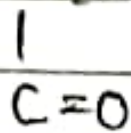
(2) Tetrose:- They are four carbon monosaccharides with a general formula of  $C_4H_8O_4$ .  
eg - erythrose.



(3) PENTOSE:- They are five carbon monosaccharides with a general formula of  $C_5H_{10}O_5$  with the exception of deoxyribose ( $C_5H_{10}O_4$ )

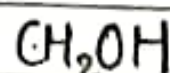
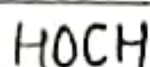
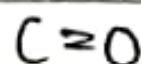


KETOSE :-  $\text{CH}_2\text{OH}$



D-ribulose

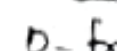
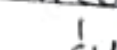
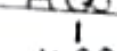
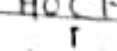
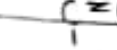
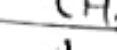
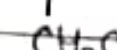
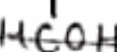
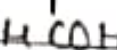
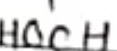
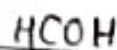
$\text{CH}_2\text{OH}$



D-xylulose.

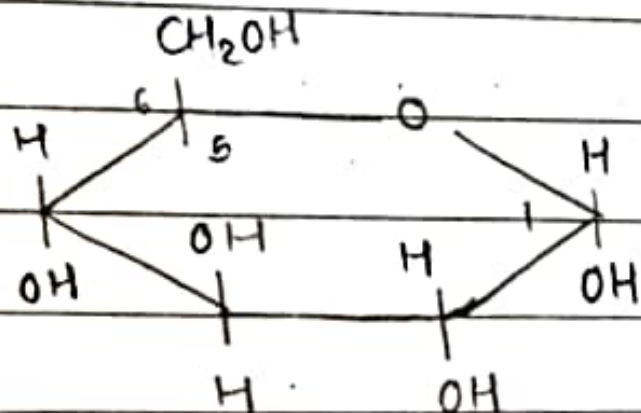
(4) Hexoses:- They are six carbon monosaccharides with a general formula  $\text{C}_6\text{H}_{12}\text{O}_6$ . There are sixteen types of hexoses, eight each in D-series & L-series.

ALDOSE :-  $\text{CHO}$

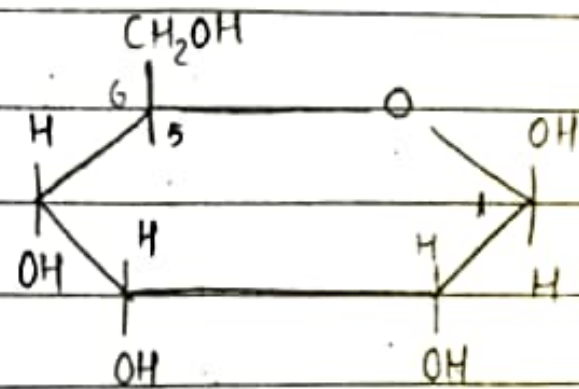




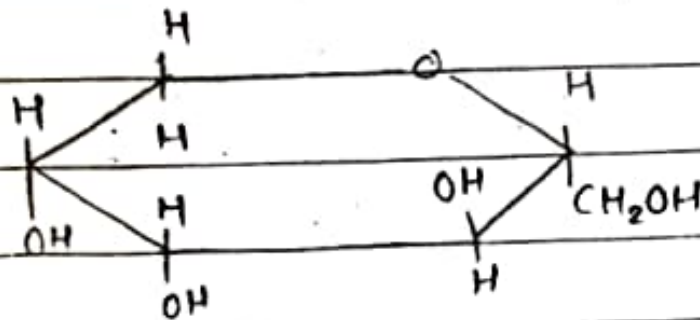
# Hexose SUGARS WITH PYRANOSE & FRUCTOSE CONFIGURATION.



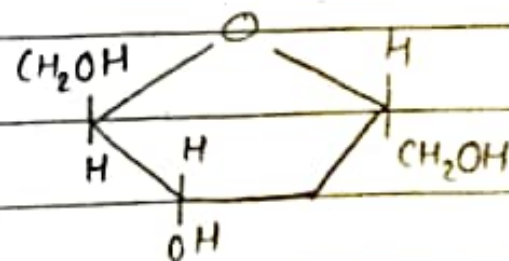
$\alpha$ -D-glucose.  
( $\alpha$ -D-glucopyranose)



$\beta$ -D-glucose.  
( $\beta$ -D-glucopyranose)



$\beta$ -D-fructose  
( $\beta$ -D-fructofuranose)

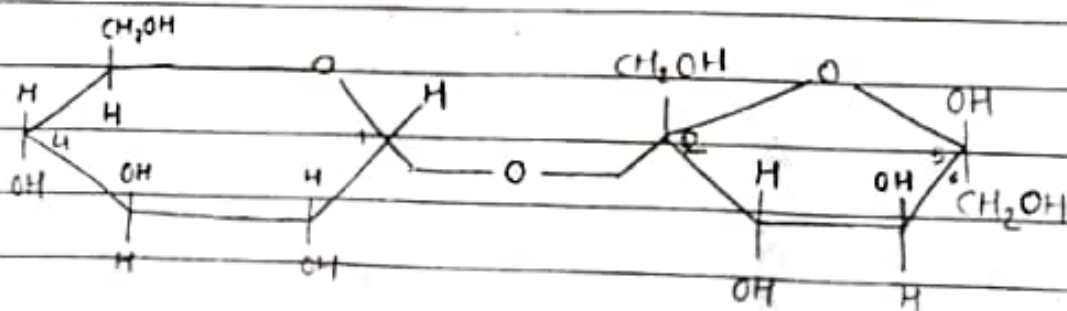
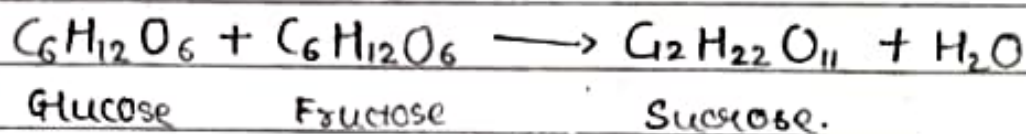


$\beta$ -D-fructose  
( $\beta$ -D-fructopyranose)

(B) Oligosaccharides :- (some) (Breakdown into monos.)  
 • These are carbohydrates which are formed by condensation of monosaccharides monomers.  
 • They are also soluble in water and are sweet in taste. Hence they are called 'sugar'.

(i) Disaccharides :- They are the smallest and the most common of the oligosaccharides, which are formed by the condensation of two monosaccharides monomers. e.g- sucrose, maltose, cellobiose, mellibiose, lactose etc.

- Sucrose is the commercial sugar (also called cane-sugar) and is the sweetest of all sugars.
- It is formed by the condensation of one molecule each of glucose and fructose.



( $\alpha$ -D-Glucopyranose 1:2- $\beta$ -D-fructofuranoside)

(a) Sucrose



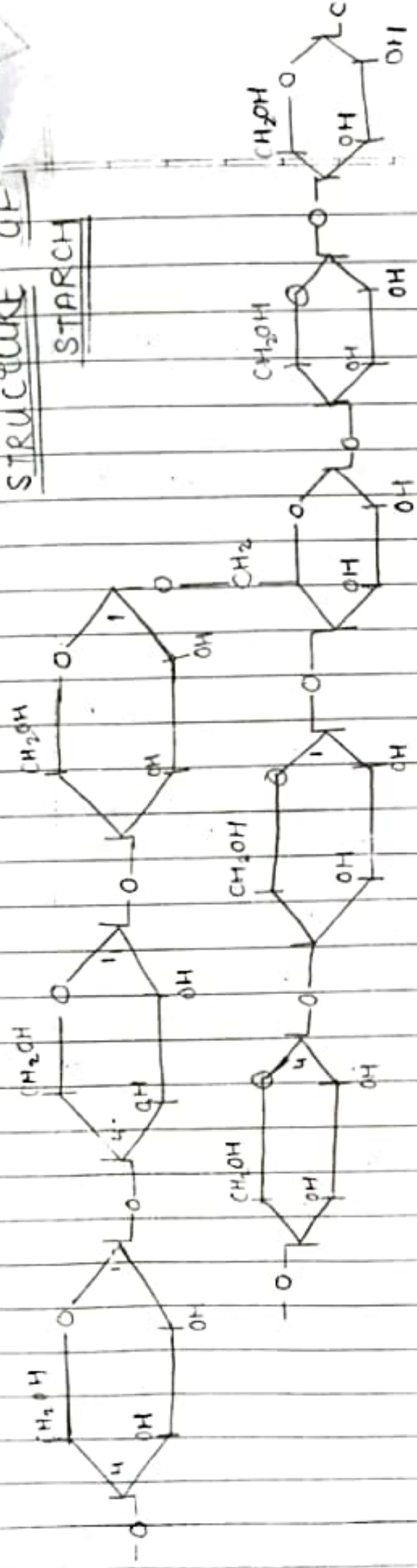
### (C) POLYSACCHARIDES :-

- (not sweet in taste)
- They are amorphous
- Insoluble in water
- Break down into monosac.
- They are complex carbohydrates, which are formed by the condensation or polymerisation of a large number of monosaccharides.
- monomers. [more than nine, but usually numerous]
- unlike sugars, they are not sweet.

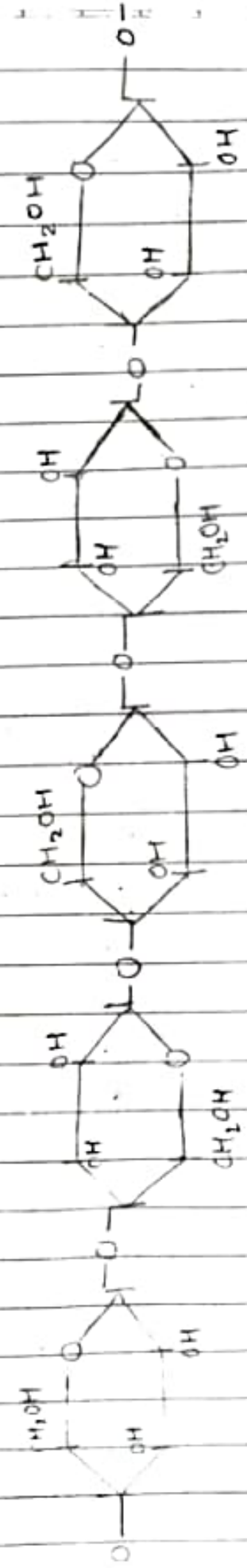
#### (i) Starch :-

- It is the product of plants, which occurs in the form of microscopic granules called starch grains.
- The starch grains may be rounded, oval, polygonal & rod shaped.
- They are formed inside chloroplast and leucoplast.

# STRUCTURE OF STARCH



# STRUCTURE OF CELLULOSE





(ii) Glycogen :- It is the polysaccharide food reserve of animals, bacteria and fungi. It is popularly called 'animal starch'. Chemically, it is similar to starch and has about 30,000 glucose residues arranged in a highly branched bush like-chain.

(iii) Cellulose :- It occurs in the cell wall of the majority of plants. It is the most abundant organic substance. Cellulose is a glucosan, which is made up of 5000 to 20,000  $\beta$ -D-glucose residues.

(iv) Chitin or Fungus Cellulose :- It is a complex polysaccharide which functions as the structural substance of fungal walls and ex-skeleton of arthropods. It consists of straight chain of large number of N-acetyl glucosamine.

- vii. Soap is manufactured from plants fats (previously from animal fat).

### Function of Carbohydrates :-

- i. Carbohydrates are the preferred source of energy for most of tissue in the body, including the nervous system and the heart.
- ii. Carbohydrates from the diet are converted into glucose, which can either be immediately used to as a source of energy or stored in the form of glycogen.
- iii. Carbohydrates are especially important for the normal functioning of the central nervous system, brain & red blood cells.
- iv. Glycolipids and glycoproteins are important for cell-cell interaction.

(v) Cellulose form major part of cell wall in plants  
(vi) Heparin prevents blood clotting inside blood vessels of animals  
(vii) Pectin salts function as filler substances in cell wall