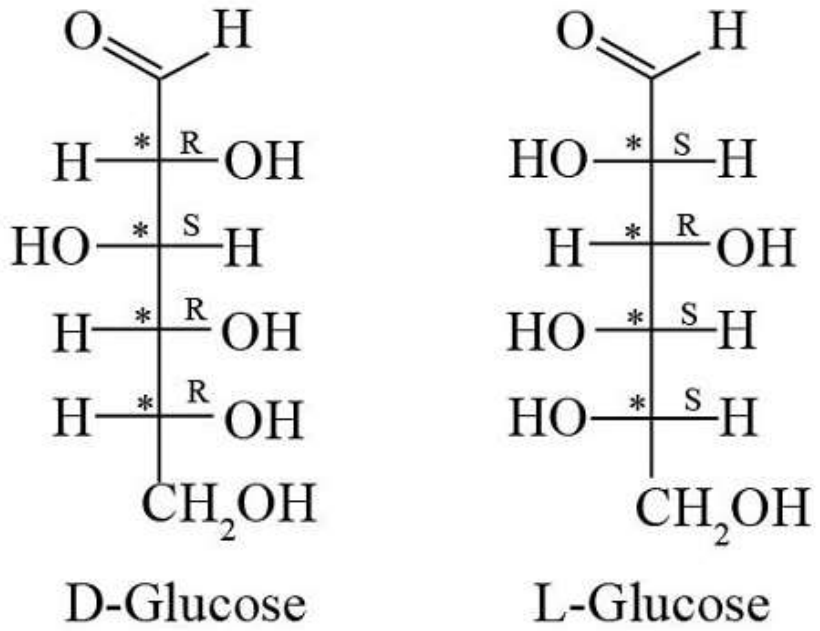
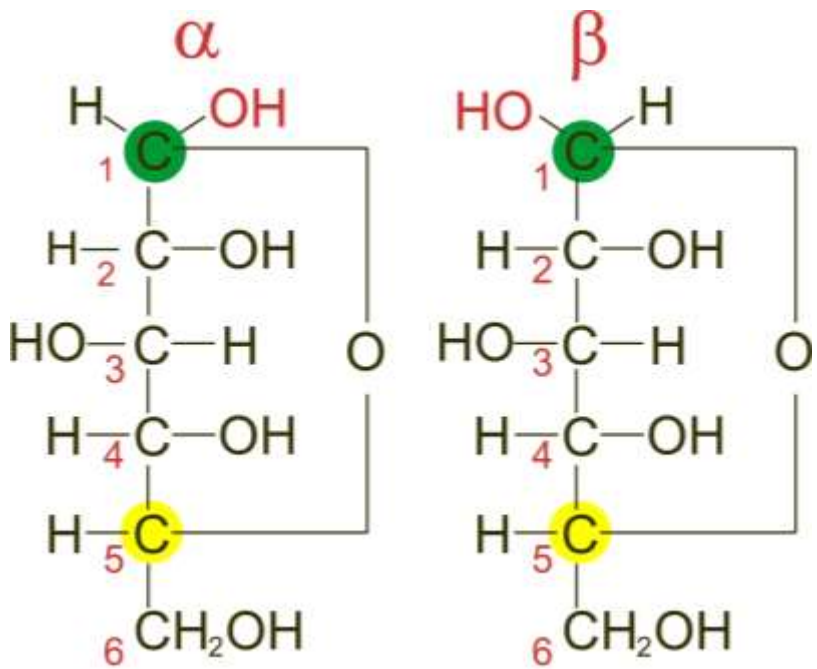
FYUG DSC-151
(Organic Chemistry-I)

UNIT-5 (Carbohydrates)

Configuration of Glucose

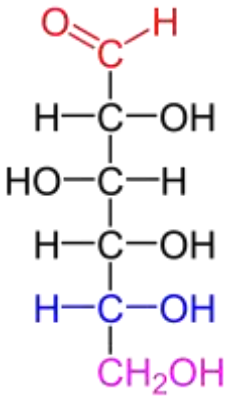


Anomers: Anomers are the cyclic monosaccharides which differ from each other only at the configuration of one carbon atom. For aldose it is C-1 and for ketose it C-2. Example: α-D-Glucose and β-D- Glucose

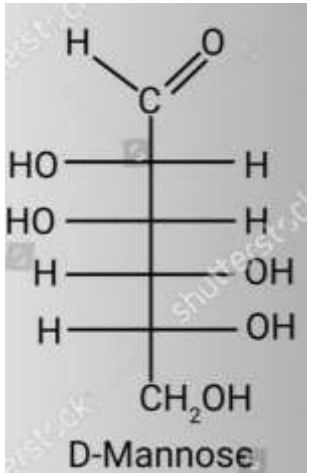


Epimers:

Epimers are diastereomers that contain more than one chiral center but differ from each other in the absolute configuration at only one chiral center. Example: D-Glucose and D-Mannose

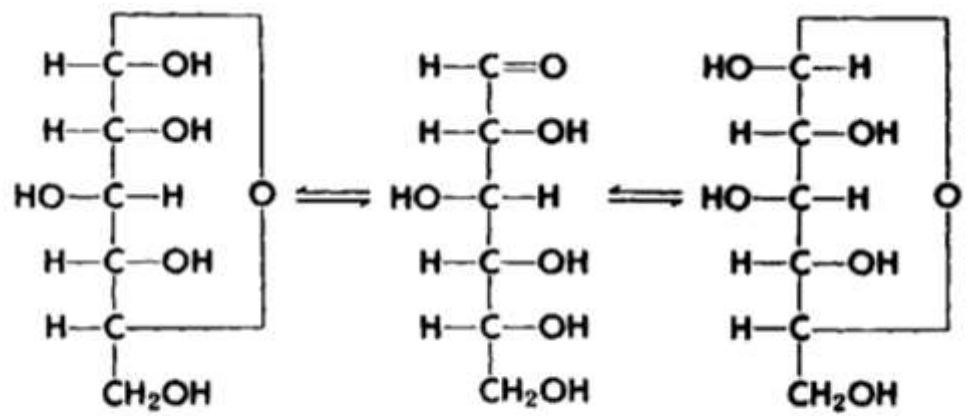


D-Glucose



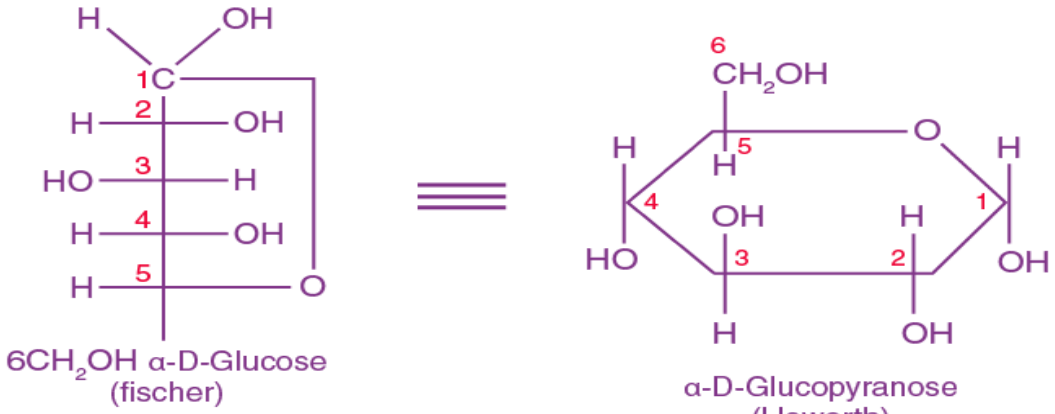
Mutarotation of Glucose:

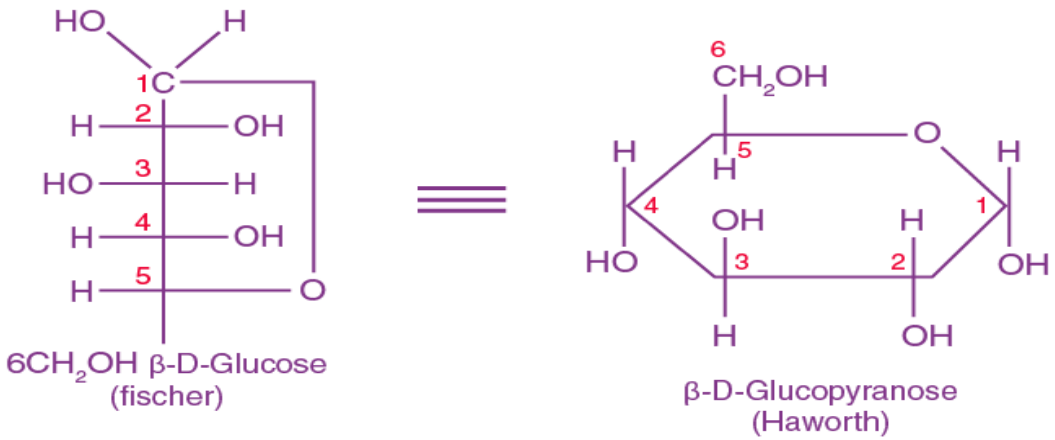
- When α or β form of D-Glucose is dissolved in water, after some time a gradual change in specific rotation is observed. The specific rotation of the α form falls and the β form increases until a constant value of +53° is reached.
- The change in optical rotation of the solution of either form of glucose until a constant value is obtained is called Mutarotation.



Haworth Representation

- Haworth introduces the hexagonal representations resembling the heterocycle pyran which contain five carbons and one oxygen in the ring. Thus, he claimed the name α-D-glucopyranose and β-D-glucopyranose for the hexagonal structures ofα-D-glucose and β-D-glucose





Killiani-Fischer Synthesis:

The Kiliani–Fischer synthesis lengthens the carbon chain of carbohydrates by adding one carbon to the aldehyde group of an aldose.

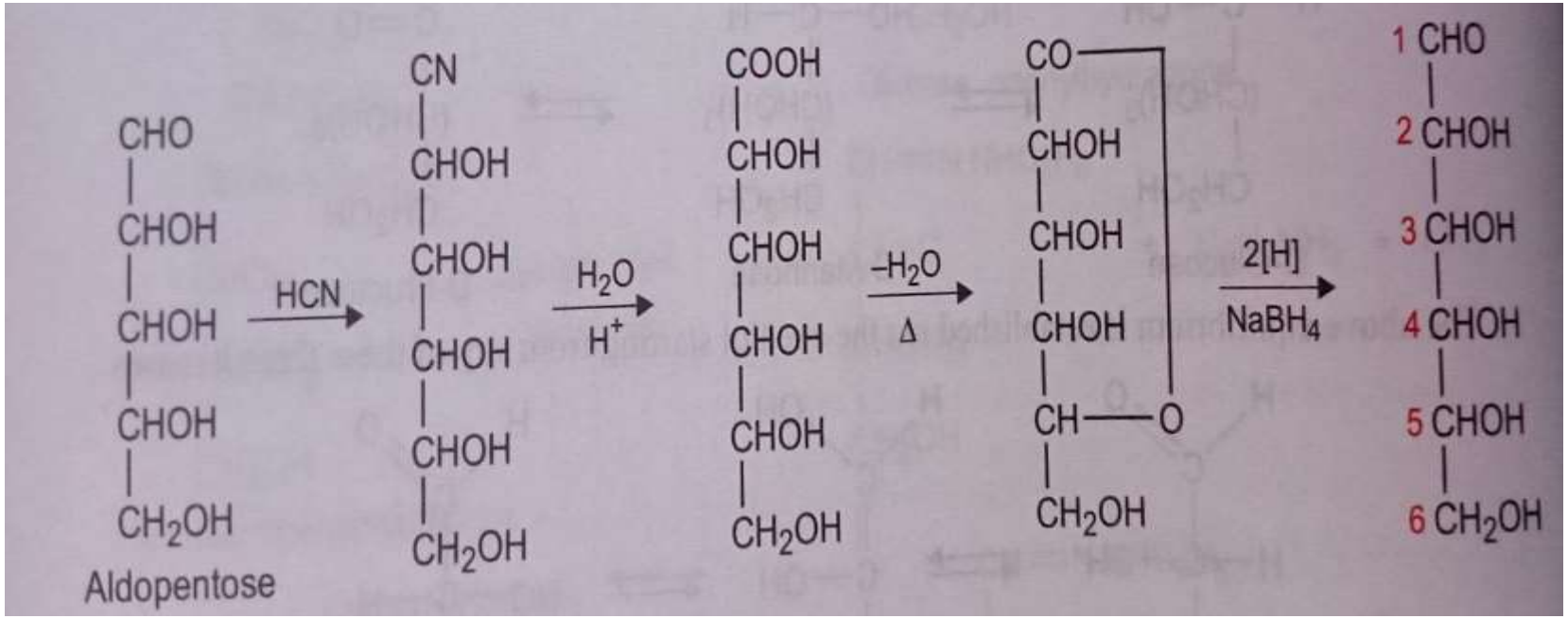
Steps:

Step 1: Formation of cyanohydrin

Step 2: Hydrolysis of -CN to -COOH to form aldonic acid

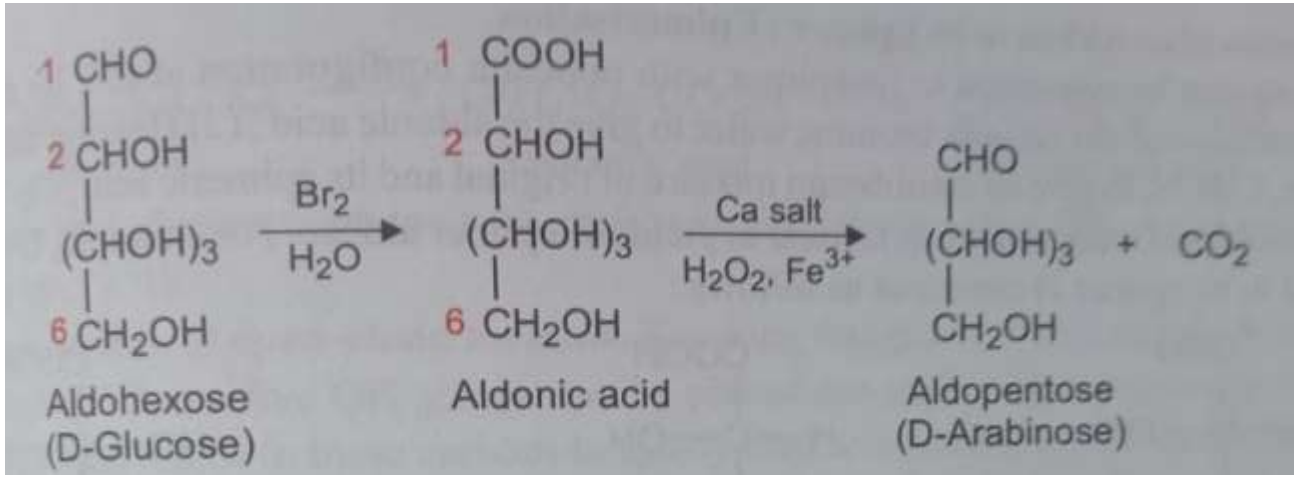
Step 3: Conversion of Aldonic acid to Lactone upon heating

Step 4: Reduction of lactone with sodium borohydride to get higher aldose



Ruff Degradation:

Ruff degradation is a reaction used to shorten the open chain forms of monosaccharides



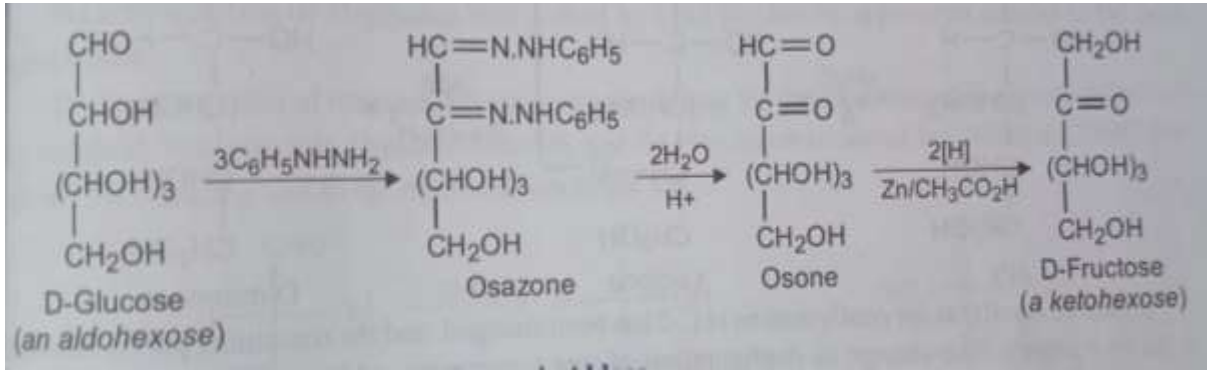
Steps:

Step 1: Oxidation of the aldose to aldonic acid with bromine water

Step 2: Oxidative decarboxylation of aldonic acid by treating the calcium salt with hydrogen peroxide in the presence of ferric sulphate catalyst

Conversion of Aldose to Ketose:

Steps:
Step 1: Formation of osazone by treating with excess phenylhydrazine
Step 2: Hydrolysis of osazone to Osone with dilute HCl
Step 3: Reduction of ozone to ketose with zinc and acetic acid, when –CHO is reduced in preference to the ketone group



Conversion of Ketose to Aldose:

Steps:
Step 1: Reduction of the carbonyl group to CHOH with Hydrogen in presence of Ni
Step 2: Oxidation of adjacent CH_2OH to CHO, with H_2O_2 in presence of ferric sulphate