

carbohydrates, proteins and nucleic acids are all polymers of a small, repeating chemical unit

Aldose vs ketose

Aldose

- carbonyl group is an **aldehyde** (-CHO) at C1, e.g. glucose
- gives a positive Tollens'/Fehling's test in its open-chain form
- e.g. glucose, an aldohexose (6 carbons, aldehyde)

Ketose

- carbonyl group is a **ketone** (C=O), usually at C2, e.g. fructose
- also reduces Tollens'/Fehling's reagent despite being a ketone, because base isomerises it to an aldose first
- e.g. fructose, a ketohexose (6 carbons, ketone)

both glucose and fructose are **REDUCING** sugars: fructose reduces Fehling's/Tollens' because under basic conditions it isomerises partly into an aldose before reacting

Classification of carbohydrates

- monosaccharide: cannot be hydrolysed to a simpler sugar, e.g. glucose, fructose, ribose
- oligosaccharide: hydrolyses to 2-10 monosaccharide units; a disaccharide (sucrose, maltose, lactose) hydrolyses to exactly two
- polysaccharide: hydrolyses to many monosaccharide units, e.g. starch, cellulose, glycogen; usually not sweet and not reducing
- reducing sugar: free -CHO , or anomeric -OH that opens to one, reduces Tollens'/Fehling's
- sucrose is the one common **NON-reducing** disaccharide: both anomeric carbons locked in the glycosidic bond



Tollens' test, positive

a reducing sugar deposits metallic silver when warmed with Tollens' reagent, seen here settled at the bottom

Glucose: cyclic structure and glycosidic bond



cyclic hemiacetal, C1 becomes the anomeric carbon

$\alpha\text{D-glucose} \rightleftharpoons \beta\text{D-glucose}$

sucrose glycosidic linkage, glucose C1 to fructose C2

glucose(C1)-O-fructose(C2)

mutarotation



alpha and beta glucose interconvert in solution through the open-chain form, differing only in the C1 -OH orientation

alpha and beta glucose differ only in the orientation of the C1 -OH ; they interconvert in solution through the open-chain form, called mutarotation

the anomeric carbon is the tell: free, it reduces Fehling's; locked into a glycosidic bond on both sides (as in sucrose), it can't