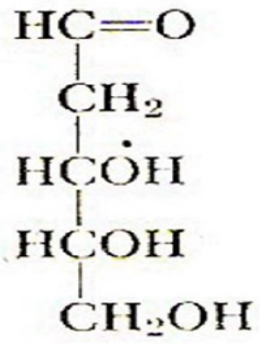
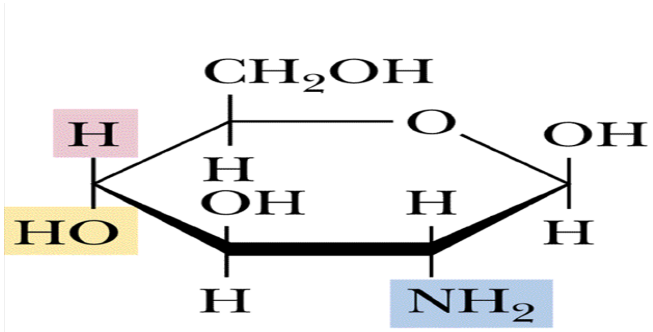
Deoxy Sugars and Amino Sugars

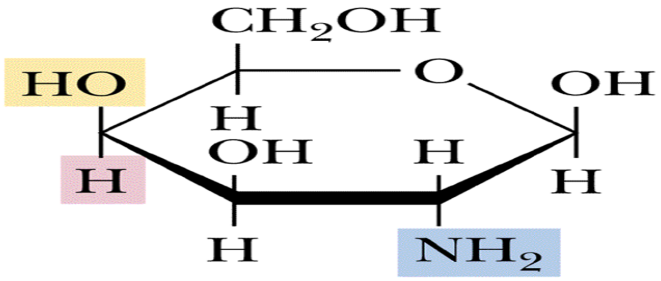
- one quite ubiquitous deoxy sugar is 2'-deoxy ribose which is the sugar found in DNA.



الريبوز المنقوص
الاوكسجين - D



β-D-Glucosamine



β-D-Galactosamine

Reducing Sugars

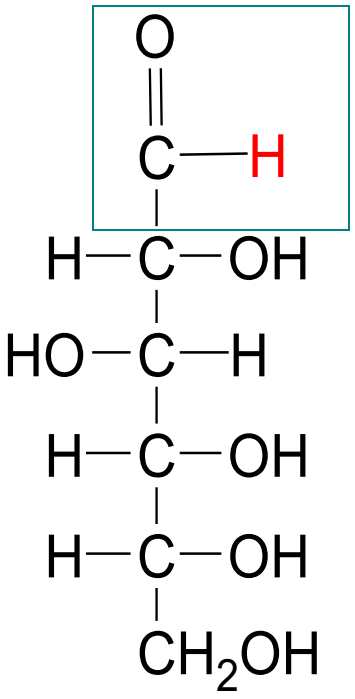
Reducing sugars

- Are monosaccharides with a carbonyl group that oxidizes to give a carboxylic acid.
- Undergo reaction with Benedict's reagent (Cu^{2+}) to give the corresponding carboxylic acid.
- Include the monosaccharides glucose, galactose, and fructose.

Oxidation reactions

- Aldoses may be oxidized to 3 types of acids
- Aldonic acids: aldehyde group is converted to a carboxyl group
- Uronic acids: aldehyde is left intact and primary alcohol at the other end is oxidized to COOH
- Saccharic acids (glycaric acids) – oxidation at both ends of monosaccharide)

Oxidation of D-Glucose

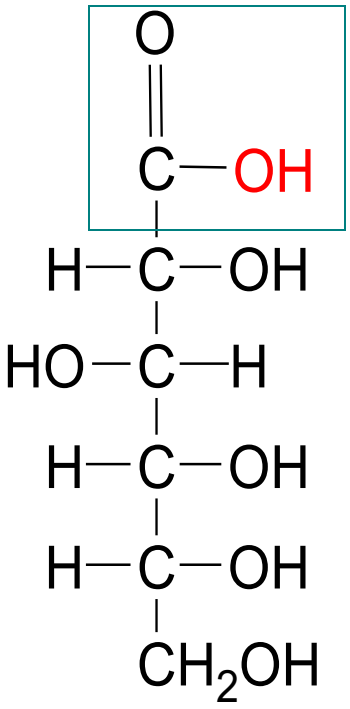


D-glucose

Benedicts reagent

+ Cu^{2+}

[O]



D-gluconic acid

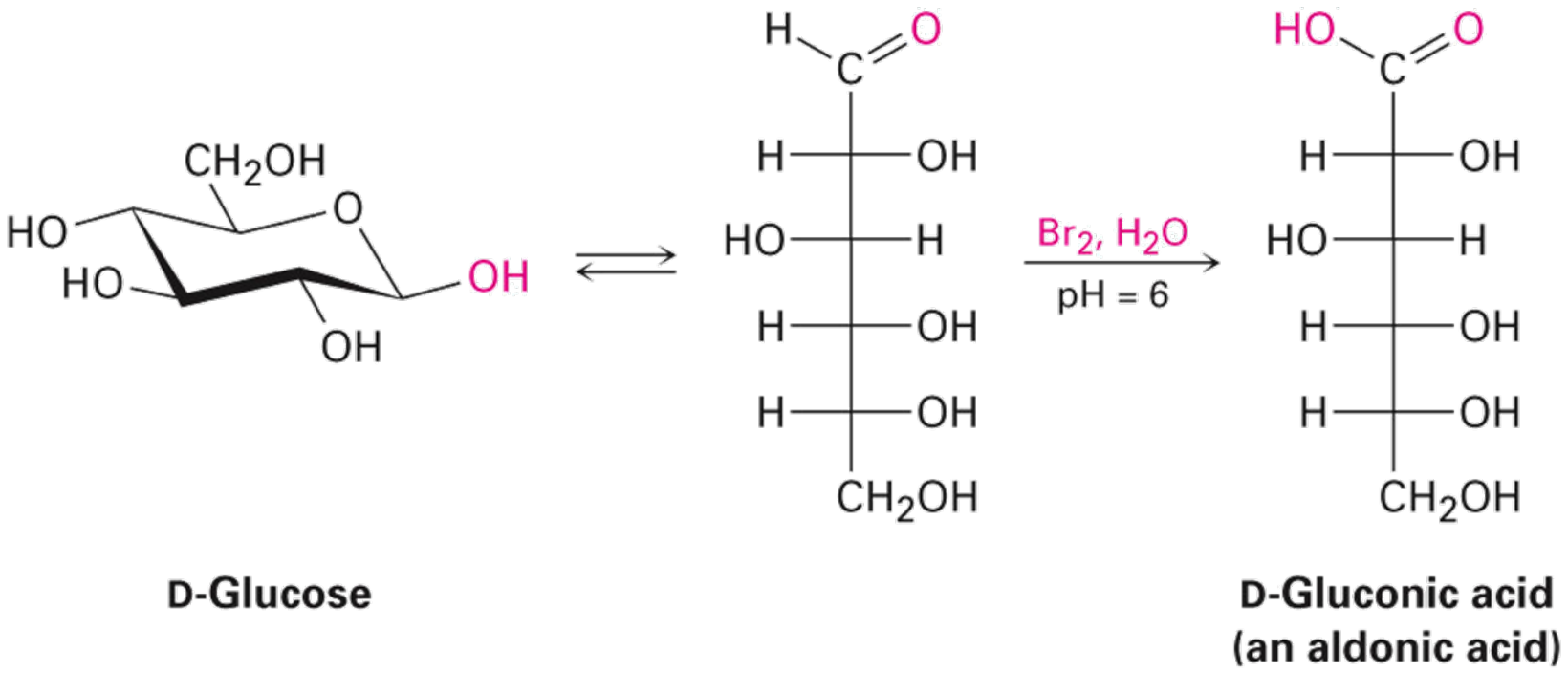
Glucose is oxidized to a carboxylic acid

+ $Cu_2O(s)$

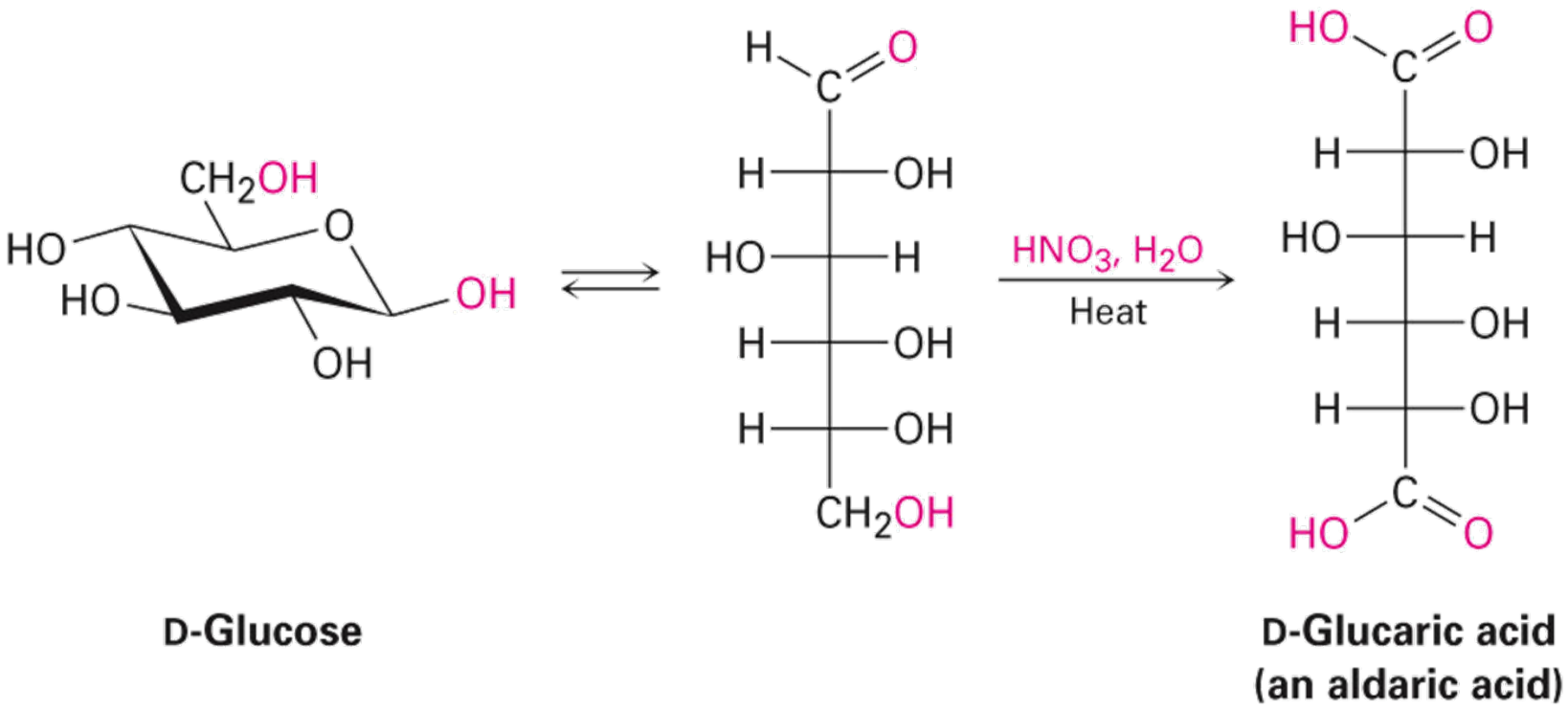
Cu^+ (reduced form)

Glucose is a reducing sugar

Br2 is a mild oxidant that gives good yields of aldonic acid products



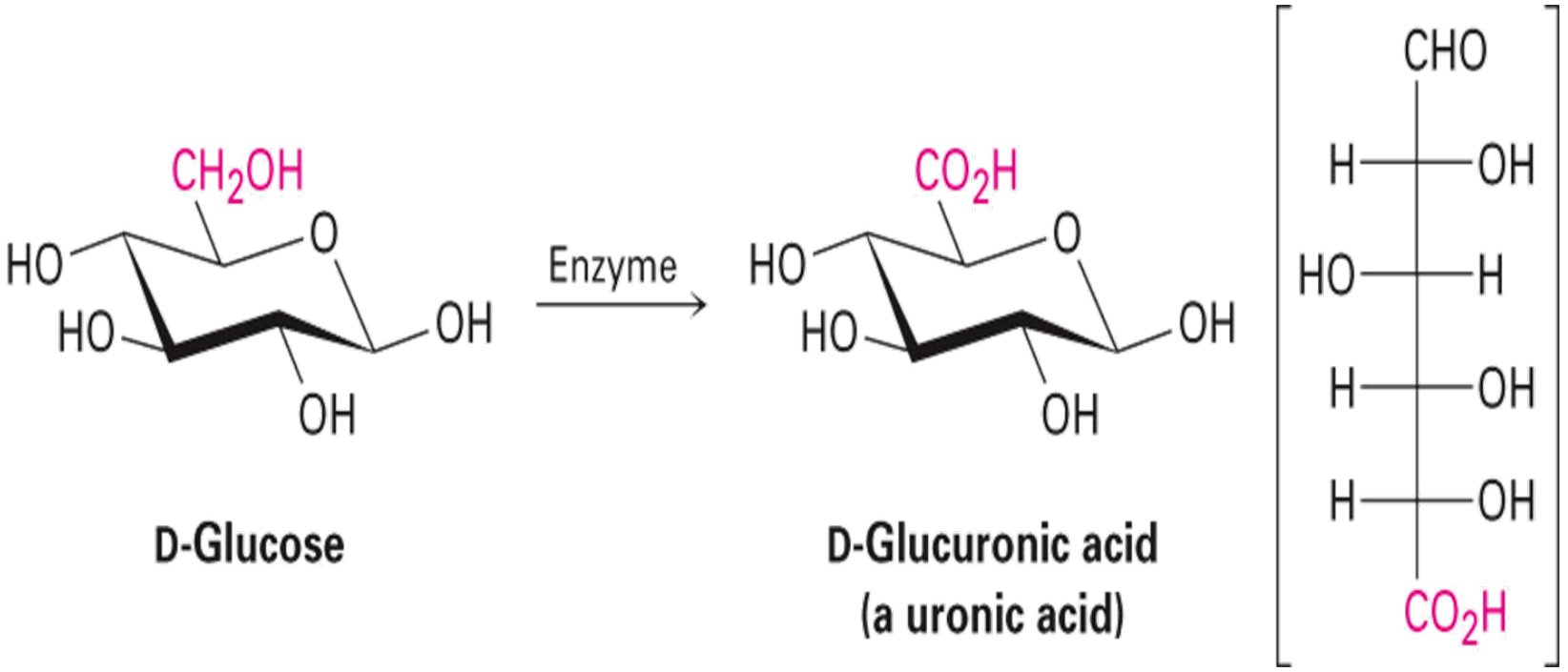
Aldoses are oxidized in warm, dilute HNO3 to dicarboxylic acids called aldaric acids



D-Glucose

D-Glucaric acid
(an aldaric acid)

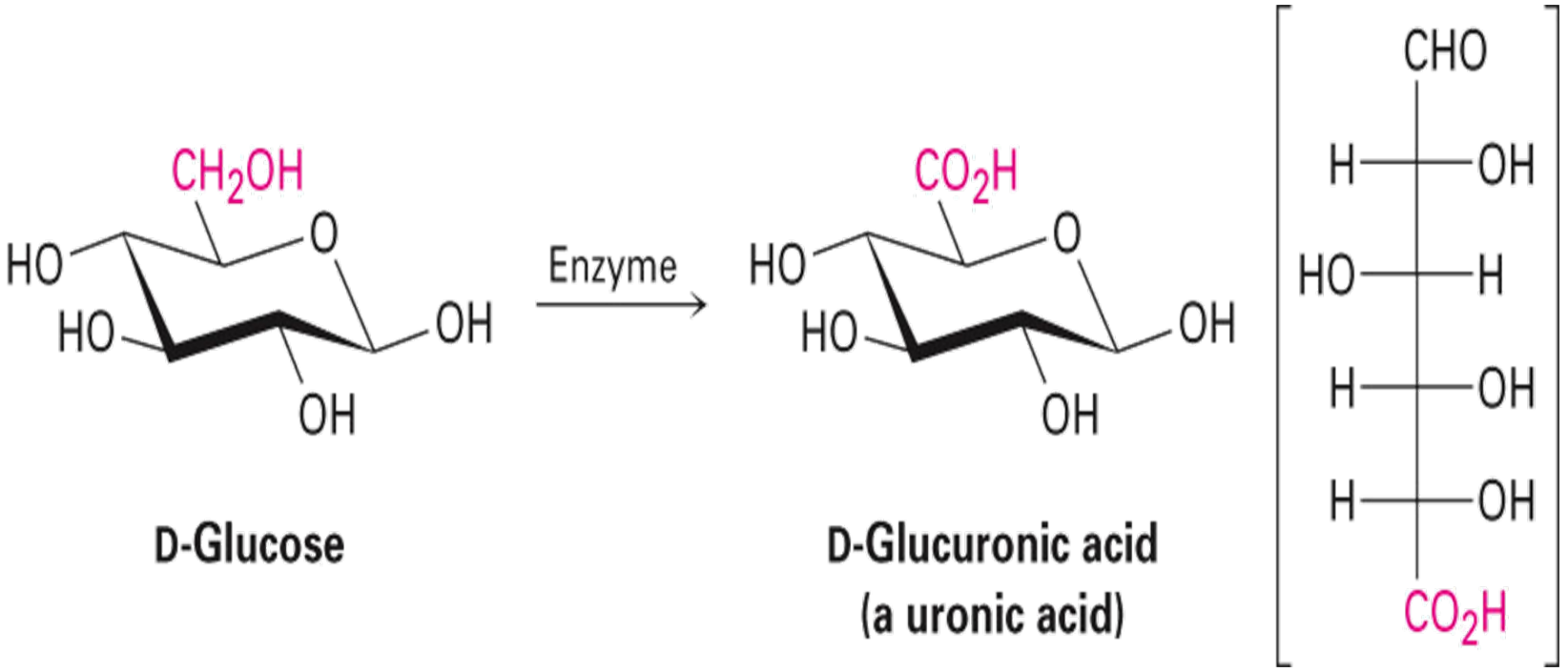
Enzymatic oxidation at the –CH2OH end of aldoses yields uronic acids



D-Glucose

D-Glucuronic acid
(a uronic acid)

Enzymatic oxidation at the –CH2OH end of aldoses yields uronic acids



D-Glucose

D-Glucuronic acid
(a uronic acid)

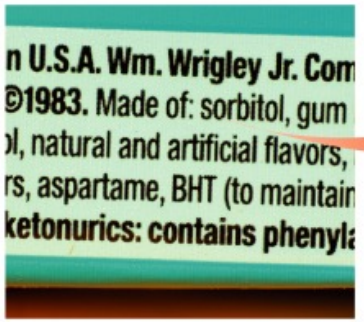
Reduction of Monosaccharides

The reduction of monosaccharides

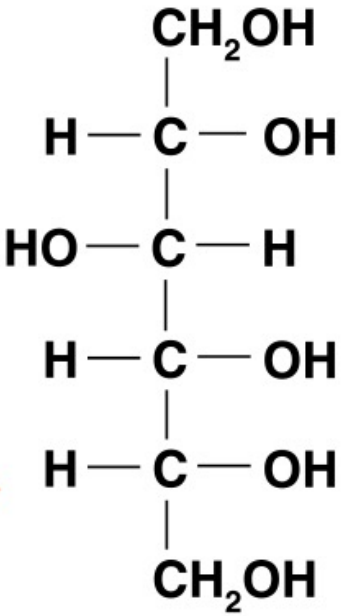
- Involves the carbonyl group.
- Produces sugar alcohols called *alditols.*
- Such as D-glucose gives D-glucitol also called sorbitol.
- Learning Check

Write the products of the oxidation and reduction of

D-mannose.

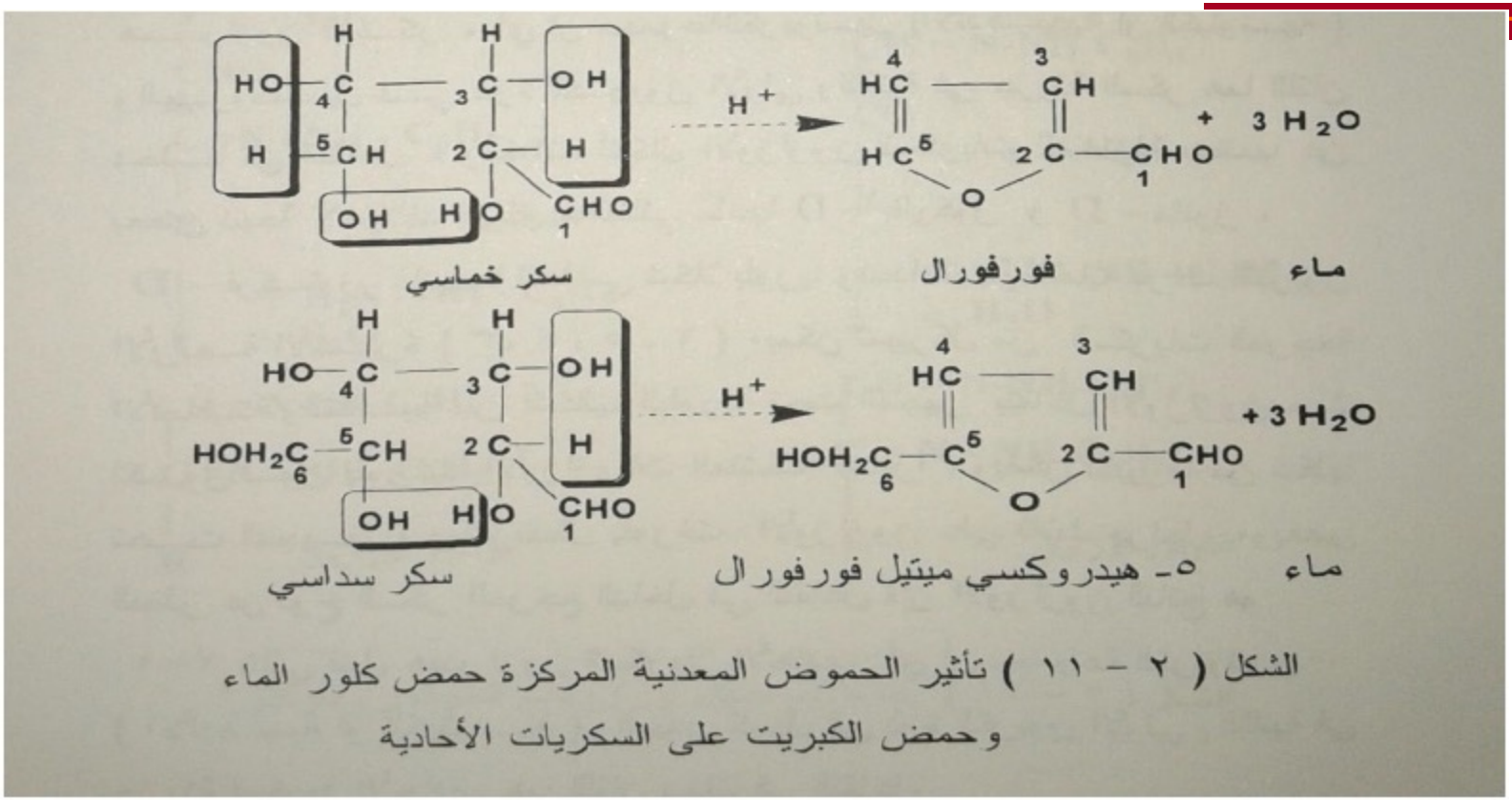


D-Glucitol



D-Sorbitol

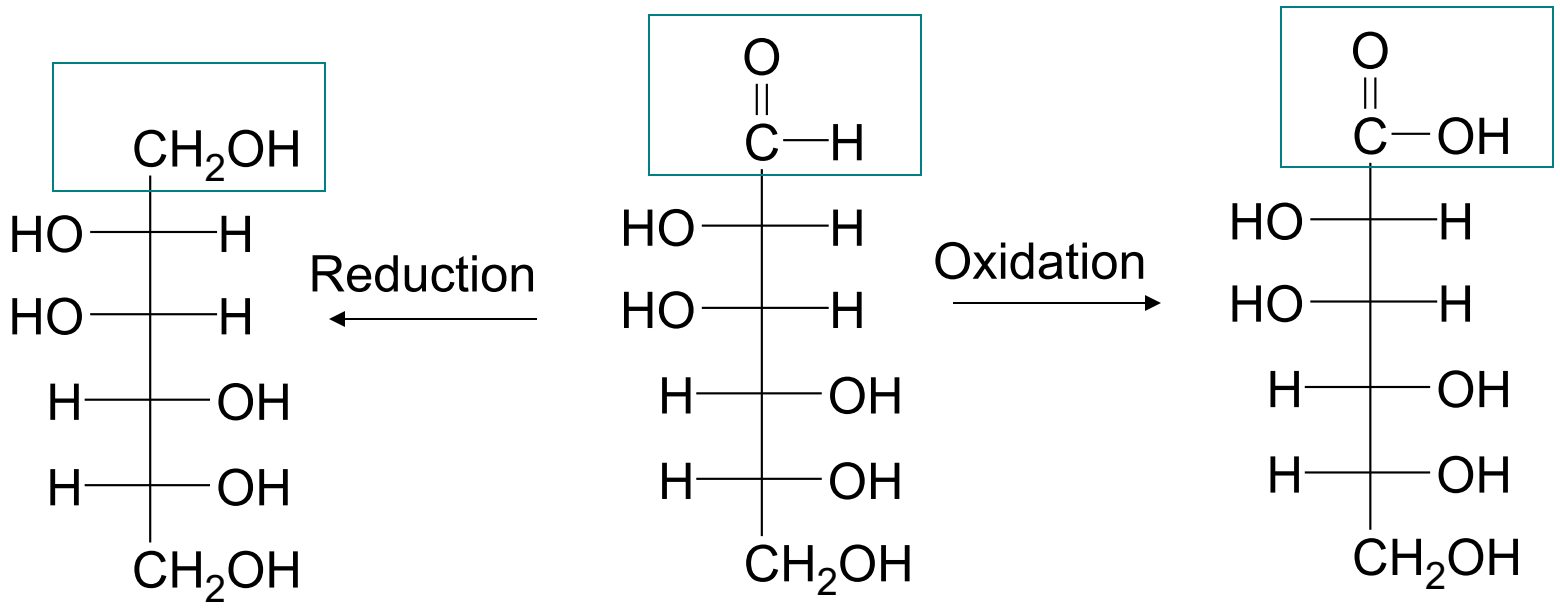
Effect of acids :



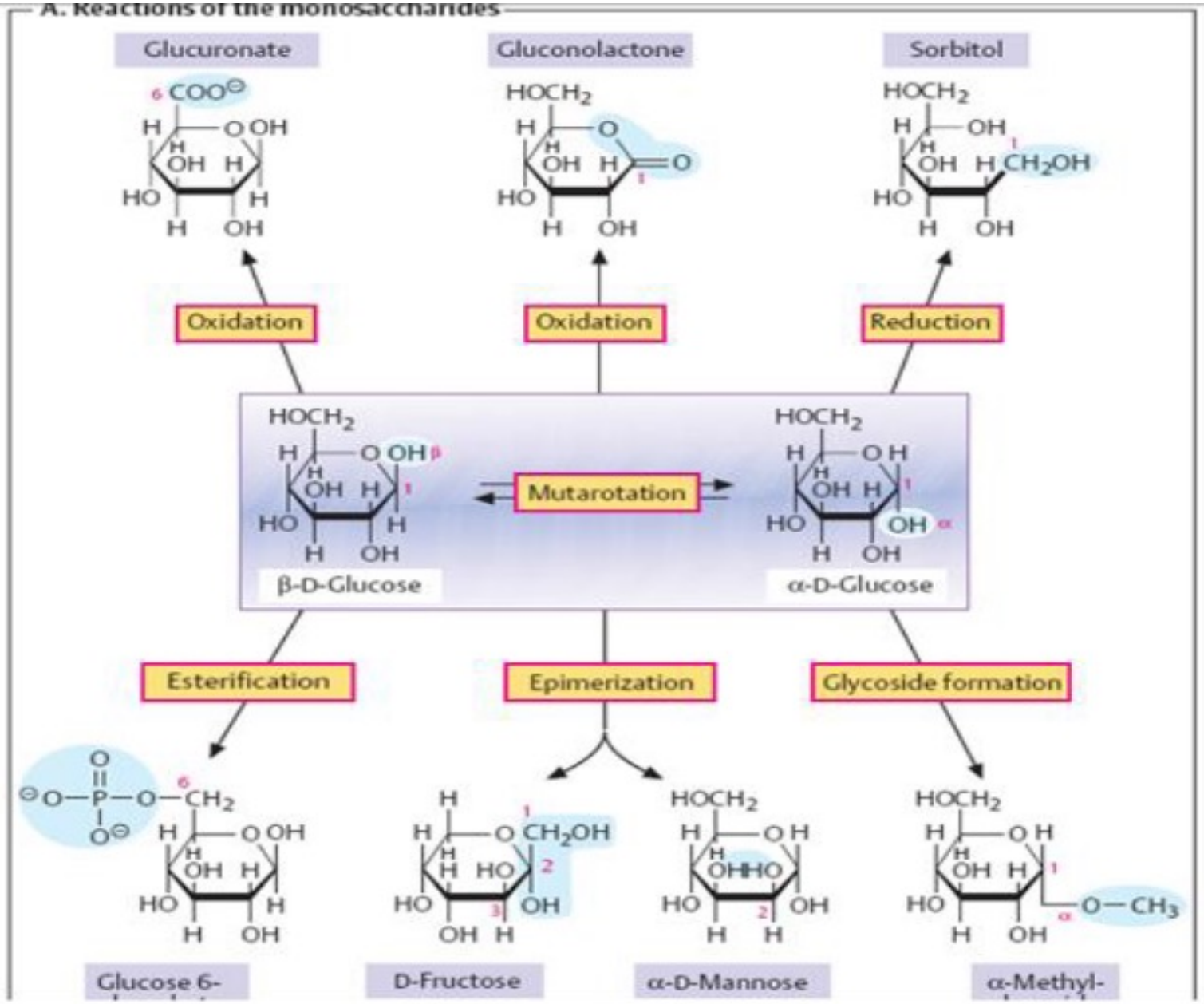
الشكل (٢ - ١١) تأثير الحموض المعدنية المركزة حمض كلور الماء وحمض الكبريت على السكريات الأحادية

Learning Check

****Write the products of the oxidation and reduction of D-mannose.



D-mannitol D-mannose D-mannonic acid


A. Reactions of the monosaccharides
Glucuronate
Gluconolactone
Sorbitol
Oxidation
Oxidation
Reduction
Mutarotation
β-D-Glucose
α-D-Glucose
Esterification
Epimerization
Glycoside formation
Glucose 6-
D-Fructose
α-D-Mannose
α-Methyl-

Important Disaccharides

A disaccharide

- Consists of two monosaccharides.

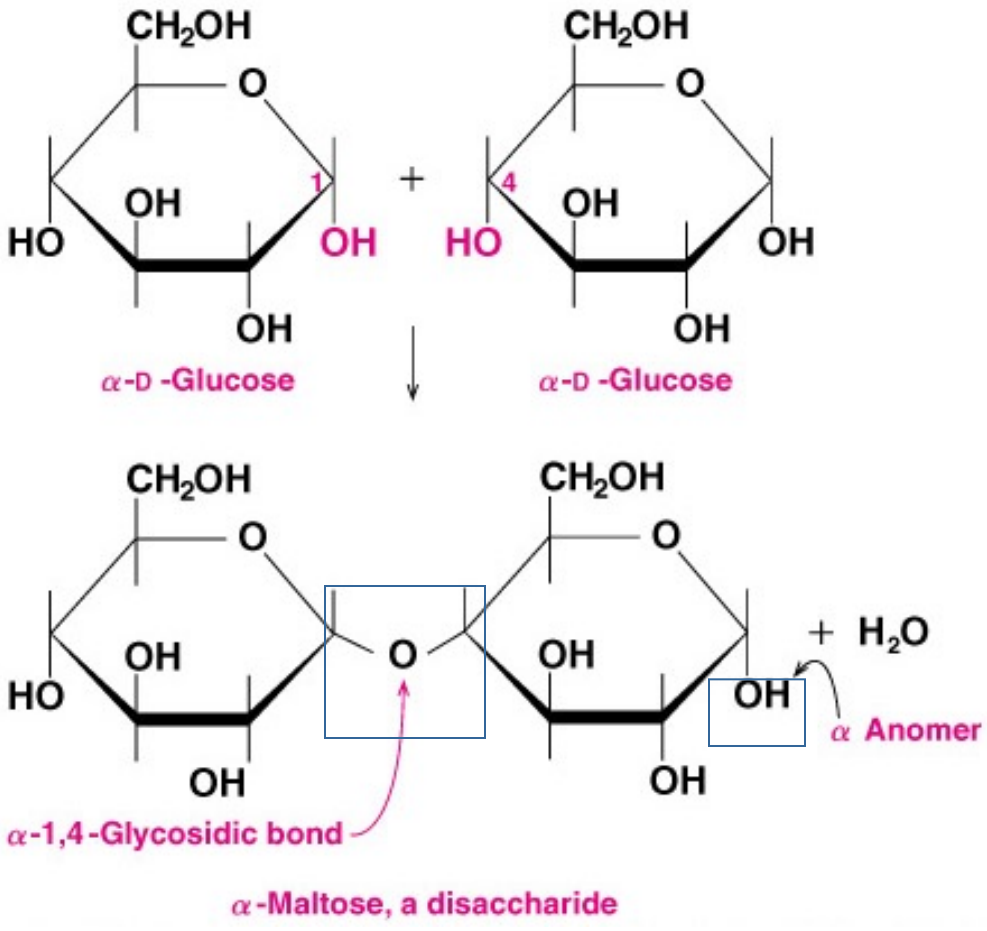
Monosaccharides		Disaccharide
Glucose + glucose	→	maltose + H_2O
Glucose + galactose	→	lactose + H_2O
Glucose + fructose	→	sucrose + H_2O

Maltose

Maltose is

- A disaccharide also known as *malt sugar.*
- Composed of two D-glucose molecules.
- Obtained from the hydrolysis of starch.
- Linked by an α-1,4-glycosidic bond formed from the α –OH on C1 of the first glucose and –OH on C4 of the second glucose.
- Used in cereals, candies, and brewing.
- Found in both the α- and *β* - forms.

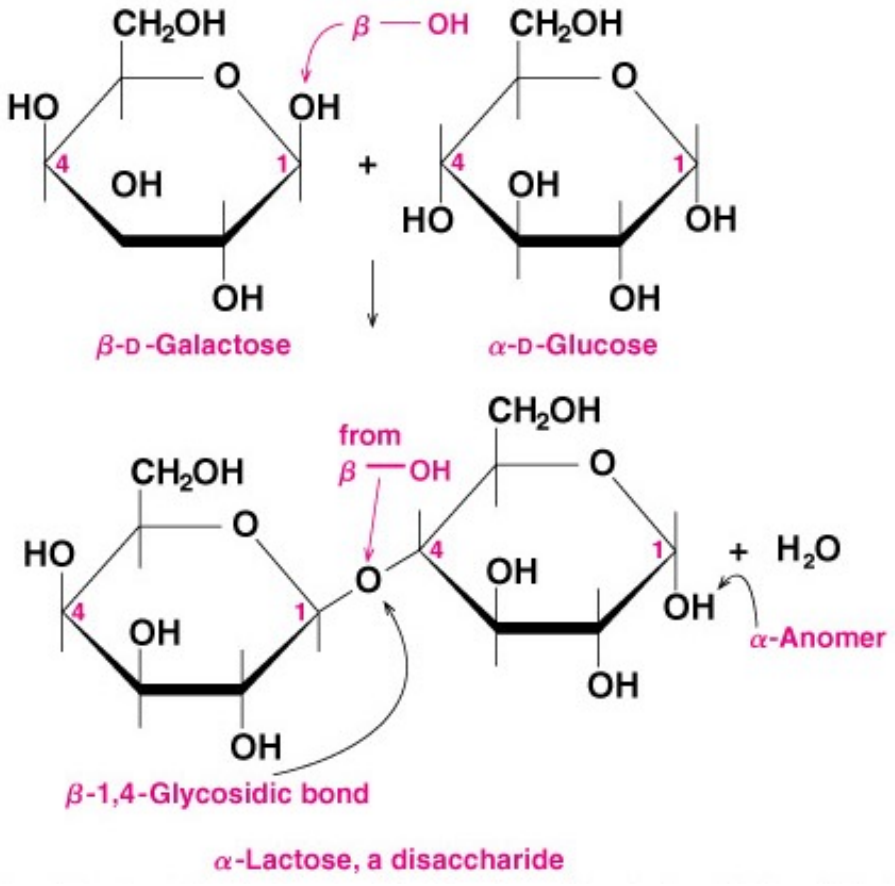
Formation of Maltose



Lactose

Lactose

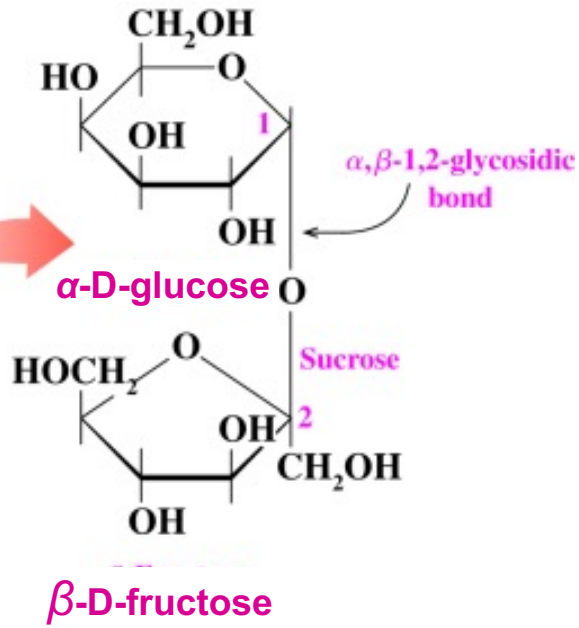
- Is a disaccharide of *β*-D-galactose and *α- or β*-D-glucose.
- Contains a *β* -1,4-glycosidic bond.
- Is found in milk and milk products.



Sucrose

Sucrose or *table sugar*

- Is obtained from sugar cane and sugar beets.
- Consists of *α*-D-glucose and *β*-D-fructose..
- Has an *α,β*-1,2-glycosidic bond.



Learning Check

***Write the structures and names of the two monosaccharides that form when sucrose is hydrolyzed.

****Identify the monosaccharides in each of the following:

A. lactose

(1) α-D-glucose (2) β-D-fructose (3) β-D-galactose

B. maltose

(1) α-D-glucose (2) β-D-fructose (3) β-D-galactose

C. sucrose

(1) α-D-glucose (2) β-D-fructose (3) β-D-galactose