



CARBOHYDRATES



Since-1981

Dr. MANISH RAO
Deptt.-CHEMISTRY

Carbohydrate

Compounds contain C, H, O with
general formula of $C_m(H_2O)_n$

All have C=O and -OH functional groups

Classified based on

Size of base carbon chain

Number of sugar unit

Location of C=O group

Stereochemistry

Types of Carbohydrates

Classification based on the number of sugar units in the total chain

Monosachcarides

Disaccharides

Trisachcarides

Oligosaccharides

Polysaccharides

Single sugar unit

Two sugar units

Three sugar units

up to 10/13/ sugar units

> 13 sugar units

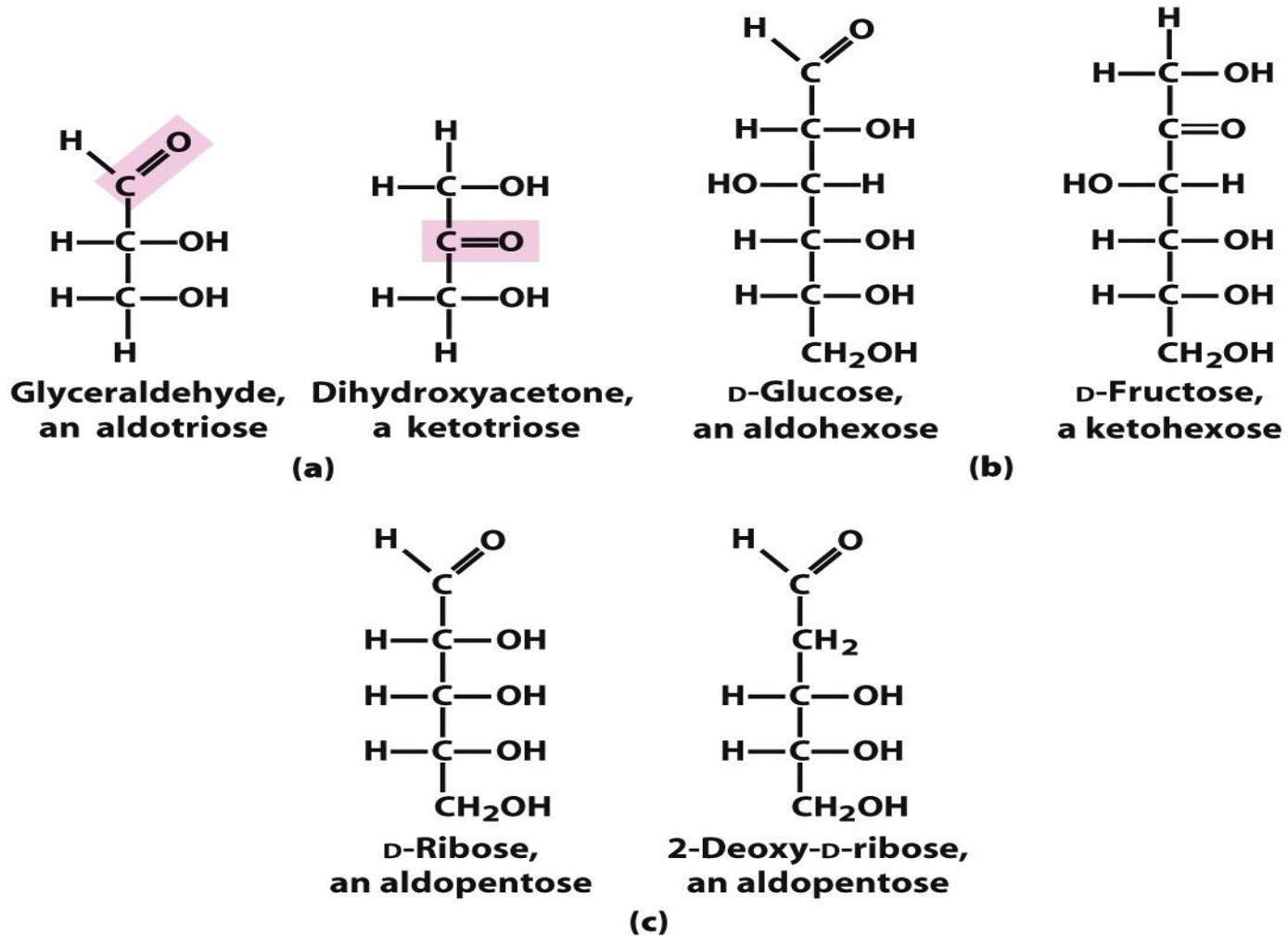
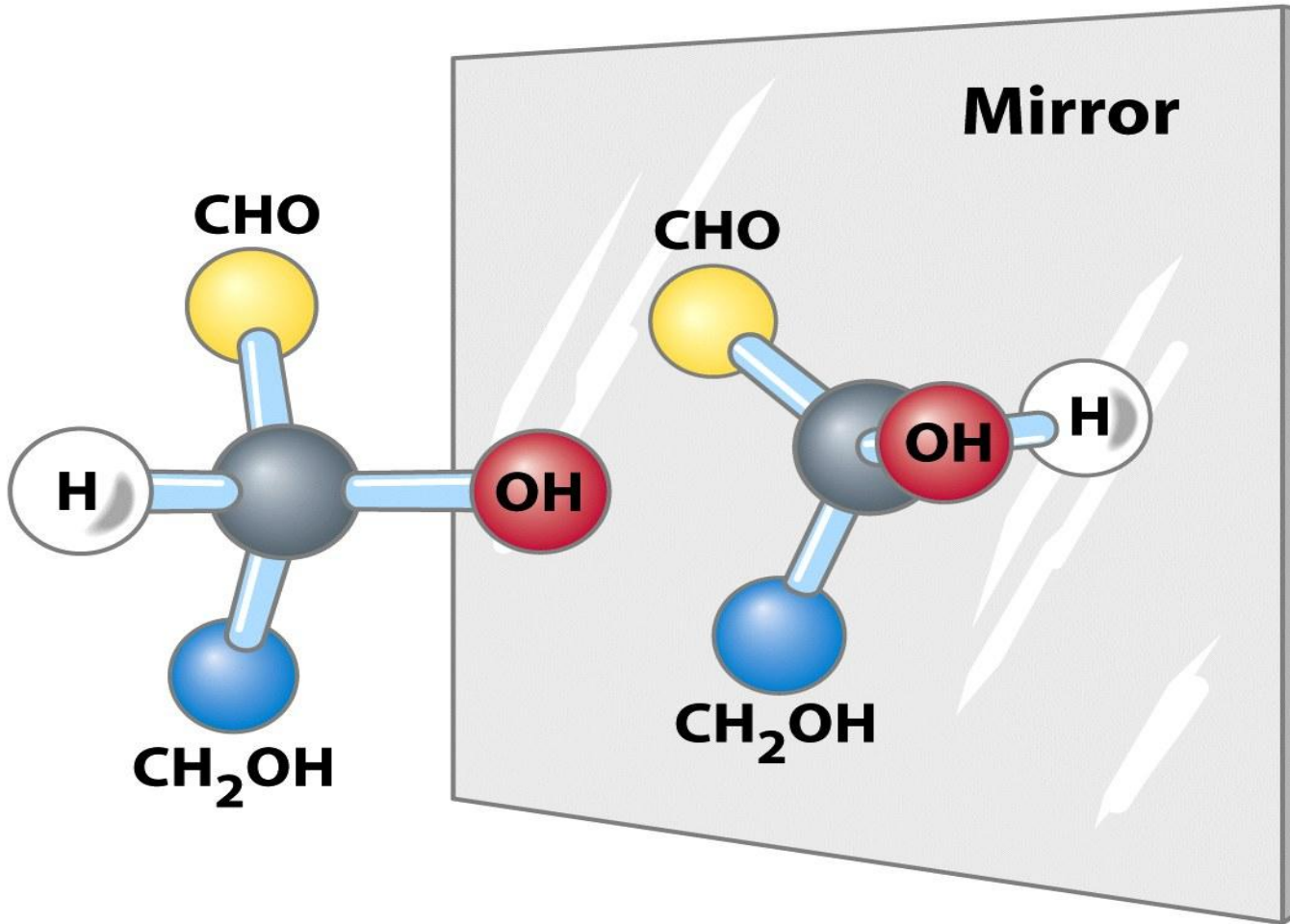


Figure 7-1
Lehninger Principles of Biochemistry, Fifth Edition
 © 2008 W. H. Freeman and Company

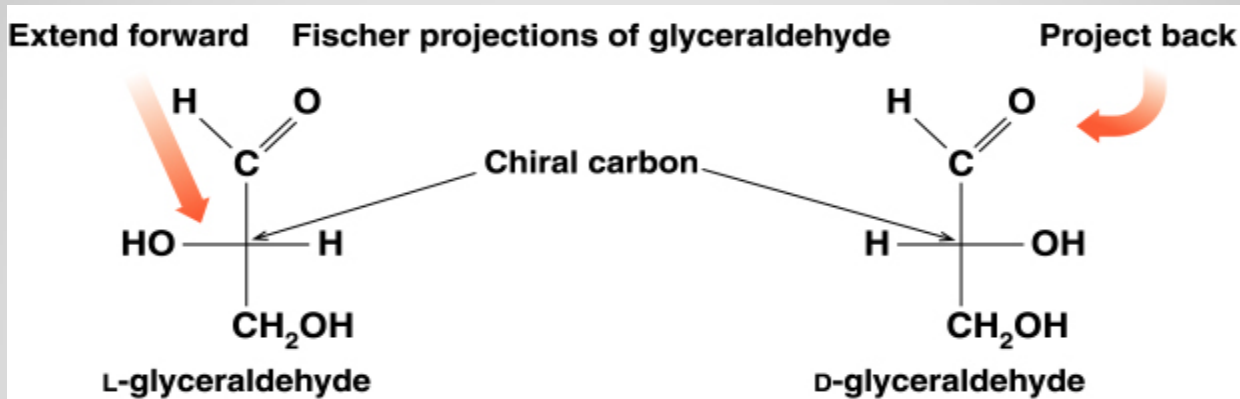


Ball-and-stick models

Figure 7-2 part 1
Lehninger Principles of Biochemistry, Fifth Edition
© 2008 W. H. Freeman and Company

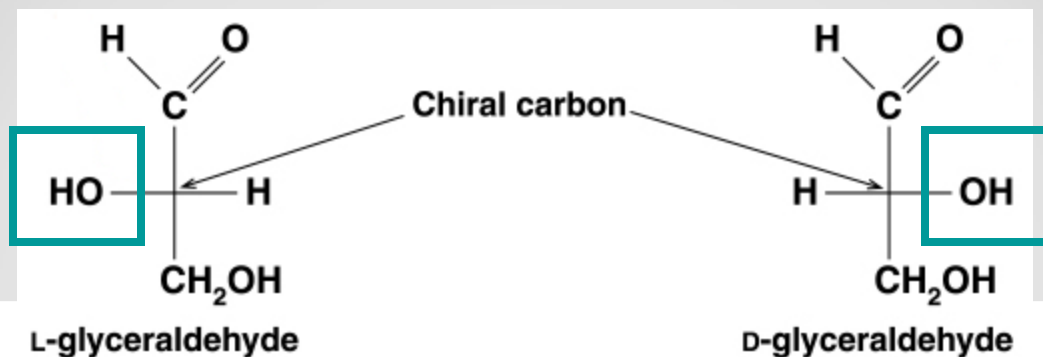
Fischer Projections

- Used to represent carbohydrates (chiral carbons)
- Places the most oxidized group at the top (C1)
- Uses horizontal lines for bonds that come forward
- Uses vertical lines for bonds that go back



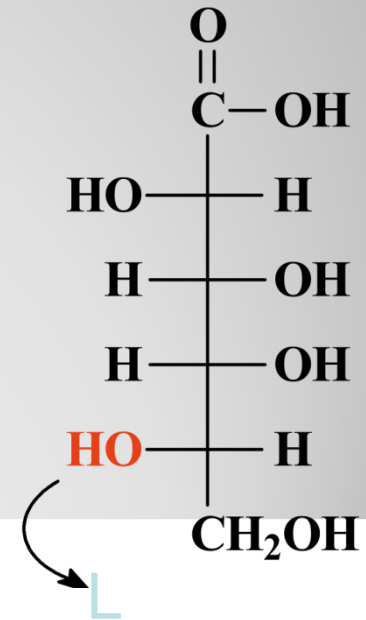
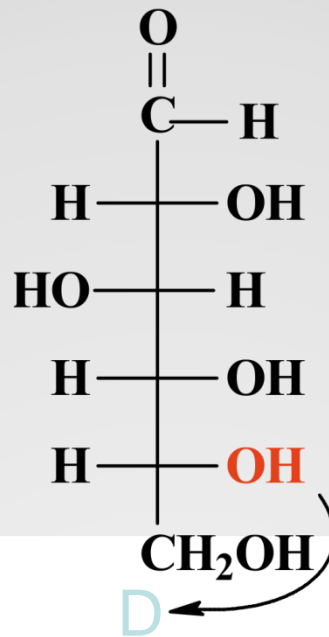
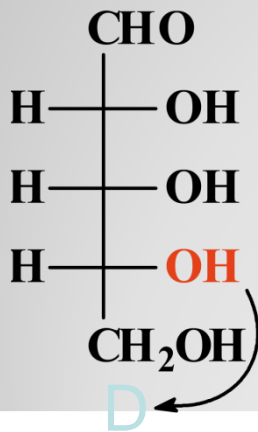
D and L Notations

- By convention, the letter **L** is assigned to the structure with the —OH on the left
- The letter **D** is assigned to the structure with —OH on the right



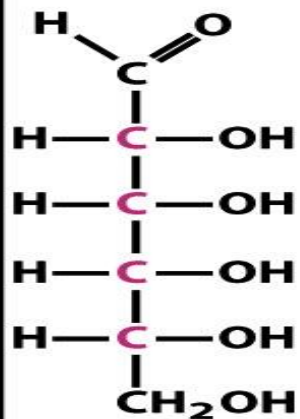
D and L Monosaccharides

- ▣ Stereochemistry determined by the asymmetric center farthest from the carbonyl group
- ▣ Most monosaccharides found in living organisms are D

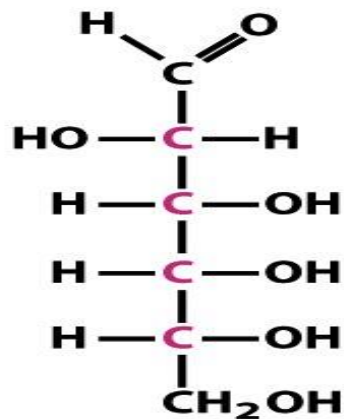


D-Aldoses

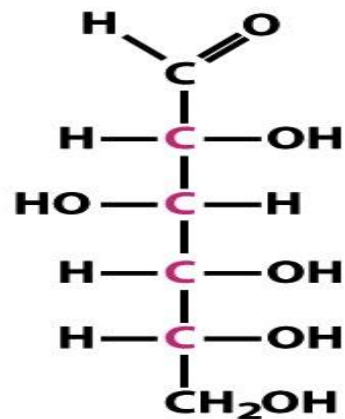
Six carbons



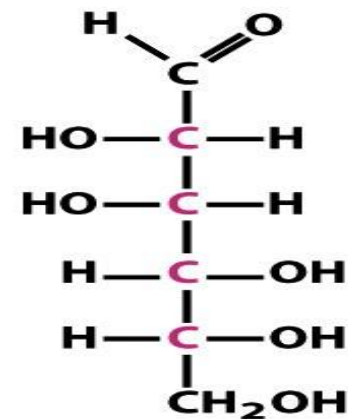
D-Allose



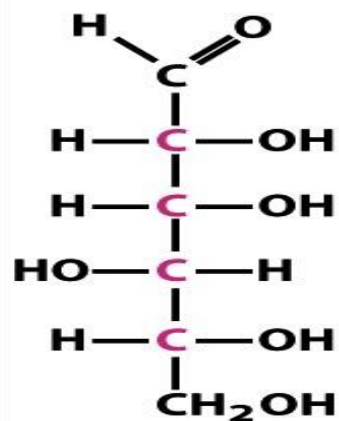
D-Altrose



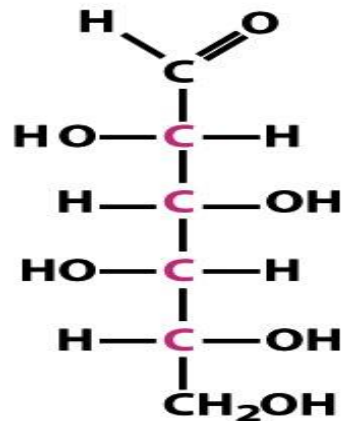
D-Glucose



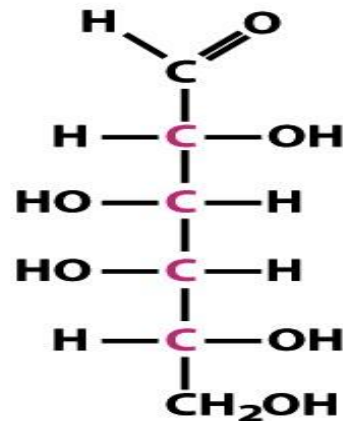
D-Mannose



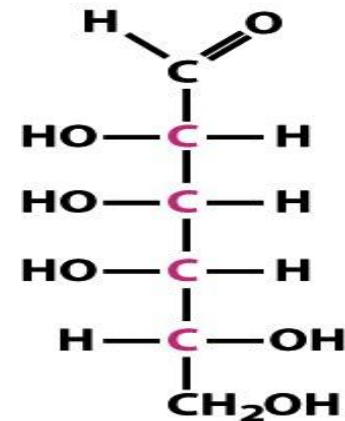
D-Gulose



D-Idose



D-Galactose



D-Talose

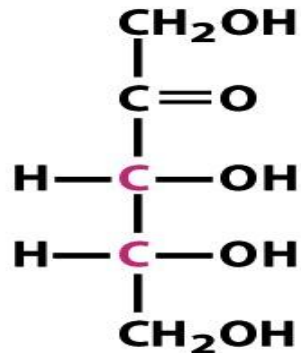
Figure 7-3a part 3

Lehninger Principles of Biochemistry, Fifth Edition

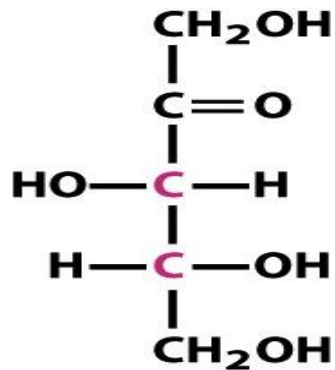
© 2008 W. H. Freeman and Company

D-Ketoses

Five carbons

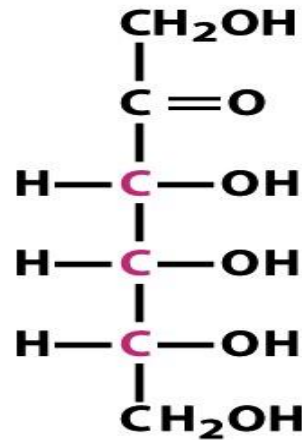


D-Ribulose

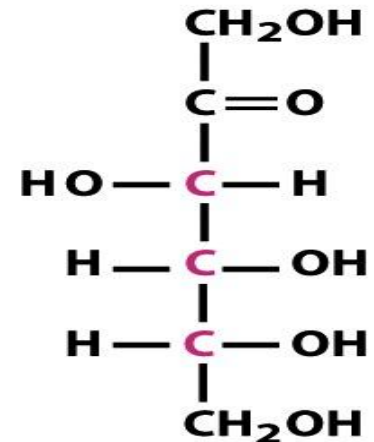


D-Xylulose

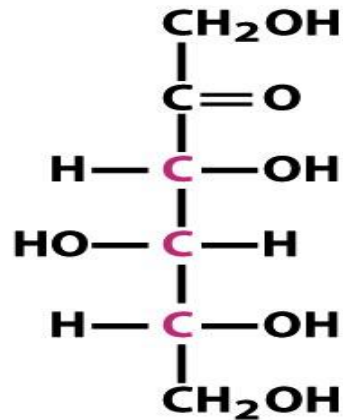
Six carbons



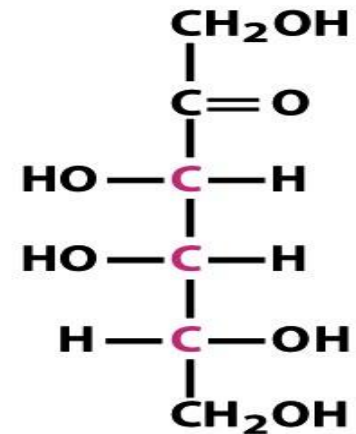
D- Psicose



D-Fructose



D-Sorbose



D-Tagatose

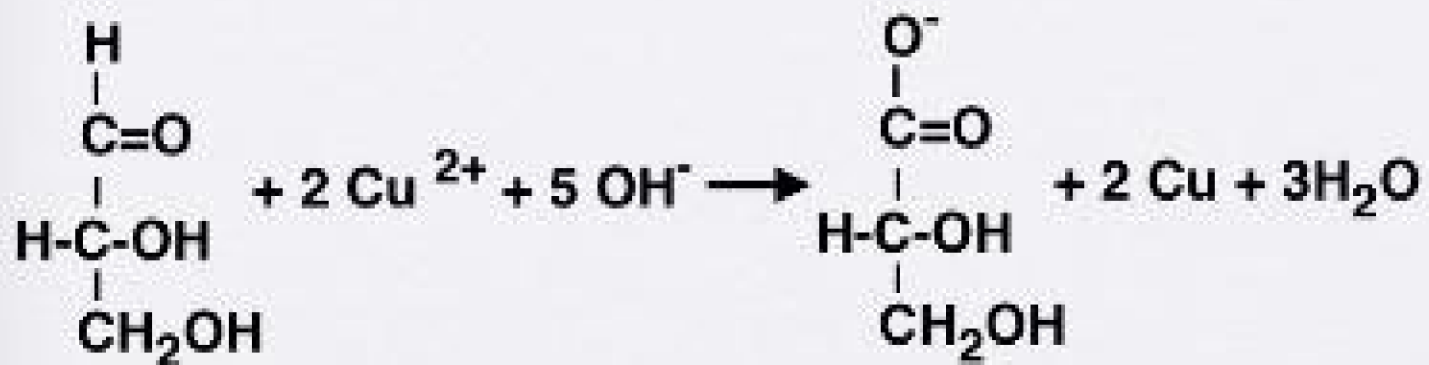
Figure 7-3b part 2

Lehninger Principles of Biochemistry, Fifth Edition

© 2008 W. H. Freeman and Company

Reducing sugars

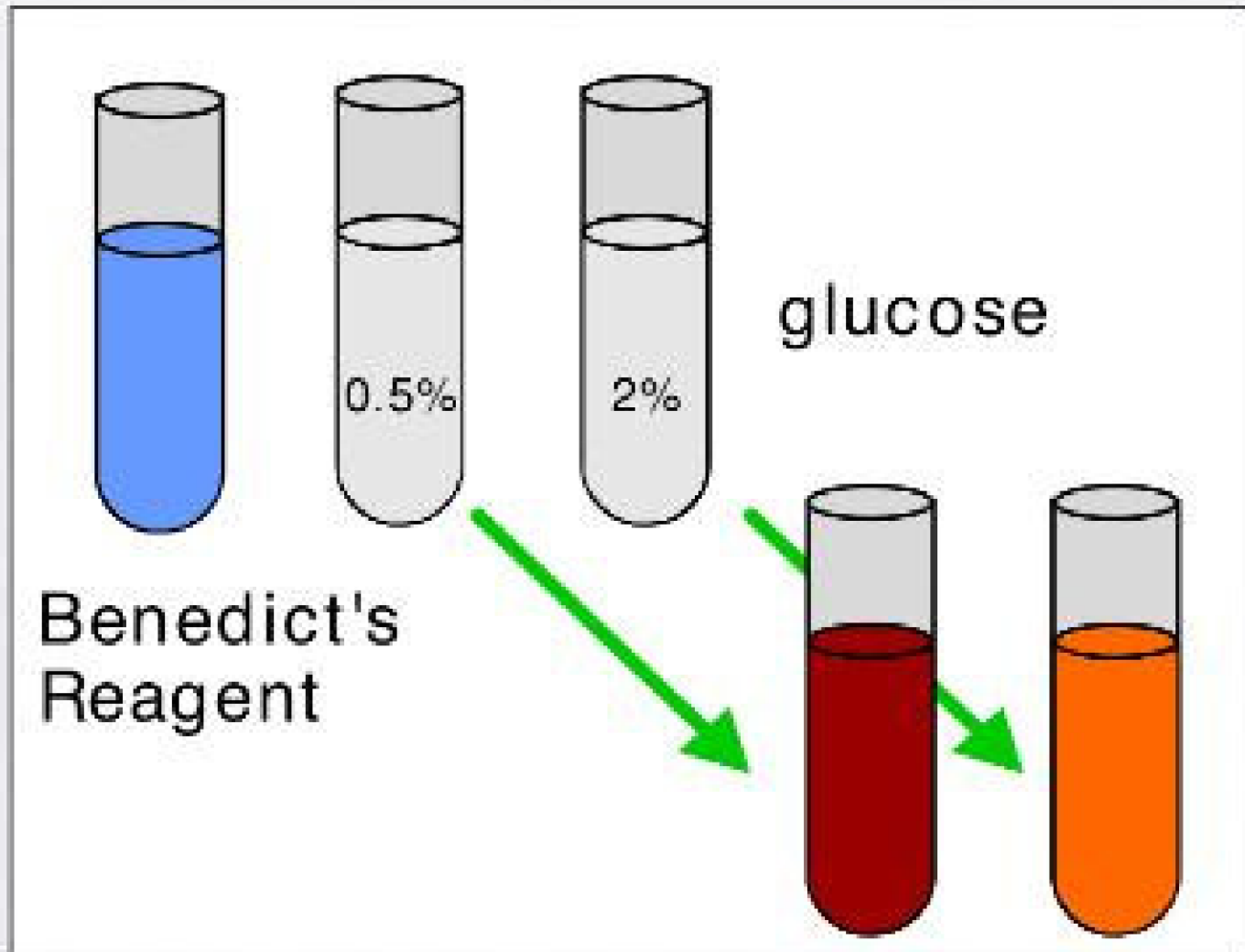
Aldehyde sugars are readily oxidized and will react with Benedict's reagent.



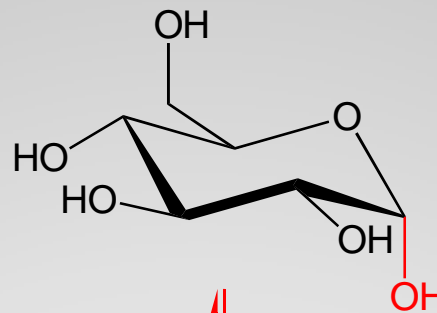
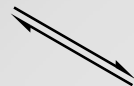
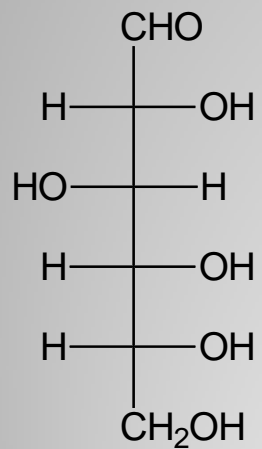
This provides a good test for presence of glucose in urine. You get a red precipitate.

Other tests - Tollen's or Fehling's solutions.

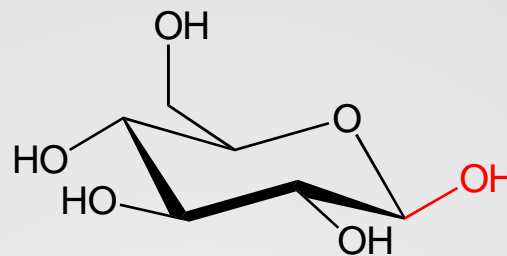
Benedict's reagent



Cyclization of D-glucose



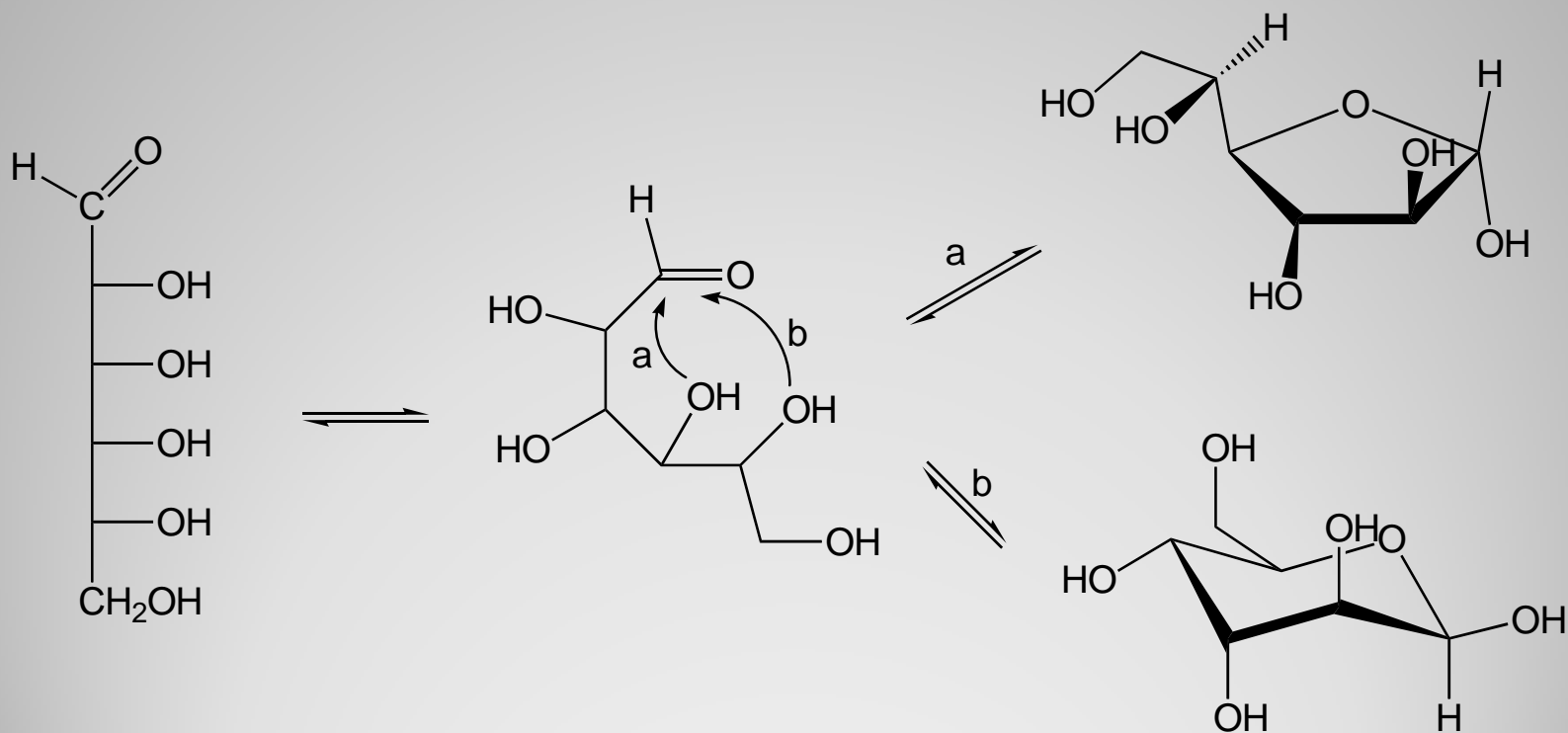
α -D-glucose



β -D-glucose

Intramolecular Cyclization

Chain can bend and rotate



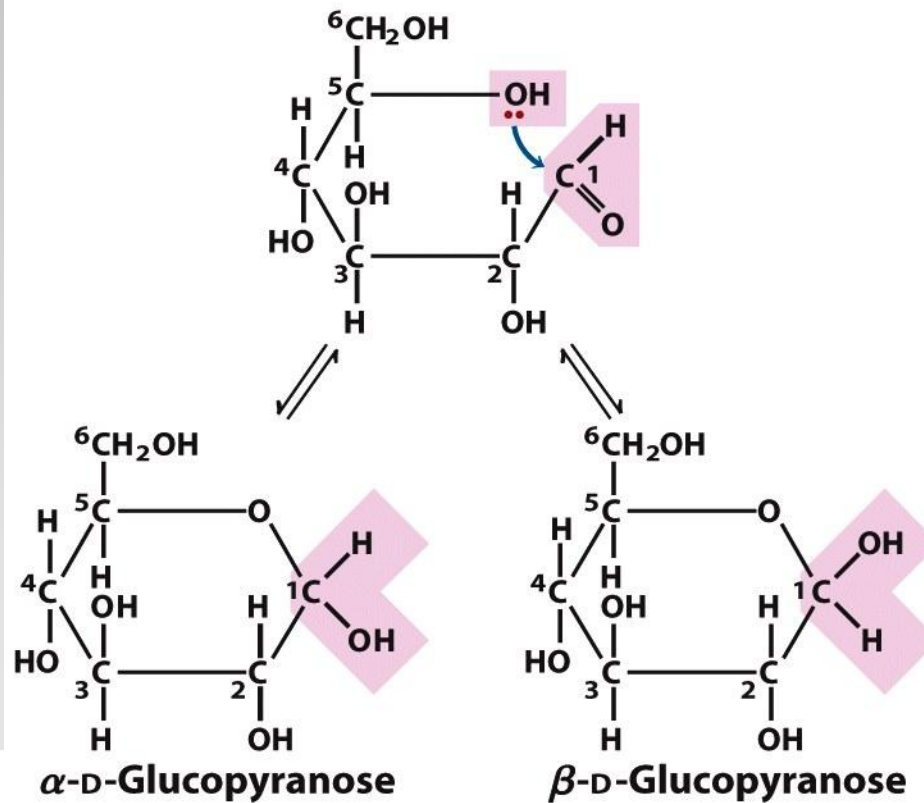
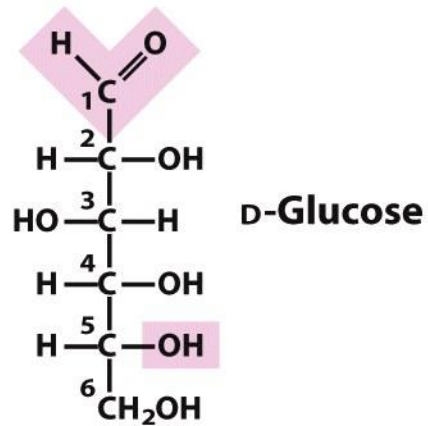
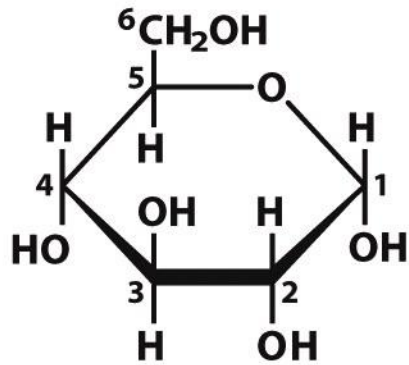
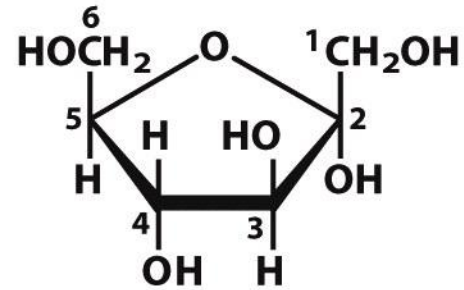


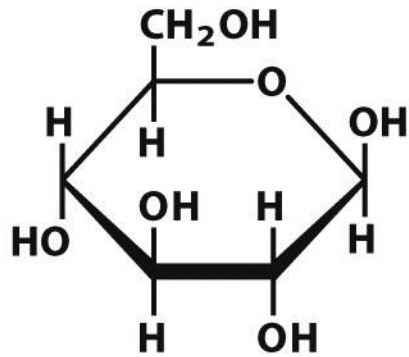
Figure 7-6
Lehninger Principles of Biochemistry, Fifth Edition
 © 2008 W.H. Freeman and Company



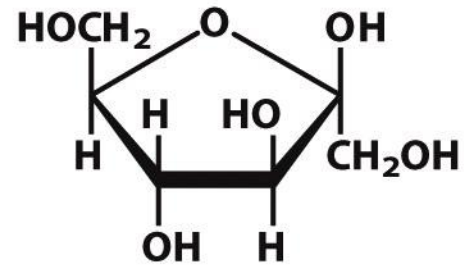
α -D-Glucopyranose



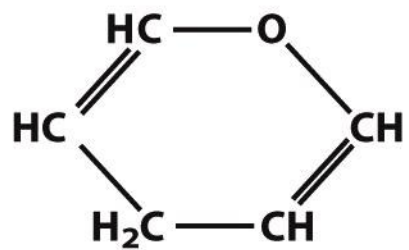
α -D-Fructofuranose



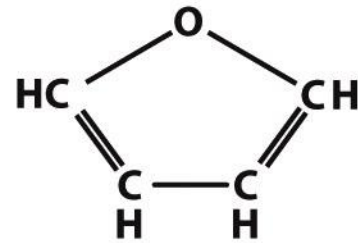
β -D-Glucopyranose



β -D-Fructofuranose

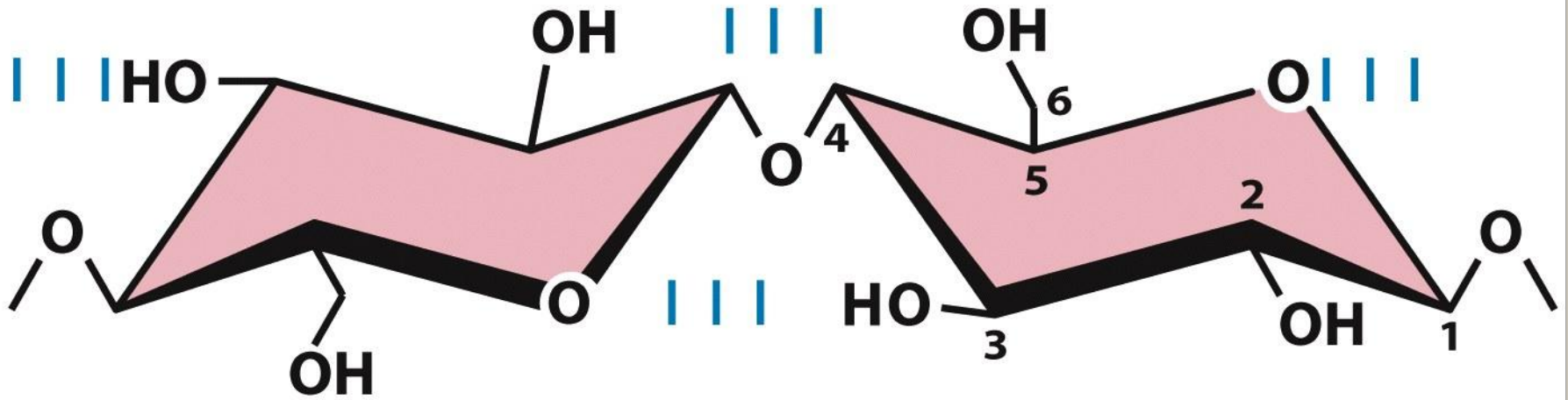


Pyran



Furan

Figure 7-7
Lehninger Principles of Biochemistry, Fifth Edition
 © 2008 W. H. Freeman and Company



$(\beta 1 \rightarrow 4)$ -linked D-glucose units

Figure 7-15a

Lehninger Principles of Biochemistry, Fifth Edition

© 2008 W. H. Freeman and Company

How sweet it is!

Sugar	Sweetness
Lactose	0.16
Galactose	0.32
Maltose	0.33
Sucrose	1.00
Fructose	1.73
Aspartame	180
Saccharin	450

Values are relative to sucrose.

Starch

Energy storage used by plant

Long repeating chain of α -D-glucose

Chain up to 4000 units

Amylose

Straight chain

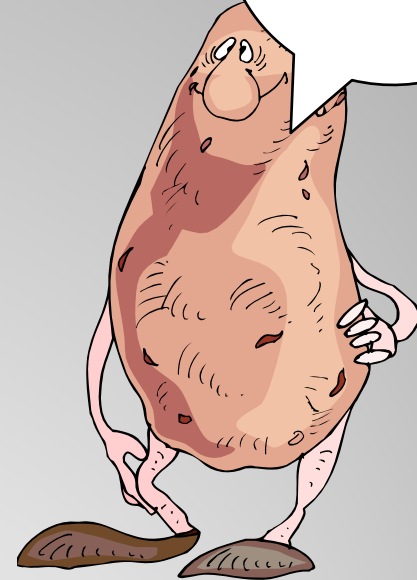
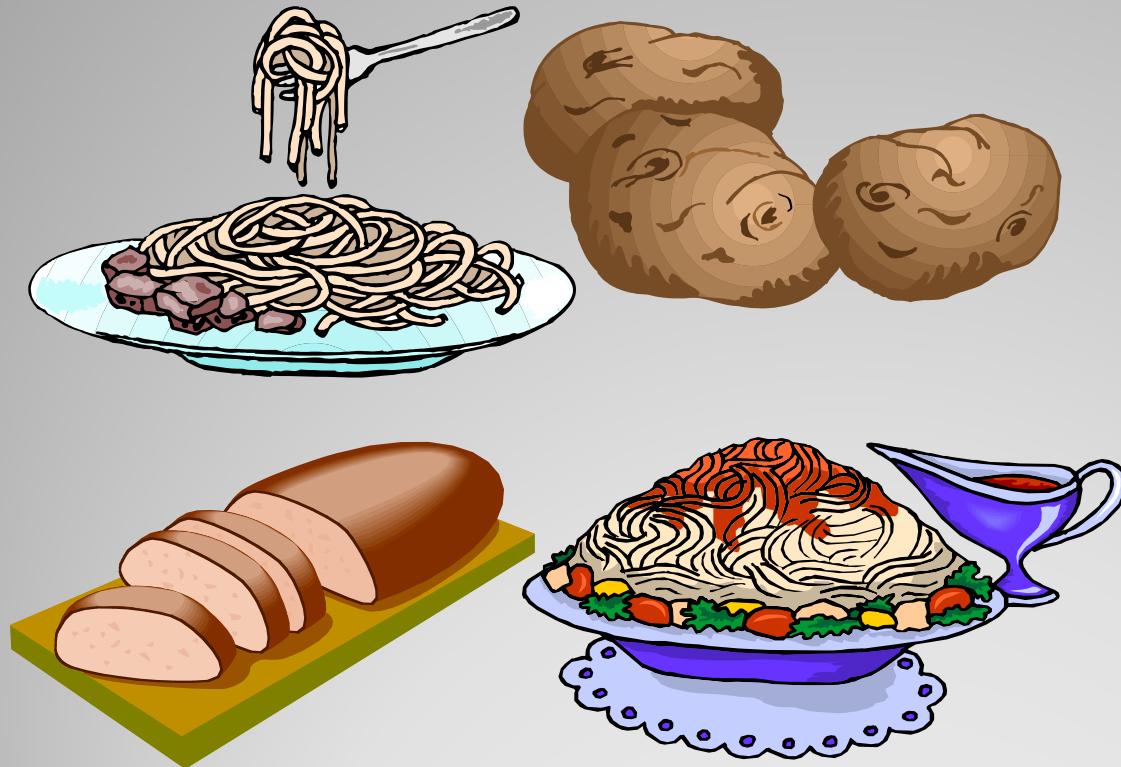
Amylopectin

Branched structure

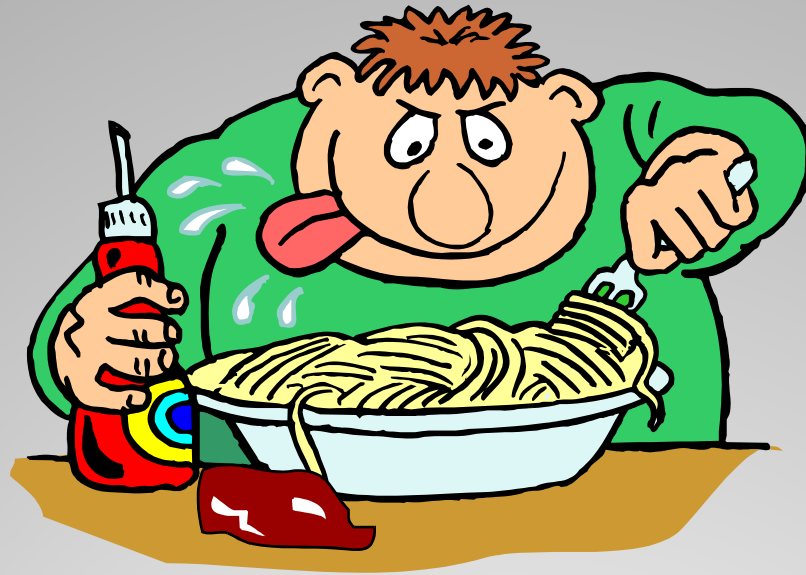
Major part of starch

Great for making gravy, jam & jelly

Pasta, Rice , Potatos
Bread



Starch
can be found



Too much

Carbohydrate will be converted into fat and stored under the skin leading to weight gain!

• THANKYOU