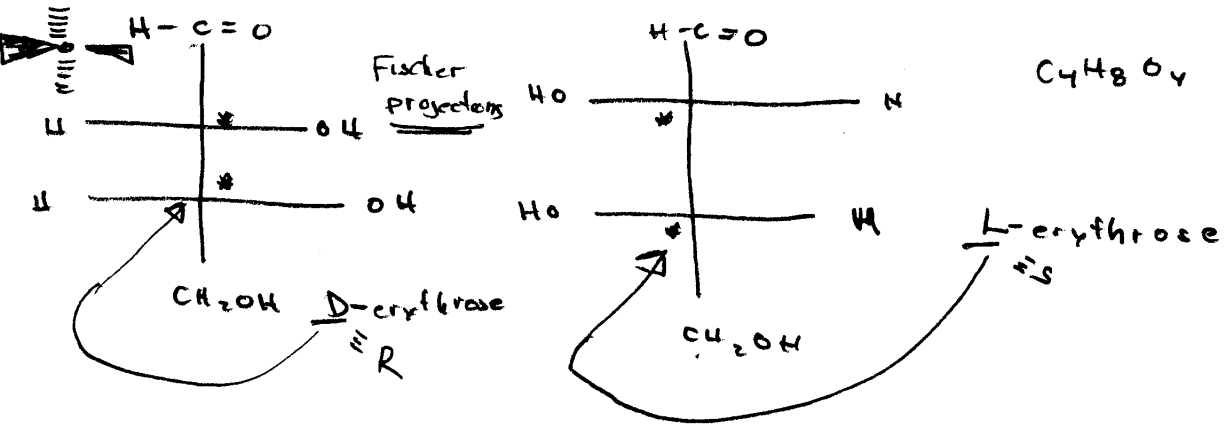
March 13, 2003

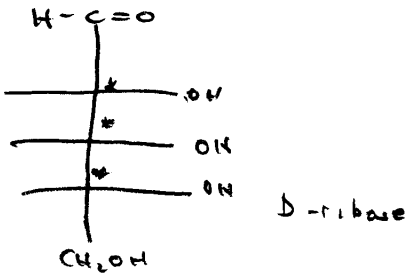
Quiz # 2 : 2206, 2208 & A-H of 2204 in Porter Hall

*** PS #6 Chapt 23 #31 e, 32, a bc, 33
2nd ed

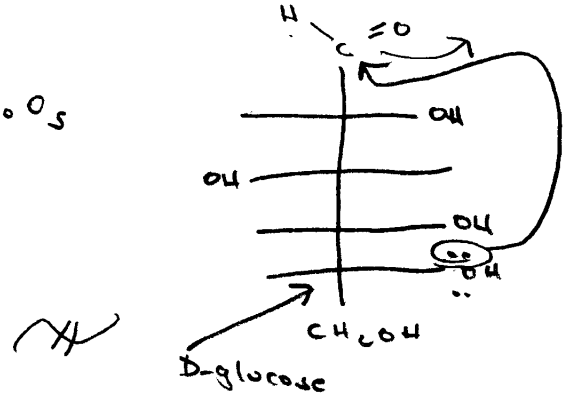
Intro to Carbohydrate cont'd | Aldo-tetroses



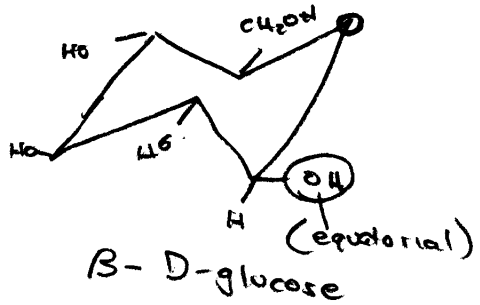
Aldopentoses



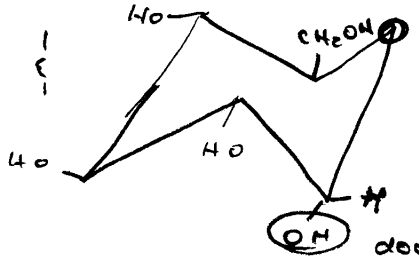
$C_5H_{10}O_5$



Cyclic Structures of Glucose



β-D-glucose

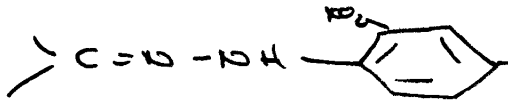


α-D-glucose

① Expt'l IR spectrum of glucose: very weak C=O stretch

② But, glucose reacts with reducing agents such as $LiAlH_4$ & NaBH$_4$ essentially quantitatively!

③ Also: Can make crystalline C=O derivatives of it!

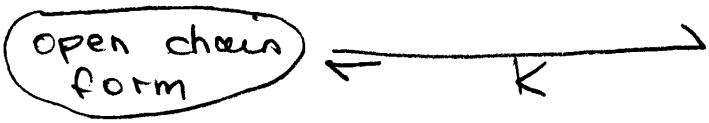
ie  (2,4 DNP derivative)

Interpretation: of these expt'l Results:

① An equilibrium must exist between α & β D-glucose

② α + β D-glucose interconvert via open chain form.

∴ a small amount of open chain form is always present. (in aqueous solution)



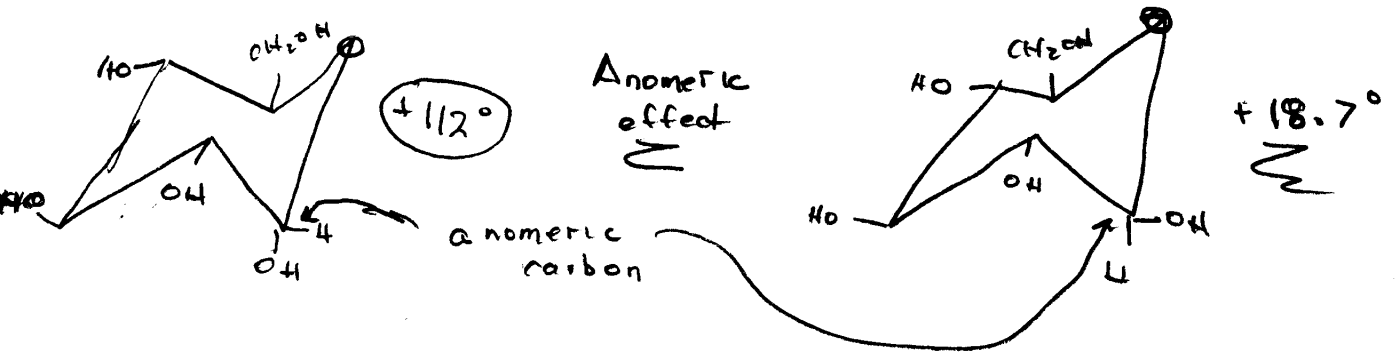
according to Le Chatlier's Principle, if reaction occurs from here it can go to completion regardless of value of K

Also: Consider optical rotation results:

Pure, crystalline α-D-glucose → +112°

Pure crystalline β-D-glucose → +18.7°

Anomeric effect



After about 1 hour, aqueous solutions of both α & β give optical rotation of [+52.7°]

∴ Conclude that the α ⇌ β-D-glucose must interconvert in H_2O !

^{13}C NMR Studies: start with either α or β (6 unique c's)

Get 6 peaks in each spectrum.

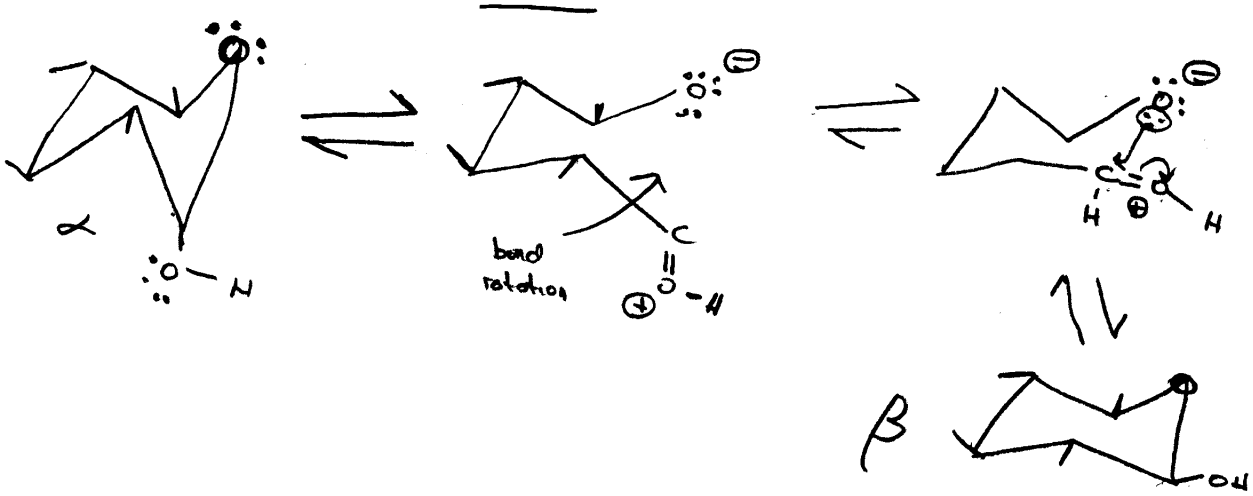
After ~1 hour, ^{13}C NMR shows 12 peaks in ratio of:

↳ (6 pairs each of which has 2:1 ratio of intensity)

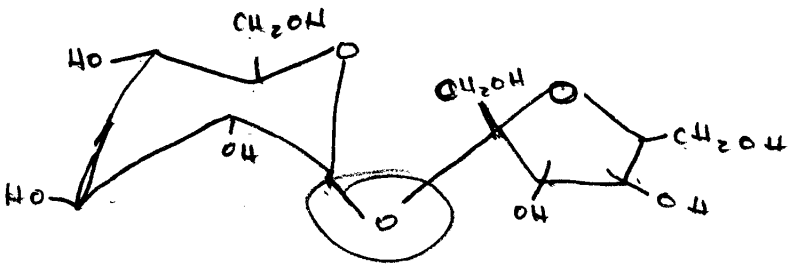
α form ∴ ~66%

β form ∴ 33% populations

Mutarotation of Glucose



Disaccharides (Latin for 2 sugars ∇!) Sucrose

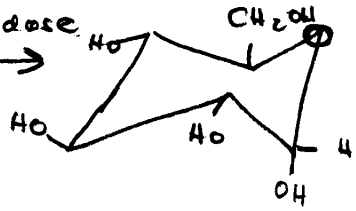


$C_{12}H_{22}O_{11}$

glycosidic bond (linkage)
α-linkage.

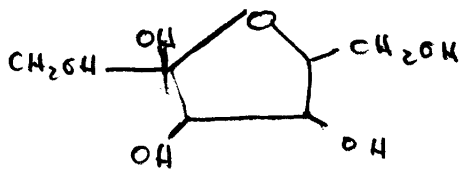
Metabolism

Sucrose + H_2O $\xrightarrow{\text{enzyme glucosidase}}$



α-D-glucose
$C_6H_{12}O_6$

+



$C_6H_{12}O_6$

Polysaccharides Most common cellulose, glucose polymer.
β-1,4-glycosidic links.