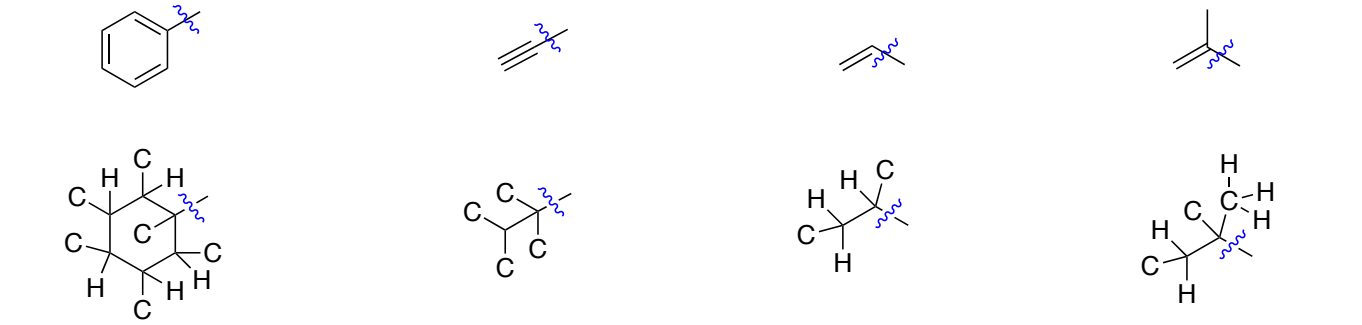
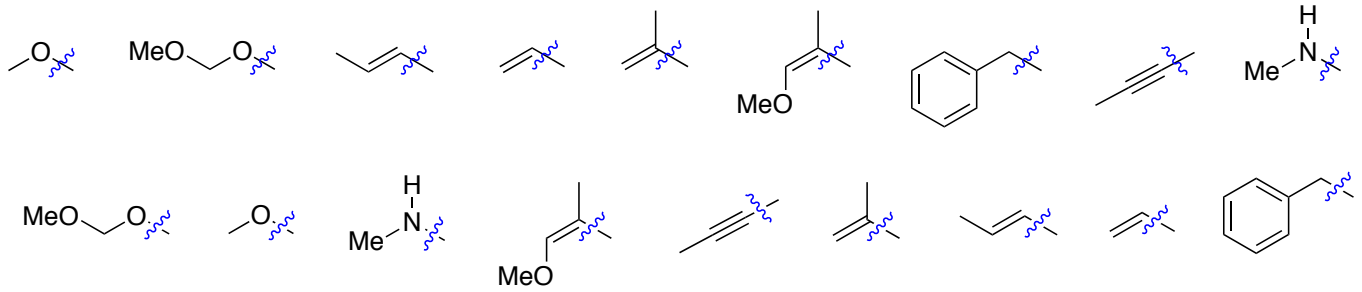
Stereochemistry Illustrated By Carbohydrates

from chapter(s) _____ in the recommended text

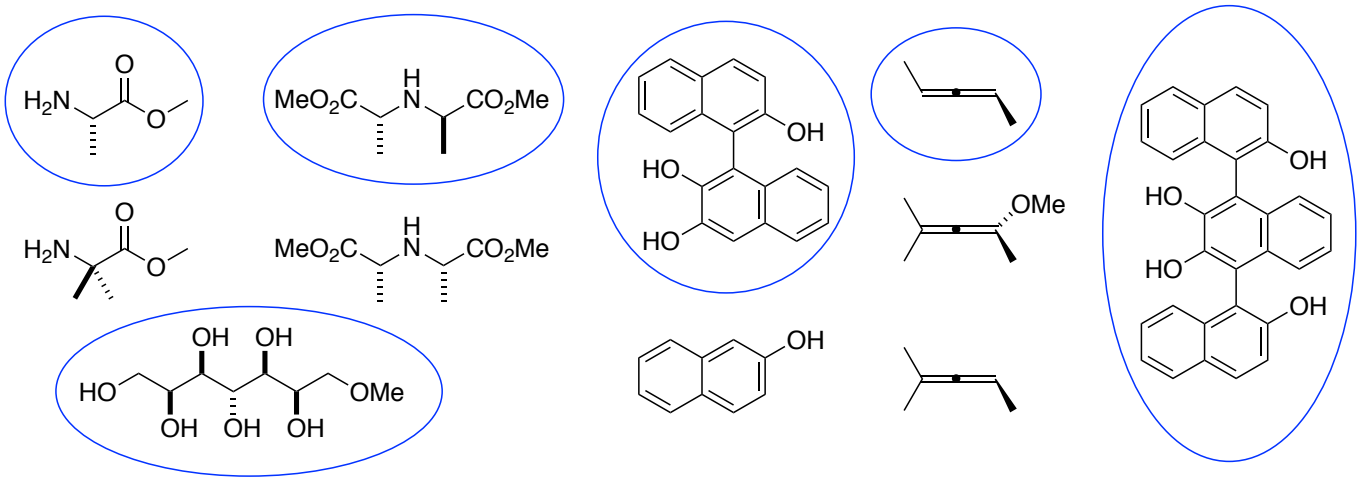
A. Introduction

B. Assigning *R*- and *S*-Configurations

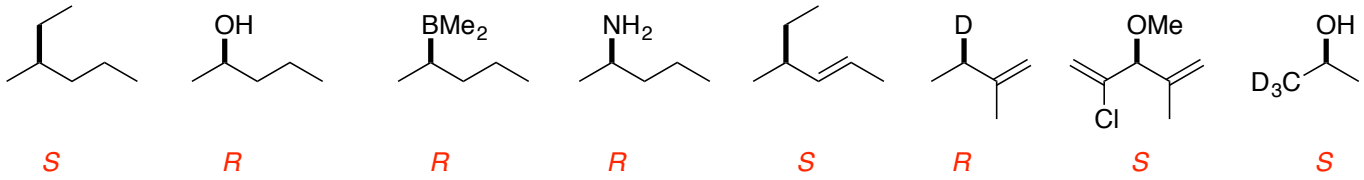




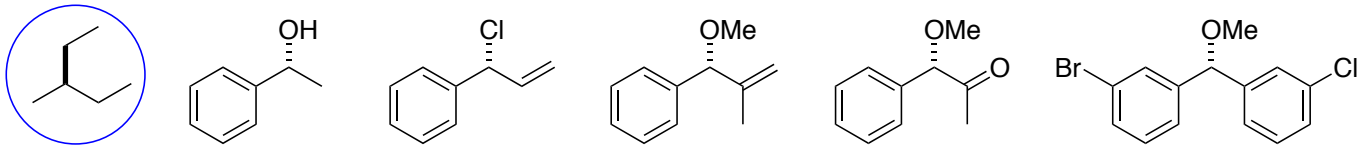
highest priority *lowest*



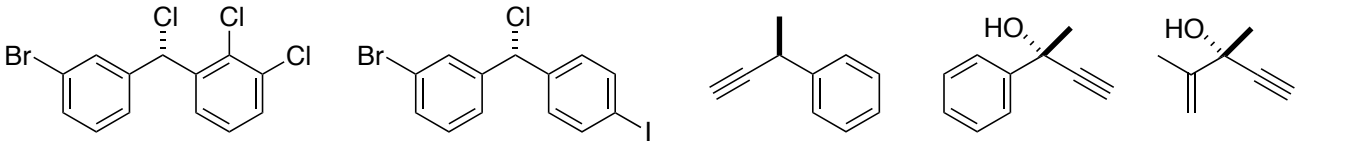
meso *enantiomers*



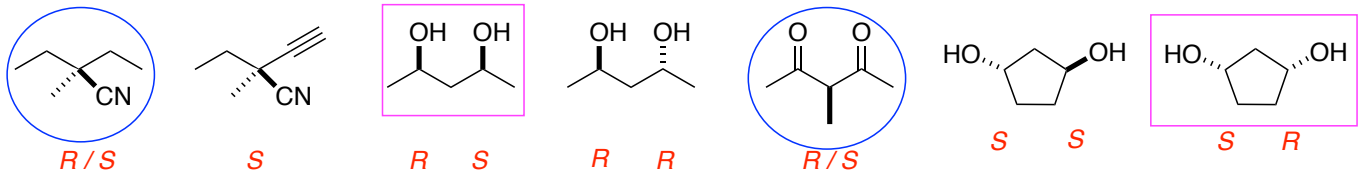
S R R R S R S S



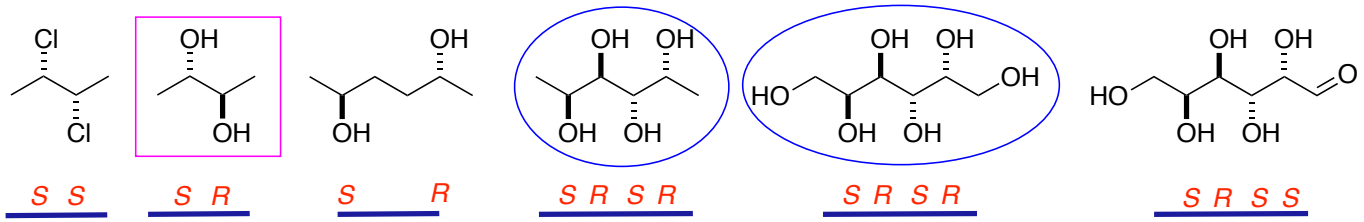
R / S R R R S R



S R S S S



R / S S R S R R R / S S S S R



S S S R S R S R S R S R S R S S

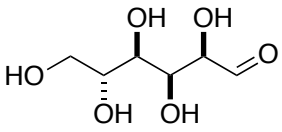
write assignments

C. Stereochemical Representations Of Carbohydrates

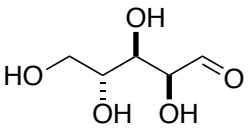
are all used to describe compounds in this series.

(*eg* glucose): if they contain an aldehyde they are called *aldoses*

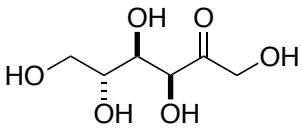
ketoses.



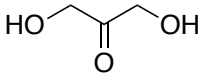
D-glucose
aldose



D-ribose
aldose

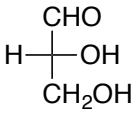


D-fructose
ketose

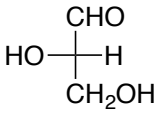


dihydroxyacetone
ketose

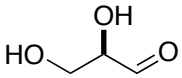
top



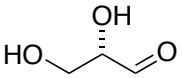
D-glyceraldehyde Fischer projection



L-glyceraldehyde Fischer projection

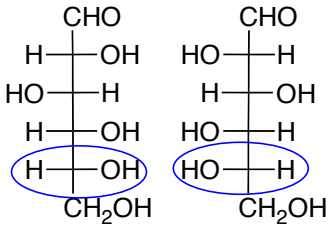


D-gylceraldehyde zig-zag



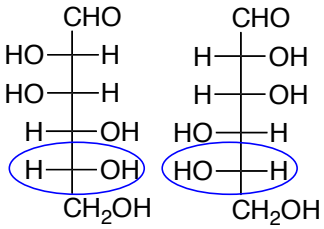
L-glyceraldehyde zig-zag

triose
pentoses,
hexose.



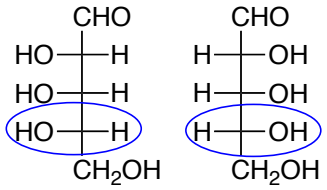
glucose

D- or L- D- or L-



mannose

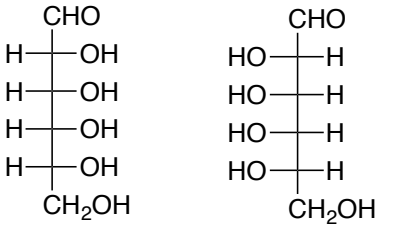
D- or L- D- or L-



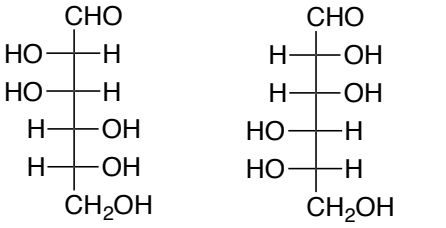
ribose

D- or L- D- or L-

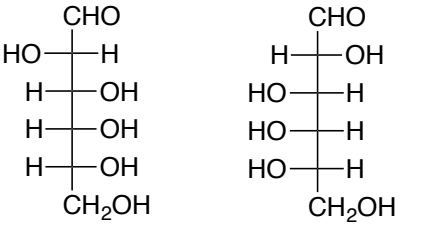
enantiomers.
epimers.



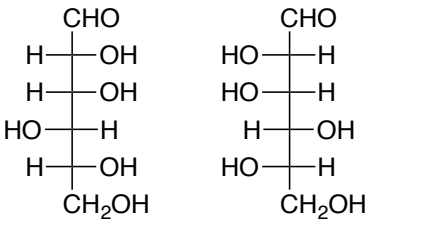
enantiomer



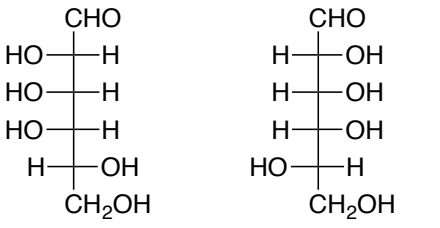
enantiomer



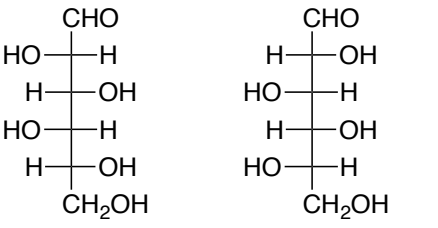
enantiomer



enantiomer



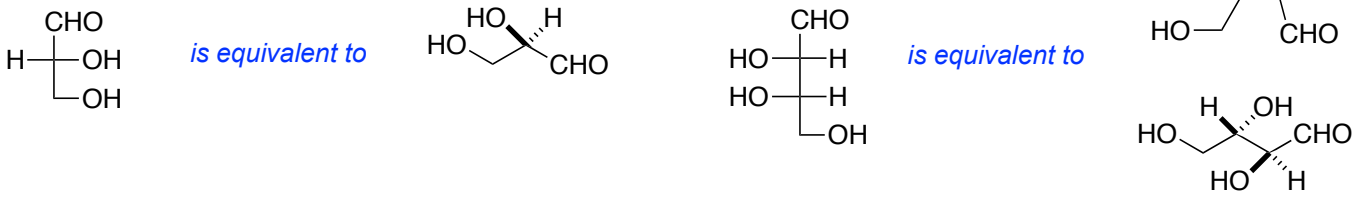
enantiomer

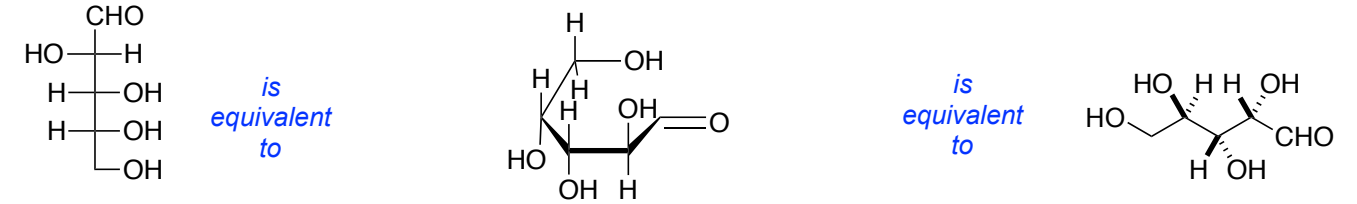


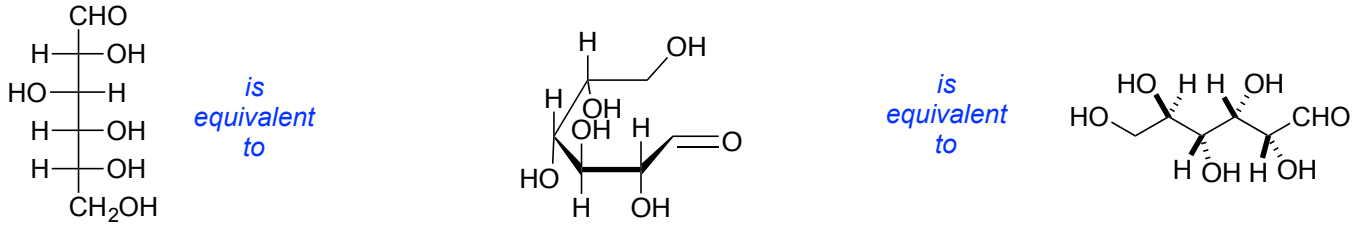
enantiomer

be *D*-.

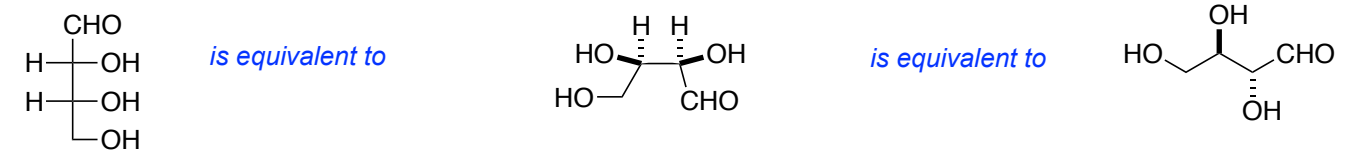
are *D*-.

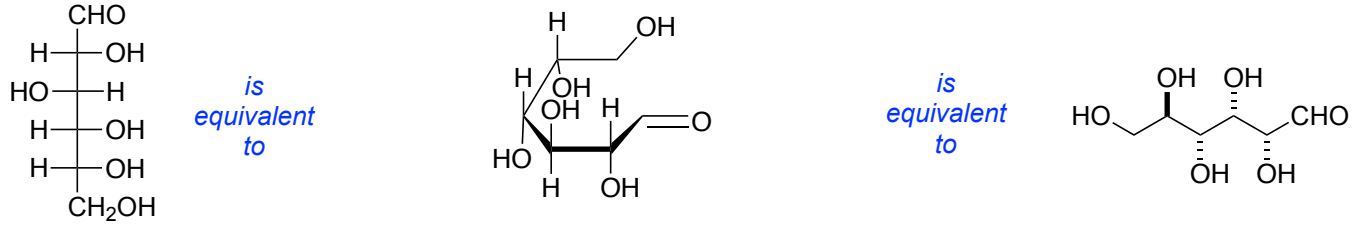




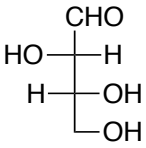


THESE ANSWERS ARE FOR THE UPDATED SECOND EDITION.

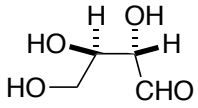




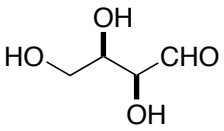
Extra examples:

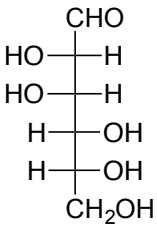


is equivalent to

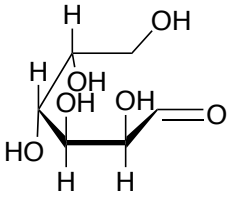


is equivalent to

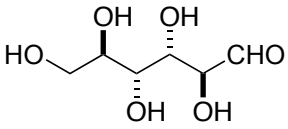




is equivalent to



is equivalent to

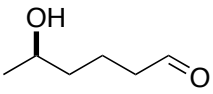


D. Carbohydrates Can Cyclize To Hemiacetals Or Hemiketals

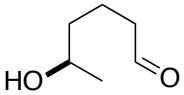
THF

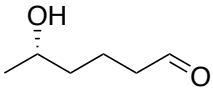
4H-pyran

tetrahydropyran

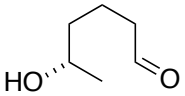


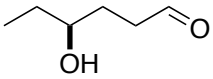
is the same as



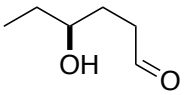


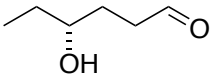
is the same as



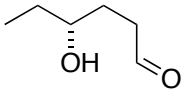


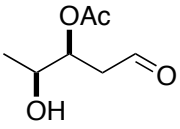
is the same as



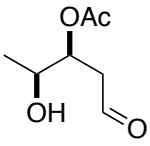


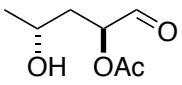
is the same as



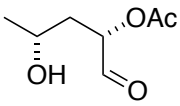


is the same as

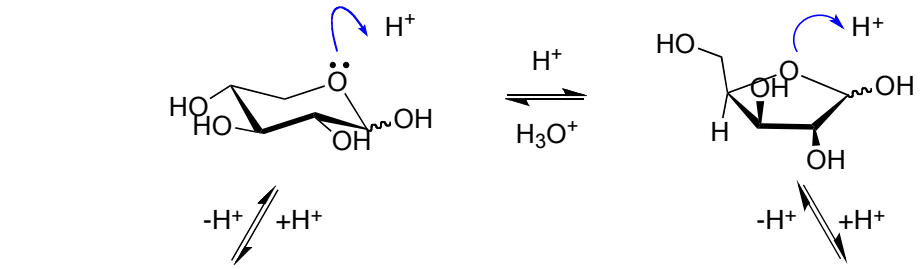




is the same as



(*six*-membered ring)
(*five*-membered ring

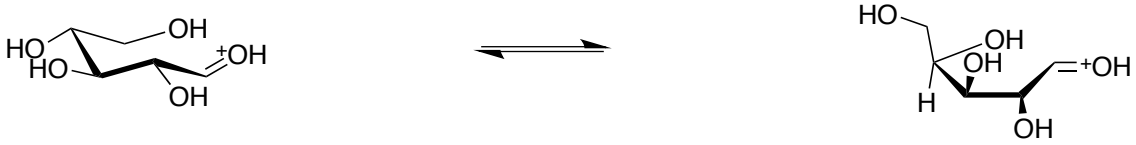


protonated pyranose form

protonated furanose form

ring closing ⇕ *ring opening*

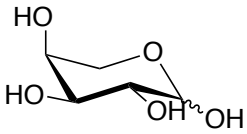
ring closing ⇕ *ring opening*



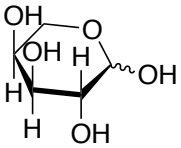
protonated aldehyde

protonated aldehyde redrawn
poised for 5-membered ring formation

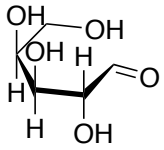
Glucose *and*



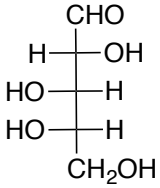
is the same as

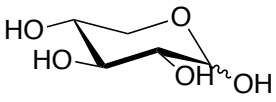


is the cyclized form of

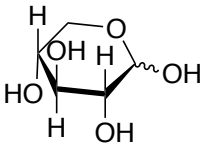


is the same as

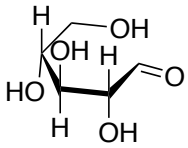




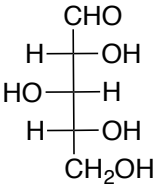
is the same as



is the cyclized form of

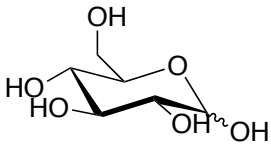


is the same as



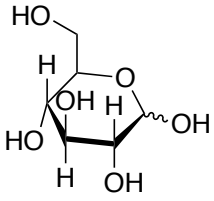
pyranose

hexoses to Fischer projections.

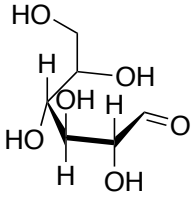


glucose

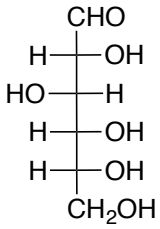
is the same as



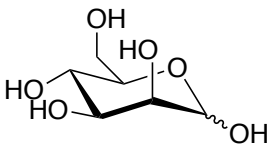
is the cyclized form of



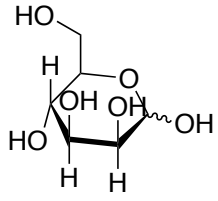
is the same as



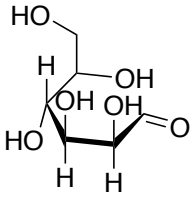
is β-.



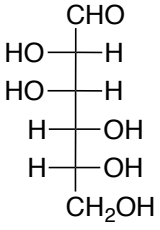
is the same as

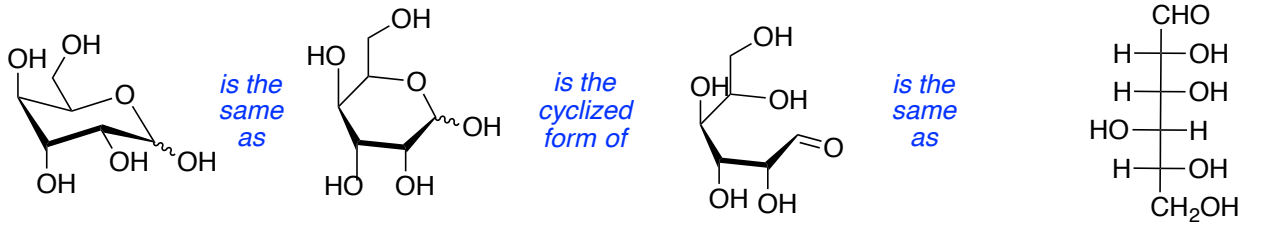


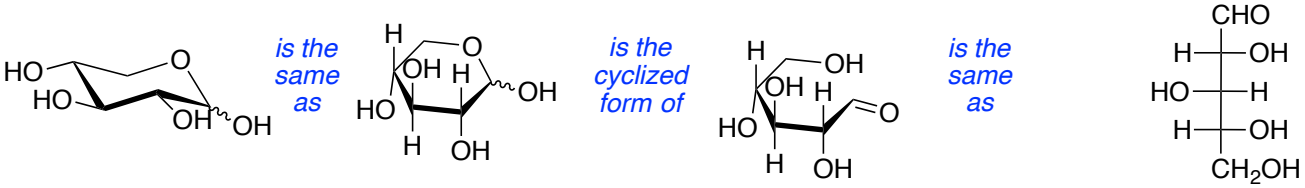
is the cyclized form of

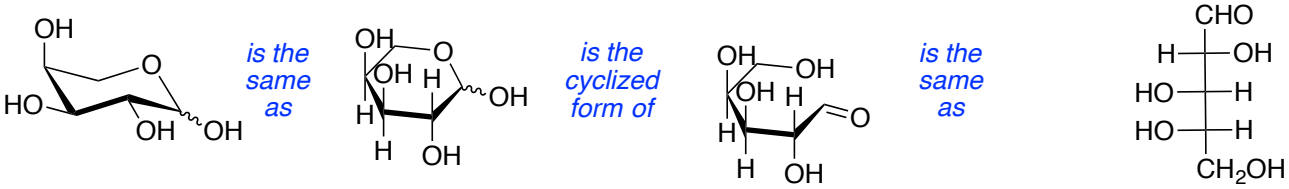


is the same as

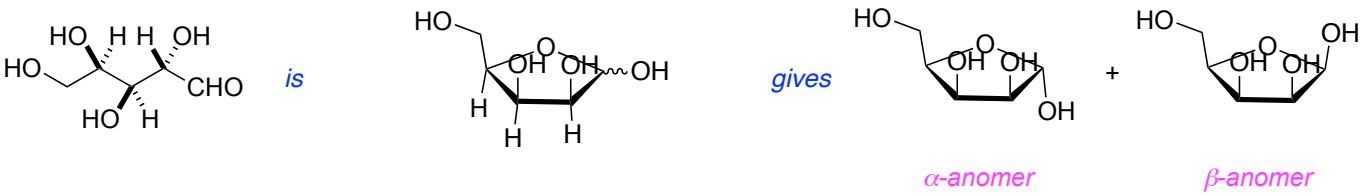


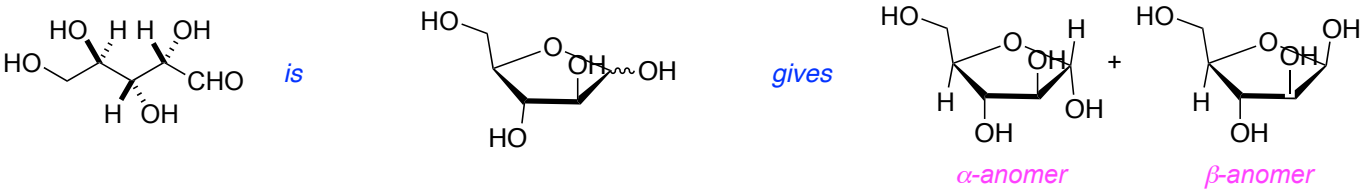






trans to the -CH_2OH




HO H H OH
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+
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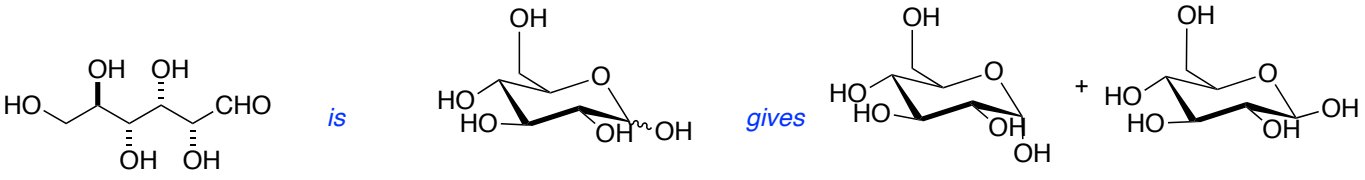
OH
H
OH
α-anomer
β-anomer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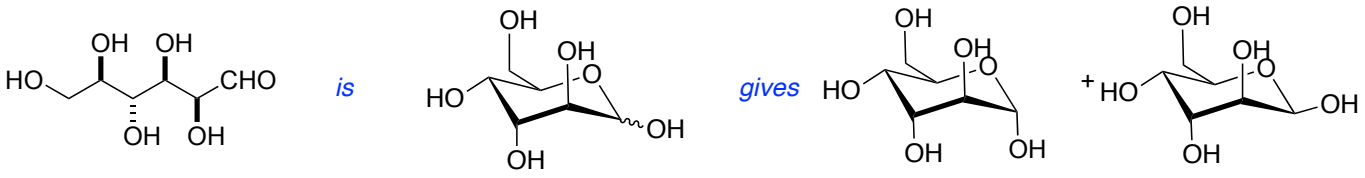
α-anomer
β-anomer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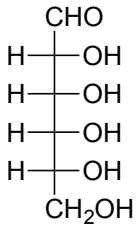
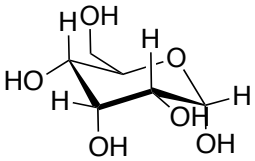
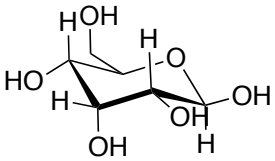
β-anomer

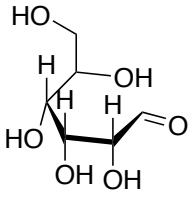




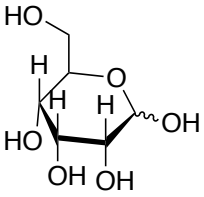
α-anomer

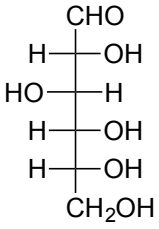


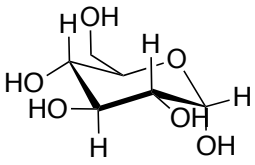
β-anomer



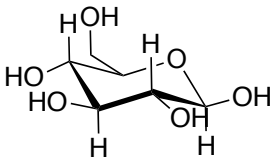
convert to the cyclized form



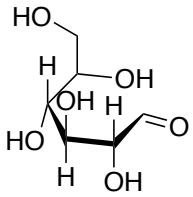




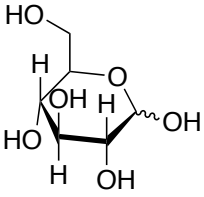
α-anomer

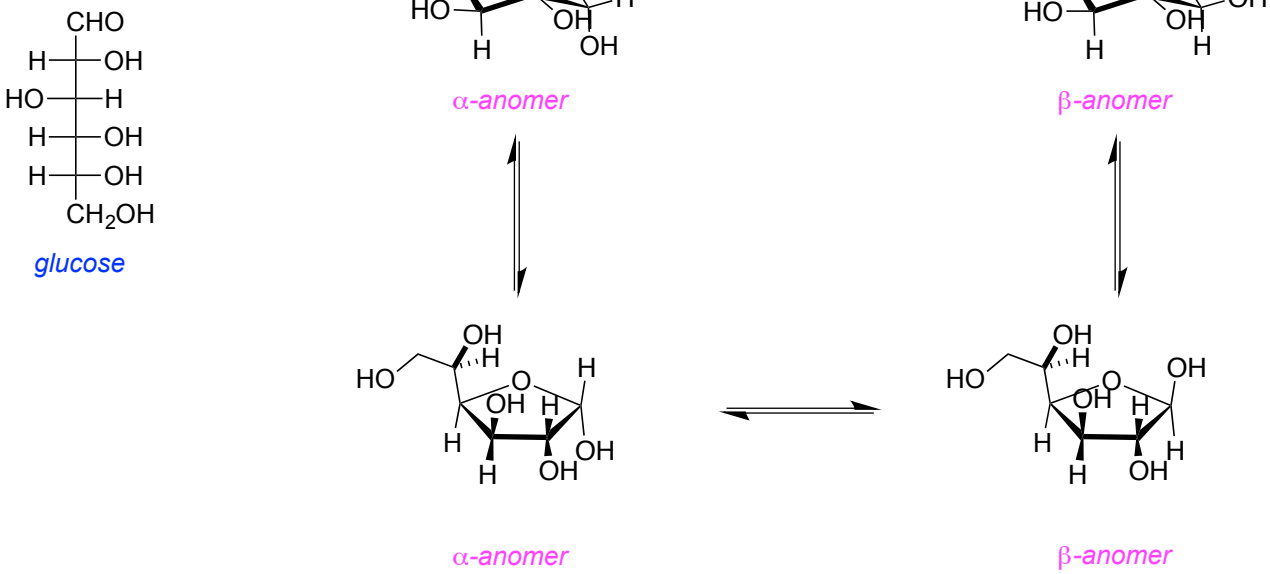


β-anomer

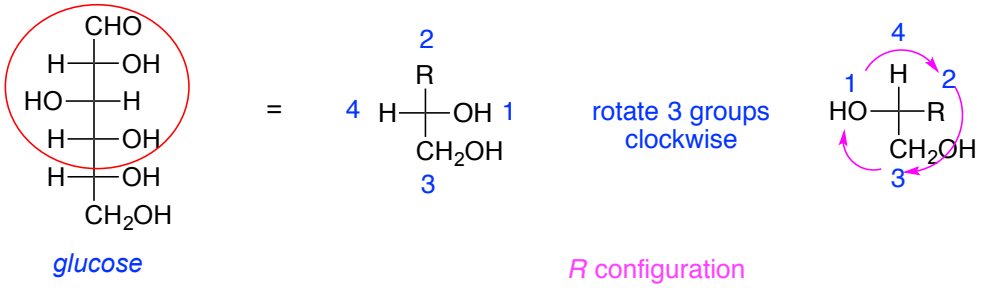


convert to the cyclized form





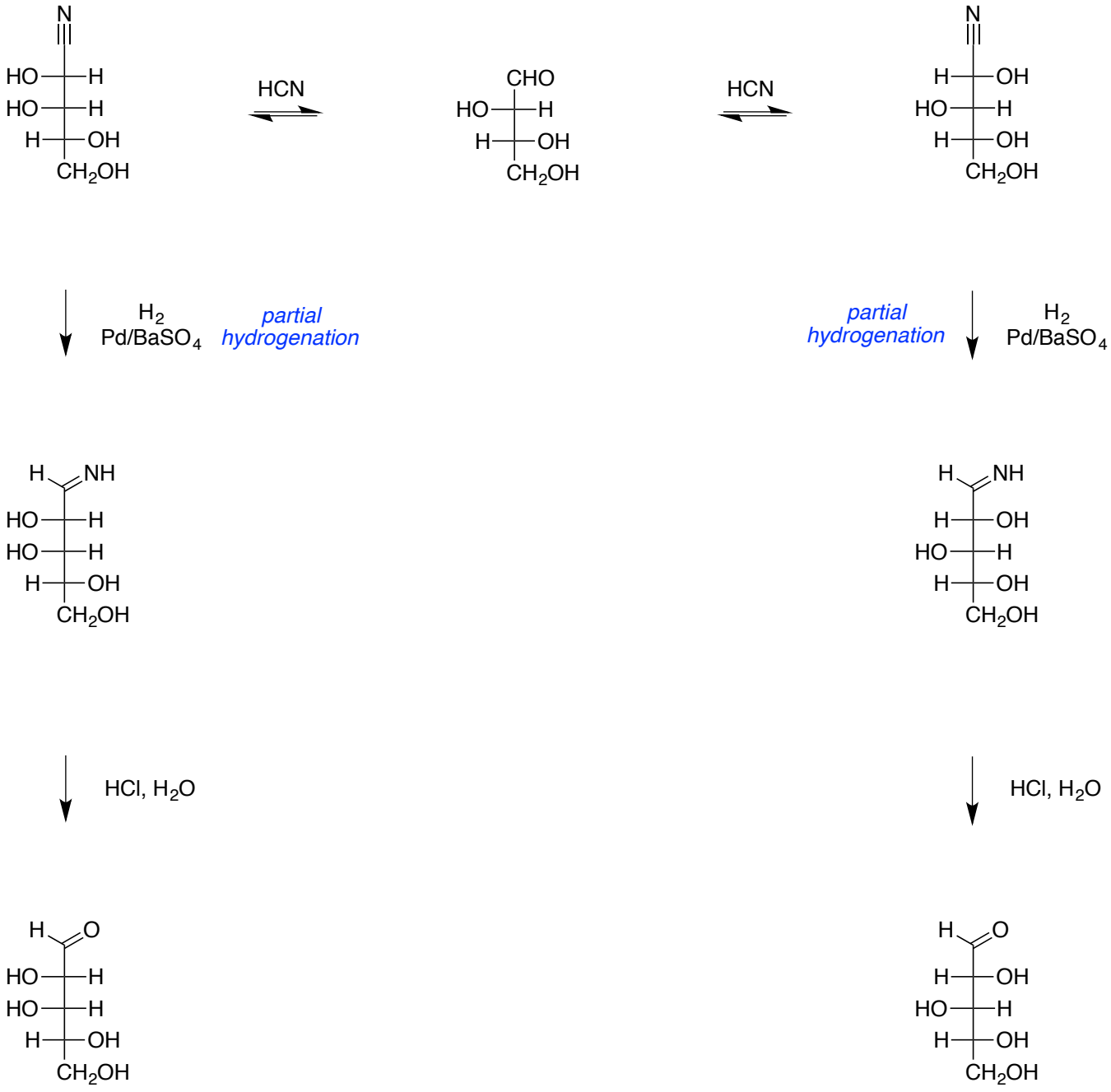
box for reasoning, write answers above



E. Homologation Of Sugars By Reaction With HCN

imines

aldoses

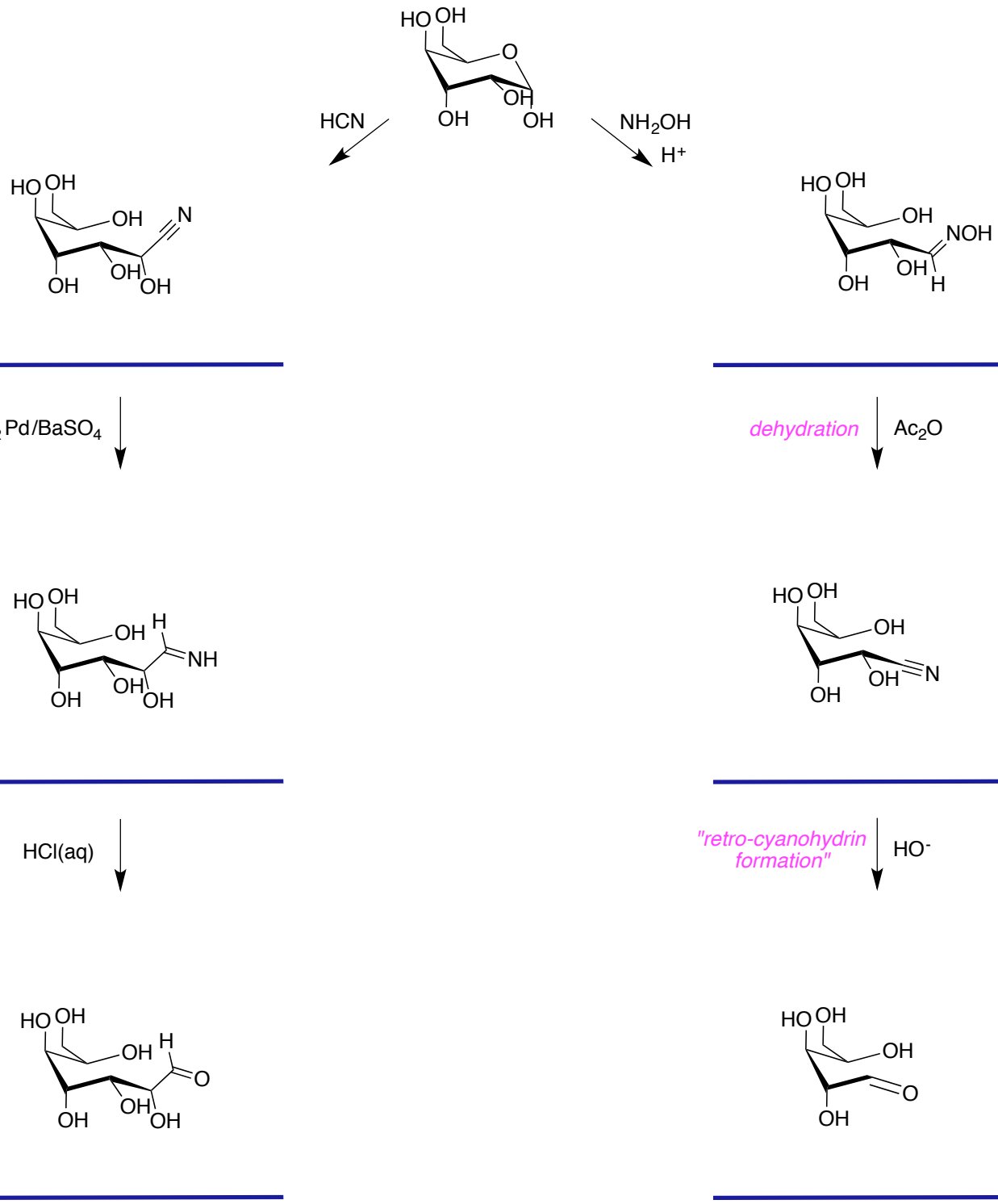


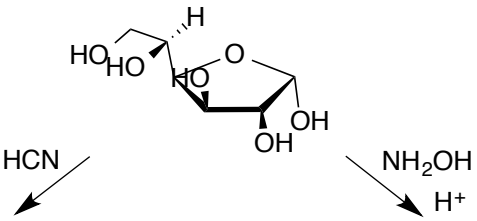
epimers

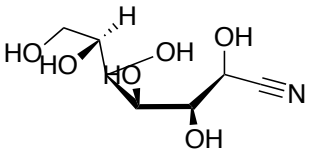
would be

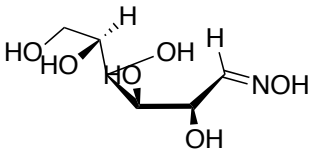
F. Conversion Of Aldoses To Lower Homologs

left
right.



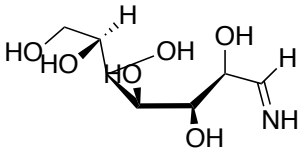


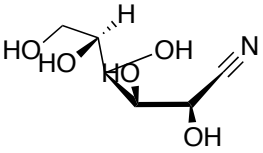




H_2 Pd/$BaSO_4$

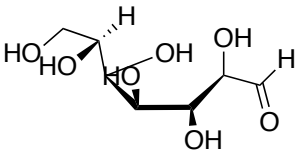
Ac_2O

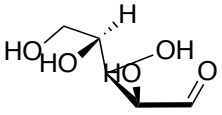




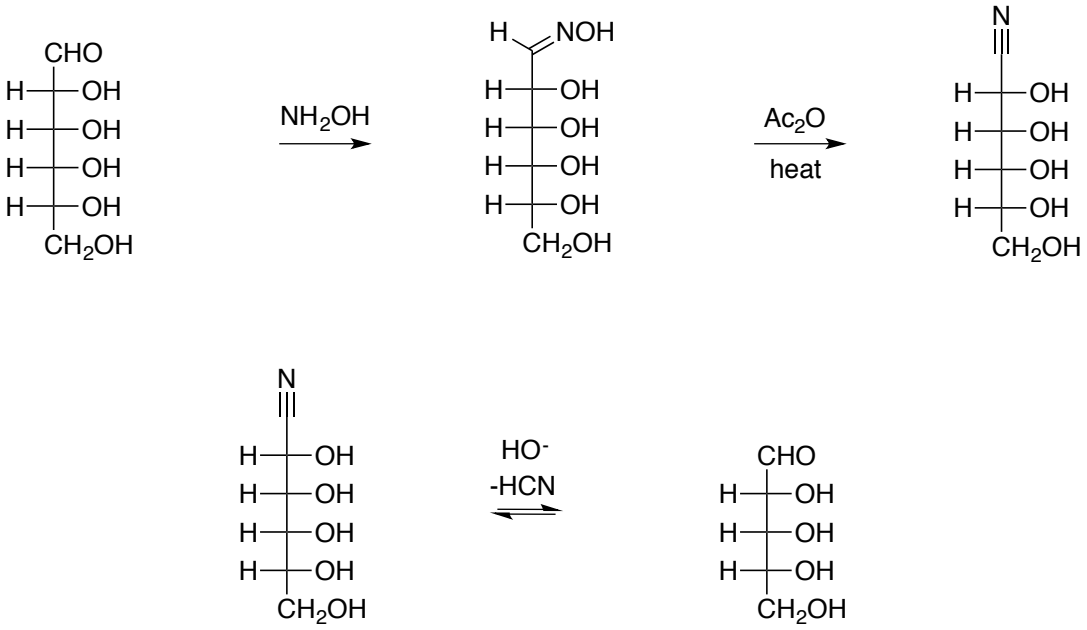
HCl(aq)

HO^-





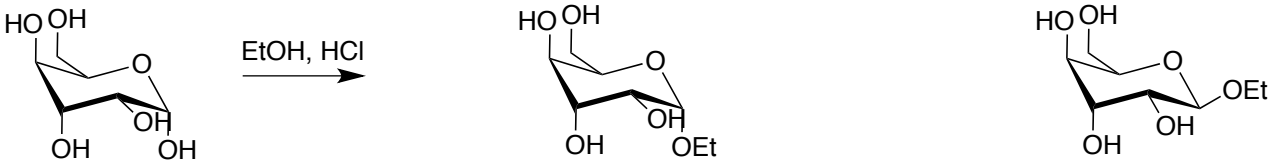
Fill in the gaps in the following sequence.



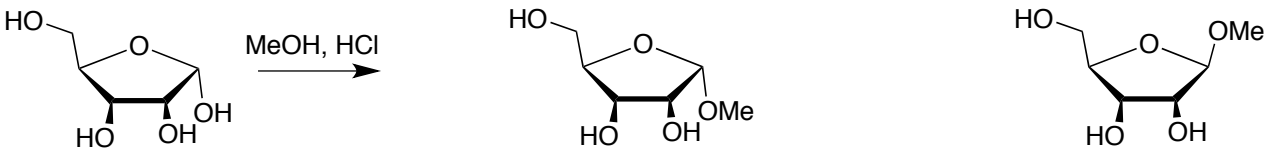
G. Other Reactions Of Sugars

oxidized

reducing



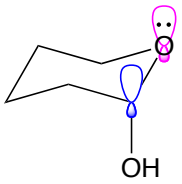
α-anomer β-anomer



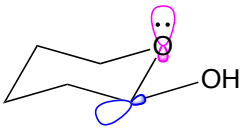
α-anomer β-anomer

H. Relative Stabilities Of Anomers

axial non-bonded



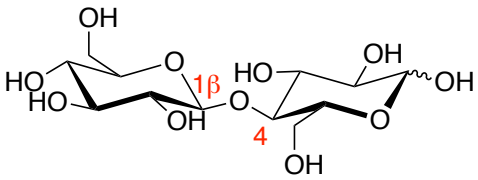
α-anomer
σ-to-σ* interactions possible



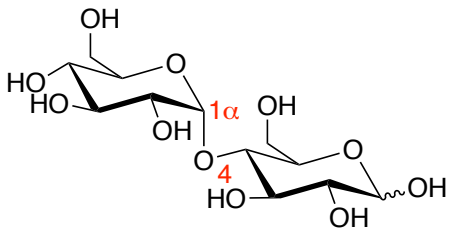
β-anomer
σ-to-σ* interactions impossible

I. Di- And Oligosaccharides

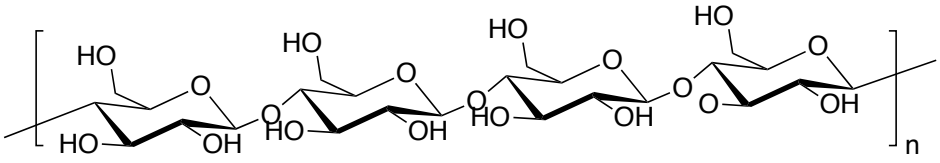
acetal or ketal



cellobiose

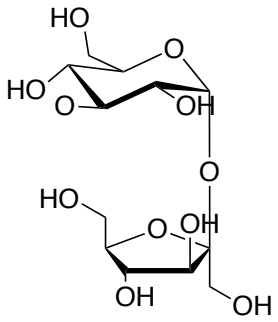


maltose



cellulose

linkages are: β-1,4

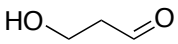


sucrose

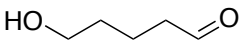
linkage is: α1, β2

poly-saccharide,
di-saccharide.
photosynthesis.

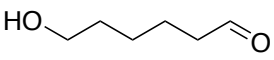
J. Carbohydrates In Summary



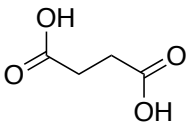
D-(+)-glyceraldehyde



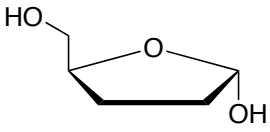
D-ribose



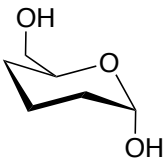
D-glucose



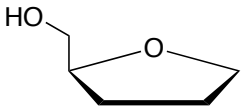
D-(-)-tartaric acid



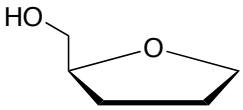
α-D-ribofuranose



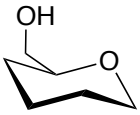
α-D-glucopyranose



β-D-2-deoxyribofuranose



β-D-ribofuranose



β-D-glucopyranose

β-D-ribofuranose.
β-D-2-deoxyribofuranose.