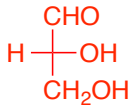
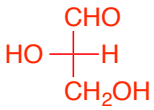
1. Draw one example of each of the following types of monosaccharides (there may be several correct answers) and indicate the number of possible stereoisomers while keeping the same D/L configuration.

(a) D-Aldotriose



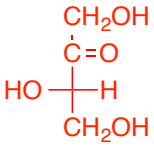
1 possible

(b) L-Aldotriose



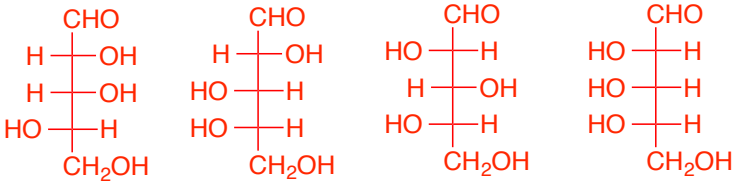
1 possible

(c) L-Ketotetrose



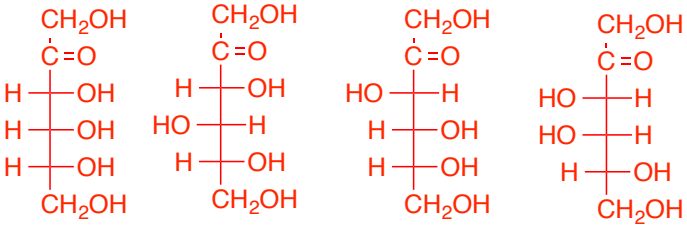
1 possible

(d) L-Aldopentose 4 possible



(e) D-Ketohexose

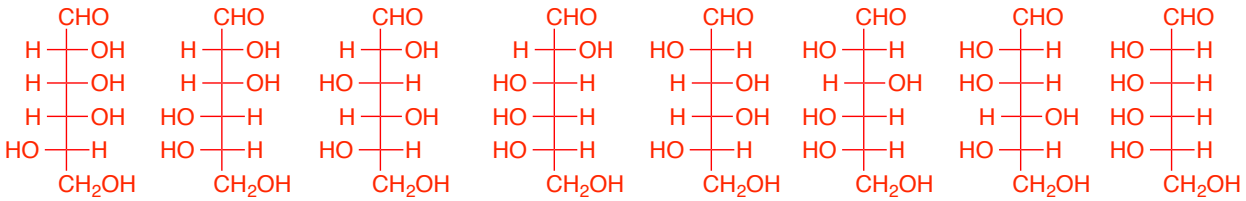
4 possible



ANY ONE EXAMPLE IS CORRECT FOR (d), (e), & (f).
I WOULDN'T EXPECT YOU TO DRAW ALL STEREOISOMERS ON AN EXAM!

(f) L-Aldohexose

8 possible

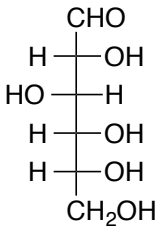


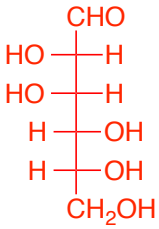
2. What is the relationship between the following monosaccarides (enantiomers, diastereomers, or epimers)? You'll find the structures of D-monosaccharides in chapter 25. You should be able to figure out the structures of the corresponding L-monosaccharides if you're paying attention to the reading! The only monosaccharide you're expected to memorize for exams is D-glucose.

a. D-glucose and L-glucose ARE ENANTIOMERS
b. D-glucose and D-allose ARE C3 EPIMERS (more specific than diastereomers)
c. D-allose and D-altrose ARE C3 EPIMERS (more specific than diastereomers)
d. D-altrose and D-glucose ARE DIASTEREOMERS (more than one chiral center is different)
e. D-glucose and D-mannose ARE C2 EPIMERS (more specific than diastereomers)
f. L-glucose and D-idose ARE C5 EPIMERS (more specific than diastereomers)

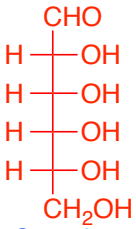
3. Fischer projections of D-glucose's epimers

D-Glucose

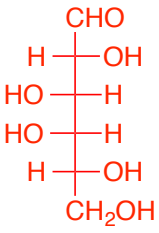




C2 epimer



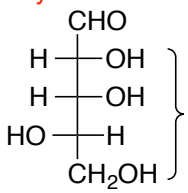
C3 epimer



C4 epimer

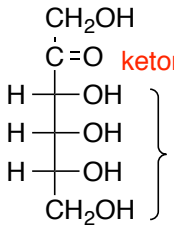
4. Monosaccharides can act as nucleophiles and/or electrophiles. Redraw any sugar from #1d and #1e and indicate the functional groups that could act as nucleophiles and those that can serve as electrophiles.

aldehyde = electrophile



4 alcohols = nucleophiles

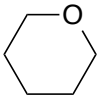
alcohol = nucleophile



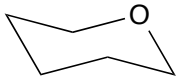
ketone = electrophile

4 alcohols = nucleophiles

5. Redraw the following structures *exactly*. These are the backbone structures to be used for #6 of this worksheet. Pay special attention to the placement of the oxygen and the particular chair conformation used (no ring flips necessary!).



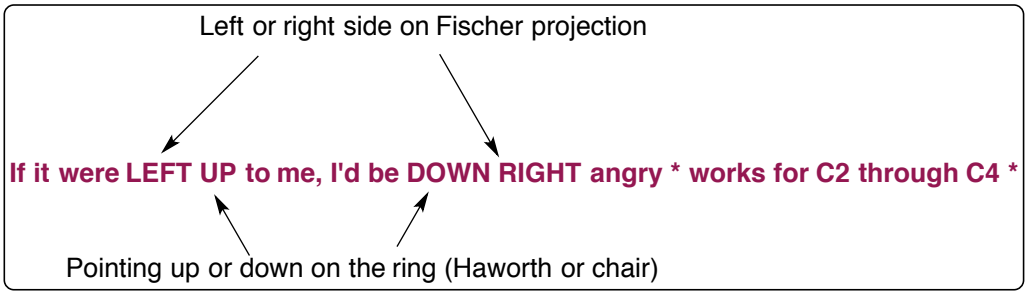
Haworth projection



Chair conformation

(NO KEY SHOULD BE NECESSARY!)

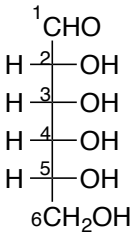
6. Draw Haworth projections and the chair conformation for the following aldohexoses using the backbone structures from #5. Consult Fig 25.3 of McMurry; memorize the structure of D-Glucose for the final exam.



(a)

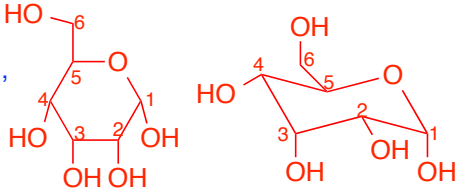
Haworth **Chair**

The C5 CH_2OH (penultimate) group always points "up" for D-sugars



D-Allose

Bonds in Haworth projections are up/down only, no axial or equatorial, no wedge/dash

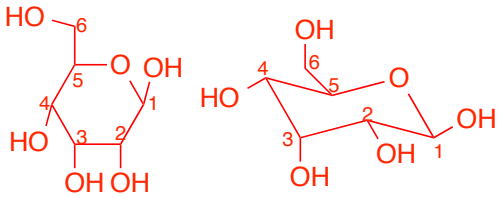


C1-C4 are "down" but alternate axial-equatorial. Take special note of the angles of the equatorial groups - parallel to bonds in the ring.

C1 OH (anomeric) points "down" for alpha (α)

α-D-Allopyranose

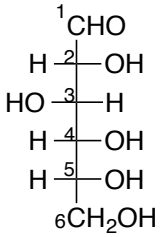
(b)



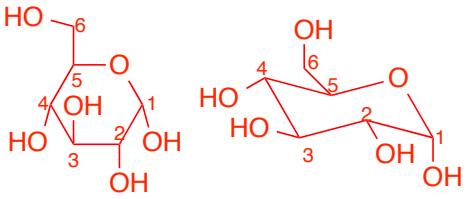
Everything except C1 is the same as part (a)

β-D-Allopyranose

(c)



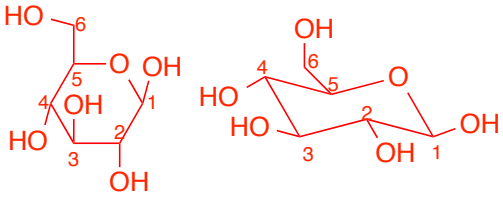
D-Glucose



Everything except C3 is the same as part (a)

α-D-Glucopyranose

(d)

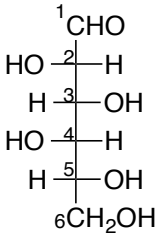


Hey, look at that! They're all equatorial! Notice that equatorial bond angles still point up or down, not horizontally

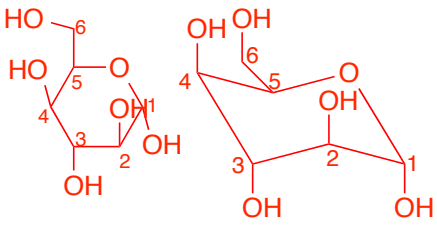
Everything except C1 is the same as part (c)

β-D-Glucopyranose

(e)



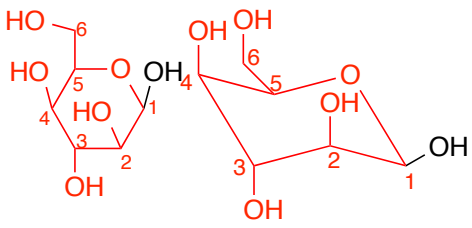
D-Idose



C2 and C4 differ from part (a)

α-D-Idopyranose

(f)



Everything except C1 is the same as part (e)

α-D-Idopyranose