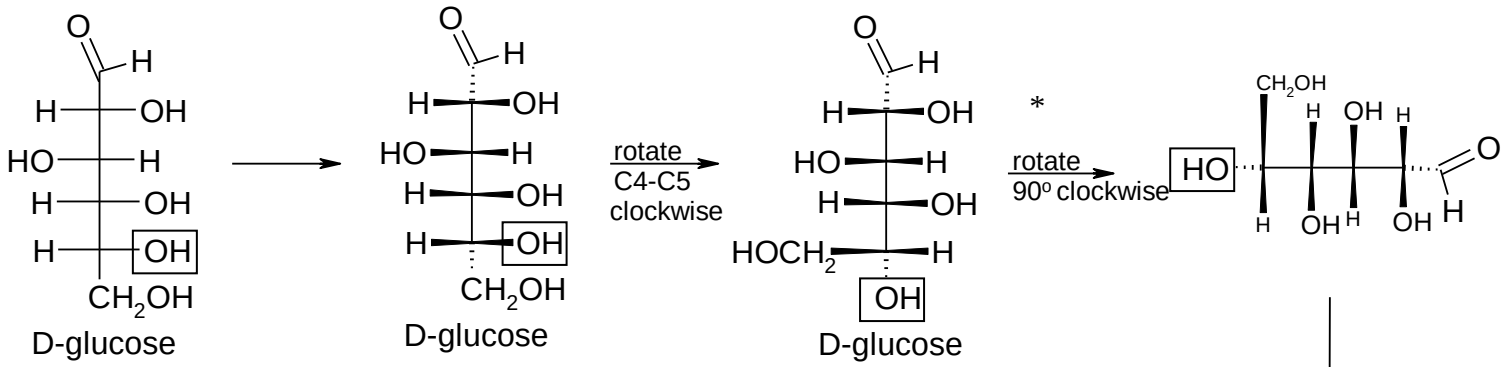
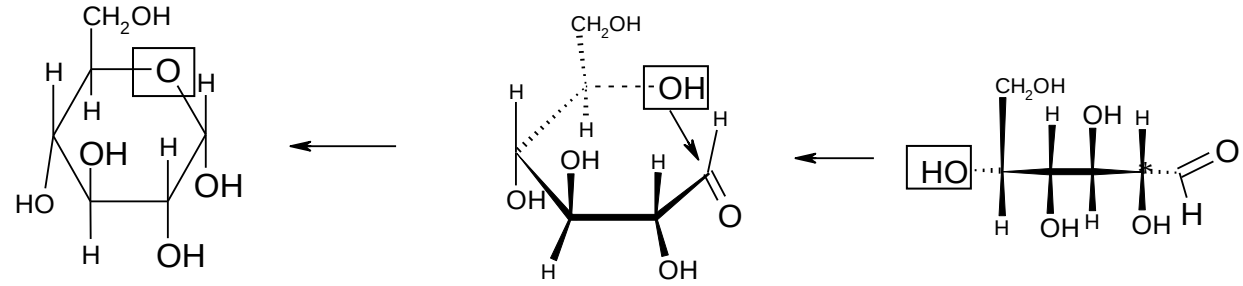
CONVERTING FISCHER PROJECTIONS OF "D" MONOSACCHARIDES INTO HAWORTH STRUCTURES

Fisher projection





Haworth structure

In the Fischer projection:

1. Carbon-#1 is carbon-#1, the hemiacetal carbon (with a *), in the Haworth structure
2. All of the atoms on the **right** are pointed **down** in the Haworth structure.
3. All of the atoms on the **left** are pointed **up** in the Haworth structure.
4. The CH_2OH (the carbon-#6 in D-glucose) is pointed **up** in the Haworth structure
5. The OH attached to carbon-#5 (box around it) becomes part of the ring.
6. The linear Fischer projection becomes a cyclic hemiacetal in the Haworth structure.

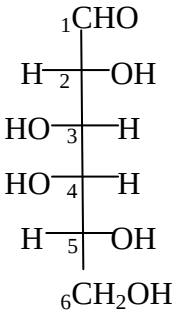
In the Haworth Stucture:

1. Carbon-1 "*" is the anomeric carbon
2. The anomeric carbon is derived from the C=O in the Fischer projection.
3. Notice there are no carbonyls in the Haworth projection.
4. The carbonyl has become the hemiacetal group.

Drawing Haworth Projections of D-aldohexoses

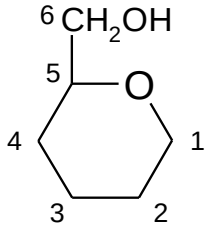
1. Draw the Fischer projection and number the carbon atoms.

D-Galactose



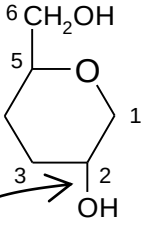
2. For an <u>aldohexose</u> draw the pyranose template for the Haworth projection and number the carbon atom.

D-galactose is an aldohexose, so……..

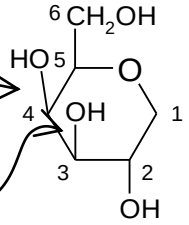


3. Add hydroxyl groups to $C_2 - C_4$ of the Haworth template.

A. In the Fisher projection the hydroxyl groups on the right (only C_2) are placed on a <u>downward</u> bond (a bond below the ring).

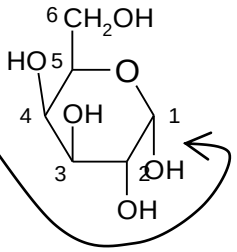


B. In the Fisher projection, the hydroxyl groups on the left (only C_3 and C_4) are placed on an <u>upward</u> bond (a bond above the ring).

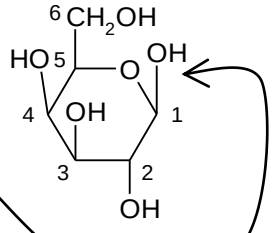


4. Add a hydroxyl group to C_1 :

downward for an alpha (α) hydroxyl (opposite side of ring as the CH_2OH)



upward for a beta (β) hydroxyl (same side of ring as the CH_2OH)

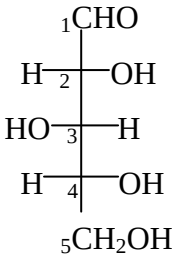


FINISHED!

Drawing Haworth Projections of D-aldopentoses

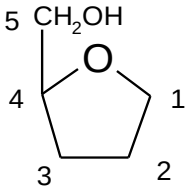
1. Draw the Fischer projection and number the carbon atoms.

D-xylose



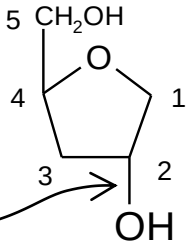
2. For an <u>aldopentose</u> draw the furanose template for the Haworth projection and number the carbon atoms.

D-xylose is an aldopentose, so……..

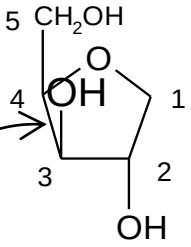


3. Add hydroxyl groups to $C_2 - C_3$ of the Haworth template.

A. In the Fisher projection the hydroxyl groups on the right (only C_2) are placed on a <u>downward</u> bond (a bond below the ring).

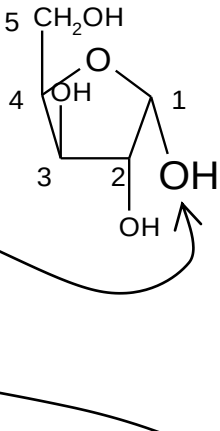


B. In the Fisher projection, the hydroxyl groups on the left (only C_3) are placed on an <u>upward</u> bond (a bond above the ring).

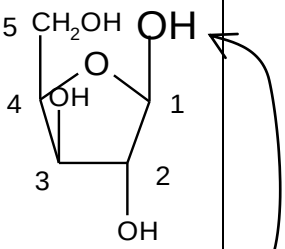


4. Add a hydroxyl group to C_1 :

down<u>ward</u> for an alpha (α) hydroxyl (opposite side of ring as the CH_2OH)

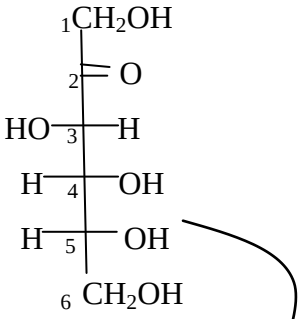
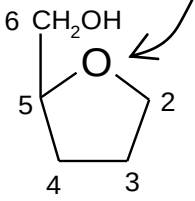
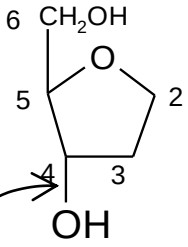
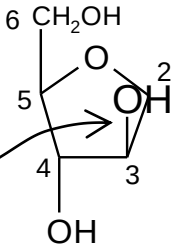
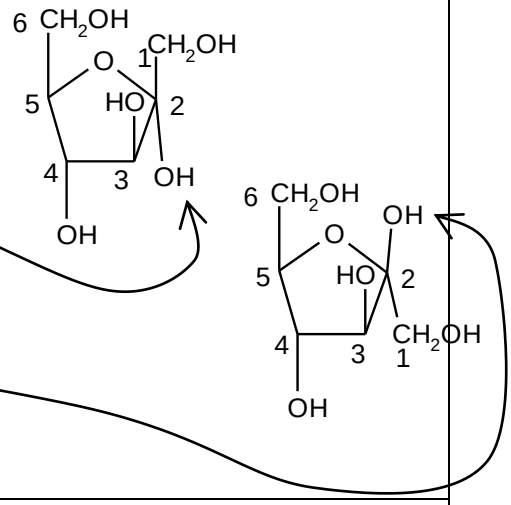


upward for a beta (β) hydroxyl (same side of ring as the CH_2OH)



FINISHED!

Drawing Haworth Projections of D-ketohexoses

1. Draw the Fischer projection and number the carbon atoms. D-fructose	
2. For an <u>ketohexose</u> draw the furanose template for the Haworth projection and number the carbon atoms. Notice that carbon 1 is not present at this point and the OH at carbon 5 has become part of the ring. D-fructose is a ketohexose, so……..	
3. Add hydroxyl groups to $C_3 - C_4$ of the Haworth template. A. In the Fisher projection the hydroxyl groups on the right (only C_4) are placed on a <u>downward</u> bond (a bond below the ring).	
B. In the Fisher projection, the hydroxyl groups on the left (only C_3) are placed on an <u>upward</u> bond (a bond above the ring).	
4. Add a hydroxyl group to C_2 : **down<u>ward</u>** for an alpha (α) hydroxyl (opposite side of ring as the CH_2OH) **upward** for a beta (β) hydroxyl (same side of ring as the CH_2OH) ***Notice that the carbon-1 CH_2OH is placed opposite the OH at C_2***	
FINISHED!	