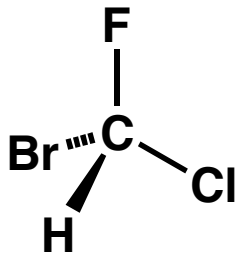
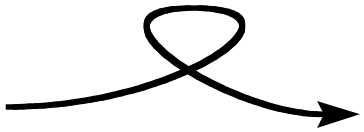
The Stereocenter

A tetrahedral carbon with four different substituents is called a stereocenter (some texts call this a "chiral carbon" but we will generally use stereocenter). A stereocenter has the property that permuting (i.e., exchanging) any two substituents results in a new stereoisomer. For example, if the hydrogen and bromine of bromochlorofluoromethane are exchanged, is an isomer produced? A stereoisomer? If so, what kind of stereoisomer?



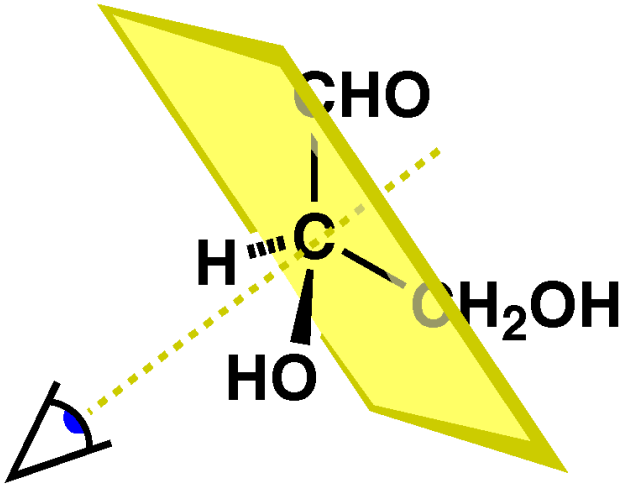
bromochlorofluoromethane

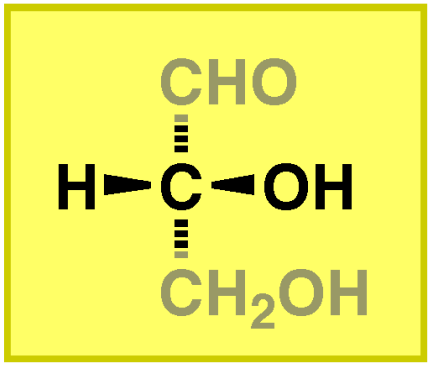


Permute -H and -Br.
What does this generate?

Fischer Projection

The **Fischer projection** is a shortcut way to draw structures possessing stereocenters. The Fischer projection represents each stereocenter as a perpendicular pair of crossing lines. In the Fischer projection, the carbon chain is oriented vertically. The stereocenter's substituents are positioned to the left and right projecting above the plane of the page. The drawings below show the relationship between the 3D structure and the 2D drawing that is used for the Fischer projection.





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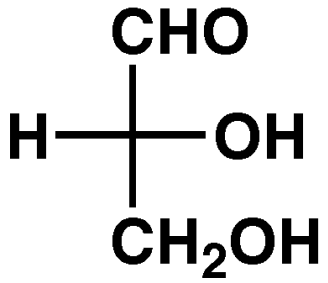


Fischer projection

Stereochemical Descriptors

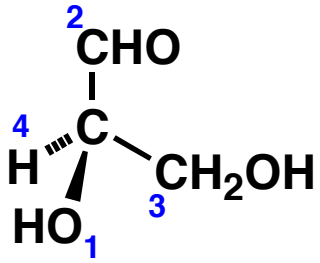
The configuration of stereocenters can be assigned a designation known as an R,S-descriptor. **ACE will make R,S assignments automatically so be sure you know how to use this tool!** To do the assignment manually, you first assign priority to the four different substituents according to the rules below. To complete the process, it is very helpful to make a physical model. Orient the structure about the stereocenter so that the substituent of lowest priority is directed to the back of the plane of the page. You should be staring at three substituents that are oriented toward you. Starting from the highest priority substituent, move to the second highest then the third highest. If the direction you traced was clockwise, the stereocenter is assigned the R-descriptor. If the direction you traced was counterclockwise, the stereocenter is assigned the S-descriptor.

1. The higher the atomic number, the higher the priority.
(Different isotopes of the same element are assigned a priority according to their atomic mass.)

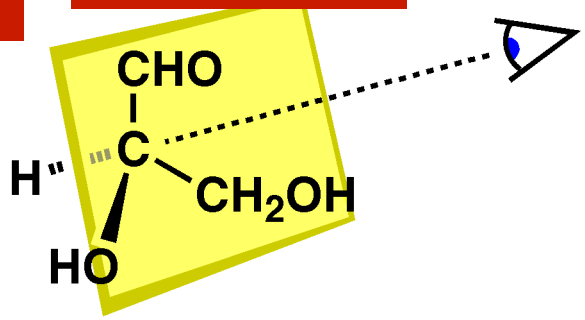
2. If two substituents have the same immediate substituent atom, evaluate atoms progressively further away from the stereocenter until a difference is found.

3. If double or triple bonded groups are encountered, they are treated as an equivalent set of s

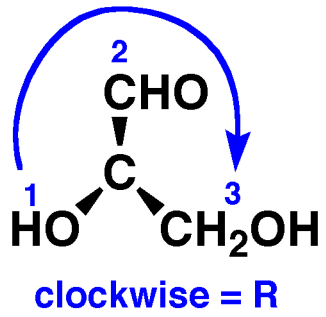
Step #1 - assign substituent priorities



Step #2 - view



Step #3 - assign rotation direction



clockwise = R