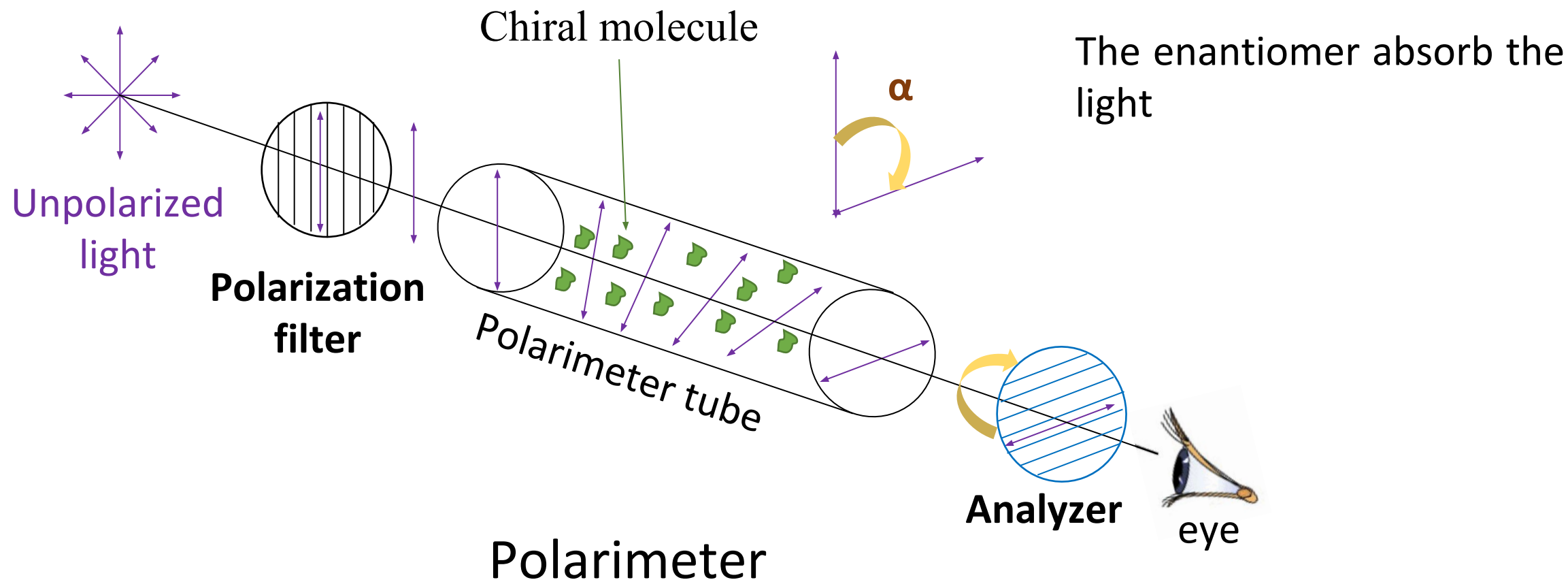
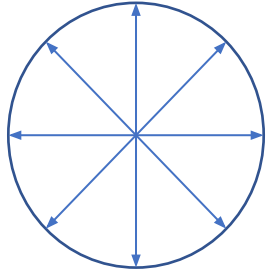


Optical activity

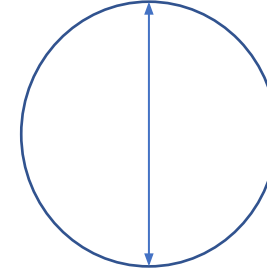


Optical Activity



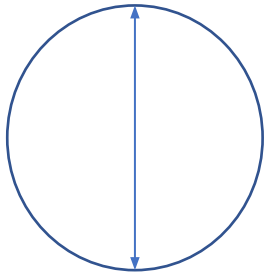
Ordinary light

Vibrations in all planes at right angle to the line of propagation

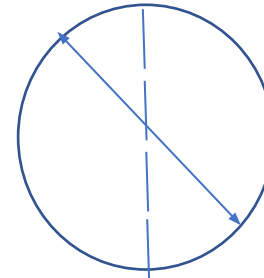


Plane polarized light

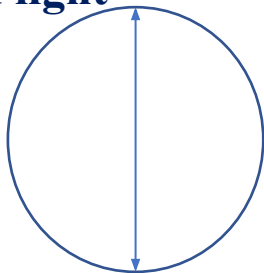
Vibration only in one plane at right angle to the line of propagation



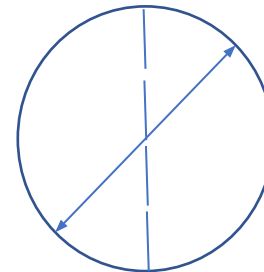
Compound (optically active)



Levo (l)



Compound (optically active)

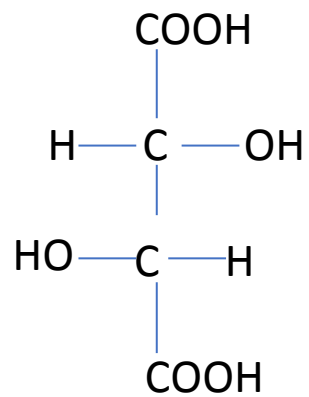


Dextro (d)

Plane polarized light

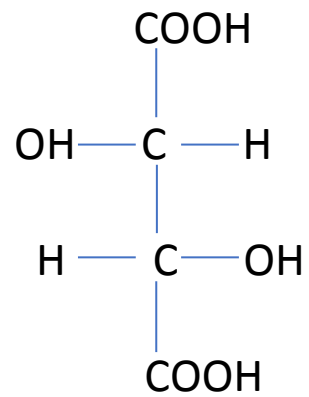
Two important conditions for optical activity:

- ❖ Molecule must have chiral or asymmetric carbon
- ❖ Molecule must have no plane of symmetry



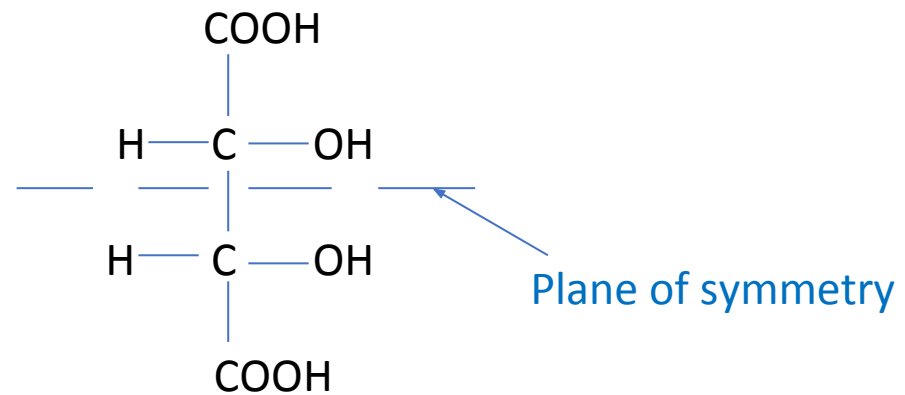
(I)

Optically active



(II)

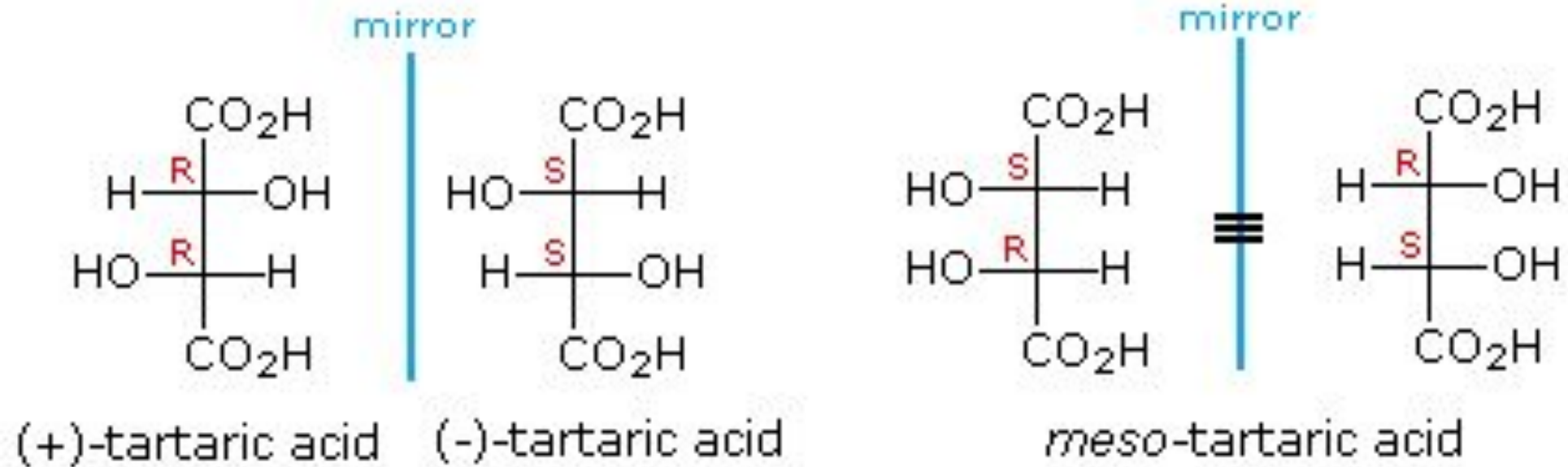
Optically active



(III)

Optically inactive

Effect in physico-chemical properties

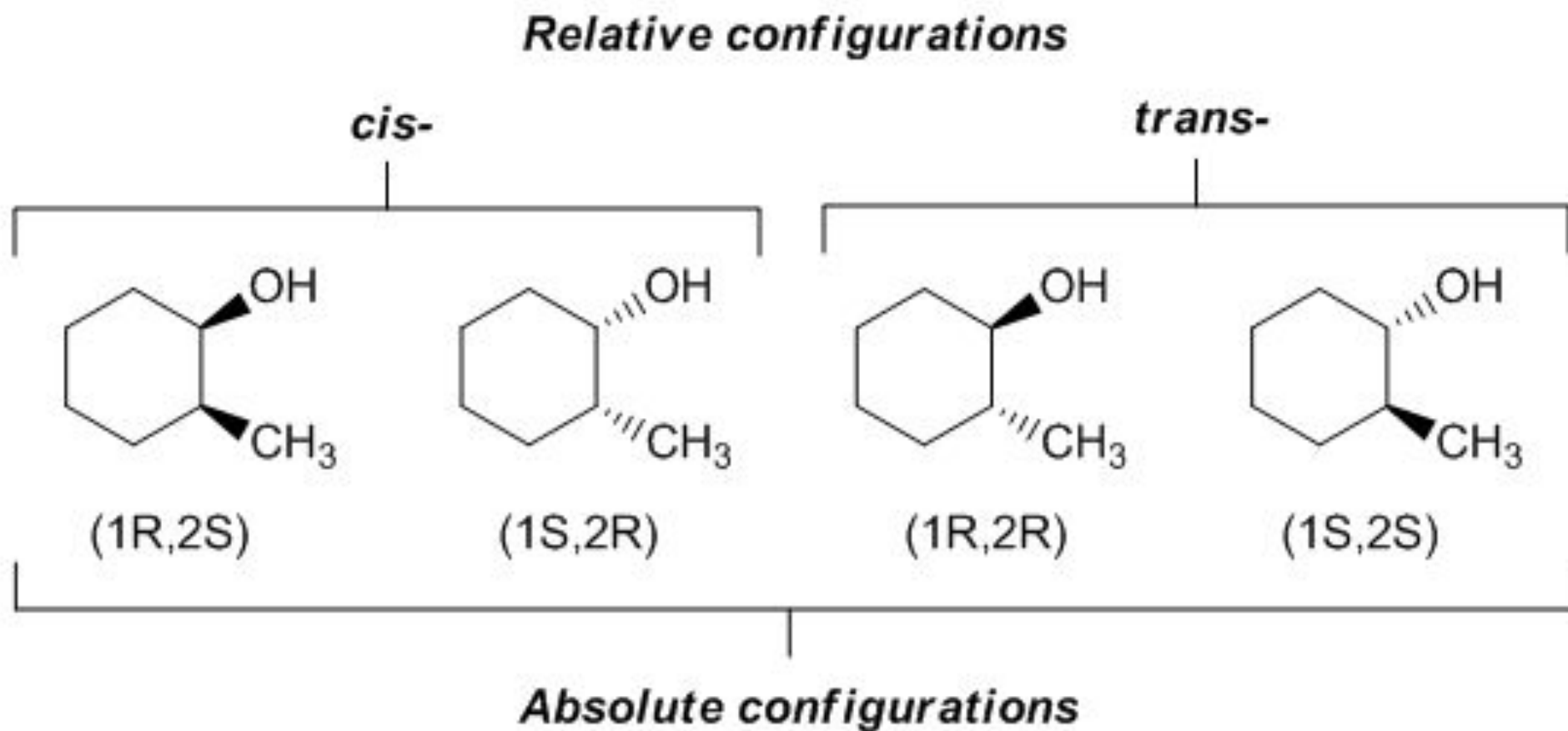


(+)-tartaric acid: $[\alpha]_{\text{D}} = +13^\circ$ m.p. 172°C

(-)-tartaric acid: $[\alpha]_{\text{D}} = -13^\circ$ m.p. 172°C

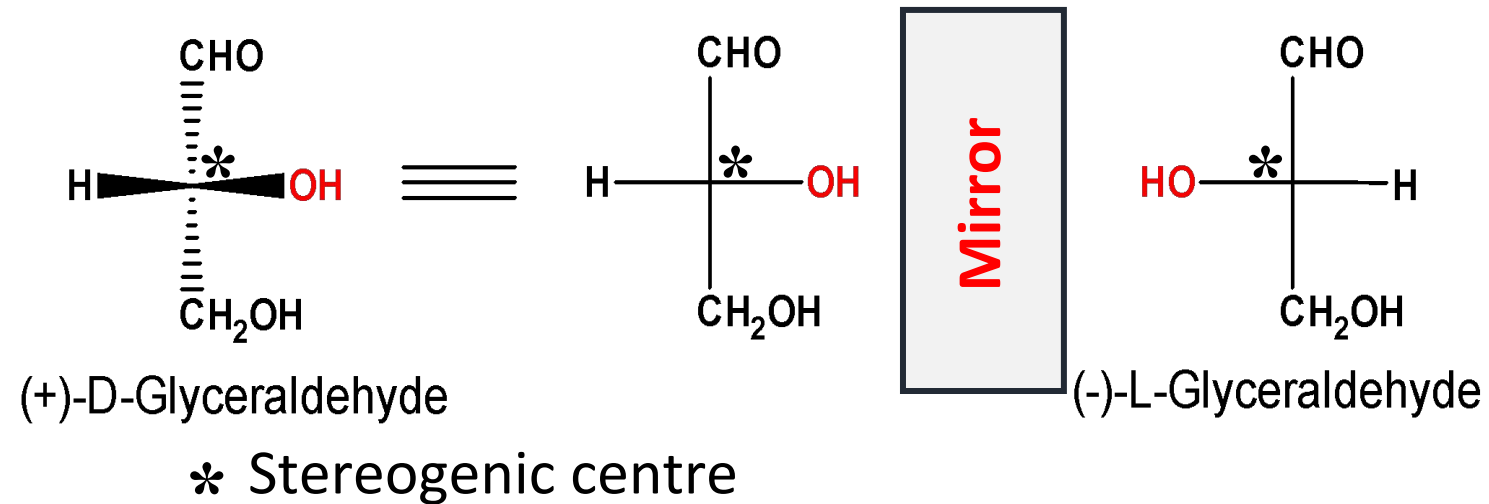
meso-tartaric acid: $[\alpha]_{\text{D}} = 0^\circ$ m.p. 140°C

Absolute configuration and Relative configuration



Conventions, terminologies and projections

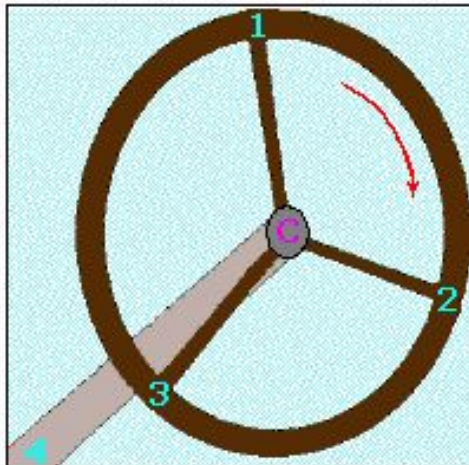
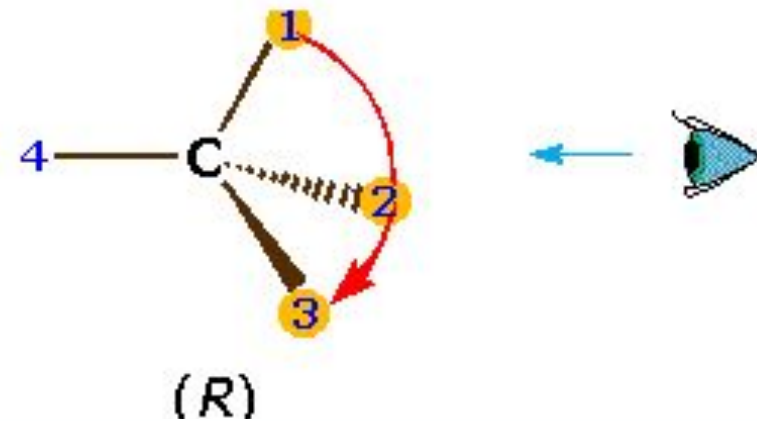
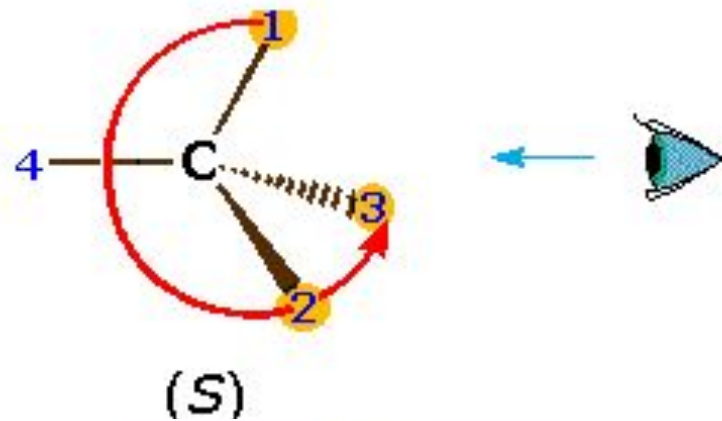
Fisher projection (for the lactic acids, amino acids, carbohydrates)



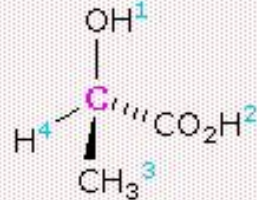
Rule: Position of the OH keeping -CH₂OH at rear position

How to look at a 3D molecule

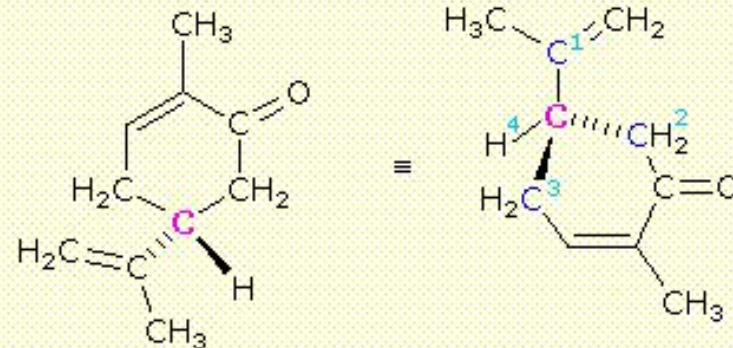
Atom or functional group with least atomic weight should be placed at rear position



A Right Turn



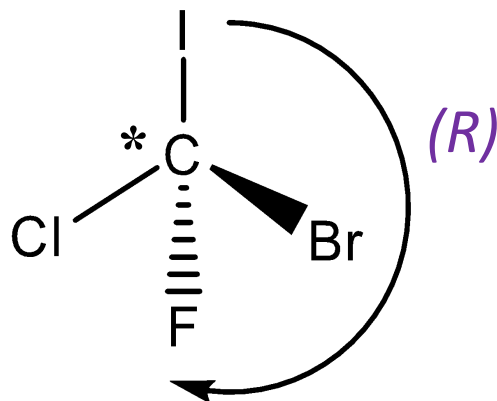
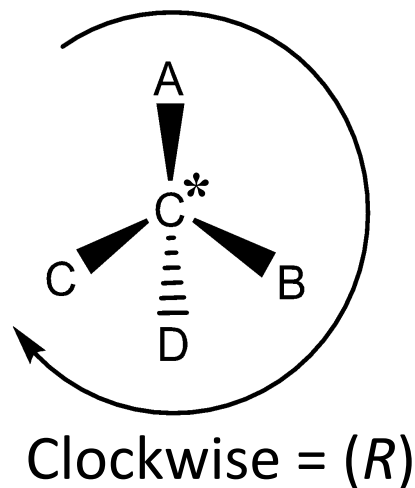
(R)-(-)-Lactic Acid



(R)-(-)-Carvone

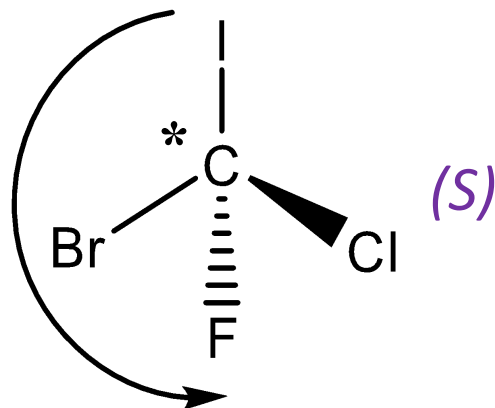
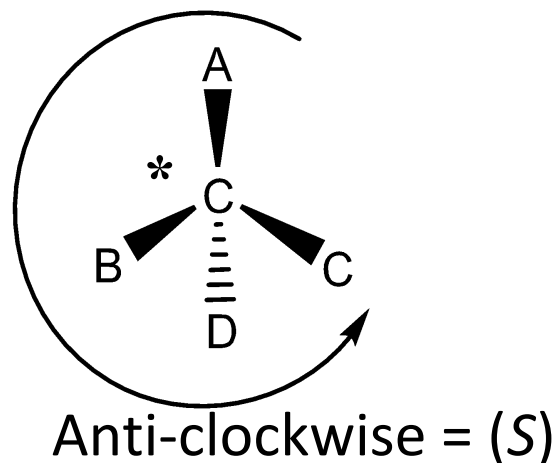
Conventions and terminologies

The (R, S) - convention (or Cahn-Ingold-Prelog system, mostly covers all areas)



R = latin “rectus” means right
S = latin “sinister” means left

Atom or functional group with least atomic weight should be placed at rear position



Sequence rules:

- (1) Sequence $A > B > C > D$ atomic number
- (2) Sense the rotation from A to D

CIP- Priority rule

The Sequence Rule for Assignment of Configurations to Chiral Centers

Assign sequence priorities to the four substituents by looking at the atoms attached directly to the chiral center.

1. The higher the atomic number of the immediate substituent atom, the higher the priority.

For example, $\text{H}- < \text{C}- < \text{N}- < \text{O}- < \text{Cl}-$. (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 chiral center until a difference is found.

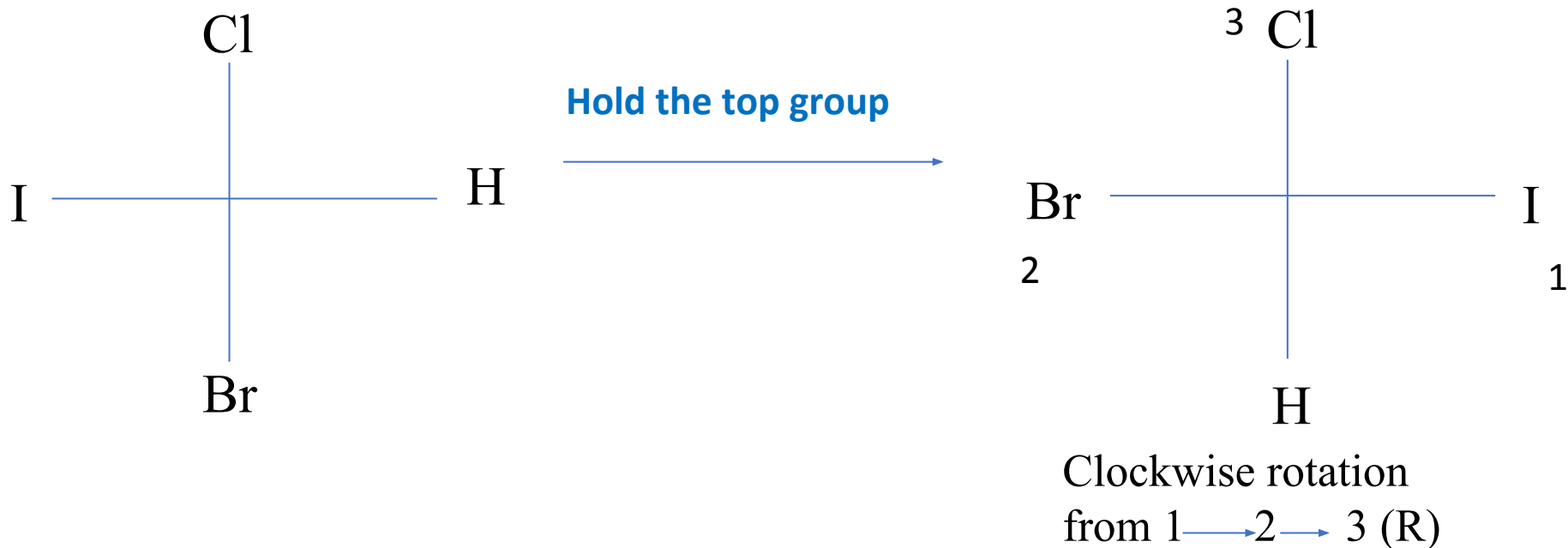
For example, $\text{CH}_3- < \text{C}_2\text{H}_5- < \text{ClCH}_2- < \text{BrCH}_2- < \text{CH}_3\text{O}-$.

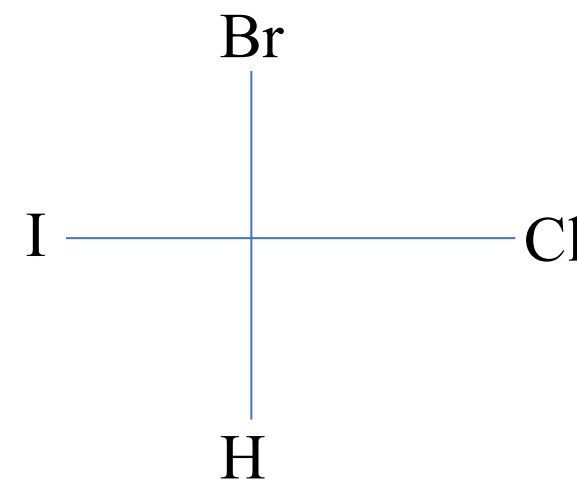
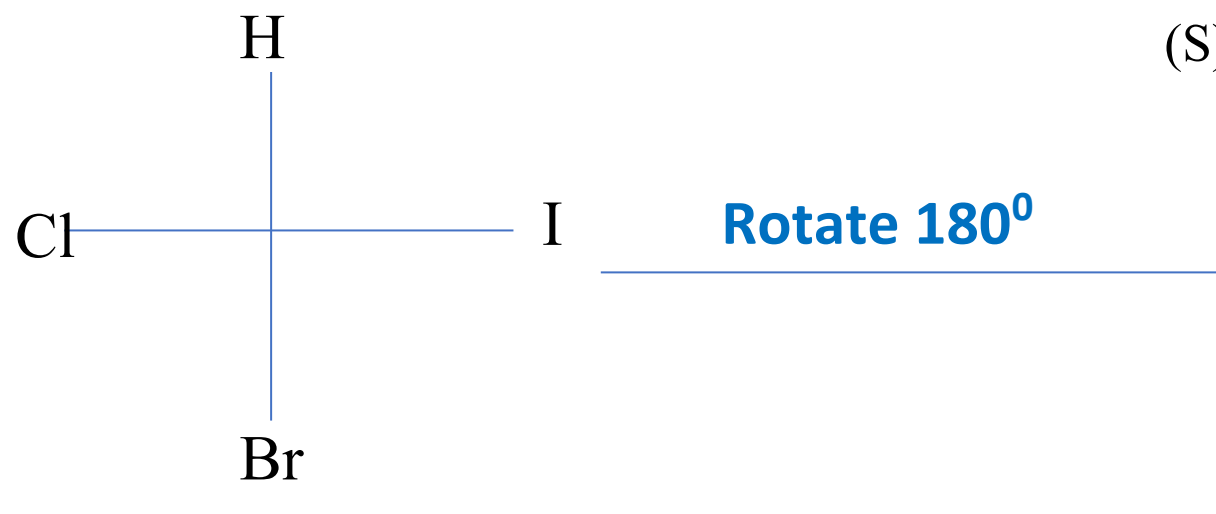
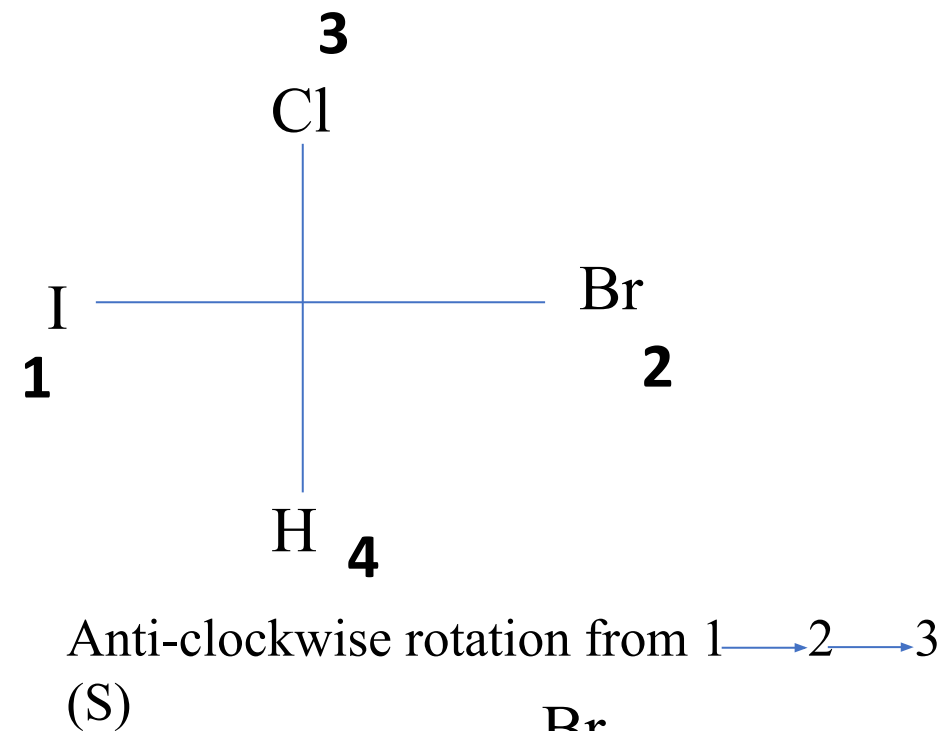
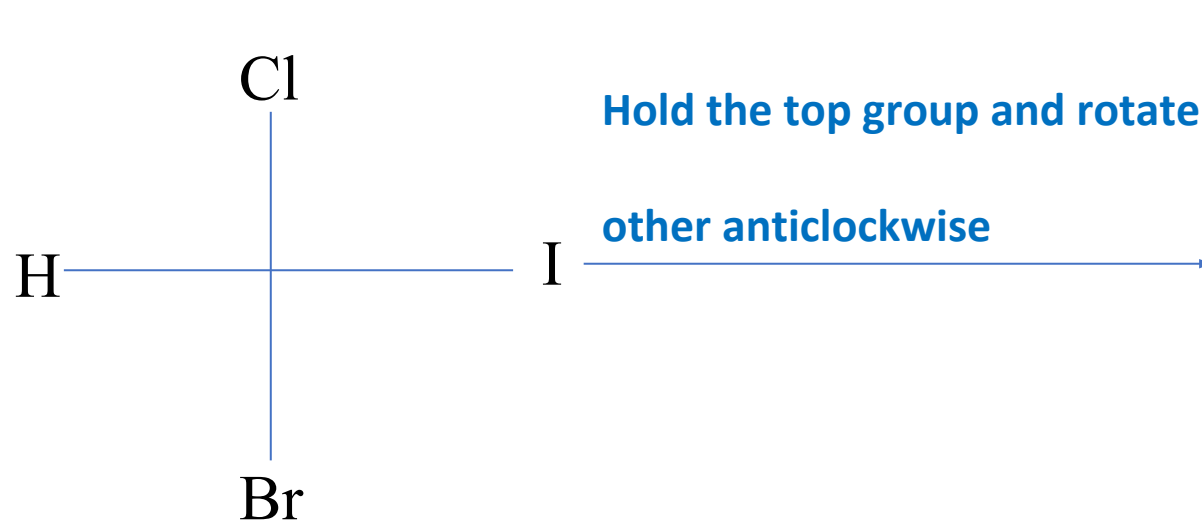
3. If double or triple bonded groups are encountered as substituents, they are treated as an equivalent set of single-bonded atoms.

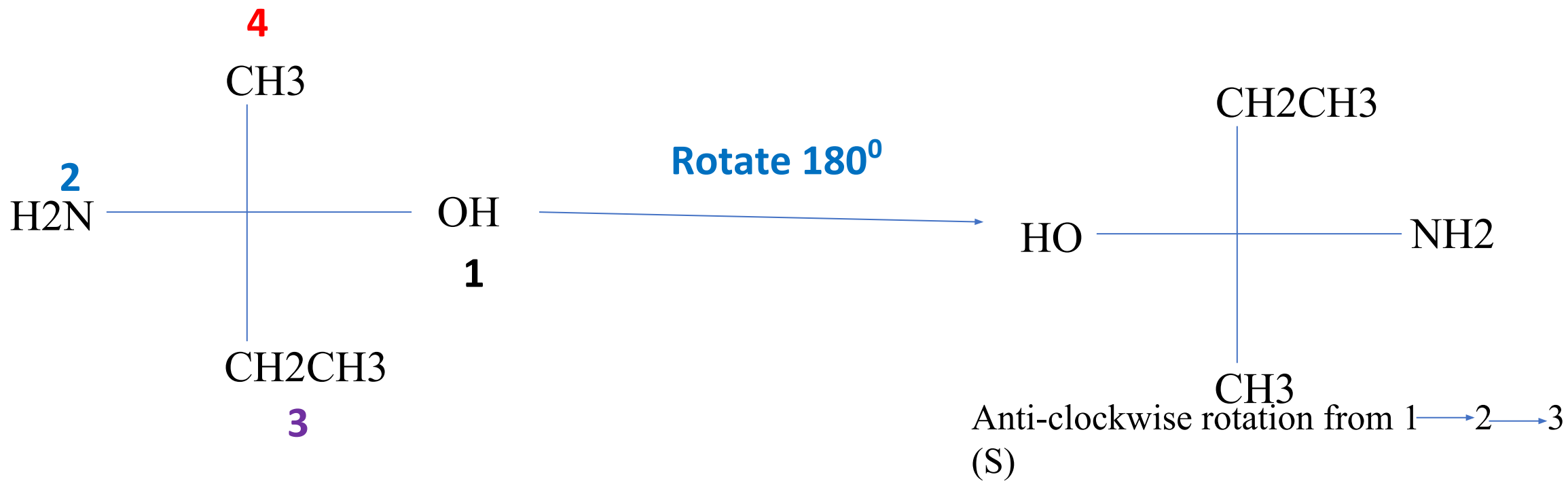
For example, $\text{C}_2\text{H}_5- < \text{CH}_2=\text{CH}- < \text{HC}\equiv\text{C}-$

1. Higher atomic number: Higher priority
2. Try to keep the lower priority group at the bottom
3. R \rightarrow right turn, S \rightarrow left turn

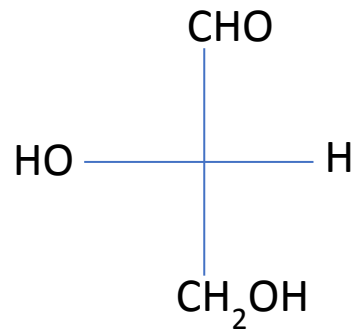
EX:



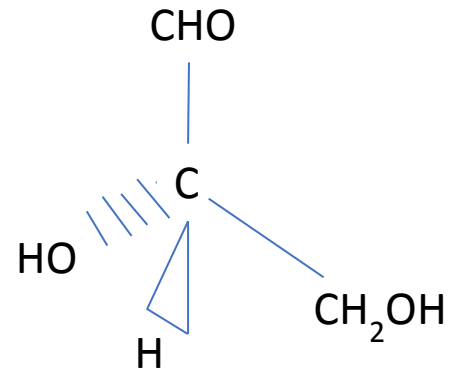
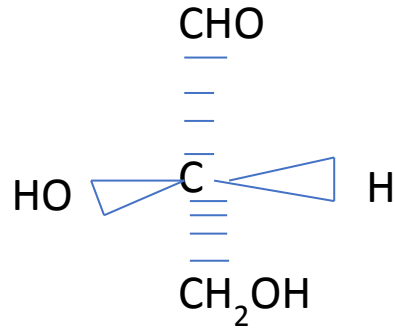




Interconversion



Fischer



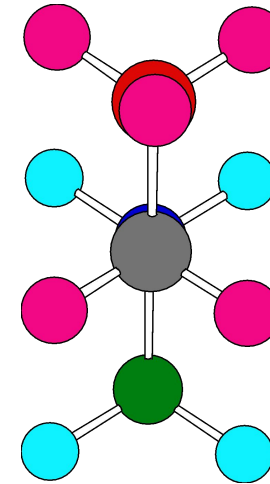
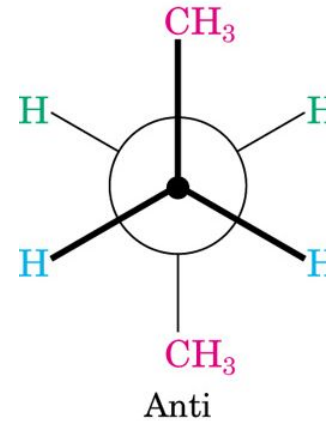
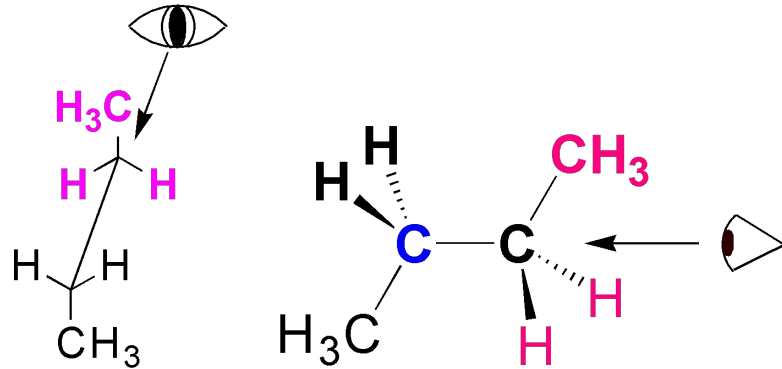
Wedge-dash
h

Conformational analysis of n-butane

Conformational Analysis of

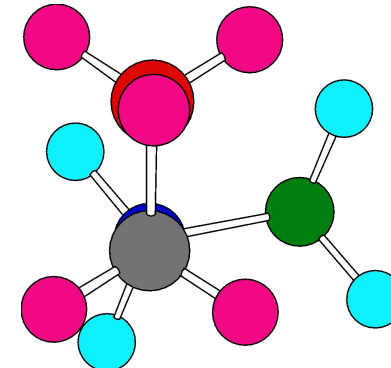
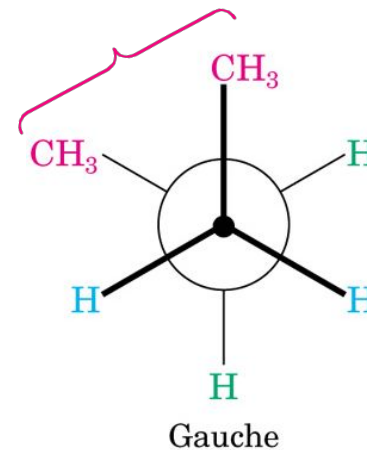
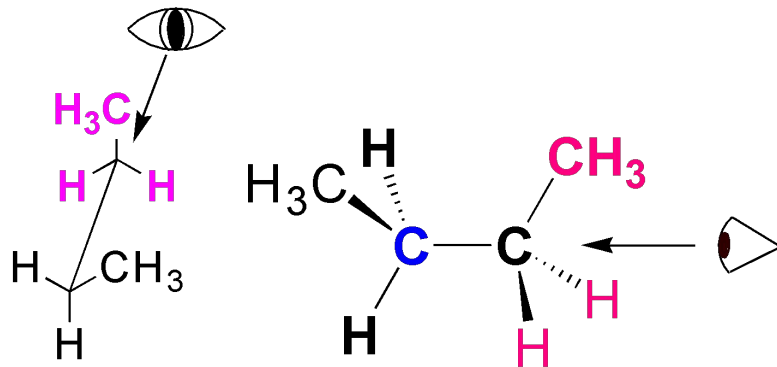
Butane

Staggered: anti



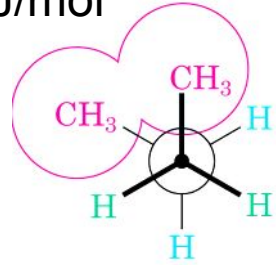
Staggered: gauche

3 KJ/mol

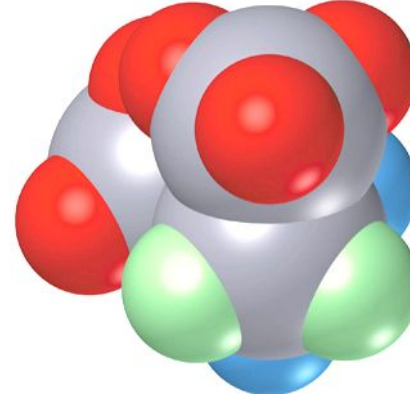
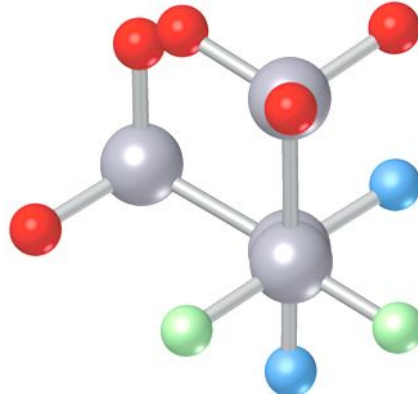


Steric Strain: repulsive interaction that occurs when two groups are closer than their atomic radii

3 KJ/mol

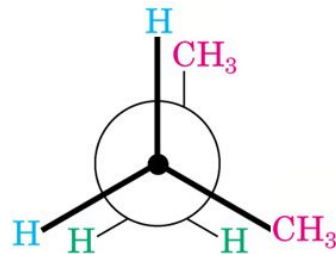
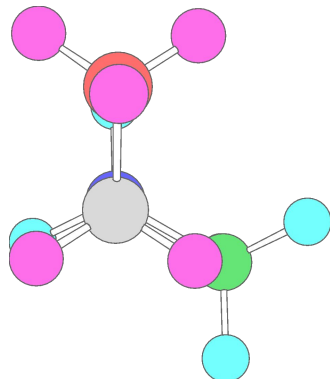


©2001 Brooks/Cole - Thomson Learning

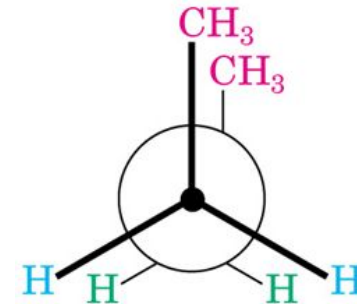
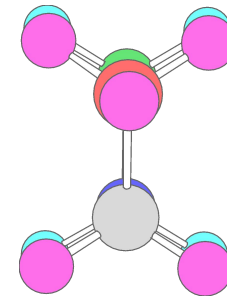


Eclipsed conformations of butane: rotational barrier of butane is 25 KJ/mol. A *CH₃-CH₃ eclipsing interaction is 17 KJ/mol.*

CH₃ - H



CH₃ - CH₃



Least stable eclipsed