7.6
The Cahn Ingold Prelog *R*-*S* Notational System

Two requirements for a system for specifying absolute configuration

1. need rules for ranking substituents at stereogenic center in order of decreasing precedence

2. need convention for orienting molecule so that order of appearance of substituents can be compared with rank

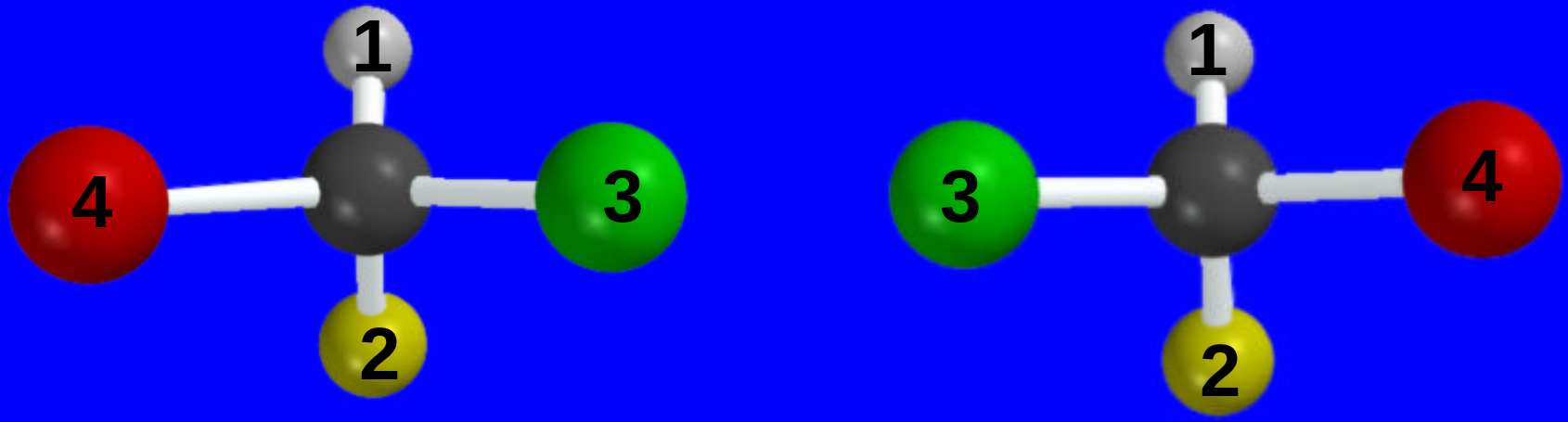
The system that is used was devised by R. S. Cahn, Sir Christopher Ingold, and V. Prelog.

The Cahn-Ingold-Prelog Rules (Table 7.1)

1. Rank the substituents at the stereogenic center according to same rules used in *E-Z* notation.

2. Orient the molecule so that lowest-ranked substituent points away from you.

Example



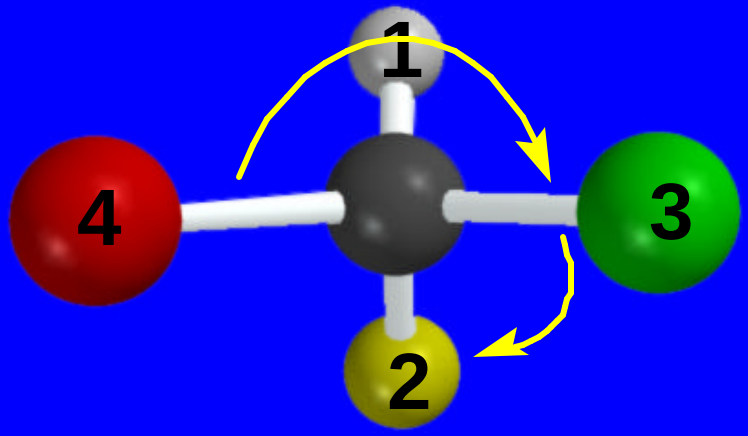
Order of decreasing rank:

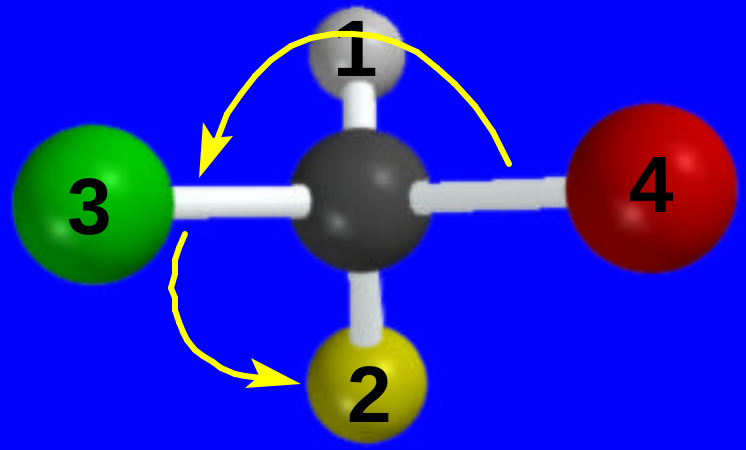
4 > 3 > 2 > 1

The Cahn-Ingold-Prelog Rules (Table 7.1)

- 1. Rank the substituents at the stereogenic center according to same rules used in *E-Z* notation.
- 2. Orient the molecule so that lowest-ranked substituent points away from you.
- 3. If the order of decreasing precedence traces a clockwise path, the absolute configuration is *R*. If the path is anticlockwise, the configuration is *S*.

Example



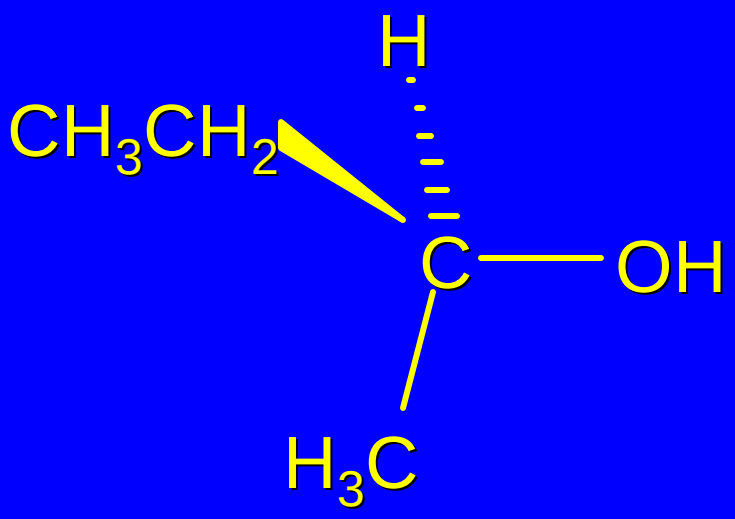


Order of decreasing rank:

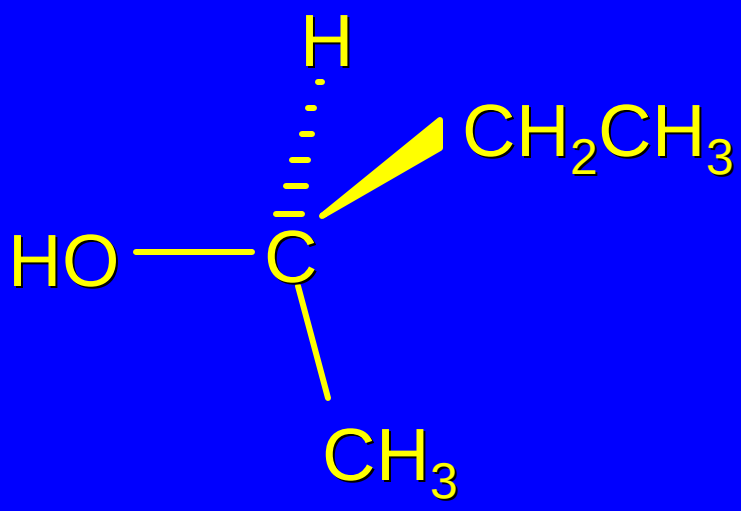
4 ∅ 3 ∅ 2

clockwise	anticlockwise
R	*S*

Enantiomers of 2-butanol



(*S*)-2-Butanol

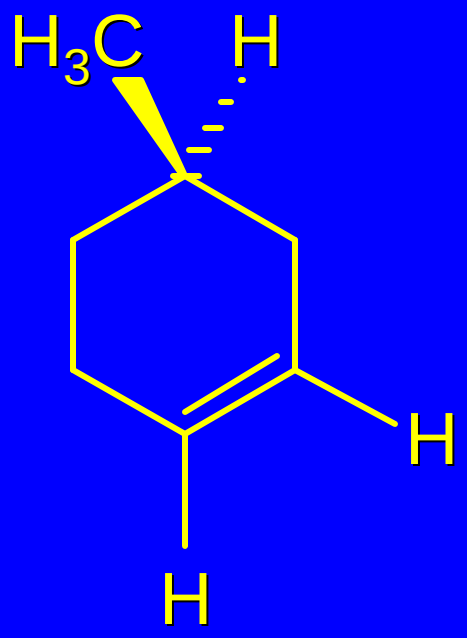


(*R*)-2-Butanol

Very important! Two different compounds with the same sign of rotation need not have the same configuration.

Verify this statement by doing Problem 7.7 on page 269. All four compounds have positive rotations. What are their configurations according to the Cahn-Ingold-Prelog rules?

Stereogenic center in a ring



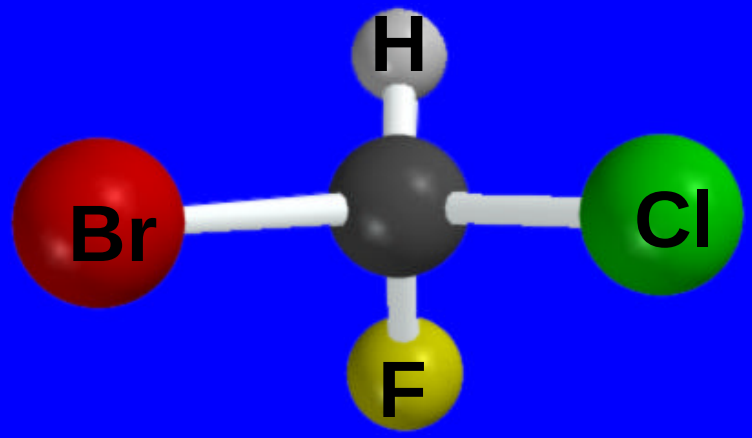
R

—$CH_2C{=}C$ > —CH_2CH_2 > —CH_3 > —H

7.7
Fischer Projections

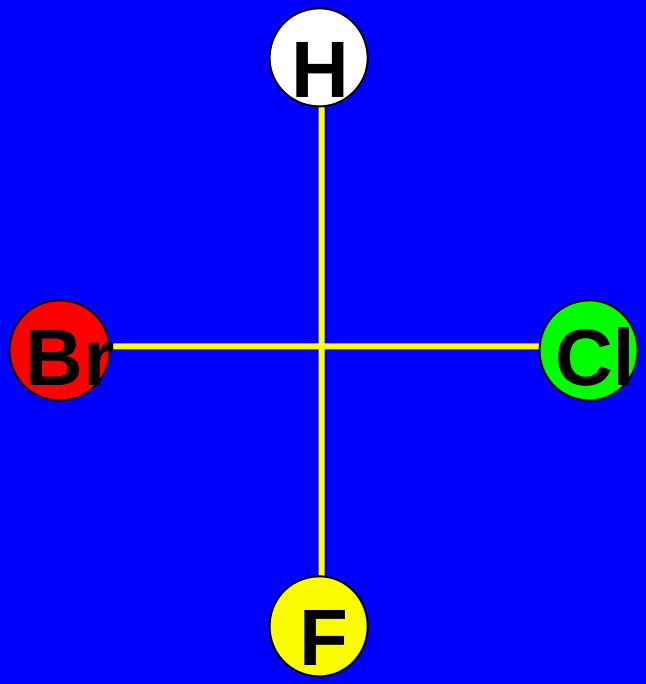
- Purpose of Fischer projections is to show configuration at stereogenic center without necessity of drawing wedges and dashes or using models.

Rules for Fischer projections



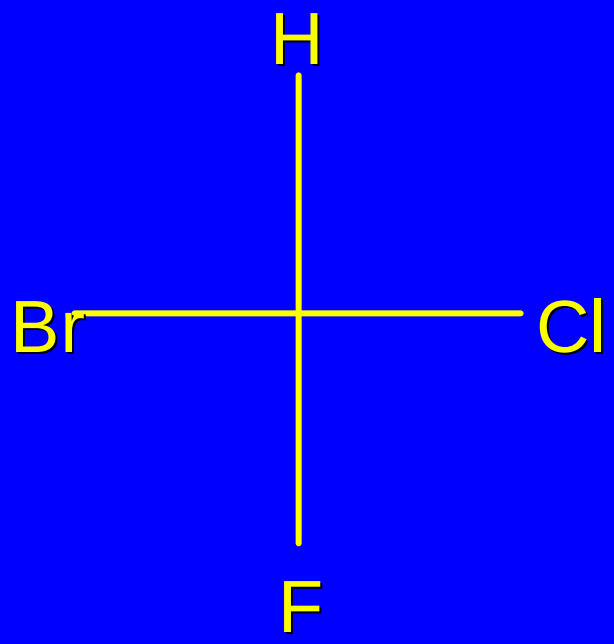
Arrange the molecule so that horizontal bonds at stereogenic center point toward you and vertical bonds point away from you.

Rules for Fischer projections



Projection of molecule on page is a cross. When represented this way it is understood that horizontal bonds project outward, vertical bonds are back.

Rules for Fischer projections



Projection of molecule on page is a cross. When represented this way it is understood that horizontal bonds project outward, vertical bonds are back.

7.8
Physical Properties of Enantiomers

Physical properties of enantiomers

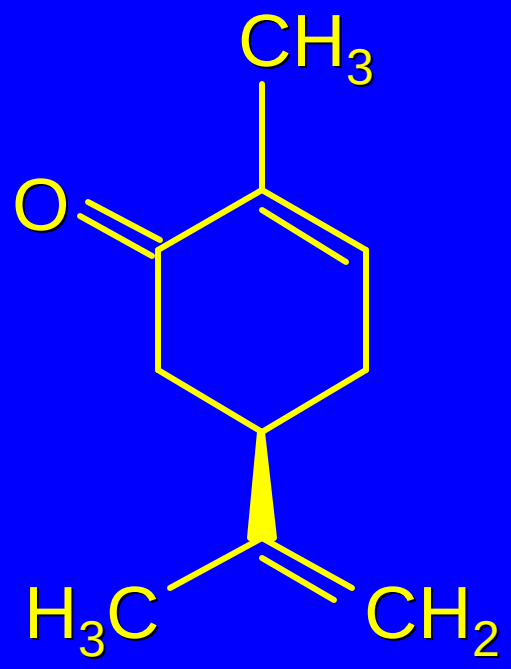
Same:

melting point, boiling point, density, etc

Different:

properties that depend on shape of molecule (biological-physiological properties) can be different

Odor



(–)-Carvone
spearmint oil

(+)-Carvone
caraway seed oil

Chiral drugs

Ibuprofen is chiral, but normally sold as a racemic mixture. The *S* enantiomer is the one responsible for its analgesic and antiinflammatory properties.