Stereochemistry 4-Final Thoughts

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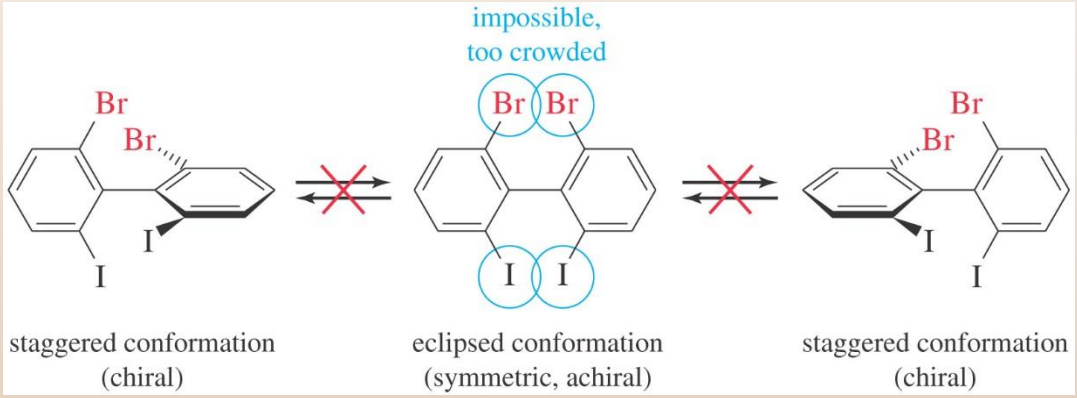
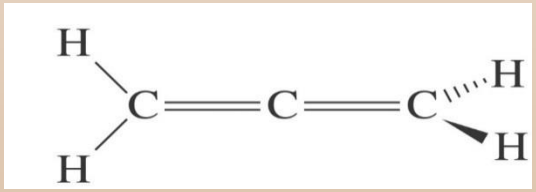
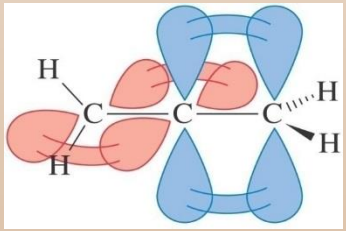
Stereoisomers With no Chiral Centers

If the conformer is sterically hindered, it may exist as enantiomers. Examples given below and allenes.

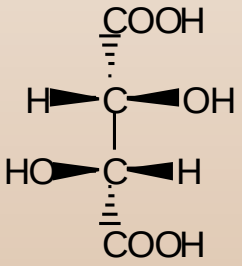
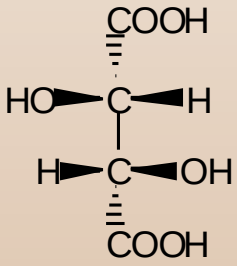
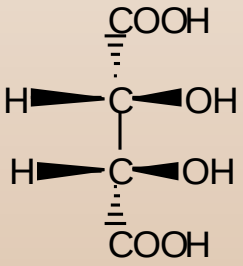






Properties of Stereoisomers

- Enantiomers have identical physical and chemical properties in achiral environments.
- Diastereomers are different compounds and have different physical and chemical properties.
  - meso tartaric acid, for example, has different physical and chemical properties from the R,R and S,S enantiomers
  - Some properties of the stereoisomers of tartaric acid.

			
	(*R*,*R*)-Tartaric acid	**(*S*,*S*)-Tartaric acid**	**Meso tartaric acid**
specific rotation	+12.7	-12.7	0
melting point (° C)	171-174	171-174	146-148
density at 20°C (g/cm ^{3})	1.7598	1.7598	1.660
solubility in water at 20°C (g/100 mL)	139	139	125
pK_1 (25°C)	2.98	2.98	3.23
pK_2 (25°C)	4.34	4.34	4.82

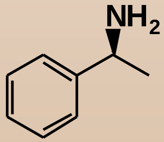
Resolution

- Racemic mixture: An equimolar mixture of two enantiomers.
  - because a racemic mixture contains equal numbers of dextrorotatory and levorotatory molecules, its specific rotation is zero.
- Resolution: The separation of a racemic mixture into its enantiomers.
- One means of resolution is to convert the pair of enantiomers into two diastereomers.
  - Diastereomers are different compounds and have different physical properties.
- A common reaction for chemical resolution is salt formation.

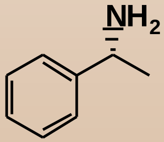
$$RCOOH \quad + \quad :B \rightleftharpoons RCOO^{-} \quad HB^{+}$$

(*R* + *S*)-Carboxylic acid **(*R*)-Base** **(*R*,*R*)-Salt + (*S*,*R*)-Salt)**

- After separation of the diastereomers, the enantiomerically pure acids are recovered by addition of an achiral acid.
- Racemic acids can be resolved using commercially available chiral bases such as 1-phenylethanamine.

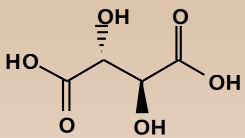


(*S*)-1-Phenylethanamine

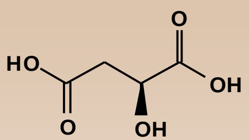


(*R*)-1-Phenylethanamine

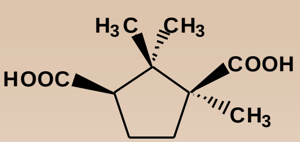
- Racemic bases can be resolved using chiral acids such as



(2*S*,3*S*)-(+)-Tartaric acid



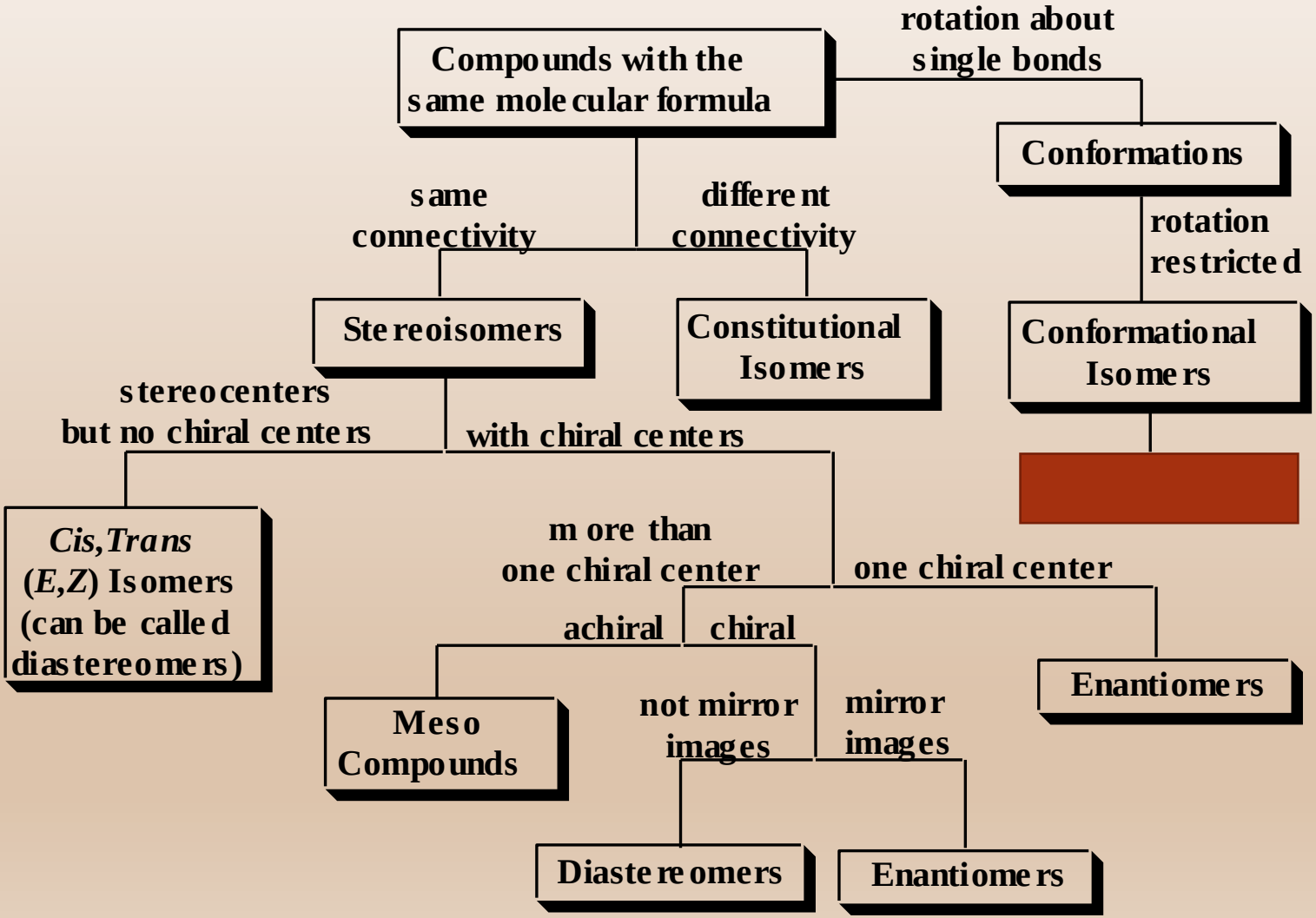
(S)-(-)-Malic acid



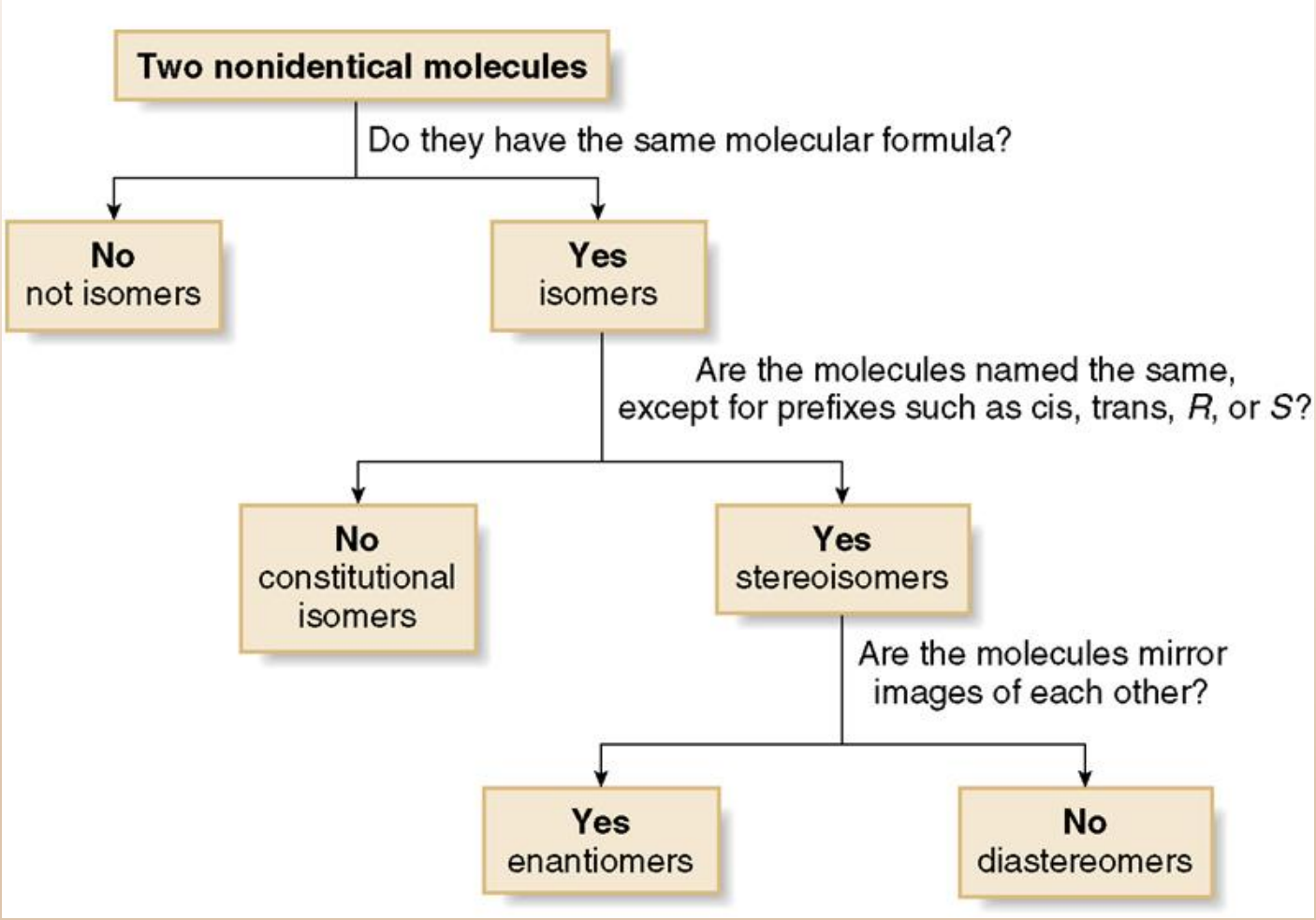
(1S,3R)-(+)-Camphoric acid

Review of all Isomers

- Here is a flowchart of all isomers we have done so far.



Determining Stereochemistry



Key Words/Concepts

- Stereoisomers
- Chiral Center
- Chirality
- Enantiomer
- Plane polarized light
- Dextrorotatory (d)
- Laevorotatory (l)
- Diastereomers
- Meso compounds
- Cahn Ingold and Prelog nomenclature
- Configurations (R and S)
- Racemic mixtures
- Fisher projections
- Enantiomeric excess
- Absolute configuration
- Resolution