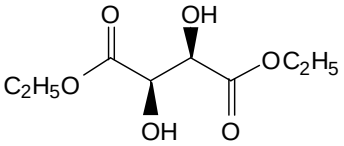
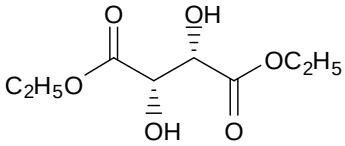
Properties of Enantiomers

Most physical properties of enantiomers are identical.



diethyl-(*R*,*R*)-tartrate

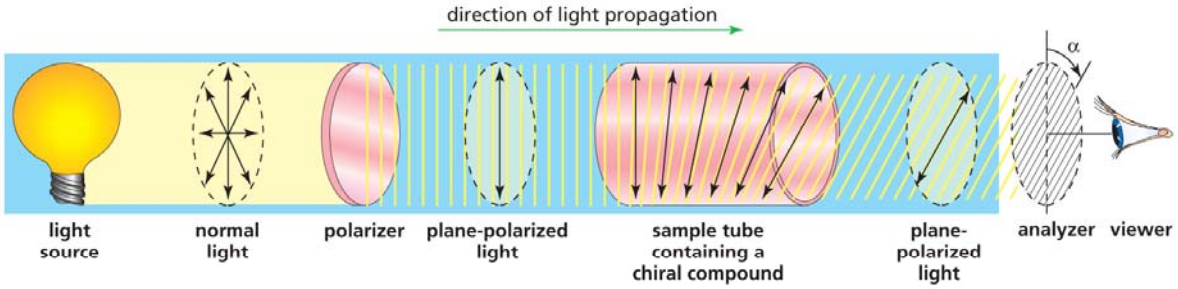


diethyl-(*S*,*S*)-tartrate

boiling point	280 °C	280 °C
melting point	19 °C	19 °C
density	1.204 g/mL	1.204 g/mL
refractive index	1.447	1.447

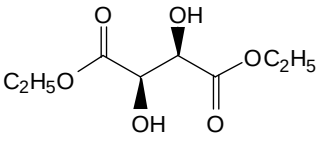
i.e., chirality does not affect most physical properties.

Chiral Molecules Rotate Plane-Polarized Light



(rotation of light passed through 10 cm of substance; + is clockwise)

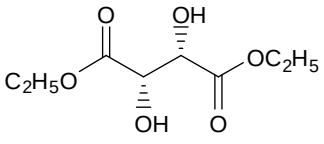
specific rotation [α]



diethyl-(*R*,*R*)-tartrate

+8.5°

(+)-diethyl tartrate



diethyl-(*S*,*S*)-tartrate

-8.5°

(-)-diethyl tartrate

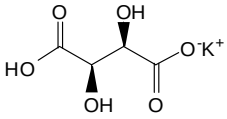
molecules are sometimes named (+) or (-) after this property.

enantiomers rotate light in opposite directions.

Racemic Mixtures

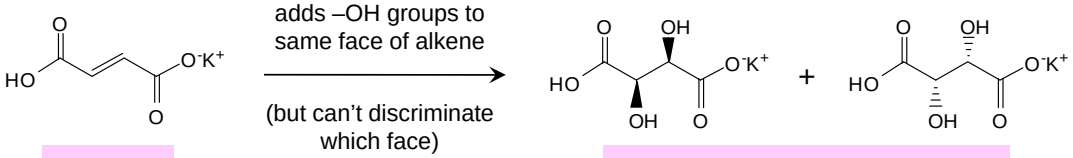
Racemate, or
Racemic mixture: A perfect, 1:1 mixture of enantiomers.

- Biological processes normally produce enantiomerically pure materials (are *stereospecific*).



(+)-tartaric acid, potassium salt

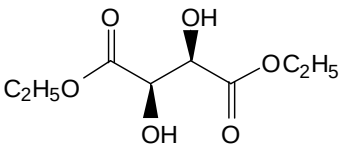
- Chemical processes usually produce racemates.



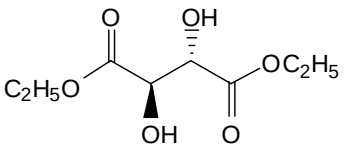
achiral

racemic mixture; does not rotate polarized light

Diastereomers Have Different Physical Properties



diethyl-(*R*,*R*)-tartrate



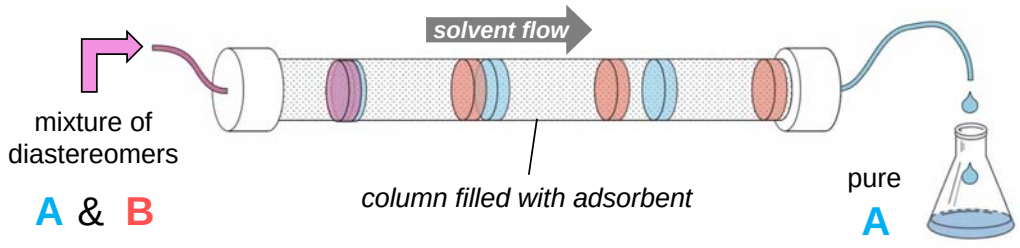
diethyl-(*R*,*S*)-tartrate

boiling point	280 °C	> 300 °C	
melting point	19 °C	60 °C	
density	1.204 g/mL	1.135 g/mL	
refractive index	1.447	1.432	
specific rotation [α]	+8.5°	0°	meso, achiral

Diastereomers Can Be Separated

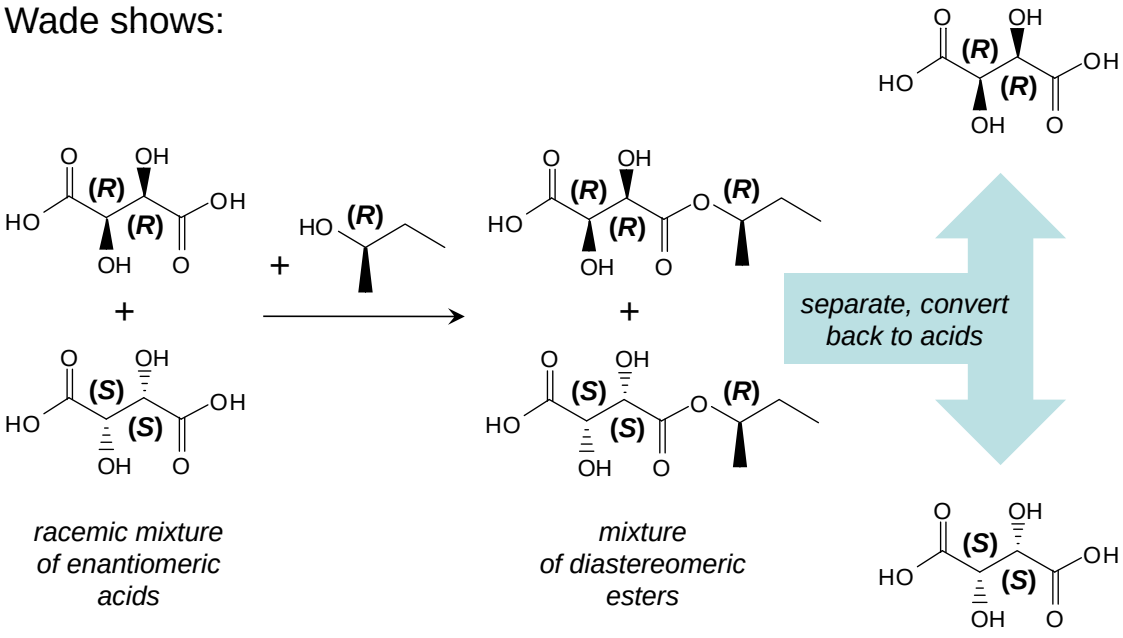
Different properties mean diastereomers can often be physically separated from one another.

Property	*Separation Technique*
boiling point	distillation
solubility	recrystallization
affinity for a solid support	chromatography



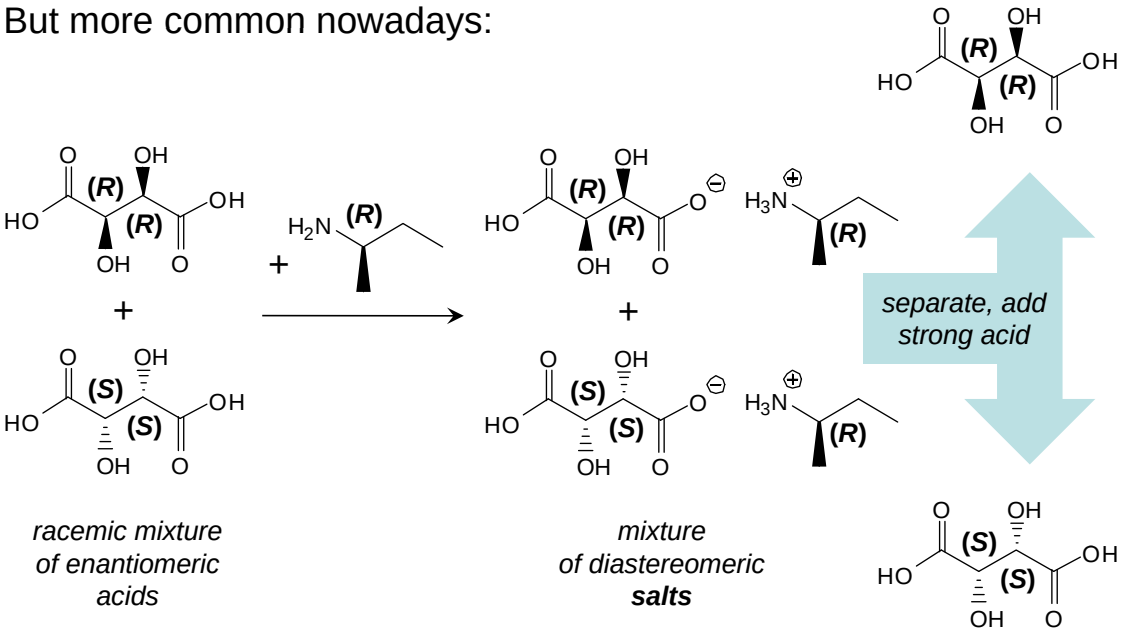
Resolution of Enantiomers (by Conversion to Diastereomers)

Wade shows:



Resolution of Enantiomers (by Conversion to Diastereomers)

But more common nowadays:



Chapter 5 Material Not Covered in Lecture:

Calculating Specific Rotation:	Read Wade, Chap. 5.4.
Calculating Optical Purity:	Read Wade, Chap. 5.7.
Chiral Compounds without Chiral Centers:	Read Wade, Chap. 5.9.
Fisher Projections:	Read Wade, Chap. 5.10.
Chromatographic Resolution of Enantiomers:	Read Wade, Chap. 5.16B.