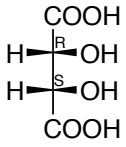
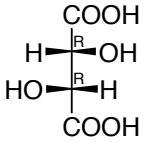
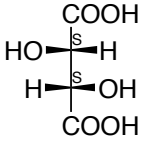
Tartaric Acids



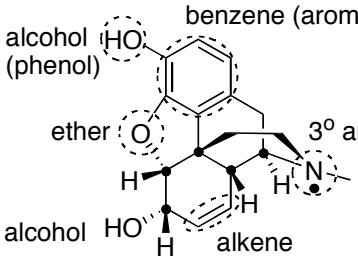
Meso
Achiral



R,R



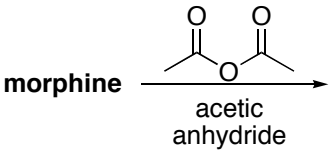
S,S

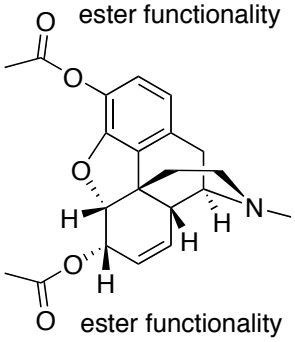


- stereogenic centers (6)

- morphine from Morpheus (god of sleep)
- 10% opium is morphine, from opium poppy (Papaver somniferum).
- **Alkaloid:** N-containing substance, from plants
- Analgesic and addictive

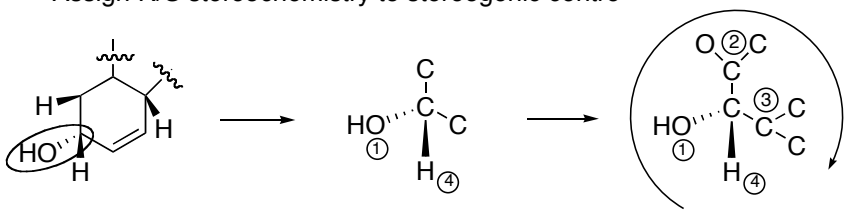
morphine





Heroin
- 1000x better analgesic
- 1000x more addictive

Assign R/S stereochemistry to stereogenic centre



CW rotation (but H is up) = S-configuration

Physical Properties + Stereochemistry

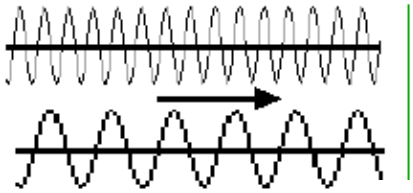
- Diastereomers → Different properties
  - M.P, B.P, solubility, and density

- Enantiomers → Same physical properties with achiral agents
  - M.P, B.P, solubility, etc…

- Enantiomers → different properties with chiral agents
  - rotate plane of polarized light in equal but opposite direction.

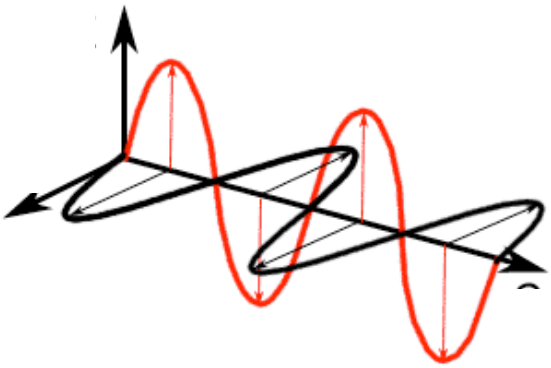
Light → $E = h\upsilon = \frac{hc}{\lambda}$

υ = frequency E = energy h = Planck's constant λ = wavelength

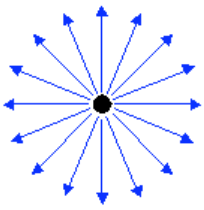


short wavelength = high frequency High energy

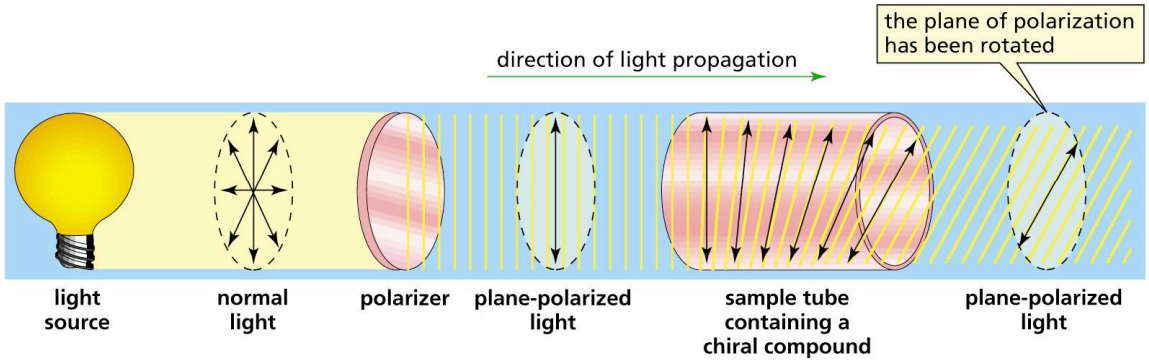
long wavelength **low frequency** Low energy



Light has oscillating Electric field (red) combined with magnetic field (black)



End on view of vector components of normal light



$$[\alpha]_D = \frac{x}{c \bullet l}$$

x = measured rotation c = concentration (mol/L) l = path length (cm)
D = D-line of sodium light [α] = absolute rotation

- 1:1 mixture of enantiomers = **racemic mixture** or **racemate**
- RR tartaric acid = 170°C
- SS tartaric acid = 120°C
- RR + SS racemic tartaric acid = 206°C

- enantiomers rotate plane-polarized light in equal but opposite directions.

Optical Purity = enantiomeric excess
- excess of one enantiomer over the other

$$\text{Optical purity} = \frac{[\alpha]_{observed}}{[\alpha]_{pure-enantiomer}} \text{ x } 100\%$$

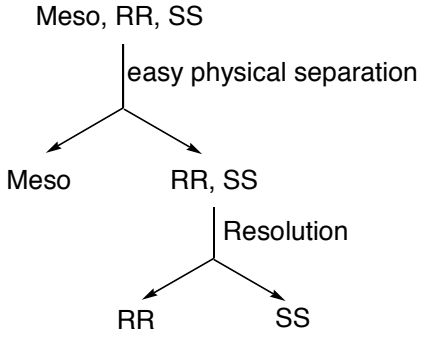
Eg. Assume pure enantiomer has 100° rotation (pure R isomer = +100° ; S isomer = -100°)

R	S	Rotation (°)	Optical purity
100%	0%	100	100%
75%	25%	50	50%
50%	50%	0	0%
25%	75%	-50	50%
0%	100%	-100	100%

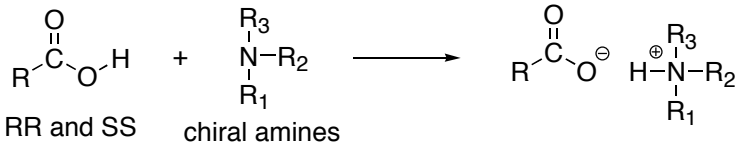
Resolution: Separation of enantiomers.

- Always need chiral agents
- Physical separation (crystallization of specific enantiomer)
- "reaction" with chiral substance to get 2 diastereomers, which can be separated.

Ex) Tartaric Acid – mixture of meso, RR, and SS



RR + SS separation ⟶ Resolution



- RR acid with S-amine = RRS salt
- SS acid with S-amine = SSS salt the 2 salts are diastereomers

Reactions + Stereochemistry

- **stereospecific reaction** = stereochemistry of starting material determines stereochemistry of product.
- **stereoselective reaction** = one isomer of product preferred.
- Non-stereospecific reaction = no stereoisomer preferred.

Example of Stereospecific Reaction (previously discussed)

The specific example shown below would NOT work well in practice because of COOH groups; it is used only to help understand concept in relation to tartaric acids