Optical Isomerism Map

AQA A-level Chemistry · 3.3.7 Optical isomerism

1 Chiral centres 3.3.7

- A carbon with **four different groups**
- Also called an **asymmetric carbon**
- Follow each chain to its end
- CH_2, CH_3 and C=O carbons: never



2 Enantiomers 3.3.7

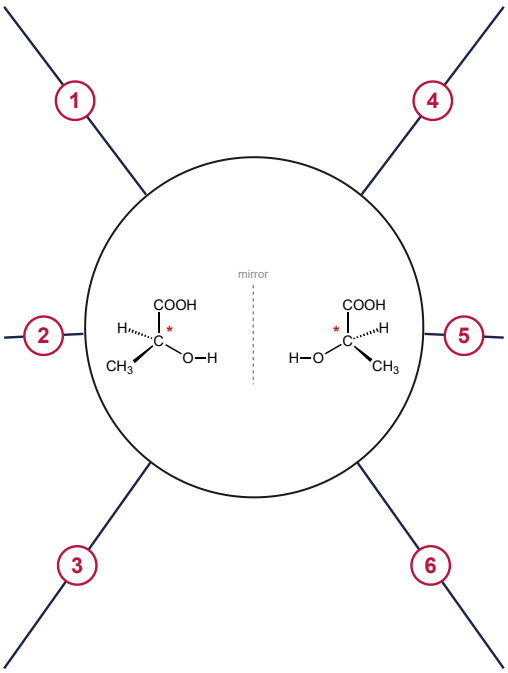
- **Non-superimposable mirror images**
- Same structural formula
- Different arrangement in space
- Optical isomers: stereoisomers



3 Drawing in 3D 3.3.7

- Two plain bonds in the plane
- **Wedge**: towards you
- **Hash**: away from you
- Reflect across a mirror line





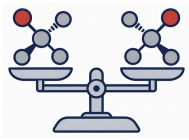
4 Plane-polarised light 3.3.7

- Light vibrating in **one plane**
- One enantiomer **rotates the plane**
- Partner: same angle, opposite way
- Same physical properties otherwise



5 Racemic mixtures 3.3.7

- **50 : 50** of two enantiomers
- Rotations cancel: **inactive**
- Every molecule is still chiral
- Also called a **racemate**



6 Where racemates come from 3.3.7

- A **planar** intermediate or group
- Attacked from **either side** equally
- HBr + but-1-ene: planar C^+
- KCN + aldehyde: planar C=O (3.3.8)



Chiral or not? Reading the evidence

one enantiomer rotates the plane; a racemate does not

Compound or sample	Chiral centre?	Effect on plane-polarised light	Reason
propan-2-ol	no	none	two CH_3 groups on C2
one enantiomer of butan-2-ol	yes (C2)	rotates the plane	single optical isomer
racemic butan-2-ol	yes (C2)	none	equal and opposite rotations
2-bromobutane from but-1-ene + HBr	yes (C2)	none	planar carbocation: racemic
propanal + KCN, then acid	yes	none	planar C=O: racemic
propanone + KCN, then acid	no	none	two CH_3 groups: not chiral

Worked examples

Spot the centre

- $CH_3CH(OH)COOH$
- C2: H, OH, CH_3, COOH
- **one chiral centre**

The mirror image

- one enantiomer: clockwise
- its partner: same angle
- **anticlockwise**

Racemic or not?

- butanal + KCN, acid
- planar C=O, both faces
- **racemic: inactive**

Optical isomers return with the racemic hydroxynitriles of 3.3.8 and with amino acids in 3.3.13.

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