Chirality Map

Edexcel International A Level Chemistry · Unit 4 · Topic 15A Chirality

1 Chiral centres

15.1, 15.2

- 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

15.2

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

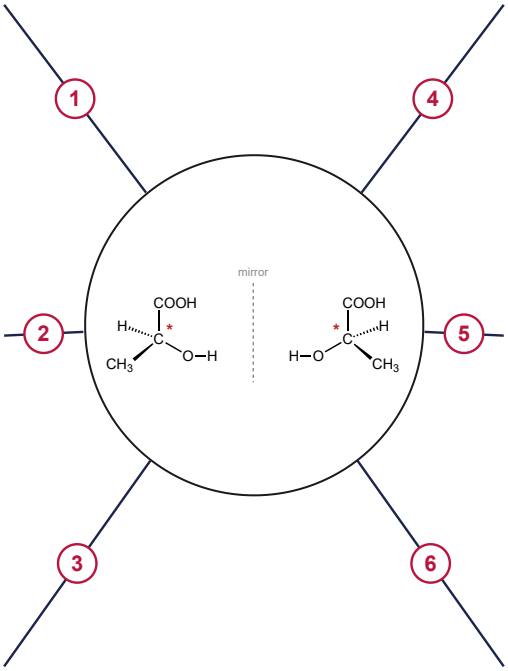


3 Drawing in 3D

15.2

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





4 Optical activity

15.3

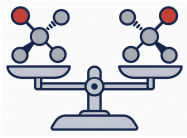
- **Plane-polarised**, monochromatic light
- One enantiomer **rotates the plane**
- Partner: same angle, opposite way
- Measured with a polarimeter



5 Racemic mixtures

15.4

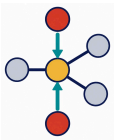
- **50 : 50** of two enantiomers
- Rotations cancel: **inactive**
- Formed from planar intermediates
- Excess of one: smaller rotation



6 Evidence for mechanisms

15.5

- Start with **one enantiomer**
- **SN1**: planar C^+: racemic
- **SN2**: inversion: still active
- Carbonyl + HCN: racemic (15B)



Chiral or not? Reading the evidence

rotations measured in the same tube at the same concentration

Compound or sample	Chiral centre?	What the polarimeter shows	Reason
propan-2-ol	no	0°	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)	0°	equal and opposite rotations
SN1 product (tertiary)	yes	0°	planar carbocation: racemic
SN2 product (one enantiomer in)	yes	rotates the plane	inversion: one enantiomer
75 : 25 mixture	yes	half the pure value	50% excess of one

Worked examples

Spot the centre

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

Mixture rotation

- pure (+): +20°
- 75% (+), 25% (−)
- excess 50%: **+10°**

Which mechanism?

- active reactant
- inactive product
- planar intermediate: **SN1**

Chirality returns with the racemic hydroxynitriles of Topic 15B and with amino acids in Topic 19.

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