# Chirality Map

Cambridge International AS & A Level Chemistry · Topic 29 Optical isomerism

## 1 Chiral centres 13.4

- A carbon with **four different groups**
- Follow each chain to its end
- **Enantiomers**: mirror images
- Non-superimposable



## 2 Same and different 29.4.1

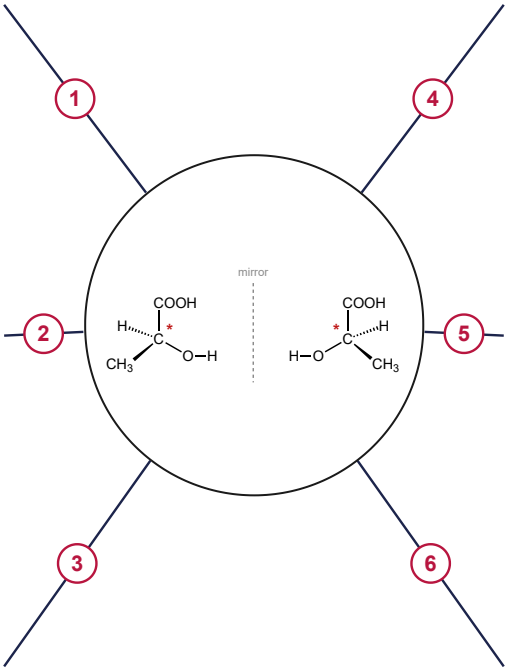
- Same melting and boiling points
- Same reactions with achiral reagents
- Differ: **rotate the plane**
- Differ: **biological activity**



## 3 The polarimeter 29.4.3

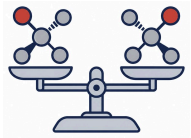
- **Monochromatic** light
- Polariser: **one plane**
- Sample tube, then analyser
- Same angle, opposite sign






## 4 Racemic mixtures 29.4.2

- **50 : 50** of two enantiomers
- Rotations cancel: **inactive**
- From a **planar** group
- Attacked from either side



## 5 Chiral drugs 29.4.4

- Receptors and enzymes are **chiral**
- One enantiomer **fits** the site
- Other: inactive or harmful
- Racemate: **separate** it



## 6 One isomer only 29.4.4

- Use a **chiral catalyst**
- Enzymes: natural chiral catalysts
- No separation, less waste
- Smaller dose, fewer side effects



## Optically active or not?

one enantiomer rotates the plane; a racemic mixture 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 |
| ethanal + HCN, KCN catalyst | yes | none | planar C=O: racemic |
| drug made with a chiral catalyst | yes | rotates the plane | one enantiomer only |

## Worked examples

### The other enantiomer

- one: +17° (clockwise)
- same angle, other way
- **−17°**

### Racemic or not?

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

### Make one isomer

- racemate: half wasted
- chiral catalyst
- **single enantiomer**

Optical isomers return with amino acids in Topic 34 and in planning a synthesis in Topic 36.

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