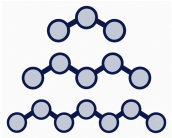
# Boiling Points Map

Cambridge International AS & A Level Chemistry · Topic 3 Chemical bonding · Boiling points

## 1 Alkane chain length

4.2.2(b)

- Each $CH_2$ adds **8 electrons**
- More contact: **stronger id–id**
- $CH_4$ 112 K → $C_8H_{18}$ 399 K
- The rise per $CH_2$ shrinks



## 2 Branching

4.2.2(b)

- Isomers: **same electrons**
- Branched: compact, **less contact**
- Pentane 309 K; 2,2-dimethylpropane 283 K
- More branching, lower bp

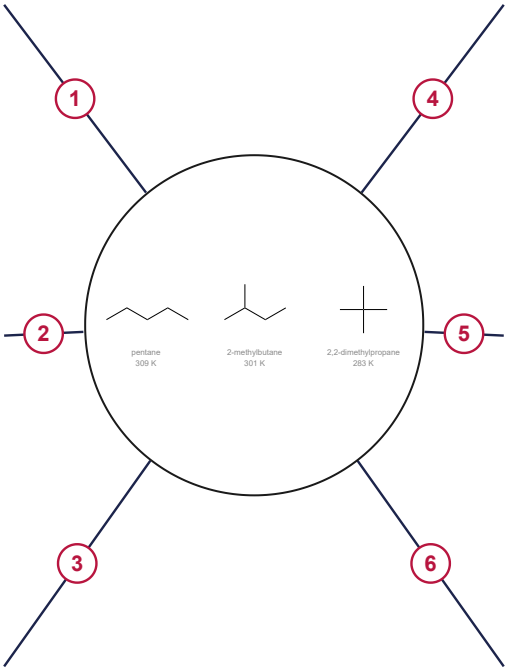


## 3 Alcohols and alkanes

4.2.2(b)

- Compare at **equal electrons**
- O–H: **hydrogen bonds**
- Ethanol 351 K; propane 231 K
- Alcohols: **less volatile**

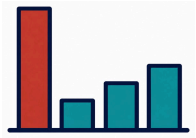





## 4 Hydrogen halides

4.2.2(b)

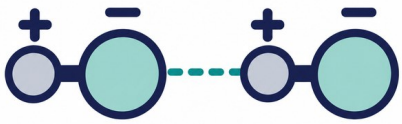
- HCl → HI: **more electrons**
- id–id rise outweighs polarity
- HCl 188, HBr 206, HI 238 K
- **HF** 293 K: hydrogen bonds



## 5 Listing the forces

3.6.3

- **id–id** in every molecule
- Polar: **pd–pd** as well
- H on N, O or F: **hydrogen bonds**
- O or N with no H: **none**



## 6 Unfamiliar molecules

4.2.3

- List **every** force first
- Compare **like with like**
- $CH_3SH$ 279 K; $CH_3OH$ 338 K
- Hydrogen bonds beat extra electrons

## Which forces? Molecules you may not have met

boiling points from the data book; compare like with like

| Substance | Electrons | Strongest force between molecules | Boiling point |
|---|---|---|---|
| propane, $C_3H_8$ | 26 | id–id forces | 231 K |
| methoxymethane, $CH_3OCH_3$ | 26 | pd–pd | 249 K |
| ethanol, $C_2H_5OH$ | 26 | hydrogen bonds (O–H) | 351 K |
| ethanal, $CH_3CHO$ | 24 | pd–pd | 294 K |
| methylamine, $CH_3NH_2$ | 18 | hydrogen bonds (N–H) | 267 K |
| butanone, $C_2H_5COCH_3$ | 40 | pd–pd | 353 K |

## Worked examples

### Same electrons

- propan-1-ol 34 $e^-$: 370 K
- butane 34 $e^-$: 273 K
- **hydrogen bonds** add 97 K

### Polar but low

- HCl most polar: 188 K
- HI least polar: 238 K
- **id–id forces** dominate

### Polar wins

- propanone 32 $e^-$: 329 K
- butane 34 $e^-$: 273 K
- **pd–pd** forces add

These ideas return with halogenoalkanes, alcohols and carbonyl compounds (Topics 15, 17 and 18).

**Online Learning System** · onlinelearningsystem.net · © 2026 Online Learning System. All rights reserved. Not for redistribution.