Structures Map

AQA A-level Chemistry · 3.1.3 Bonding · Structures

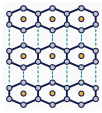
1 Diamond 3.1.3.4

- Each C: **four** covalent bonds, tetrahedral
- A giant 3D network
- Very **hard**, very high m.p.
- **No** conduction: every electron in a bond
- Uses: cutting and drilling tools, jewellery



2 Graphite 3.1.3.4

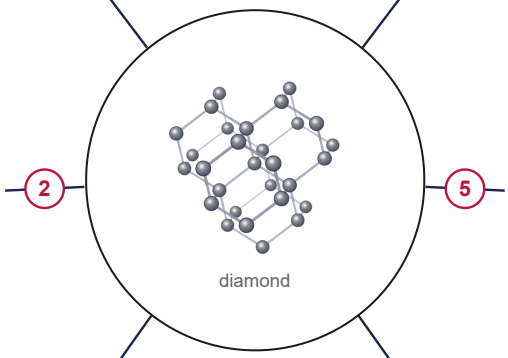
- Each C: **three** bonds in hexagonal layers
- One electron per C **delocalised**
- **Weak** forces between layers: they slide
- Conducts along the layers; high m.p.
- Uses: electrodes, lubricant, pencils



3 Drawing structures 3.1.3.4

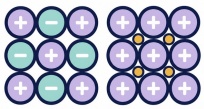
- Diamond, five C: a centre bonded to **four**
- Draw in 3D: wedge and hash, **109.5°**
- Graphite: **flat hexagons**, three bonds per C
- Two layers: parallel, gap = **weak forces**
- NaCl: Na^+ and Cl^- **alternate** in a cube





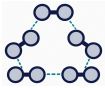
4 Ionic and metallic 3.1.3.4

- Ionic (NaCl): oppositely charged **ions**
- Conducts only **molten or dissolved**
- Metallic (Mg): ions in delocalised electrons
- Conducts as a **solid**
- Both: strong attractions, high m.p.



5 Molecular 3.1.3.4

- Separate **molecules**: iodine I_2, ice H_2O
- Strong bonds **inside** each molecule
- **Weak** forces between molecules (hydrogen bonds in ice)
- Low m.p.: molecules stay intact
- No conduction: no ions, no free electrons



6 Deducing the structure 3.1.3.4

- Relate m.p. and conductivity to the **bonding**
- High m.p.? A giant structure
- Conducts as a solid? Metallic (or graphite)
- Conducts only molten? Ionic
- Never conducts, high m.p.? Giant covalent



The four types of crystal structure

m.p. in °C, rounded; *graphite conducts

Structure	Particles	Held by	m.p.	Solid conducts?	Example
ionic	ions	ionic bonds	801	no	NaCl
metallic	ions, electrons	metallic bonding	650	yes	Mg
macromolecular	atoms	covalent bonds	3550	no*	diamond, graphite
molecular	molecules	weak forces between	114	no	I_2, ice

Worked examples

Which structure?

- m.p. high or low
- Conducts solid or only molten
- Then name it

Why a high m.p.?

- A giant structure
- Strong attractions throughout
- Many to overcome

Why it conducts

- Metal, graphite: delocalised e^-
- Ionic: ions free when molten
- Molecular: nothing to move

The forces between simple molecules are 3.1.3.7: Forces between molecules.

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