Structure Types Map

Cambridge International AS & A Level Chemistry · 4.2 Giant and simple lattices · Structure types

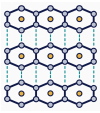
1 Diamond 4.2.1(c)

- 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



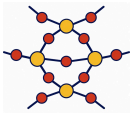
2 Graphite 4.2.1(c)

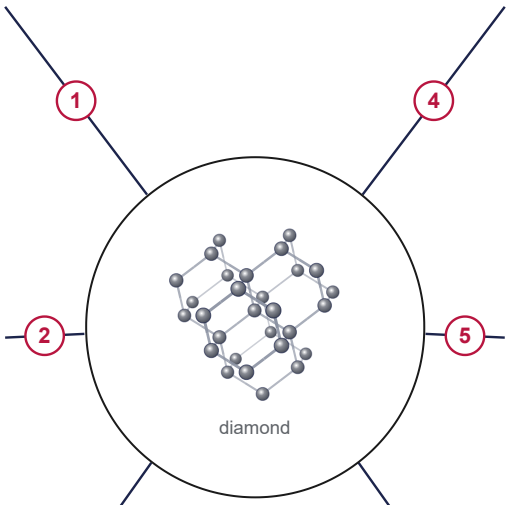
- Each C: **three** bonds in hexagonal layers
- One electron per C **delocalised**
- **Weak** forces between layers: they slide
- Conducts along the layers; high m.p.
- Uses: electrodes, lubricant, pencils



3 Silicon(IV) oxide 4.2.1(c)

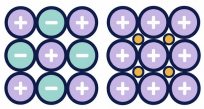
- Each Si bonded to **four** O; each O to two Si
- A giant molecular 3D network
- Very **high** m.p., hard
- **No** conduction, even molten
- Insoluble in water





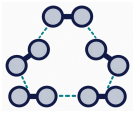
4 Giant ionic and metallic 4.2.1(a), (d)

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



5 Simple molecular 4.2.1(b)

- Separate **molecules**: I_2, ice, C_{60}
- Strong bonds **inside** each molecule
- **Weak** forces between molecules
- Low m.p.: molecules stay intact
- No conduction: no ions, no free electrons



6 Deducing the structure 4.2.2–4.2.3

- C_{60}: separate cages, low m.p., some solvents
- 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 kinds of lattice

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

Structure	Particles	Held by	m.p.	Solid conducts?	Example
giant ionic	ions	ionic bonds	801	no	NaCl
giant metallic	ions, electrons	metallic bonding	1085	yes	Cu
giant molecular	atoms	covalent bonds	1713	no*	SiO_2, diamond
simple molecular	molecules	weak forces between	114	no	I_2

Worked examples

Which lattice?

- 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 in Topic 3: Intermolecular forces.

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