Structure Types Map

OCR A Level Chemistry A · 3.1.1 Periodicity · Metallic bonding and structure types

1 Diamond and silicon

3.1.1(e)

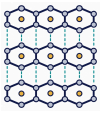
- Each C (or Si): **four** covalent bonds, tetrahedral
- A giant 3D network
- Very **hard**, very high m.p.
- **No** conduction: every electron in a bond
- Uses: cutting and drilling tools, jewellery



2 Graphite

3.1.1(e)

- 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

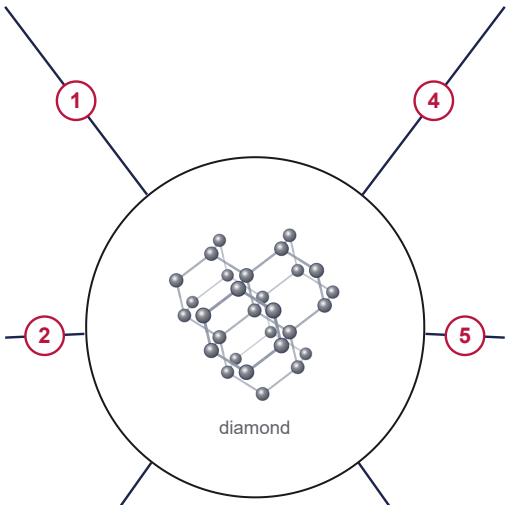


3 Graphene

3.1.1(e)

- A **single layer** of graphite
- One atom thick
- Very **strong**, light, flexible
- **Conducts**; nearly transparent
- Uses: electronics, touchscreens, composites

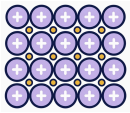




4 Giant metallic lattices

3.1.1(d), (f)

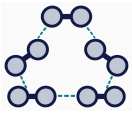
- **Cations** in a sea of **delocalised electrons**
- Strong electrostatic attraction, all directions
- Higher charge, more electrons: **higher** m.p.
- Conducts as **solid and liquid**
- **Insoluble**: the bonding is too strong



5 Simple molecular

2.2.2(n)–(o)

- Separate **molecules** (I_2, H_2O, CO_2)
- 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

3.1.1(f)

- Giant covalent: **insoluble**, very high m.p.
- 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 solid

m.p. in °C, rounded; *graphite and graphene conduct

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 covalent	atoms	covalent bonds	1414	no*	Si, 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 2.2.2 Intermolecular forces.

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