

Exercise walk-through

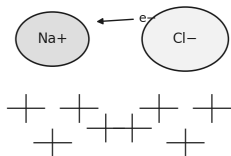
2.2

Bonding, structure and properties (4.2.2.1–4.2.2.7)

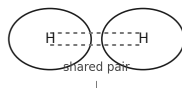
AQA · GCSE · Chemistry

Ionic bonding

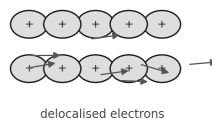
ionic — electrons transferred,
oppositely charged ions attract



covalent — shared
pairs of electrons



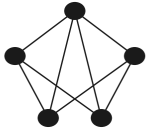
metallic — lattice of ions in a
sea of delocalised electrons



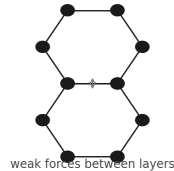
- Metal atoms lose electrons; non-metals gain them.
- Ion charges read straight off the group number.
- Opposite ions attract in a giant lattice.

Carbon's four forms

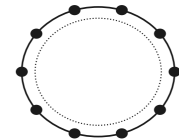
diamond — 4 bonds per atom,
very hard, no conduction



graphite — 3 bonds per atom, layers,
one delocalised electron



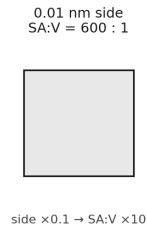
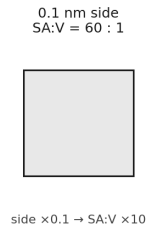
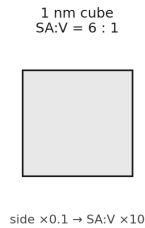
fullerene / nanotube



fullerene C60 — hollow sphere;
nanotubes are cylinders

- Diamond — four bonds per atom; hard, high-melting, non-conducting.
- Graphite — three bonds, layers, one delocalised electron.
- Graphene one layer; fullerenes hollow; nanotubes cylinders.

Nanoparticles



- Chemistry only — 1 to 100 nm; fine particles to 2500 nm; coarse to 10 micrometres.
- Side shrinks ten times — surface-to-volume ratio grows ten times.
- Uses — catalysts, medicine, cosmetics; concerns — unknown long-term effects.

Exercises 2.1·2.3

2.1 Which forces are overcome when water boils – covalent bonds or intermolecular forces? [1]

2.2 Why does molten sodium chloride conduct electricity but solid sodium chloride does not? [2]

2.3 Give the state symbols for a solid reactant and an aqueous solution. [2]

Exercises 2.1·2.3

2.1 Which forces are overcome when water boils – covalent bonds or intermolecular forces? [1]

2.1 Intermolecular forces.

2.2 Why does molten sodium chloride conduct electricity but solid sodium chloride does not? [2]

2.2 In the molten state the ions are free to move, so charge can flow; in the solid the ions are held fixed in the lattice.

2.3 Give the state symbols for a solid reactant and an aqueous solution. [2]

2.3 (s) for solid; (aq) for aqueous solution.

Exercises 3.1·3.3

3.1 Explain why propane is a gas at room temperature but hexane is a liquid, in terms of structure and forces. [4]

3.2 Explain why silicon dioxide has a very high melting point and does not conduct electricity. [4]

3.3 (*HT*) A student says “when iodine crystals are heated, the covalent bonds break, so iodine becomes a gas.” Correct the student. [3]

Exercises 3.1·3.3

3.1 Explain why propane is a gas at room temperature but hexane is a liquid, in terms of structure and forces. [4]

3.1 Both are small molecules with weak intermolecular forces between them; hexane is a bigger molecule than propane; so the intermolecular forces between hexane molecules are stronger; more energy is needed to separate them, giving the higher boiling point of a liquid at room temperature.

3.2 Explain why silicon dioxide has a very high melting point and does not conduct electricity. [4]

3.2 Silicon dioxide is a giant covalent structure; every atom is joined to others by strong covalent bonds; a very large amount of energy is needed to break the many bonds, so the melting point is very high; there are no free electrons or ions to carry charge.

3.3 (*HT*) A student says “when iodine crystals are heated, the covalent bonds break, so iodine becomes a gas.” Correct the student. [3]

3.3 The covalent bonds inside each I_2 molecule do not break when it boils; only the weak intermolecular forces between molecules are overcome; the molecules separate into a gas while each molecule stays intact.