

Exercise walk-through

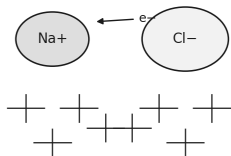
2.1

ionic, covalent and metallic bonding (4.2.1.1–4.2.1.5)

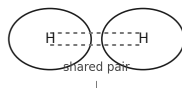
AQA · GCSE · Chemistry

Ionic bonding

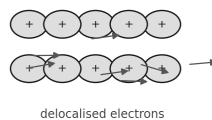
ionic — electrons transferred,
oppositely charged ions attract



covalent — shared
pairs of electrons



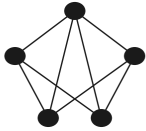
metallic — lattice of ions in a
sea of delocalised electrons



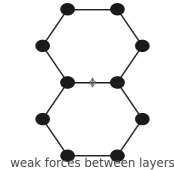
- Metal atoms lose electrons; non-metals gain them.
- Ion charges read straight off the group number.
- Opposite ions attract in a giant lattice.

Carbon's four forms

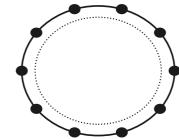
diamond — 4 bonds per atom,
very hard, no conduction



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

1 nm cube
SA:V = 6 : 1



side $\times 0.1 \rightarrow$ SA:V $\times 10$

0.1 nm side
SA:V = 60 : 1



side $\times 0.1 \rightarrow$ SA:V $\times 10$

0.01 nm side
SA:V = 600 : 1



side $\times 0.1 \rightarrow$ SA:V $\times 10$

- 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 Give the charge on the ion formed by (a) calcium; (b) sulfur. [2]

2.2 How many electrons are shared in a molecule of nitrogen, N_2 ? [1]

2.3 Why do metals conduct electricity? [2]

Exercises 2.1·2.3

2.1 Give the charge on the ion formed by (a) calcium; (b) sulfur. [2]

2.1 (a) Ca^{2+} ; (b) S^{2-} .

2.2 How many electrons are shared in a molecule of nitrogen, N_2 ? [1]

2.2 Six – a triple bond shares three pairs.

2.3 Why do metals conduct electricity? [2]

2.3 The outer electrons are delocalised/free to move through the whole structure; they carry charge through the metal.

Exercises 3.1·3.3

3.1 Draw a dot and cross diagram to show the bonding in magnesium chloride, showing outer shell electrons only. State the formula. [4]

3.2 Explain the difference between a covalent bond and an ionic bond, in terms of electrons. [4]

3.3 Give two limitations of using ball-and-stick diagrams to represent a giant ionic structure. [2]

Exercises 3.1·3.3

3.1 Draw a dot and cross diagram to show the bonding in magnesium chloride, showing outer shell electrons only. State the formula. [4]

3.1 Mg (2,8,2) loses two electrons $\rightarrow$ Mg^{2+} shown with empty outer shell; each chlo-

3.2 Explain the difference between a covalent bond and an ionic bond, in terms of electrons. [4]

3.2 Covalent – non-metal atoms share one or more pairs of electrons; the shared pair attracts both nuclei, bonding the atoms in a molecule. Ionic – a metal transfers electrons to a non-metal; forming oppositely charged ions held together by electrostatic attraction in a lattice.

3.3 Give two limitations of using ball-and-stick diagrams to represent a giant ionic structure. [2]

3.3 Any two: it suggests there are spaces/gaps between the ions, but the lattice is touching; it shows bonds as sticks, whereas the force is electrostatic attraction; only a tiny fragment of a giant structure can be drawn; the real 3D arrangement is flattened into 2D.