Covalent Bonding Map

OCR A Level Chemistry A · 2.2.2 Bonding and structure · Covalent bonding

1 The covalent bond 2.2.2(d)

- Non-metal atoms **share** a pair of electrons
- Both **nuclei attract** the shared pair between them
- A strong electrostatic attraction
- Attraction to the pair outweighs nuclear repulsion
- Giant covalent solids: very high melting temperatures

2 Dot-and-cross diagrams 2.2.2(e)

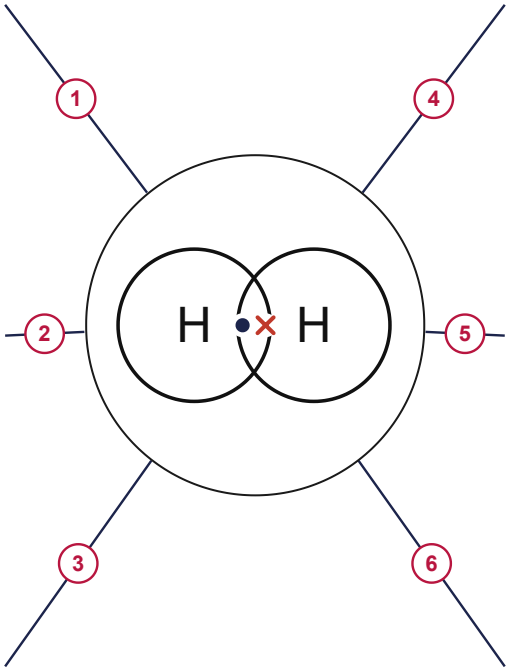
- Outer shells overlap; shared pairs in the overlap
- Dots for one atom, crosses for the other
- **Lone pairs**: unshared outer pairs
- Usually 8 round each atom (2 for H)
- Double bond: 2 pairs (O=C=O); triple: 3 (N≡N)



3 Average bond enthalpy 2.2.2(f)

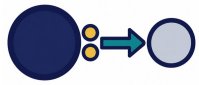
- Energy to break **one mole** of a bond (gaseous)
- Always **positive**: breaking takes in energy
- An **average** over many compounds
- Larger value: **stronger** bond
- C–C 347 < C=C 612 < C≡C 838 kJ mol^{-1}





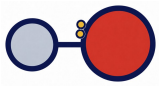
4 Dative covalent bonds 2.2.2(e)

- Both shared electrons from **one atom**
- Donor: a **lone pair**; acceptor: an **empty orbital**
- Drawn as an arrow: $H_3N \rightarrow H^+$
- NH_4^+ and H_3O^+: brackets and + round the ion
- Al_2Cl_6: two Cl→Al dative bonds



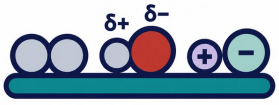
5 Electronegativity 2.2.2(i)

- Attraction of an atom for a **bonding pair**
- Pauling scale: F 4.0 the highest
- **Increases across** a period: more protons
- **Decreases down** a group: larger, more shielded
- O 3.5, N 3.0, Cl 3.0, C 2.5, H 2.1



6 Polarity and the continuum 2.2.2(j)

- Different electronegativities: a **polar** bond
- δ− on the more electronegative atom
- Difference 0: non-polar; small: polar covalent
- Large difference: **ionic**, electron transferred
- Ionic and covalent: ends of one **continuum**



Electronegativity difference and bond type

Pauling values; the boundaries are gradual, not sharp

Bond	Electronegativities	Difference	Partial charges	Bond type
Cl–Cl	3.0, 3.0	0	none	non-polar covalent
C–H	2.5, 2.1	0.4	almost none	almost non-polar
H–Cl	2.1, 3.0	0.9	Hδ+ Clδ−	polar covalent
O–H	3.5, 2.1	1.4	Oδ− Hδ+	polar covalent
Al–Cl	1.5, 3.0	1.5	Alδ+ Clδ−	polar, ionic character
Na–Cl	0.9, 3.0	2.1	Na^+ Cl^-	ionic

Worked examples

Drawing a molecule

- Count outer electrons of each atom
- Share until each has 8 (H: 2)
- Add the lone pairs last

Spotting a dative bond

- Is there a lone pair (N, O, Cl)?
- Is there an empty orbital (H^+, B, Al)?
- Arrow from the lone pair to it

Comparing bonds

- More pairs: larger bond enthalpy
- Bigger difference: more polar
- Very big difference: ionic

Polar bonds do not always make polar molecules: the shape decides (Shapes of molecules).

Online Learning System · onlinelearningsystem.net · © 2026 Online Learning System. All rights reserved. Not for redistribution.