Chemistry · Revision

Bonding Revision Notes

The three types of bond, and how structure explains a substance's properties. Most exam marks here come from linking the two.

The three types of bonding

Type	Between	What happens
Ionic	metal + non-metal	Electrons are transferred, making oppositely charged ions.
Covalent	non-metal + non-metal	Pairs of electrons are shared.
Metallic	metal atoms	Positive ions sit in a sea of delocalised electrons.

Ionic bonding: sodium chloride

- Na (2, 8, 1) loses one electron to become Na^+ (2, 8).
- Cl (2, 8, 7) gains one electron to become Cl^- (2, 8, 8).
- Both now have full outer shells. The opposite charges attract strongly in every direction, forming a giant ionic lattice.

Working out ionic formulas

Ions	Balance the charges	Formula
Na^+ and Cl^-	+1 and −1	NaCl
Mg^{2+} and Cl^-	+2 and two lots of −1	$MgCl_2$
Mg^{2+} and O^{2-}	+2 and −2	MgO
Al^{3+} and O^{2-}	two lots of +3 and three lots of −2	Al_2O_3

Covalent bonding

Molecule	Bonds
H_2	1 single bond
HCl	1 single bond
H_2O	2 single bonds
NH_3	3 single bonds
CH_4	4 single bonds
O_2	1 double bond
CO_2	2 double bonds
N_2	1 triple bond

Structure and properties

Structure	Examples	Melting point	Conducts electricity?
Giant ionic	NaCl, MgO	High: strong forces between ions	Only when molten or dissolved, when the ions can move
Simple molecular	H_2O, CO_2	Low: weak forces between molecules	No: no charged particles to carry charge
Giant covalent	diamond, silicon dioxide	Very high: many strong covalent bonds	No (graphite is the exception)
Metallic	Cu, Fe	Generally high: strong attraction between ions and electrons	Yes: delocalised electrons carry charge

Carbon structures

Form	Bonds to each carbon	Key properties
Diamond	4	Very hard, very high melting point, does not conduct
Graphite	3, in layers	Soft and slippery because layers slide; conducts because of delocalised electrons
Graphene	3, one layer thick	Very strong, conducts well

> **Common slip:** when a simple molecular substance melts, the weak forces *between* molecules break, not the covalent bonds inside them.

Exam technique

For "explain" questions, use this chain: **structure → type of force → how strong it is → how much energy it takes to overcome.** Saying only that "it has strong bonds" rarely earns full marks.