

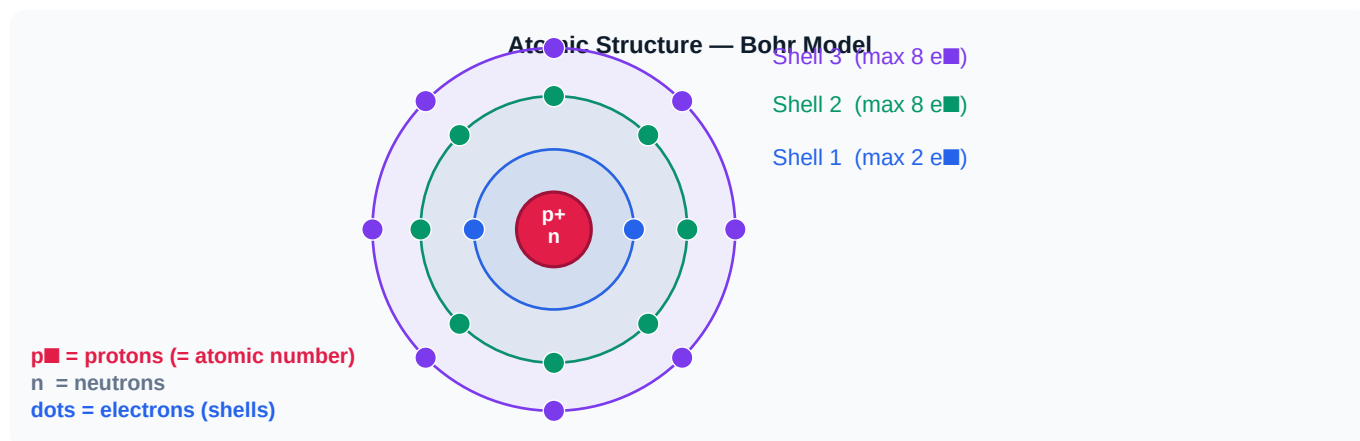
GCSE Chemistry

Key Concepts, Diagrams & Exam Tips | StudyVolt

■ Key Definitions

Element	A pure substance made of only one type of atom. Cannot be broken down by chemical means.
Compound	Two or more elements chemically bonded in fixed ratios. Different properties to its elements.
Mixture	Two or more substances not chemically combined. Can be separated by physical methods.
Ion	An atom that has gained or lost electrons, giving it a positive or negative charge.
Molecule	Two or more atoms covalently bonded together — same element (O ₂) or compound (H ₂ O).
Relative formula mass (Mr)	Sum of all relative atomic masses in a formula unit.

■ Atomic Structure & the Periodic Table

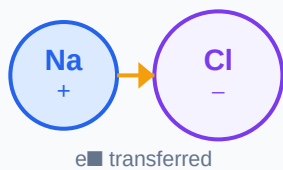


Topic	Key fact	Remember
Atomic number	Number of protons	= electrons (neutral atom)
Mass number	Protons + neutrons	Neutrons = mass – atomic no.
Isotopes	Same protons, different neutrons	Same element, different mass
Group number	Number of outer electrons	Groups 1–7 + Group 0
Period number	Number of electron shells	Period 3 = 3 shells

■ Bonding

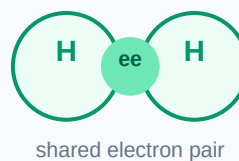
Ionic vs Covalent Bonding

IONIC (electron transfer)



Electrostatic attraction between ions

COVALENT (electron sharing)



Shared pair = covalent bond

Bond type	Between...	Properties
Ionic	Metal + non-metal (e⁻ transfer)	High MP; conducts when molten/dissolved
Covalent (simple)	Non-metals (sharing)	Low MP; does not conduct
Covalent (giant)	e.g. diamond, SiO₂	Very high MP; very hard
Metallic	Metal atoms + delocalised e⁻	Conducts; malleable; high MP

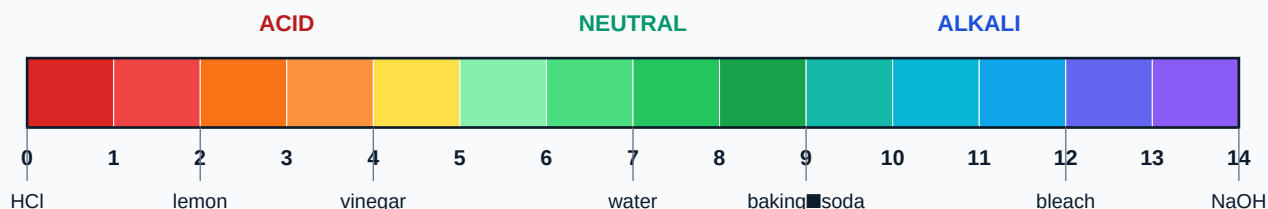
Exam tip: Bonding 6-mark: (1) State bond type (2) What holds it together (3) Link to the property asked.

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Acids, Alkalis, Rates of Reaction & Quantitative Chemistry | StudyVolt

■ Acids & Alkalis

The pH Scale



Acid: pH < 7 | Neutral: pH = 7 | Alkali: pH > 7

Acid	Produces H^+ ions in solution. pH < 7. Examples: HCl, H_2SO_4 , HNO_3 , citric acid.
Alkali	Soluble base producing OH^- ions. pH > 7. Examples: NaOH, KOH, NH_3 .
Neutralisation	Acid + Base $\rightarrow$ Salt + Water. $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
Strong acid	Fully dissociates in water. e.g. $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$ (completely)
Weak acid	Partially dissociates. e.g. ethanoic acid (vinegar)

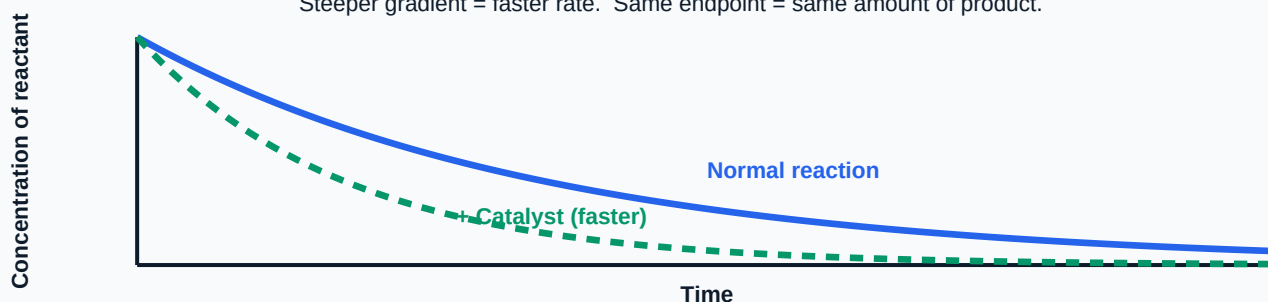
Reaction	Equation	Example
Acid + metal	acid + metal $\rightarrow$ salt + hydrogen	$\text{HCl} + \text{Zn} \rightarrow \text{ZnCl}_2 + \text{H}_2$
Acid + base	acid + base $\rightarrow$ salt + water	$\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
Acid + carbonate	acid + carbonate $\rightarrow$ salt + H_2O + CO_2	$\text{HCl} + \text{CaCO}_3 \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
Acid + metal oxide	acid + metal oxide $\rightarrow$ salt + water	$\text{H}_2\text{SO}_4 + \text{CuO} \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$

Exam tip: Salt naming: metal name from base/carbonate + acid ending (HCl $\rightarrow$ chloride, $\text{H}_2\text{SO}_4 \rightarrow$ sulphate, $\text{HNO}_3 \rightarrow$ nitrate).

■ Rates of Reaction

Rate of Reaction — Concentration vs Time

Steeper gradient = faster rate. Same endpoint = same amount of product.



Factor	Effect on rate	Why (collision theory)
Temperature ↑	Rate increases	Particles move faster → more frequent, higher-energy collisions
Concentration ↑	Rate increases	More particles per unit volume → more collisions
Surface area ↑	Rate increases	More particles exposed → more collisions at surface
Catalyst added	Rate increases	Lowers activation energy → more particles have enough energy
Pressure ↑ (gases)	Rate increases	Particles closer together → more collisions

Exam tip: Rate questions: always use collision theory — state what changes, then explain why this affects number or energy of collisions.

■ Quantitative Chemistry

Quantity	Formula	Units
Moles	$n = \text{mass} / M_r$	mol
Concentration	$c = n / V$	mol/dm ³
Moles from conc.	$n = c \times V$	V in dm ³
Percentage yield	$(\text{actual} / \text{theoretical}) \times 100$	%
Atom economy	$(\text{useful } M_r / \text{total } M_r) \times 100$	%
Avogadro's number	6.02×10^{23} per mole	mol ⁻¹