Chemistry with Chloe

A Level Chemistry

# Definitions Bank

All Boards · All Topics · Exam-Ready Language

12 Topic Sections · ~100 Definitions · Precise mark-scheme language throughout

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**Need help making these definitions stick?**

I offer personalised 1-1 A Level Chemistry tuition online — working through definitions, applying them to past paper questions, and building the exam-ready language that gets marks.

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| Section 1: Atomic Structure & Amount of Substance | |
|---|---|
| **Relative isotopic mass** | The mass of one atom of an isotope compared to 1/12 of the mass of one atom of carbon-12. |
| **Relative atomic mass (Ar)** | The weighted mean mass of one atom of an element compared to 1/12 of the mass of one atom of carbon-12. |
| **Relative molecular mass (Mr)** | The sum of the relative atomic masses of all atoms in a molecule. |
| **Relative formula mass** | The sum of the relative atomic masses of all atoms in a formula unit (used for ionic compounds). |
| **First ionisation energy** | The energy required to remove one mole of electrons from one mole of gaseous atoms of an element to form one mole of gaseous 1+ ions. |
| **Successive ionisation energies** | The energies required to remove each subsequent electron from a mole of gaseous ions. |
| **Empirical formula** | The simplest whole-number ratio of atoms of each element in a compound. |
| **Molecular formula** | The actual number of atoms of each element in one molecule. |
| **Molar mass** | The mass per mole of a substance, in g mol-1; numerically equal to Mr. |
| **The Avogadro constant (NA)** | The number of particles in one mole of a substance: 6.022 x 10^23 mol-1. |
| **Atom economy** | The percentage of the total mass of reactants that becomes the desired product. Atom economy = (Mr of desired product / sum of Mr of all reactants) x 100%. |
| **Percentage yield** | (Actual mass of product / theoretical mass of product) x 100%. |

| Section 2: Bonding & Structure | |
|---|---|
| **Ionic bonding** | The strong electrostatic attraction between oppositely charged ions in a giant ionic lattice. |
| **Covalent bond** | A shared pair of electrons between two atoms, resulting from the overlap of atomic orbitals. |
| **Dative (coordinate) covalent bond** | A covalent bond in which both electrons in the shared pair come from the same atom. |
| **Metallic bonding** | The strong electrostatic attraction between positive metal ions (cations) and a sea of delocalised electrons. |
| **Electronegativity** | The power of an atom to attract the bonding pair of electrons in a covalent bond towards itself. |
| **Hydrogen bond** | A strong permanent dipole-dipole interaction between a delta+ hydrogen atom bonded to N, O or F, and a lone pair on an N, O or F atom of a neighbouring molecule. |
| **Homolytic fission** | A covalent bond breaks so that each atom takes one electron from the shared pair, forming two radicals. |
| **Heterolytic fission** | A covalent bond breaks so that both electrons from the shared pair go to one atom, forming a cation and an anion. |

## Section 3: Energetics

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|---|---|
| **Standard enthalpy of formation (DfH)** | The enthalpy change when one mole of a compound is formed from its elements in their standard states under standard conditions (298 K, 100 kPa). |
| **Standard enthalpy of combustion (DcH)** | The enthalpy change when one mole of a substance is completely burned in oxygen under standard conditions. |
| **Standard enthalpy of neutralisation** | The enthalpy change when one mole of water is formed by the reaction of an acid and an alkali under standard conditions. |
| **Standard enthalpy of atomisation (DatH)** | The enthalpy change when one mole of gaseous atoms is formed from the element in its standard state. |
| **Bond enthalpy** | The energy required to break one mole of a specified covalent bond in the gaseous phase, averaged over a range of molecules. |
| **Mean bond enthalpy** | The average energy required to break one mole of a particular type of covalent bond, averaged across different compounds. |
| **Hess's Law** | The total enthalpy change for a reaction is independent of the route taken, provided the initial and final conditions are the same. |
| **Lattice energy (DlattH)** | The enthalpy change when one mole of an ionic solid is formed from its constituent gaseous ions under standard conditions. Always exothermic; always negative. |
| **Enthalpy of hydration (DhydH)** | The enthalpy change when one mole of gaseous ions is completely surrounded by water molecules to form an infinitely dilute solution. |
| **Enthalpy of solution (DsolH)** | The enthalpy change when one mole of a solute completely dissolves in a solvent to form an infinitely dilute solution. |
| **Entropy (S)** | A measure of the dispersal of energy or the number of ways of arranging particles and distributing energy in a system; a measure of disorder. |
| **Second Law of Thermodynamics** | The total entropy of the universe always increases for any spontaneous process. |
| **Gibbs free energy (DG)** | A measure of feasibility: DG = DH - TDS. A reaction is feasible (thermodynamically spontaneous) when DG is less than or equal to zero. |
| **Board note** | Lattice energy convention: Edexcel & OCR define as lattice formation (exothermic, negative). AQA accepts both formation and dissociation — check your board's mark scheme. |

**Struggling with Energetics calculations?**

Lattice energies, Hess's Law cycles, Born-Haber diagrams — these are the topics where 1-1 tuition makes the biggest difference.

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| Section 4: Kinetics | |
|---|---|
| **Rate of reaction** | The change in concentration of a reactant or product per unit time (units: mol dm-3 s-1). |
| **Activation energy (Ea)** | The minimum energy required for a successful collision between reacting particles; the minimum energy needed to break the bonds in the reactants. |
| **Order of reaction** | The power to which the concentration of a reactant is raised in the rate equation. Determined experimentally — NOT from the stoichiometric equation. |
| **Overall order** | The sum of all the individual orders in the rate equation. |
| **Rate constant (k)** | The proportionality constant in the rate equation; its value depends on temperature and increases with increasing temperature. |
| **Rate-determining step** | The slowest step in a multi-step reaction mechanism; the step that determines the overall rate of the reaction. |
| **Half-life** | The time taken for the concentration of a reactant to fall to half its initial value. For a first-order reaction, half-life is constant and independent of concentration. |
| **Catalyst** | A substance that increases the rate of a reaction without being used up; it provides an alternative reaction pathway with a lower activation energy. |
| **Homogeneous catalyst** | A catalyst in the same phase as the reactants. |
| **Heterogeneous catalyst** | A catalyst in a different phase from the reactants. |

| Section 5: Equilibrium | |
|---|---|
| **Dynamic equilibrium** | A state in which the rate of the forward reaction equals the rate of the reverse reaction, and the concentrations of reactants and products remain constant, in a closed system. |
| **Le Chatelier's Principle** | When a system in dynamic equilibrium is subjected to a change, the equilibrium position shifts in the direction that opposes the change. |
| **Equilibrium constant Kc** | The ratio of the product of the molar concentrations of products to the product of the molar concentrations of reactants, each raised to the power of their stoichiometric coefficient, at a given temperature. |
| **Equilibrium constant Kp** | The equilibrium constant expressed in terms of the partial pressures of gaseous reactants and products. |
| **Partial pressure** | The pressure that a gas in a mixture would exert if it alone occupied the total volume; partial pressure = mole fraction x total pressure. |

## Section 6: Acids, Bases & pH

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|---|---|
| **Bronsted-Lowry acid** | A species that donates a proton (H+) to another species. |
| **Bronsted-Lowry base** | A species that accepts a proton (H+) from another species. |
| **Conjugate acid-base pair** | Two species related by the transfer of a single proton; the conjugate base is formed when the acid donates a proton. |
| **Strong acid** | An acid that is completely dissociated into ions in aqueous solution. |
| **Weak acid** | An acid that is only partially dissociated in aqueous solution; exists in equilibrium with its ions. |
| **Acid dissociation constant Ka** | The equilibrium constant for the partial dissociation of a weak acid: Ka = [H+][A-] / [HA]. Units: mol dm-3. |
| **pKa** | The negative logarithm (base 10) of Ka. The lower the pKa, the stronger the acid. |
| **pH** | A measure of the hydrogen ion concentration in solution: pH = -log10[H+]. |
| **Ionic product of water Kw** | The equilibrium constant for the autoionisation of water: Kw = [H+][OH-] = 1.00 x 10-14 mol2 dm-6 at 25 degrees C. |
| **Buffer solution** | A solution that resists changes in pH when small amounts of acid or alkali are added; typically contains a weak acid and its conjugate base. |

### Acids, buffers and pH calculations — a common mark-loser

These definitions underpin a whole class of calculation questions. In 1-1 sessions I work through Ka, buffers and titration curves until you can do them under exam conditions.

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| Section 7: Redox & Electrode Potentials | |
|---|---|
| **Oxidation** | Loss of electrons (or increase in oxidation state). |
| **Reduction** | Gain of electrons (or decrease in oxidation state). |
| **Oxidising agent** | A species that oxidises another species by accepting electrons from it; it is itself reduced. |
| **Reducing agent** | A species that reduces another species by donating electrons to it; it is itself oxidised. |
| **Oxidation state** | A measure of the number of electrons an atom has gained or lost relative to its neutral state; assigned according to a set of rules. |
| **Standard electrode potential (E°)** | The potential difference (in volts) of a half-cell under standard conditions (298 K, 100 kPa, 1 mol dm-3) relative to the standard hydrogen electrode (E° = 0.00 V). |
| **Standard hydrogen electrode (SHE)** | The reference electrode: H+(aq, 1 mol dm-3) / H2(g, 100 kPa) / Pt, with E° defined as 0.00 V. |
| **Cell EMF (E°cell)** | E°cell = E°(cathode) - E°(anode) = E°(more positive) - E°(less positive). |

| Section 8: Organic Chemistry — Core Terms | |
|---|---|
| **Homologous series** | A family of compounds with the same functional group and general formula, differing by a CH2 unit, with a gradual trend in physical properties. |
| **Functional group** | An atom or group of atoms responsible for the characteristic chemical reactions of a compound. |
| **Structural isomers** | Compounds with the same molecular formula but different structural arrangements of atoms. |
| **Stereoisomers** | Compounds with the same molecular formula and same bonds, but different spatial arrangements of atoms. |
| **E/Z isomerism** | A type of stereoisomerism arising from restricted rotation about a C=C double bond; requires two different groups on each carbon of the double bond. |
| **Optical isomerism** | A type of stereoisomerism in which non-superimposable mirror-image molecules (enantiomers) exist, arising from a chiral centre. |
| **Chiral centre** | An atom (usually carbon) bonded to four different groups, giving rise to optical isomers. |
| **Free radical** | A species with an unpaired electron; highly reactive. |
| **Electrophile** | An electron-pair acceptor; attracted to areas of high electron density. |
| **Nucleophile** | An electron-pair donor; attacks areas of low electron density (e.g. delta+ carbon atoms). |

| Section 9: Organic Chemistry — Reaction Types | |
|---|---|
| **Electrophilic addition** | An addition reaction initiated by an electrophile attacking a C=C double bond; the pi electrons attack the electrophile. |
| **Nucleophilic substitution SN2** | A one-step mechanism: the nucleophile attacks from the back as the leaving group departs simultaneously; favoured by primary halogenoalkanes. |
| **Nucleophilic substitution SN1** | A two-step mechanism: the leaving group departs to form a carbocation, then the nucleophile attacks; favoured by tertiary halogenoalkanes. |
| **Nucleophilic addition** | An addition reaction initiated by a nucleophile attacking the delta+ carbon of a C=O group. |
| **Electrophilic substitution** | A substitution in which an electrophile replaces a hydrogen atom on a benzene ring, preserving the delocalised ring system. |
| **Condensation reaction** | A reaction between two molecules in which a small molecule (usually H2O) is eliminated as a new bond forms. |
| **Esterification** | The reaction of a carboxylic acid with an alcohol (acid catalyst, reflux) to form an ester and water; a reversible condensation reaction. |

**Master organic mechanisms with expert 1-1 tuition**

Mechanisms are the most commonly dropped marks in A Level Chemistry. I'll fix the arrow-pushing, intermediate structures and curly arrow notation until it's automatic.

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| Section 10: Organic — Functional Group Tests | |
|---|---|
| **2,4-DNPH test** | Gives an orange/yellow precipitate with aldehydes and ketones (indicates a C=O group). |
| **Tollens' reagent test** | Gives a silver mirror with aldehydes only (not ketones); confirms an aldehyde. |
| **Fehling's / Benedict's** | Gives a brick-red precipitate with aldehydes only (not ketones); confirms an aldehyde. |
| **Bromine water test** | Decolourises from orange-brown to colourless with an alkene (C=C) or phenol; no reaction with alkanes. |
| **Acidified potassium dichromate** | Turns from orange to green with a primary or secondary alcohol, or an aldehyde. |

## Section 11: Transition Metals & Coordination Chemistry

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| **Transition metal** | A d-block element that forms at least one stable ion with an incomplete d subshell. |
| **Complex ion** | A metal ion surrounded by ligands joined by coordinate (dative covalent) bonds. |
| **Ligand** | A molecule or ion that donates a lone pair of electrons to a metal ion to form a coordinate bond. |
| **Monodentate ligand** | A ligand that donates one lone pair to the metal (e.g. H2O, NH3, Cl-, CN-). |
| **Bidentate ligand** | A ligand that donates two lone pairs to the metal (e.g. ethane-1,2-diamine, ethanedioate C2O4 2-). |
| **Multidentate ligand** | A ligand that donates more than two lone pairs to the metal (e.g. EDTA4-, which is hexadentate). |
| **Coordination number** | The total number of coordinate bonds from ligands to the central metal ion. |
| **The chelate effect** | Polydentate ligands form more stable complexes than equivalent monodentate ligands; driven by a large positive entropy change when multiple small ligands are released. |
| **Ligand substitution** | A reaction in which one or more ligands in a complex are replaced by different ligands. |
| **Autocatalysis** | A reaction in which one of the products acts as a catalyst; the reaction starts slowly then accelerates as the catalyst builds up (e.g. MnO4- / oxalic acid — Mn2+ is the autocatalyst). |

## Section 12: Polymer Chemistry

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| **Addition polymer** | A polymer formed by the repeated addition of monomer molecules containing C=C double bonds, with no other product formed. |
| **Condensation polymer** | A polymer formed by the repeated condensation of monomer molecules, with the elimination of a small molecule (usually H2O or HCl) at each step. |
| **Polyester** | A condensation polymer formed from a diol and a dicarboxylic acid (or diacyl chloride); linked by ester bonds (-COO-). |
| **Polyamide** | A condensation polymer formed from a diamine and a dicarboxylic acid (or diacyl chloride); linked by amide bonds (-CONH-). |
| **Amino acid** | A bifunctional molecule containing both an -NH2 group and a -COOH group; the building blocks of polypeptides and proteins. |
| **Peptide bond** | The amide bond (-CONH-) formed between two amino acids in a condensation reaction. |

**Ready to turn these definitions into exam marks?**

Knowing the definitions is the foundation. Applying them under exam conditions — with the right phrasing, in context — is where the A* is won. That's what we work on together.

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