

Atomic Structure

Fundamental Particles

Atomic number: number of protons (or electrons in an element)

Mass number: number of protons plus neutrons

Isotopes: atoms of the same element that have different number of neutrons

Time of Flight Mass Spectroscopy

m/z: mass to charge ratio

Electron Configuration

Orbital: a region that can hold 2 electrons of opposite spins

Ionisation Energy

Ionisation Energy: the energy required to remove one mole of electrons from one mole of gaseous atoms to form one mole of gaseous ions.

Amount of Substance

Relative atomic mass: the average mass of an atom of an element relative to $1/12^{\text{th}}$ of the mass of a ^{12}C atom

Relative molecular mass: the average mass of one molecule of an element or compound relative to $1/12^{\text{th}}$ of the mass of a ^{12}C atom

Avogadro: the number of particles in one mole

Bonding

Covalent bond: electrostatic attraction that occurs due to the sharing of two electrons between two non-metal atoms

Ionic bond: electrostatic attraction that occurs due to the electron transfer from a metal to a non-metal forming positive and negative ions

Metallic bond: electrostatic attraction that occurs when a positive metal ion is surrounded by a sea of delocalised electrons

Electronegativity: a measure of how well an atom can attract electrons towards itself in a covalent bond

Energetics

Enthalpy change (ΔH): the heat energy measured under standard conditions

Standard conditions: 100 kPa and 298 K

Mean bond enthalpy: the average energy required to break 1 mole of a given covalent bond

Enthalpy of combustion: enthalpy change when one mole of a substance is completely burned in excess oxygen

Enthalpy of formation: enthalpy change when one mole of a compound is formed from its elements in their standard states under standard conditions

Group 7

Disproportionation: simultaneous oxidation and reduction of a species

Equilibrium

Equilibrium: the rate of the forwards and backwards reactions are equal

Equilibrium: the concentrations of reactants and products are constant

Redox

Oxidising agent: electron acceptor

Reducing agent: electron donor

Kinetics (Rates)

Activation energy: minimum energy required for a reaction to occur

Organic Introduction

Saturated: contains single C-C bonds only

Unsaturated: contains a C=C bond

Homologous series: family of compounds with same general formula, same empirical formula, similar reactivity and shows a trend in physical properties.

Structural isomers: two molecules with the same molecular formula but different structural formula

Stereoisomers/geometric isomers: two molecules with the same molecular formula but different spatial arrangement of atoms

Halogenoalkanes

Nucleophile: electron pair donor

Alkenes

Electrophile: electron pair acceptor

Alkanes

Radical: a species with an unpaired (or lone) electron

Sigma bond: overlap of two s-orbitals

Pi bond: overlap of two p-orbitals

Homolytic fission: splitting of a bond to form two radicals

Heterolytic fission: splitting of a bond to form two oppositely charged ions

Alcohols

Reflux: a continuous cycle of boiling and condensation

Biofuel: a fuel produced from a renewable energy resource

Thermodynamics

Enthalpy of atomisation: enthalpy change when one mole of gaseous atoms is formed from an element in its standard state

Electron affinity: enthalpy change when one mole of gaseous ions is formed from one mole of gaseous atoms

Lattice enthalpy: enthalpy change when one mole of an ionic solid is formed from its gaseous ions under standard conditions

Enthalpy of hydration: the enthalpy change that occurs when 1 mole of gaseous ions form aqueous ions.

Entropy: a measure of chaos or disorder

Electrode Potentials

Standard conditions: concentration 1 mol dm⁻³ H⁺ ions, temperature = 298 K and pressure = 101 kPa (1 atm).

Fuel Cells: converts energy from a chemical reaction into electricity

Acids and Bases

Bronsted-Lowry acid: proton donor

Bronsted-Lowry base: proton acceptor

Strong acid/base: completely dissociates in water

Weak acid/base: incomplete dissociation in water

Definition of pH...use $\text{pH} = -\log_{10} [\text{H}^+]$

Definition of K_w ...use $K_w = [\text{H}^+][\text{OH}^-]$

Buffer solution: a solution that resists changes in pH when small amounts of acid or base are added

Period 3

Amphoteric: reacts with acid and base

Transition Metals

Transition metal: a metal that can form one or more ions that have partially filled d orbitals

Ligand: a molecule that has at least one lone pair of electrons

Complex ion: a central metal ion surrounded by ligands

Coordination number: how many bonds are there to the metal ion

Coordinate bond: dative bond from the ligand to the metal

Monodentate: a ligand with only one lone pair of electrons

Bidentate: a ligand with only two lone pair of electrons

Multi or polydentate: a ligand with more than two lone pair of electrons

Chelate effect: increase in entropy when doing a ligand substitution reaction

Heterogenous catalyst: a catalyst that is in a different state from the reactants

Homogenous catalyst: a catalyst that is in the same state as the reactants

Auto catalysis: a reaction that generates the catalyst

Rates

Order: the factor by which each reactant affects the rate

Rate constant: k , relates the rate of reaction to the reactant concentrations

Rate-determining step: the slow step in a multi-step reaction

Chiral Compounds

Chiral centre: a carbon atom surrounded by 4 different groups

Optical isomers/Enantiomers: two non-superimposable mirror images

Optical activity: the amount by which an enantiomer rotates the plane of plane polarised light

Racemic mixture: a 50/50 mixture of two enantiomers

Carboxylic Acids

Condensation: removal of a small molecule, usually the removal of water (or HCl)

Hydrolysis: the breaking of a bond, usually by adding water

Saponification: alkaline hydrolysis of an acid or fat → soap

Amino Acids, Proteins & DNA

Isoelectric point: the pH at which a zwitterion forms in solution

DNA: 2-deoxynucleic acid

NMR & Chromatography

TLC: thin layer chromatography

GC: Gas Chromatography

Retention time: how long it takes for a compound to come off the column or to be detected

NMR: Nuclear Magnetic Resonance

TMS: tetramethylsilane

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