

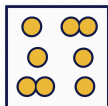
Atoms, Elements and Molecules Map

Edexcel A Level Chemistry · Topic 5 Formulae, Equations and Amounts of Substance · Atoms, Elements and Molecules

1 Atoms and elements

5.6

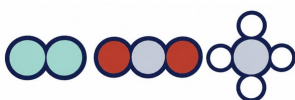
- **Atom**: smallest particle of an element
- **Element**: only one type of atom
- Monatomic: He, Ne, Ar
- Diatomic: H₂, N₂, O₂, Cl₂
- Polyatomic: P₄, S₈



2 Molecules

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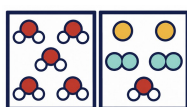
- **Molecule**: two or more atoms bonded
- Element molecules: O₂, O₃
- Compound molecules: H₂O, CO₂
- Count atoms: C₃H₈ has 11
- Ionic solids have no molecules



3 Compounds and mixtures

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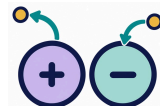
- **Compound**: elements chemically combined
- Always a **fixed ratio**
- **Mixture**: not combined, any ratio
- Pure: sharp melting temperature
- Air, brass and sea water are mixtures



4 Ions

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- **Ion**: charged atom or group
- Lose electrons: **positive** (cation)
- Gain electrons: **negative** (anion)
- Electrons = protons – charge
- CO₃²⁻: 30 protons, 32 electrons



5 Charges from the Periodic Table

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- Groups 1, 2, 3: **1+**, **2+**, **3+**
- Groups 5, 6, 7: **3-**, **2-**, **1-**
- Roman numeral: metal charge
- Fe(II) is Fe²⁺; Fe(III) is Fe³⁺
- Ag⁺, Zn²⁺, H⁺ to learn



6 Formulae of ionic compounds

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- Total charge **zero**
- Al³⁺ and O²⁻: **Al₂O₃**
- **Brackets** round repeated groups
- Mg(OH)₂, (NH₄)₂SO₄
- Formula: the ratio of ions



Common polyatomic ions learn the formula and charge of each; brackets when more than one is needed

Ion	Formula	Charge	Example compound	Formula
ammonium	NH ₄ ⁺	1+	ammonium chloride	NH ₄ Cl
hydroxide	OH ⁻	1-	calcium hydroxide	Ca(OH) ₂
nitrate	NO ₃ ⁻	1-	copper(II) nitrate	Cu(NO ₃) ₂
hydrogencarbonate	HCO ₃ ⁻	1-	sodium hydrogencarbonate	NaHCO ₃
carbonate	CO ₃ ²⁻	2-	potassium carbonate	K ₂ CO ₃
sulfate	SO ₄ ²⁻	2-	aluminium sulfate	Al ₂ (SO ₄) ₃
phosphate	PO ₄ ³⁻	3-	ammonium phosphate	(NH ₄) ₃ PO ₄

Writing a formula

Simple ions

- Ca²⁺ and Cl⁻
- Two Cl⁻ balance one Ca²⁺
- **CaCl₂**

Swap the numbers

- Al³⁺ and SO₄²⁻
- 2 × 3+ = 3 × 2-
- **Al₂(SO₄)₃**

Working back

- Fe(NO₃)₃: three 1- ions
- so the iron is Fe³⁺
- name: **iron(III) nitrate**

Formulae become balanced equations (Equations and Reaction Types); their masses and moles come in Mole Calculations.



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