

Chemical Reactions in Solution

Solubility rules, electrolytes, dissociation, ionic equations, and the aqueous reaction types.

01 Solubility rules

REFERENCE

Soluble: Group 1 & NH_4^+ salts; NO_3^- , acetate, ClO_3^- , ClO_4^- ; most $\text{Cl}^-/\text{Br}^-/\text{I}^-$ (except Ag^+ , Pb^{2+} , Hg_2^{2+}); most SO_4^{2-} (except Ba^{2+} , Sr^{2+} , Pb^{2+} , often Ca^{2+}). Insoluble: carbonates, phosphates, chromates, sulfides, most hydroxides, except with Group 1 / NH_4^+ ($\text{Ba}(\text{OH})_2$ is the common soluble exception).

02 Electrolyte classes

CORE RULE

Strong: soluble ionic salts, strong acids, strong bases (fully ionize). Weak: weak acids/bases (partial). Nonelectrolyte: molecular substances that don't ionize.

03 Writing dissociation

CORE RULE

Acids release H^+ : strong acids use a single arrow, weak acids an equilibrium arrow; polyprotic acids dissociate one proton at a time.

Salts split into cation + anion in stoichiometric ratio; polyatomic ions stay intact and $\text{Hg}(\text{l})$ is Hg_2^{2+} . Insoluble salts do not dissociate.

04 Molecular → ionic → net ionic

METHOD

Molecular: intact formulas. Complete ionic: split ONLY soluble strong electrolytes; keep solids, liquids, gases, weak electrolytes, and covalent species intact.

Net ionic: cancel spectator ions (unchanged on both sides); show only species that actually change.

05 Precipitation

CORE RULE

Exchange the ions of two aqueous reactants; if a candidate product is insoluble by the rules, write it as a solid precipitate.

06 Acid-base neutralization

CORE RULE

Strong acid + strong base net ionic: $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$. The driving force is water formation.

07 Gas-forming reactions

CORE RULE

Carbonate/bicarbonate + acid $\rightarrow \text{CO}_2 + \text{H}_2\text{O}$ (via H_2CO_3).

Sulfite/bisulfite + acid $\rightarrow \text{SO}_2 + \text{H}_2\text{O}$ (via H_2SO_3). Ammonium salt + strong base $\rightarrow \text{NH}_3 + \text{H}_2\text{O}$.

08 Aqueous reaction types

CORE RULE

Precipitation, acid-base, gas-forming, redox (recognition only here; oxidation numbers are Topic 7), or no reaction.

09 When to write 'no reaction'

WATCH OUT

If all possible products stay soluble strong electrolytes and no gas, precipitate, water, or weak electrolyte forms, it is no reaction.