

TABLE 3.2 Solubility of ionic compounds

Classes of soluble compounds	Classes of insoluble compounds
compounds of Group I elements ammonium (NH ₄ ⁺) compounds chlorides (Cl ⁻), bromides (Br ⁻), and iodides (I ⁻), EXCEPT Ag ⁺ , Hg ₂ ²⁺ , Pb ²⁺ nitrates (NO ₃ ⁻), chlorates (ClO ₃ ⁻), perchlorates (ClO ₄ ⁻), acetates (CH ₃ CO ₂ ⁻) sulfates (SO ₄ ²⁻), EXCEPT Sr ²⁺ , Ba ²⁺ , Pb ²⁺	carbonates (CO ₃ ²⁻), phosphates (PO ₄ ³⁻), oxalates (C ₂ O ₄ ²⁻), and chromates (CrO ₄ ²⁻), EXCEPT Group I elements and NH ₄ ⁺ sulfides (S ²⁻), EXCEPT Group I elements, Group II elements, and NH ₄ ⁺ hydroxides (OH ⁻) and oxides (O ²⁻), EXCEPT Group I elements and Group II elements*

*Ca(OH)₂ and Sr(OH)₂ are sparingly (slightly) soluble; Mg(OH)₂ is only very slightly soluble.

TABLE 3.1 Classifications of reactions

Type of reaction	Distinguishing features*
<i>Classification scheme 1 (based on compositions of reactants and products)</i>	
synthesis	formation of compound from simpler starting materials <i>Example:</i> 2H ₂ (g) + O ₂ (g) → 2H ₂ O(l)
decomposition	formation of simpler substances from the starting material <i>Example:</i> CaCO ₃ (s) → CaO(s) + CO ₂ (g)
double replacement (metathesis)	the exchange of partners <i>Example:</i> 2NaCl(aq) + Pb(NO ₃) ₂ (aq) → 2NaNO ₃ (aq) + PbCl ₂ (s)
combustion	reaction with oxygen to form CO ₂ , H ₂ O, N ₂ , and oxides of any other elements present <i>Example:</i> CH ₄ (g) + 2O ₂ (g) → CO ₂ (g) + 2H ₂ O(g)
corrosion	reaction of a metal with oxygen to form the metal oxide <i>Example:</i> 4Fe(s) + 3O ₂ (g) → 2Fe ₂ O ₃ (s)
<i>Classification scheme 2 (based on driving force of reaction)</i>	
gas evolution	formation of gas <i>Example:</i> CaCO ₃ (s) + 2HCl(aq) → CaCl ₂ (aq) + H ₂ O(l) + CO ₂ (g) <i>Driving force:</i> Escape of gas
precipitation	formation of precipitate when one solution is added to another <i>Example:</i> 3CaCl ₂ (aq) + 2Na ₃ PO ₄ (aq) → Ca ₃ (PO ₄) ₂ (s) + 6NaCl(aq) <i>Driving force:</i> Formation of insoluble solid
neutralization	reaction between an acid and a base <i>Example:</i> HCl(aq) + NaOH(aq) → NaCl(aq) + H ₂ O(l) <i>Driving force:</i> Formation of solvent (water)
redox	transfer of electrons from one species to another (accompanied by atoms in many cases) <i>Example:</i> 2Mg(s) + O ₂ (g) → 2MgO(s) <i>Driving force:</i> Electron transfer to achieve greater stability

*Key to symbols representing physical states of reactants and products: (aq), aqueous solution; (g), gas; (l), liquid; (s), solid.