

Strong & Weak Acids at a glance

When chemists refer to strong and weak acids they are referring to the degree with which the acid molecules break apart to give ions in aqueous solution (dissociation). A strong acid completely breaks apart to give ions in solution (100% dissociation) whereas a weak acid only slightly dissociates in solution (perhaps less than 1%)			
Strong acids e.g. HCl, HNO ₃ & H ₂ SO ₄	<p>e.g. hydrochloric acid HCl</p> $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^- \text{ or } \text{HCl} + \text{aq} \rightarrow \text{H}^+ + \text{Cl}^-$ <ul style="list-style-type: none"> Reaction with water is complete (all the HCl molecules have reacted with H₂O) Acid, HCl is completely ionised or completely dissociated (all HCl molecules have “split” into ions) Reaction effectively “goes to completion” / to the right 	<p>e.g. ethanoic acid CH₃COOH</p> $\text{CH}_3\text{COOH} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{CH}_3\text{COO}^- \text{ or } \text{CH}_3\text{COOH} + \text{aq} \rightleftharpoons \text{H}^+ + \text{CH}_3\text{COO}^-$ <ul style="list-style-type: none"> Reaction with water is incomplete (NOT all the CH₃COOH molecules have reacted with H₂O) Acid, CH₃COOH is incompletely ionised or incompletely dissociated (NOT all CH₃COOH molecules have “split” into ions) Reaction is an equilibrium reaction; equilibrium lies towards the left, i.e. most of CH₃COOH is unionised 	Weak acids e.g. carboxylic acids such as CH ₃ COOH
	<p>Properties</p> <ul style="list-style-type: none"> Low pH – because the [H₃O⁺] is high Turn blue litmus red, turn UI pink/red Fast reaction with Mg or CaCO₃ – because the [H₃O⁺] is high and so there are many collisions / second between H₃O⁺ and Mg or CaCO₃ Good conductor of electricity – as there are many H₃O⁺ AND Cl⁻ ions available to carry the current 	<p>Properties</p> <ul style="list-style-type: none"> Not such a low pH (but still < 7) – because the [H₃O⁺] is low Turn blue litmus red, turn UI orange Slow reaction with Mg or CaCO₃ – because the [H₃O⁺] is low and so there are not many collisions / second between H₃O⁺ and Mg or CaCO₃ Poor conductor of electricity – as there are very few H₃O⁺ AND CH₃COO⁻ ions available to carry the current 	
	<p>pH</p> <ul style="list-style-type: none"> Can be calculated by knowing the concentration of the acid; pH = -log[H₃O⁺] e.g. 0.500 mol L⁻¹ HCl pH = -log 0.500 = 0.301 e.g. 0.350 mol L⁻¹ H₂SO₄ pH = -log 0.700 = 0.155 (Note H₂SO₄ contains 2 x H⁺ so [H⁺] or [H₃O⁺] is 2 x concentration of the acid). 	<p>pH</p> <ul style="list-style-type: none"> Can NOT be calculated by knowing just the concentration of the acid as we do NOT know the extent to which ionisation occurs and therefore we can't know the [H₃O⁺] To calculate, you will have to wait to level 3 Chemistry!!! 	
	<p>How much “stuff” will the acid react with?</p> <ul style="list-style-type: none"> Equal volumes of strong and weak acids*, of the same concentration, will react with the same amount of magnesium, for example (same mass / same amount of mol), because they both have the SAME TOTAL AMOUNT of H₃O⁺ ions available, since n = cV. <p>*monoprotic acids like HCl and CH₃COOH</p>	<p>Weak acids that come disguised as salts!</p> <ul style="list-style-type: none"> NH₄Cl is a salt. It is ionic and will dissolve in water and produces NH₄⁺ (the conjugate acid of NH₃) and Cl⁻ Dissolving: NH₄Cl(s) + aq → NH₄⁺(aq) + Cl⁻(aq) The NH₄⁺ will react with water to some extent to form NH₃ and H₃O⁺. This makes the solution acidic. NH₄⁺(aq) + H₂O(l) ⇌ NH₃(aq) + H₃O⁺(aq) 	

Strong & Weak Bases at a glance

When chemists refer to strong and weak bases they are referring to the degree with which the bases (ionic compounds or molecules) break apart to give ions in aqueous solution (dissociation). A strong base completely breaks apart to give ions in solution whereas a weak base only slightly dissociates in solution.	
Strong bases e.g. NaOH, KOH, and Ca(OH) ₂	<p>e.g. sodium hydroxide, NaOH (an ionic solid)</p> $\text{NaOH} + \text{aq} \rightarrow \text{Na}^+ + \text{OH}^- *$ <ul style="list-style-type: none"> Reaction with water is complete The NaOH is completely ionised or completely dissociated (the NaOH ionic lattice has “split” into ions) Reaction effectively “goes to completion” / to the right <p>*Don't write $\text{NaOH} + \text{H}_2\text{O} \rightarrow \dots$ or you will end up with problems or end up writing H_2O on both sides of the arrow!</p>
	<p>e.g. ammonia, NH₃</p> $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$ <ul style="list-style-type: none"> Reaction with water is incomplete (NOT all the NH₃ molecules have reacted with H₂O) The base NH₃ is incompletely ionised or incompletely dissociated (NOT all NH₃ molecules have “split” into ions) Reaction is an equilibrium reaction; equilibrium lies towards the left, i.e. most of NH₃ is unionised
	<p>Properties</p> <ul style="list-style-type: none"> High pH – because the [OH⁻] is high Turn red litmus blue, turn UI purple Good conductor of electricity – as there are many ions available to carry the current
	<p>Properties</p> <ul style="list-style-type: none"> Not such a high pH (but still > 7) – because the [OH⁻] is low Turn red litmus blue, turn UI dark green-blue Poor conductor of electricity – as there are very few ions available to carry the current
	<p>pH</p> <ul style="list-style-type: none"> Can be calculated by knowing the concentration of the base; <ul style="list-style-type: none"> Find [H₃O⁺]; [H₃O⁺] = 1 x 10⁻¹⁴ / [OH⁻] Then find the pH; pH = -log[H₃O⁺] e.g. 0.800 mol L⁻¹ NaOH <ul style="list-style-type: none"> [OH⁻] = 0.800 mol L⁻¹ ; [H₃O⁺] = 1 x 10⁻¹⁴ / 0.800 = 1.25 x 10⁻¹⁴ mol L⁻¹ pH = - log 1.25 x 10⁻¹⁴ and so pH = 13.9
	<p>pH</p> <ul style="list-style-type: none"> Can NOT be calculated by knowing just the concentration of the base as we do NOT know the extent to which ionisation occurs and therefore we can't know the [OH⁻] To calculate, you will have to wait to level 3 Chemistry!!!
	<p>NOTE:</p> <p>There are usually less questions comparing strong and weak bases as the bases don't have such visible reactions with other substances.</p> <p>e.g. when base + acid → salt + water</p> <p>there is no visible sign of reaction, no bubbles of any gas etc, so it is hard to compare any “rate of reaction”.</p>
	<p>Weak bases that come disguised as salts!</p> <ul style="list-style-type: none"> NaHCO₃ is a salt. It is ionic and will dissolve in water and produces Na⁺ and HCO₃⁻ Dissolving: $\text{NaHCO}_3(\text{s}) + \text{aq} \rightarrow \text{Na}^+(\text{aq}) + \text{HCO}_3^-(\text{aq})$ The HCO₃⁻ will react with water to some extent to form H₂CO₃ and OH⁻. This makes the solution alkaline/basic. $\text{HCO}_3^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{H}_2\text{CO}_3(\text{aq}) + \text{OH}^-(\text{aq})$
	Weak acids e.g. ammonia NH ₃