

# RELATIVE STRENGTHS OF BRØNSTED-LOWRY ACIDS AND BASES

*in aqueous solution at room temperature.*

Name of Acid	Acid	Base	$K_a$
Perchloric	$\text{HClO}_4$	$\rightarrow \text{H}^+ + \text{ClO}_4^-$	very large
Hydriodic	$\text{HI}$	$\rightarrow \text{H}^+ + \text{I}^-$	very large
Hydrobromic	$\text{HBr}$	$\rightarrow \text{H}^+ + \text{Br}^-$	very large
Hydrochloric	$\text{HCl}$	$\rightarrow \text{H}^+ + \text{Cl}^-$	very large
Nitric	$\text{HNO}_3$	$\rightarrow \text{H}^+ + \text{NO}_3^-$	very large
Sulphuric	$\text{H}_2\text{SO}_4$	$\rightarrow \text{H}^+ + \text{HSO}_4^-$	very large
Hydronium Ion	$\text{H}_3\text{O}^+$	$\rightleftharpoons \text{H}^+ + \text{H}_2\text{O}$	1.0
Iodic	$\text{HIO}_3$	$\rightleftharpoons \text{H}^+ + \text{IO}_3^-$	$1.7 \times 10^{-1}$
Oxalic	$\text{H}_2\text{C}_2\text{O}_4$	$\rightleftharpoons \text{H}^+ + \text{HC}_2\text{O}_4^-$	$5.9 \times 10^{-2}$
Sulphurous ( $\text{SO}_2 + \text{H}_2\text{O}$ )	$\text{H}_2\text{SO}_3$	$\rightleftharpoons \text{H}^+ + \text{HSO}_3^-$	$1.5 \times 10^{-2}$
Hydrogen sulphate ion	$\text{HSO}_4^-$	$\rightleftharpoons \text{H}^+ + \text{SO}_4^{2-}$	$1.2 \times 10^{-2}$
Phosphoric	$\text{H}_3\text{PO}_4$	$\rightleftharpoons \text{H}^+ + \text{H}_2\text{PO}_4^-$	$7.5 \times 10^{-3}$
Hexaaquoiron ion, iron(III) ion	$\text{Fe}(\text{H}_2\text{O})_6^{3+}$	$\rightleftharpoons \text{H}^+ + \text{Fe}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$6.0 \times 10^{-3}$
Citric	$\text{H}_3\text{C}_6\text{H}_5\text{O}_7$	$\rightleftharpoons \text{H}^+ + \text{H}_2\text{C}_6\text{H}_5\text{O}_7^-$	$7.1 \times 10^{-4}$
Nitrous	$\text{HNO}_2$	$\rightleftharpoons \text{H}^+ + \text{NO}_2^-$	$4.6 \times 10^{-4}$
Hydrofluoric	$\text{HF}$	$\rightleftharpoons \text{H}^+ + \text{F}^-$	$3.5 \times 10^{-4}$
Methanoic, formic	$\text{HCOOH}$	$\rightleftharpoons \text{H}^+ + \text{HCOO}^-$	$1.8 \times 10^{-4}$
Hexaaquochromium ion, chromium(III) ion	$\text{Cr}(\text{H}_2\text{O})_6^{3+}$	$\rightleftharpoons \text{H}^+ + \text{Cr}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$1.5 \times 10^{-4}$
Benzoic	$\text{C}_6\text{H}_5\text{COOH}$	$\rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{COO}^-$	$6.5 \times 10^{-5}$
Hydrogen oxalate ion	$\text{HC}_2\text{O}_4^-$	$\rightleftharpoons \text{H}^+ + \text{C}_2\text{O}_4^{2-}$	$6.4 \times 10^{-5}$
Ethanoic, acetic	$\text{CH}_3\text{COOH}$	$\rightleftharpoons \text{H}^+ + \text{CH}_3\text{COO}^-$	$1.8 \times 10^{-5}$
Dihydrogen citrate ion	$\text{H}_2\text{C}_6\text{H}_5\text{O}_7^-$	$\rightleftharpoons \text{H}^+ + \text{HC}_6\text{H}_5\text{O}_7^{2-}$	$1.7 \times 10^{-5}$
Hexaaquoaluminum ion, aluminum ion	$\text{Al}(\text{H}_2\text{O})_6^{3+}$	$\rightleftharpoons \text{H}^+ + \text{Al}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$1.4 \times 10^{-5}$
Carbonic ( $\text{CO}_2 + \text{H}_2\text{O}$ )	$\text{H}_2\text{CO}_3$	$\rightleftharpoons \text{H}^+ + \text{HCO}_3^-$	$4.3 \times 10^{-7}$
Monohydrogen citrate ion	$\text{HC}_6\text{H}_5\text{O}_7^{2-}$	$\rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{O}_7^{3-}$	$4.1 \times 10^{-7}$
Hydrogen sulphite ion	$\text{HSO}_3^-$	$\rightleftharpoons \text{H}^+ + \text{SO}_3^{2-}$	$1.0 \times 10^{-7}$
Hydrogen sulphide	$\text{H}_2\text{S}$	$\rightleftharpoons \text{H}^+ + \text{HS}^-$	$9.1 \times 10^{-8}$
Dihydrogen phosphate ion	$\text{H}_2\text{PO}_4^-$	$\rightleftharpoons \text{H}^+ + \text{HPO}_4^{2-}$	$6.2 \times 10^{-8}$
Boric	$\text{H}_3\text{BO}_3$	$\rightleftharpoons \text{H}^+ + \text{H}_2\text{BO}_3^-$	$7.3 \times 10^{-10}$
Ammonium ion	$\text{NH}_4^+$	$\rightleftharpoons \text{H}^+ + \text{NH}_3$	$5.6 \times 10^{-10}$
Hydrocyanic	$\text{HCN}$	$\rightleftharpoons \text{H}^+ + \text{CN}^-$	$4.9 \times 10^{-10}$
Phenol	$\text{C}_6\text{H}_5\text{OH}$	$\rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{O}^-$	$1.3 \times 10^{-10}$
Hydrogen carbonate ion	$\text{HCO}_3^-$	$\rightleftharpoons \text{H}^+ + \text{CO}_3^{2-}$	$5.6 \times 10^{-11}$
Hydrogen peroxide	$\text{H}_2\text{O}_2$	$\rightleftharpoons \text{H}^+ + \text{HO}_2^-$	$2.4 \times 10^{-12}$
Monohydrogen phosphate ion	$\text{HPO}_4^{2-}$	$\rightleftharpoons \text{H}^+ + \text{PO}_4^{3-}$	$2.2 \times 10^{-13}$
Water	$\text{H}_2\text{O}$	$\rightleftharpoons \text{H}^+ + \text{OH}^-$	$1.0 \times 10^{-14}$
Hydroxide ion	$\text{OH}^-$	$\leftarrow \text{H}^+ + \text{O}^{2-}$	very small
Ammonia	$\text{NH}_3$	$\leftarrow \text{H}^+ + \text{NH}_2^-$	very small

STRONG

STRENGTH OF ACID

WEAK

WEAK

STRENGTH OF BASE

STRONG

## ACID-BASE INDICATORS

Indicator	pH Range in Which Colour Change Occurs	Colour Change as pH Increases
Methyl violet	0.0 – 1.6	yellow to blue
Thymol blue	1.2 – 2.8	red to yellow
Orange IV	1.4 – 2.8	red to yellow
Methyl orange	3.2 – 4.4	red to yellow
Bromcresol green	3.8 – 5.4	yellow to blue
Methyl red	4.8 – 6.0	red to yellow
Chlorophenol red	5.2 – 6.8	yellow to red
Bromthymol blue	6.0 – 7.6	yellow to blue
Phenol red	6.6 – 8.0	yellow to red
Neutral red	6.8 – 8.0	red to amber
Thymol blue	8.0 – 9.6	yellow to blue
Phenolphthalein	8.2 – 10.0	colourless to pink
Thymolphthalein	9.4 – 10.6	colourless to blue
Alizarin yellow	10.1 – 12.0	yellow to red
Indigo carmine	11.4 – 13.0	blue to yellow