

AQUEOUS EQUILIBRIUM CONSTANTS

TABLE D.1 • Dissociation Constants for Acids at 25 °C

Name	Formula	K_{a1}	K_{a2}	K_{a3}
Acetic acid	CH ₃ COOH (or HC ₂ H ₃ O ₂)	1.8×10^{-5}		
Arsenic acid	H ₃ AsO ₄	5.6×10^{-3}	1.0×10^{-7}	3.0×10^{-12}
Arsenous acid	H ₃ AsO ₃	5.1×10^{-10}		
Ascorbic acid	H ₂ C ₆ H ₆ O ₆	8.0×10^{-5}	1.6×10^{-12}	
Benzoic acid	C ₆ H ₅ COOH (or HC ₇ H ₅ O ₂)	6.3×10^{-5}		
Boric acid	H ₃ BO ₃	5.8×10^{-10}		
Butanoic acid	C ₃ H ₇ COOH (or HC ₄ H ₇ O ₂)	1.5×10^{-5}		
Carbonic acid	H ₂ CO ₃	4.3×10^{-7}	5.6×10^{-11}	
Chloroacetic acid	CH ₂ ClCOOH (or HC ₂ H ₂ O ₂ Cl)	1.4×10^{-3}		
Chlorous acid	HClO ₂	1.1×10^{-2}		
Citric acid	HOCC(OH)(CH ₂ COOH) ₂ (or H ₃ C ₆ H ₅ O ₇)	7.4×10^{-4}	1.7×10^{-5}	4.0×10^{-7}
Cyanic acid	HCNO	3.5×10^{-4}		
Formic acid	HCOOH (or HCHO ₂)	1.8×10^{-4}		
Hydroazoic acid	HN ₃	1.9×10^{-5}		
Hydrocyanic acid	HCN	4.9×10^{-10}		
Hydrofluoric acid	HF	6.8×10^{-4}		
Hydrogen chromate ion	HCrO ₄ ⁻	3.0×10^{-7}		
Hydrogen peroxide	H ₂ O ₂	2.4×10^{-12}		
Hydrogen selenate ion	HSeO ₄ ⁻	2.2×10^{-2}		
Hydrogen sulfide	H ₂ S	9.5×10^{-8}	1×10^{-19}	
Hypobromous acid	HBrO	2.5×10^{-9}		
Hypochlorous acid	HClO	3.0×10^{-8}		
Hypoiodous acid	HIO	2.3×10^{-11}		
Iodic acid	HIO ₃	1.7×10^{-1}		
Lactic acid	CH ₃ CH(OH)COOH (or HC ₃ H ₅ O ₃)	1.4×10^{-4}		
Malonic acid	CH ₂ (COOH) ₂ (or H ₂ C ₃ H ₂ O ₄)	1.5×10^{-3}	2.0×10^{-6}	
Nitrous acid	HNO ₂	4.5×10^{-4}		
Oxalic acid	(COOH) ₂ (or H ₂ C ₂ O ₄)	5.9×10^{-2}	6.4×10^{-5}	
Paraperiodic acid	H ₅ IO ₆	2.8×10^{-2}	5.3×10^{-9}	
Phenol	C ₆ H ₅ OH (or HC ₆ H ₅ O)	1.3×10^{-10}		
Phosphoric acid	H ₃ PO ₄	7.5×10^{-3}	6.2×10^{-8}	4.2×10^{-13}
Propionic acid	C ₂ H ₅ COOH (or HC ₃ H ₅ O ₂)	1.3×10^{-5}		
Pyrophosphoric acid	H ₄ P ₂ O ₇	3.0×10^{-2}	4.4×10^{-3}	2.1×10^{-7}
Selenous acid	H ₂ SeO ₃	2.3×10^{-3}	5.3×10^{-9}	
Sulfuric acid	H ₂ SO ₄	Strong acid	1.2×10^{-2}	
Sulfurous acid	H ₂ SO ₃	1.7×10^{-2}	6.4×10^{-8}	
Tartaric acid	HOOC(CHOH) ₂ COOH (or H ₂ C ₄ H ₄ O ₆)	1.0×10^{-3}		

TABLE D.2 • Dissociation Constants for Bases at 25 °C

Name	Formula	K_b
Ammonia	NH ₃	1.8×10^{-5}
Aniline	C ₆ H ₅ NH ₂	4.3×10^{-10}
Dimethylamine	(CH ₃) ₂ NH	5.4×10^{-4}
Ethylamine	C ₂ H ₅ NH ₂	6.4×10^{-4}
Hydrazine	H ₂ NNH ₂	1.3×10^{-6}
Hydroxylamine	HONH ₂	1.1×10^{-8}
Methylamine	CH ₃ NH ₂	4.4×10^{-4}
Pyridine	C ₅ H ₅ N	1.7×10^{-9}
Trimethylamine	(CH ₃) ₃ N	6.4×10^{-5}

TABLE D.3 • Solubility-Product Constants for Compounds at 25 °C

Name	Formula	K_{sp}	Name	Formula	K_{sp}
Barium carbonate	BaCO ₃	5.0×10^{-9}	Lead(II) fluoride	PbF ₂	3.6×10^{-8}
Barium chromate	BaCrO ₄	2.1×10^{-10}	Lead(II) sulfate	PbSO ₄	6.3×10^{-7}
Barium fluoride	BaF ₂	1.7×10^{-6}	Lead(II) sulfide*	PbS	3×10^{-28}
Barium oxalate	BaC ₂ O ₄	1.6×10^{-6}	Magnesium hydroxide	Mg(OH) ₂	1.8×10^{-11}
Barium sulfate	BaSO ₄	1.1×10^{-10}	Magnesium carbonate	MgCO ₃	3.5×10^{-8}
Cadmium carbonate	CdCO ₃	1.8×10^{-14}	Magnesium oxalate	MgC ₂ O ₄	8.6×10^{-5}
Cadmium hydroxide	Cd(OH) ₂	2.5×10^{-14}	Manganese(II) carbonate	MnCO ₃	5.0×10^{-10}
Cadmium sulfide*	CdS	8×10^{-28}	Manganese(II) hydroxide	Mn(OH) ₂	1.6×10^{-13}
Calcium carbonate (calcite)	CaCO ₃	4.5×10^{-9}	Manganese(II) sulfide*	MnS	2×10^{-53}
Calcium chromate	CaCrO ₄	4.5×10^{-9}	Mercury(I) chloride	Hg ₂ Cl ₂	1.2×10^{-18}
Calcium fluoride	CaF ₂	3.9×10^{-11}	Mercury(I) iodide	Hg ₂ I ₂	1.1×10^{-11}
Calcium hydroxide	Ca(OH) ₂	6.5×10^{-6}	Mercury(II) sulfide*	HgS	2×10^{-53}
Calcium phosphate	Ca ₃ (PO ₄) ₂	2.0×10^{-29}	Nickel(II) carbonate	NiCO ₃	1.3×10^{-7}
Calcium sulfate	CaSO ₄	2.4×10^{-5}	Nickel(II) hydroxide	Ni(OH) ₂	6.0×10^{-16}
Chromium(III) hydroxide	Cr(OH) ₃	1.6×10^{-30}	Nickel(II) sulfide*	NiS	3×10^{-20}
Cobalt(II) carbonate	CoCO ₃	1.0×10^{-10}	Silver bromate	AgBrO ₃	5.5×10^{-13}
Cobalt(II) hydroxide	Co(OH) ₂	1.3×10^{-15}	Silver bromide	AgBr	5.0×10^{-13}
Cobalt(II) sulfide*	CoS	5×10^{-22}	Silver carbonate	Ag ₂ CO ₃	8.1×10^{-12}
Copper(I) bromide	CuBr	5.3×10^{-9}	Silver chloride	AgCl	1.8×10^{-10}
Copper(II) carbonate	CuCO ₃	2.3×10^{-10}	Silver chromate	Ag ₂ CrO ₄	1.2×10^{-12}
Copper(II) hydroxide	Cu(OH) ₂	4.8×10^{-20}	Silver iodide	AgI	8.3×10^{-17}
Copper(II) sulfide*	CuS	6×10^{-37}	Silver sulfate	Ag ₂ SO ₄	1.5×10^{-5}
Iron(II) carbonate	FeCO ₃	2.1×10^{-11}	Silver sulfide*	Ag ₂ S	6×10^{-51}
Iron(II) hydroxide	Fe(OH) ₂	7.9×10^{-16}	Strontium carbonate	SrCO ₃	9.3×10^{-10}
Lanthanum fluoride	LaF ₃	2×10^{-19}	Tin(II) sulfide*	SnS	1×10^{-26}
Lanthanum iodate	La(IO ₃) ₃	7.4×10^{-14}	Zinc carbonate	ZnCO ₃	1.0×10^{-10}
Lead(II) carbonate	PbCO ₃	7.4×10^{-14}	Zinc hydroxide	Zn(OH) ₂	3.0×10^{-16}
Lead(II) chloride	PbCl ₂	1.7×10^{-5}	Zinc oxalate	ZnC ₂ O ₄	2.7×10^{-8}
Lead(II) chromate	PbCrO ₄	2.8×10^{-13}	Zinc sulfide*	ZnS	2×10^{-25}

*For a solubility equilibrium of the type $MS(s) + H_2O(l) \rightleftharpoons M^{2+}(aq) + HS^-(aq) + OH^-(aq)$