

Potentially Useful Formulas and Constants

Henry's Law Constants

ID	mol/(L atm)
O ₂	1.3 x 10 ⁻³
H ₂	7.8 x 10 ⁻⁴
CO ₂	3.4 x 10 ⁻²
N ₂	6.1 x 10 ⁻⁴

Equilibrium Equation	K _a at 25°C
NH ₄ ⁺ ↔ H ⁺ + NH ₃	5.56 x 10 ⁻¹⁰
H ₂ CO ₃ ↔ H ⁺ + HCO ₃ ⁻	5 x 10 ⁻⁷ (use pK _{a1} = 6.3)
HCO ₃ ⁻ ↔ H ⁺ + CO ₃ ²⁻	5 x 10 ⁻¹¹ (use pK _{a2} = 10.3)
HCN ↔ H ⁺ + CN ⁻	4.8 x 10 ⁻¹⁰

Equilibrium Equation	K _{sp} at 25°C
FeF ₂ (s) ↔ Ba ²⁺ + 2F ⁻	2.4 x 10 ⁻⁶
PbCl ₂ (s) ↔ Pb ²⁺ + 2Cl ⁻	1.2 x 10 ⁻⁵
CaSO ₄ (s) ↔ Ca ²⁺ + SO ₄ ²⁻	7.1 x 10 ⁻⁵
Al(OH) ₃ (s) ↔ Al ³⁺ + 3OH ⁻	2 x 10 ⁻⁵
Ag ₂ SO ₄ (s) ↔ 2Ag ⁺ + SO ₄ ²⁻	1.2 x 10 ⁻⁵
Mn(OH) ₂ (s) ↔ Mn ²⁺ + 2OH ⁻	4.6 x 10 ⁻¹⁴

Ideal Gas Law

$$PV = nRT$$

Universal Gas Constant, R

$$R = 8.314 \text{ m}^3 \text{ Pa/mol K}$$

$$R = 0.083 \text{ L bar/mol K}$$

$$R = 0.082 \text{ L atm/mol K}$$

ID	ΔH _{vap} (kJ/mol)
H ₂ O	40.65
Butane	21.0
Propane	15.7

ID	ΔH _f ⁰ (kJ/mol)	ΔG _f ⁰ (kJ/mol)
HCO ₃ ⁻ (aq)	-692	-587
HOCl(aq)	-18	-80
OCi ⁻ (aq)	-107	-37
H ₂ CO ₃ (aq)	-133	-79
CH ₄ (g)	-74.9	-50.8
O ₂ (g)	0	0
Cl ⁻ (aq)	-167	-131
H ₂ O(g)	-242	-229
CO ₂ (g)	-394	-394
SO ₄ ²⁻ (aq)	-909	-745
H ⁺ (aq)	0	0

$$\mu = \frac{\mu_{\max} S}{K_s + S}$$

$$\ln(C/C_0) = -kt \quad C = C_0 e^{-kt}$$

$$\ln C = \ln C_0 - kt$$

$$C = C_0 - kt$$

$$C = C_0 / (1 + k\theta) \quad 1/C = 1/C_0 + kt$$

$$C = C_0 e^{-k\theta}$$

$$\ln(K_{T2}/K_{T1}) = (-\Delta H^0/R) * [(T_1 - T_2)/(T_1 * T_2)] \quad q = m * C_p * \Delta T$$

$$\Delta G^0 = \Delta G_{\text{rxn}}^0 + RT \ln Q$$

$$\Delta G_{\text{rxn}}^0 = -RT(\ln K) \quad \text{where } R = 8.314 \text{ J/}^\circ\text{K}\cdot\text{mol}$$

$$\text{Alkalinity (eq/L)} = [\text{HCO}_3^-] + 2[\text{CO}_3^{2-}] + [\text{OH}^-] - [\text{H}^+]$$

$$\text{H}_2\text{CO}_3 = \text{HCO}_3^- + \text{H}^+ \quad (K_1 = 5 \times 10^{-7}, \text{ use p}K_1 = 6.3)$$

$$\text{HCO}_3^- = \text{CO}_3^{2-} + \text{H}^+ \quad (K_2 = 5 \times 10^{-11}, \text{ use p}K_2 = 10.3)$$

ID	C _p {J/(°K*g)}	Density (g/L)
H ₂ O(l)	4.184	1000
Air (g)	1.0	1.2
Iron(s)	0.45	7900

Common Atomic Weights (g/mol): C = 12, H = 1, O = 16, N = 14, Cl = 35.5, Mg = 24.3, Mn = 54.9, Na = 23, Cd = 112, Ca = 40.1, Ba = 137, K = 39.1, F = 38.0, S = 32