

# Types of Equilibrium Constants in CH 223

**K<sub>a</sub>** Acid Dissociation Constant (Chapter 17, 18)

For the reaction:  $\text{HA} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{A}^-$ ,

$$K_a = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}]}$$

**K<sub>b</sub>** Base Dissociation Constant (Chapter 17, 18)

For the reaction:  $\text{B}^- + \text{H}_2\text{O} \rightleftharpoons \text{OH}^- + \text{HB}$ ,

$$K_b = \frac{[\text{OH}^-][\text{HB}]}{[\text{B}^-]}$$

**K<sub>c</sub>** Equilibrium Constant using Molarity (Chapter 16)

For the reaction:  $a \text{A} + b \text{B} \rightleftharpoons c \text{C} + d \text{D}$ ,

$$K_c = \frac{[\text{C}]^c[\text{D}]^d}{[\text{A}]^a[\text{B}]^b}$$

**K<sub>f</sub>** Formation Constant (Chapter 18)

For the reaction:  $\text{M}^{2+} + 4 \text{L}_{(\text{aq})} \rightleftharpoons \text{ML}_4^{2+}$ ,

$$K_f = \frac{[\text{ML}_4^{2+}]}{[\text{M}^{2+}][\text{L}]^4}$$

**K<sub>p</sub>** Equilibrium Constant using Pressure (atm) (Chapter 16)

For the reaction:  $\frac{1}{2} \text{N}_{2(\text{g})} + \text{O}_{2(\text{g})} \rightleftharpoons \text{NO}_{2(\text{g})}$ ,

$$K_p = \frac{P_{\text{NO}_2}}{P_{\text{N}_2}^{0.5} P_{\text{O}_2}}$$

Also:  $K_p = K_c(\text{RT})^{\Delta n}$

**K<sub>sp</sub>** Solubility Product Constant (Chapter 18).

For the reaction:  $ML_{2(s)} \rightleftharpoons M^{2+} + 2 L^{-}$ ,

$$K_{sp} = [M^{2+}] [L^{-}]^2$$

**K<sub>spa</sub>** Solubility Product Constant in Acid (Chapter 18)

For the reaction:  $ZnS_{(s)} + 2 H_3O^{+} \rightleftharpoons Zn^{2+} + H_2S + 2 H_2O_{(l)}$ ,

$$K_{spa} = \frac{[Zn^{2+}] [H_2S]}{[H_3O^{+}]^2}$$

**K<sub>w</sub>** Autoionization of Water Constant (Chapter 17)

For the reaction:  $2 H_2O_{(l)} \rightleftharpoons H_3O^{+} + OH^{-}$ ,

$$K_w = [H_3O^{+}] [OH^{-}] = 1.00 * 10^{-14} \text{ at } 25 \text{ }^{\circ}\text{C}$$

**k** Kinetics Rate Constant (Chapter 15). The forward reaction ( $k_f$ ) and the reverse reaction ( $k_r$ ) are related to the equilibrium constant, **K**, by

$$K = \frac{k_f}{k_r}$$

**Q** Reaction Quotient (Chapter 16, 18, and 20), for non-equilibrium calculations. Q is defined in a method similar to that of K.