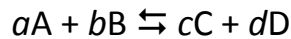


### Unit 3 Formulae

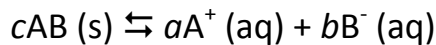
1) Equilibrium Law Expression:



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

A, B, C, and D are chemical entities in gas or aqueous phases  
*a*, *b*, *c*, and *d* are the coefficients in the balanced chemical equation  
K is the equilibrium constant

2) Solubility Product Constant



$$K_{sp} = [A^+]^a [B^-]^b$$

$A^+$  and  $B^-$  are ions formed in aqueous phases  
*a*, and *b* are the coefficients in the balanced ionic equation  
 $K_{sp}$  is the solubility product constant

3) Ion product constant for water

$$K_w = [H^+][OH^-] \quad \text{*at equilibrium } K_w = 1.0 \times 10^{-14}; [H^+] = [OH^-] = 1.0 \times 10^{-7} \text{ mol/L}$$

$$\begin{aligned} 4) \text{ pH} &= -\log[H^+] & \text{pOH} &= -\log[OH^-] \\ [H^+] &= 10^{-\text{pH}} & [OH^-] &= 10^{-\text{pOH}} \\ \text{pH} + \text{pOH} &= 14.00 \end{aligned}$$

$$5) \text{ p}K_w = -\log K_w \quad \text{pH} + \text{pOH} = \text{p}K_w$$

$$6) [H^+] = p/100 \times [HA] \quad \text{p is percent ionization; [HA] is concentration of acid}$$

$$7) K_a = \frac{[H^+][A^-]}{[HA]} \quad K_b = \frac{[B^+][OH^-]}{[BOH]}$$

$$8) K_a K_b = K_w \quad \text{or} \quad K_b = K_w / K_a \quad \text{or} \quad K_a = K_w / K_b$$

$$9) c_A v_A n_A = c_b v_b n_b$$

$c_A$  = [acid];  $c_b$  = [base]       $v_A$  = volume of acid;  $v_b$  = volume of base  
 $n_A$  = moles of acid (subscript beside H in formula);  $n_b$  = moles of base (subscript beside OH in formula)