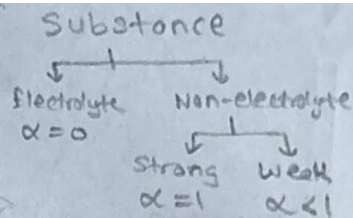


Ionic Equilibrium - P

- Arrhenius - Acid: Donate H^+ ion in aq medium
Base: Donate OH^- ion in aq medium
- Bronsted - Acid: H^+ donor is acid
Base: H^+ acceptor is base
- Lewis - Acid: e^- pair acceptor
Base: e^- pair donor

• CB is formed by losing H^+
• CA is formed by gaining H^+

Ostwald dilution law
 $\alpha \propto \frac{1}{\sqrt{c}} \propto \sqrt{V} \propto \text{Diluti}$



Common ion effect = $\alpha \downarrow$

Odd ion effect = $\alpha \uparrow$

• $pH = -\log [H^+]$
• $pOH = -\log [OH^-]$
• $K_w = K_{[H_2O]} = [H^+][OH^-]$
(10^{-14})
• $14 = pH + pOH$
(pK_w)

• conc of $H_2O = 55.55$
• At STP $[H^+] = [OH^-] = 10^{-7}$
• Ionisation constant of H_2O
 $K_b = \frac{[H^+][OH^-]}{[H_2O]} = 1.8 \times 10^{-16}$

• Degree of dissociation of H_2O

$K_w = [OH^-][H^+]$
 $10^{-14} = c^2 \alpha^2 \Rightarrow \alpha = 1.8 \times 10^{-7}$
% $\alpha = 1.8 \times 10^{-7}$

$\log 1 = 0$
$\log 2 = 0.3$
$\log 3 = 0.48$
$\log 4 = 0.60$
$\log 5 = 0.70$
$\log 6 = 0.80$
$\log 7 = 0.85$
$\log 8 = 0.90$
$\log 9 = 0.95$
$\log 10 = 1$

pH Calculations

① Strong Acid

$[H^+] = [S_A]$ ← Normality
 $pH = -\log [H^+]$

② Strong Base

$[OH^-] = [S_B]$ ← Normality
 $pOH = -\log [OH^-]$

③ Mixture of 2 SA OR 2 SB

$N_R = \frac{N_1 V_1 + N_2 V_2}{V_{Total}}$

if S_A then $N_R = [H^+]$
if S_B then $N_R = [OH^-]$
then $pH = -\log [H^+]$

④ Mixing SA and SB

$N_R = \frac{(N_1 V_1) - (N_2 V_2)}{V_{Total}}$

if $(NV)_{acid} > (NV)_{base}$
then $N_R = [H^+]$
if $(NV)_{base} > (NV)_{acid}$
then $N_R = [OH^-]$
if $(NV)_{acid} = (NV)_{base}$
then $pH = 7$

For very dilute Acid/Base soln
 $c \leq 10^{-7}$ ($10^{-7}, 10^{-8}, 10^{-9}$)
pH acid $\approx 6.7 - 6.9$
pH base $\approx 7.1 - 7.3$

For water
 $K_a/K_b = 1.8 \times 10^{-16}$
 $pK_a/pK_b = 15.74$
 $pK_a/pK_b = -1.74$

preview from Notesale.co.uk
Page 1 of 2

⑤ Weak monoprotic acid / base

$K_a = \frac{[H^+][A^-]}{[HA]}$
 $[H^+] = c\alpha$
 $\alpha = \sqrt{\frac{K_a}{c}}$
 $pH = \frac{1}{2} pK_a - \frac{1}{2} \log c$

⑥ Weak monoprotic base

• $K_b = c\alpha^2$
• $[OH^-] = c\alpha$
 $\alpha = \sqrt{\frac{K_b}{c}}$
 $pOH = \frac{1}{2} pK_b - \frac{1}{2} \log c$

⑦ Weak diprotic acid

• Overall $K_a = K_{a1} \times K_{a2}$
• $[H^+] = c\alpha$
 $\alpha = \sqrt{\frac{K_a}{c}}$
 $pH = \frac{1}{2} pK_{a1} - \frac{1}{2} \log c$
• $[A^{2-}] = K_{a2}$

⑧ Weak triprotic acid

• Overall $K_a = K_{a1} \times K_{a2} \times K_{a3}$
 $K_{a1} \gg K_{a2} \gg K_{a3}$

Strength of $HA_1 = \frac{[H^+]_1}{[H^+]_2} = \frac{c_1 \alpha_1}{c_2 \alpha_2} = \frac{\sqrt{K_{a1} c_1}}{\sqrt{K_{a2} c_2}}$