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Ionic Equilibrium: →

(I) pH calculation

(II) Solubility & Solubility poodut-

(III) Indicators

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Arrhenius theory of dissociation:→

There exist a dynamic eq$^{lb^m}$ bet^n ionised and unionised substance.

$$BA(aq) \longrightarrow B^+(aq) + A^-(aq)$$

$BA(aq)$	$B^+(aq)$	$A^-(aq)$
$C-x$	x	x
$C(1-\alpha)$	$C\alpha$	$C\alpha$

$$K_{diss} = \frac{[B^+][A^-]}{[BA]}$$

$$= \frac{x.x}{C-x} = \frac{C\alpha.C\alpha}{C(1-\alpha)} = \frac{C\alpha^2}{1-\alpha}$$

factors affecting α

(1) Nature of solute :→

(2) Nature of solvent :→ As dielectric constant ↑es α ↑es

(3) Temperature :→ since dissociation is endothermic
Therefore as T ↑es K_{diss} ↑ α ↑

(4) Concentration $K_{diss} = C\frac{\alpha^2}{1-\alpha}$ As C ↓ α ↑
This is known as ostwald dilution law

(5) Common ion effect.

$$BA(aq) \rightleftharpoons B^+(aq) + A^-(aq)$$
$$C-y \qquad y \qquad a+y$$

$$K_{diss} = \frac{x^2}{C-x}$$

$$K_{diss} = \frac{y(a+y)}{C-y}$$

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Dissociation of H_2O :→

$$H_2O(\ell) \longrightarrow H^+(aq) + OH^-(aq)$$

$$K_{diss} = \frac{[H^+][OH^-]}{[H_2O]} \qquad [H_2O] = \frac{1000}{18} = 55.55$$

$$K_{diss}[H_2O] = K_w = [H^+][OH^-]$$

↑ ionic product & $H_2O(\ell)$

At 25°C $K_w = 10^{-14} \left(\frac{mol}{lit}\right)^2$

As T ↑ K_w ↑

$2NH_3 \longrightarrow NH_4^+ + NH_2^-$

NH_4OH

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$[H^+] > [OH^-]$ Acidic

$[H^+] < [OH^-]$ basic

$[H^+] = [OH^-]$ Neutral

At 25°C $\quad 10^{-14} = [H^+][OH^-]$

$[H^+] = 10^{-7}$	$[OH^-] = 10^{-7}$	Neutral
$[H^+] > 10^{-7}$	$[OH^-] < 10^{-7}$	Acidic
$[H^+] < 10^{-7}$	$[OH^-] > 10^{-7}$	Basic

$pH = -\log [H^+]$ $\quad pOH = -\log [OH^-]$

at 25°C

$[H^+] = 10^{-7}$	$pH = 7$	Neutral
$[H^+] > 10^{-7}$	$pH < 7$	Acidic
$[H^+] < 10^{-7}$	$pH > 7$	Basic

$pH = 1$	$[H^+] = 10^{-1}$
$pH = 2$	$[H^+] = 10^{-2}$
$pH = 3$	$[H^+] = 10^{-3}$

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$$K_w = [H^+][OH^-]$$

$$-\log K_w = -\log[H^+] - \log[OH^-]$$

$$pK_w = pH + pOH$$

at 25°C

$$pH + pOH = 14$$

$$pH = -\log[H^+]$$

if $[H^+] > 1$ $\quad pH < 0$

$$H_2O(l) \longrightarrow \underline{H^+} + \underline{OH^-}$$

Q. At 80°C, $K_w = 4 \times 10^{-12}$ $(mol/lit)^2$.

(a) Find pH of pure water

(b) Define a solution as acidic, basic or neutral

Acidic → (i) 5

Basic → (ii) 6

Basic → (iii) 7

(a) $[H^+][OH^-] = 4 \times 10^{-12}$

$[H^+]^2 = 4 \times 10^{-12}$

$[H^+] = 2 \times 10^{-6}$

$pH = 6 - \log 2 = 5.7$

$\log 2 = 0.3$

$\log 3 = 0.4771$

$\log 5 = 0.7$

(c) find α of H_2O at 80°C

$H_2O(l)$	$\longrightarrow$	H^+	+	OH^-
$C - x$		x		x
$C(1-\alpha)$		$C\alpha$		$C\alpha$

$K_w = [H^+][OH^-]$

$4 \times 10^{-12} = (C\alpha)^2$

$2 \times 10^{-6} = C\alpha$

$C\alpha = [H^+] = 2 \times 10^{-6}$

$\frac{1000}{18}\alpha = 2 \times 10^{-6}$

$\alpha = \frac{18}{1000} \times 2 \times 10^{-6}$

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pH-Calculation

- Soln containing only acid or base
  - only one acid or base
    - Monoprotic
      - strong
      - weak
    - polyprotic
  - more than one acid or base
- Solution containing salts
- Soln containing acid or base + salts (Buffer soln)

J-Main ~~1-25~~

Kinetic 1-5