3/29/2019 Exam 2: Avg = 77%, σ = 19, high = 101

Base Solutions

Strong bases: 100% ionization in water

6 strong bases:

LiOH		gp IA, 2A hydroxide
NaOH		
KOH	$Ca(OH)_2$	... $Mg(OH)_2$ is only slightly sol.
(RbOH	$Sr(OH)_2$	
CsOH)	$Ba(OH)_2$	

ex: $LiOH_{(aq)} \xrightarrow{100\%} Li^+_{(aq)} + OH^-_{(aq)}$

$Sr(OH)_{2(aq)} \xrightarrow{100\%} Sr^{2+}_{(aq)} + 2OH^-_{(aq)}$

Q: What's pH of 0.10M $Sr(OH)_{2(aq)}$?

$Sr(OH)_{2(aq)} \xrightarrow{100\%} Sr^{2+}_{(aq)} + 2OH^-_{(aq)}$

0.10M $\longrightarrow$ 0.10M 0.20M

$pOH = -\log[OH^-]$ ✓

$14.00 = pH + pOH$ ✓ ? ✓

OR

$K_w = 1.0 \times 10^{-14} = [H_3O^+][OH^-]$ ✓ ✓ (solve)

$pH = -\log[H_3O^+]$

$pOH = -\log[OH^-] = -\log[0.20] = 0.70$ (2sf, 2dp)

$pH = 14.00 - 0.70 = 13.30$ (2dp, 2dp, 2dp)

Weak bases, B

partially ionize, describe use K_b

$$B(aq) + H_2O(\ell) \rightleftharpoons BH^+(aq) + OH^-(aq)$$

I	—		
C	—		
E	—		

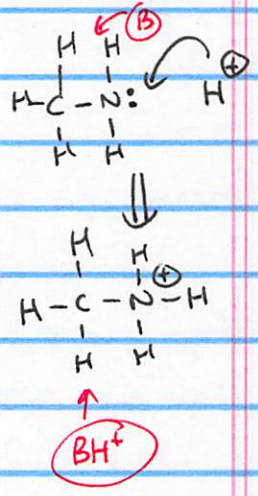
$$K_b = \frac{[BH^+][OH^-]}{[B]_{eq}}$$

$K_b \uparrow$, 'stronger' base

$K_b \downarrow$, 'weaker' base

Note

most of our weak bases contain N w/ a lp



ex: ~~CH_3Cl~~ $CH_3NH_2(aq)$ has $K_b = 4.4 \times 10^{-4}$

Q: what's pH of 0.50 M soln?

$$CH_3NH_2(aq) + H_2O(\ell) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$$

(H^+ from H_2O; 1.0×10^{-7} ≈ 0)

I	0.50	—	0	≈0
C	$-x$	—	$+x$	$+x$
E	$(0.50 - x)$	—	(x)	(x)

$$K_b = \frac{[CH_3NH_3^+][OH^-]}{[CH_3NH_2]_{eq}} \Rightarrow 4.4 \times 10^{-4} = \frac{(x)(x)}{(0.50 - x)}$$

assume: $x \ll 0.50$

then: $4.4 \times 10^{-4} \approx \frac{x^2}{0.50} \Rightarrow \sqrt{x^2} = \sqrt{0.50 \times 4.4 \times 10^{-4}}$

$\Rightarrow x = 1.48 \times 10^{-2}$ ← $[OH^-]_{eq}$

Apply 5% rule, test

$\Rightarrow \frac{x}{0.50} \times 100 = 3.0\%$ ✓ (<5%)

$$pOH = -\log[OH^-] = -\log[1.48 \times 10^{-2}] = 1.83$$

2sf 2dp.

$pH = ?$ $\quad pH + pOH = 14.00 \Rightarrow pH = 14 - pOH$

$= \boxed{12.17}$

>7, basic!

Lewis acids

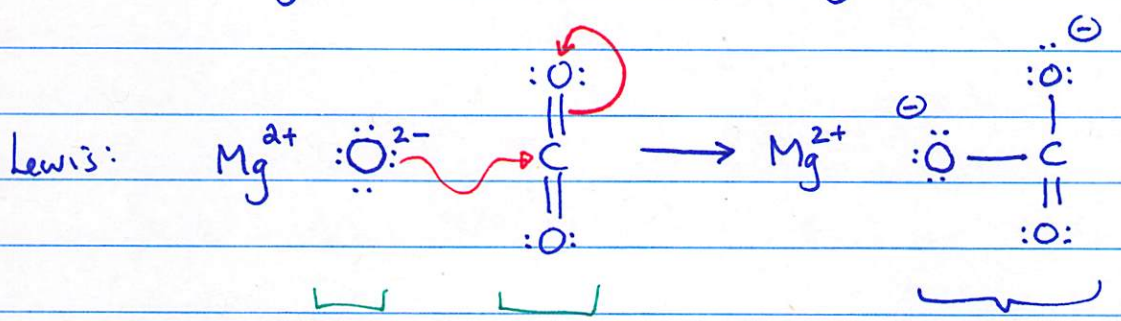
More general than Brønsted

Lewis acid = e^- pair acceptors (vowels)

base = e^- pair donor (consonants)

ex: $MgO(s) + CO_2(g) \longrightarrow MgCO_3(s)$

Lewis:



e^- pair donor e^- pair acceptor carbonate

- Lewis base - Lewis acid

Chapter 17 - Aqueous ionic equilibria

Buffers: solutions that resist changes in pH when we add small amounts of acid/base.

2 components needed to make a buffer:

neut bases

1) weak-acid
2) conjugate-base

↑ neut acids

OR

neut acids

1) weak base
2) conj. acid

↑ neut bases.