CHAPTER 16

Common ion effect ⇒ the presence of an ion that would be the product of a reversible reaction supresses the forward reaction

$$HNO_2 + H_2O \rightleftharpoons H_3O^+ + NO_2^-$$

HNO_2 in $NaNO_2$ is LESS acidic than in H_2O

$$K_a = \frac{[H+][NO_2^-]}{[HNO_2]} \qquad [NO_2^-]\uparrow,\ [H+]\downarrow$$

constant

predetermined

in general $HA \rightleftharpoons H^+ + A^-$

$$[H+] = K_a \frac{[HA]}{[A^-]} \quad -\log \text{ both sides}$$

$$\boxed{pH = pK_a + \log\frac{[A^-]}{[HA]}}$$ Henderson-Hasselbach

BUFFER → weak acid AND its conjugate base (from a separate source) both in appreciable amounts

* because HA, A^- are both weak, we can use initial amounts/concentrations

example K_a HNO_2 = 4.5×10^{-4}

What is the pH of a 0.20 M sol'n of HNO_2?

$$K_a = 4.5\times10^{-4} = \frac{x^2}{0.20} \Rightarrow x = [H+] = 0.0095M$$

$$pH = 2.02$$

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Henderson-Hasselbach

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b) What is the pH of a solution where $[HNO_2] = 0.20M$ and $[NO_2^-] = 0.10M$?

$$pH = pKa + \log\frac{[NO_2^-]}{[HNO_2]} = 3.85 + \log\frac{(0.10)}{(0.20)}$$

$$pH = 3.35 - 0.30 = 3.05$$

* BUFFERS are soln's that RESIST a change in pH caused by adding additional H^+ or OH^-

buffer: HA, A^-

add H^+: $H^+ + \underset{\text{base}}{A^-} \longrightarrow HA$

add OH^-: $OH^- + \underset{\text{acid}}{HA} \longrightarrow H_2O + A^-$

$\underset{\text{acid}}{R-COOH} \rightarrow R-COO^- + H^+$ | $\overset{H-NH_2}{R-NH_2} \xrightarrow{H_2O} R-NH_3^+ + OH^-$

HOW TO MAKE ~~AN~~ A BUFFER

① add similar amounts of HA, A^- from separate sources

② add enough OH^- to react w/ ~½ HA present
" " H^+ " " w/ ~½ A^- present

③ HCO_3^- amphoteric ion

BUFFER CAPACITY → the buffer's ability to neutralize added H^+ or OH^-

→ depends on [HA], [A^-]

1,0 M [HA], [A^-] * larger "capacity"
0,1 M [HA], [A^-]

HF, NaF ✓

~~HBr, NaBr~~

CH_3COOH
$CH_3COO^-Na^+$
$NaC_2H_3O_2$

$C_6H_5NH_2$ aniline
$C_6H_5NH_3^+$

H_3PO_4 KH_2PO_4

Na_3PO_4

KH_2PO_4 K_2HPO_4