Worksheet

LACTIC ACID

$HA_{(aq)} + H_2O_{(l)} \rightleftharpoons A^-_{(aq)} + H_3O^+_{(aq)}$

0.0034M $\qquad K_a = 1.4 \times 10^{-4}$

$K_a = \dfrac{[A^-_{(aq)}][H_3O^+_{(aq)}]}{[HA_{(aq)}]}$, $[A^-_{(aq)}] = [H_3O^+_{(aq)}]$

$K_a = \dfrac{[H_3O^+_{(aq)}]^2}{[HA_{(aq)}]}$ $\qquad [H_3O^+_{(aq)}] = 6.90 \times 10^{-4}\,M$

$[H_3O^+_{(aq)}] = \sqrt{(1.4 \times 10^{-4})[0.0034]}$

$K_a = 1.4 \times 10^{-5}$

PROPIONIC ACID

$HA_{(aq)} + H_2O_{(l)} \rightleftharpoons A^-_{(aq)} + H_3O^+_{(aq)}$

0.096M

$[H_3O^+_{(aq)}] = 8.85 \times 10^{-4}\,M$

$[H_3O^+_{(aq)}] = (6.90 \times 10^{-4}\,M) + (8.85 \times 10^{-4}\,M)$

$= 1.58 \times 10^{-3}\,M$

$pH = -\log[H_3O^+_{(aq)}]$

$pH = -\log[1.58 \times 10^{-3}\,M]$

$pH = 2.80$

Weak Bases

Weak bases react with water to form the hydroxide ion and conjugate acid of the base.

Calculate the pH of a 0.221 mol/L solution of $NH_{3(aq)}$ at equilibrium.

$$\underset{0.221\ M}{NH_{3(aq)}} + H_2O_{(l)} \rightleftharpoons NH_{4(aq)}^{+} + OH_{(aq)}^{-}$$

***Eqm greatly favours reverse reaction**

base dissociation constant

$$K_b = \frac{[NH_{4(aq)}^{+}][OH_{(aq)}^{-}]}{[NH_{3(aq)}]} \quad > \quad [NH_{4(aq)}^{+}] = [OH_{(aq)}^{-}]$$

$$K_b = \frac{[OH_{(aq)}^{-}]^2}{[NH_{3(aq)}]}$$

$$K_a K_b = K_w$$

$$K_b = \frac{1.0 \times 10^{-14}}{5.8 \times 10^{-10}}$$

$$K_b = 1.72 \times 10^{-5}$$

$$[OH_{(aq)}^{-}] = \sqrt{(1.72 \times 10^{-5})(0.221)}$$

$$[OH_{(aq)}^{-}] = 3.81 \times 10^{-6}\ M$$

$$pOH = -\log[OH_{(aq)}^{-}]$$

$$pOH = -\log[3.81 \times 10^{-6}]$$

$$pOH = 5.419$$

$$pH + pOH = 14.000$$

$$pH = 14.000 - 5.419$$

$$\boxed{pH = 8.581}$$

$KOH \longrightarrow K^+_{(aq)} + OH^-_{(aq)}$

$NaOH$

$Ba(OH)_2$

$$K_a K_b = K_w$$

$$K_b = \frac{K_w}{K_a}$$

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