1.

$$HCl \rightarrow H^+ + Cl^-$$

$4.3 \times 10^{-4} M \quad 4.3 \times 10^{-4} \quad 4.3 \times 10^{-4}$

$\emptyset$

$[H^+] = 4.3 \times 10^{-4}$

$pH = 3.36$

$pOH = 10.64$

$[OH^-] = 2.29 \times 10^{-11}$

2.3×10^{-11}

2. $K_a = 1.8 \times 10^{-5}$

$$CH_3COOH \longleftrightarrow H^+ + CH_3COO^-$$

4.3×10^{-4}	0	0
$4.3 \times 10^{-4} - \cancel{x} \rightarrow 0$	x	x

$$1.8 \times 10^{-5} = \frac{x^2}{4.3 \times 10^{-4}}$$

$x = 8.79 \times 10^{-5}$

$[H^+] = 8.8 \times 10^{-5}$ $\quad pH = 4.06$

$[OH^-] = 1.1 \times 10^{-10}$ $\quad pOH = 9.94$

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$$pH = pK_a + \log \frac{[B]}{[A]}$$

log of the K_a value.

$$pH = pK_a - \log \frac{[A]}{[B]}$$

1.

a) $HNO_2 \leftrightarrow NaNO_2 + H^+$

.025 .025 4.0×10^{-4}

Ka 4.0×10^{-4}

$3.39 + \log\left(\frac{.025}{.025}\right)$

We can lower or increase the pH by no more than 1.

log of equal amounts of Acid to Base is Ø.

PH=3.39 $[H^+] = 4.0 \times 10^{-4}$

POH=10.61 $[OH^-] = 2.5 \times 10^{-11}$

1b

$$pH = pK_a + \log \frac{[B]}{[A]}$$

$$4.0\times10^{-4} = 3.39 + \log \frac{[.01]}{[.025]}$$

3.39 - .39 .3978

.40

pH = 3.00 $[H^+]$ 1.0×10^{-3}

pOH = 11.00 $[OH^-]$ 1.0×10^{-11}

23. K_a

$$HA \longleftrightarrow H^+ + A^-$$

.25 $\quad$ 1.3489×10^{-2} $\quad$ 1.3489×10^{-2}

$pOH = 12.13$

$pH = 1.87$

$$= \frac{(1.3489\times10^{-2})^2}{.25}$$

7.278×10^{-4}

$K_a = 7.3\times10^{-4}$

Example of sig figs.

$pH = 4.\underline{738}$ $pOH = 9.\underline{262}$

$[H^+] = 1.83 \times 10^{-5}$ $[OH^-] = 5.47 \times 10^{-10}$

Blood Buffer

pH = 7.35 to 7.45

$$CO_2 + H_2O \longleftrightarrow H_2CO_3 \overset{H_2O}{\longleftrightarrow} H_3O^+ + HCO_3^-$$

produced as an end product of cellular metabolism

excess acid enters blood fluids and reacts w/ HCO_3

3c. buffer problem w/ weak acid and weak base

$$pH = 3.40 + \log\left(\frac{.057}{.132}\right)$$

$$= 3.40 + (-.3646)$$

$$= 3.035$$

$$= 3.04$$

4 a.

0 mL

$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$

$\varnothing$

$HC_2H_3O_2 \leftrightarrow H^+ + C_2H_3O_2^-$

$.100 \qquad\qquad x \qquad x$

$$1.8\times10^{-5} = \frac{x^2}{.100}$$

$x = 1.342\times10^{-3}$

$[H^+] = 1.342\times10^{-3}$ $\quad 1.3\times10^{-3}$ taken from the K_a value

$pH = 2.87$

$pOH = 11.13$

4 b. $HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$

5mL

$.100 = \frac{x}{.03}$

$\frac{30mL \times 1L}{1000mL}$

$x = .003\,mol$

$\frac{x}{.005} = .100$

$\frac{5mL \times 1L}{1000mL} =$

$x = .0065\,mol$

$$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$$

.003 − .0005 = .0025	.0005	0	0
.0025	0	.0005	.0005

$$pK_a = \log(1.8\times10^{-5})$$

$$pK_a = 4.745$$

$$pH = pK_a + \log\frac{[B]}{[A]}$$

$$pH = 4.745 + \log\left(\frac{.0005}{.0025}\right)$$

$$= 4.745 + (-.778)$$

$$pH = 4.046$$

$$pH = 4.05 \qquad pOH = 9.95$$

$HC_2H_3O_2 \longleftrightarrow C_2H_3O_2^- + H^+$

acid base

4 c.

$$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$$

.003mol

$HC_2H_3O_2$ Stays as .003

$$\frac{x}{.015} = .100$$

$$x = .0015 \text{ mol}$$

$K_a = 1.8 \times 10^{-4}$

$$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$$

$HC_2H_3O_2$	$NaOH$	$NaC_2H_3O_2$	H_2O
.003	.0015	0	0
− .0015	0	.0015	.0015
.0015			

$$pH = 4.745 + \log\left(\frac{.0015}{.0015}\right)$$

$$pH = pK_a = 4.75$$

$$pOH = 9.26$$

25 mL

$$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$$

.003

$$\frac{x}{.025} = .100$$

$$x = .0025\text{ mol}$$

25mL

$$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$$

$HC_2H_3O_2$	$NaOH$	$NaC_2H_3O_2$	H_2O
.003	.0025	0	0
− .0025			
.0005	0	.0025	.0025

4.745

$$pH = pK_a + \log\left(\frac{.0025}{.0005}\right)$$

$pH = 5.444$

$pH = 5.44$ $pOH = 8.56$

1) pH = 4.814

2) pH = 8.75

$NaNO_2 + H_2O \leftrightarrow NaOH + HNO_2$

30 mL

$$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$$

.003   0 $\frac{.003}{.060}$

$\frac{.003}{0}$

$\frac{x}{.03} = .100$

$x = .003$

equivalance pt.

The acid and base are in equal amounts

$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$

.003

has gone to the other side

$NaC_2H_3O_2 + H_2O_{(l)} \rightarrow HC_2H_3O_2 + NaOH$

.05 $\qquad x \qquad x$

$\frac{.003}{.060} = .05M$

strong base use K_b

$K_b = \frac{1 \times 10^{-14}}{1.8 \times 10^{-5}}$

$K_b = 5.55\overline{5} \times 10^{-10}$

$\frac{x^2}{.05} = 5.556 \times 10^{-10}$

$x = 5.27 \times 10^{-6}$

pOH = 5.28 $\qquad$ pH = 8.72

31 mL

$\frac{x}{.031} = .1 \quad x = .0031$

$HC_2H_3O_2 + NaOH \rightarrow NaC_2H_3O_2 + H_2O$

.003 mol .0031 mol

.0031 mol .0001 mol

$- .00\cancel{0}1$ mol

$\frac{.0001 \text{ mol}}{.061 \text{ L}} = 1.6 \times 10^{-3}$ M

30 mL + 31 mL =

pOH = 2.79 pH = 11.21