ACID & BASE REVIEW KEY

1. $NH_3 + H^+ \rightarrow NH_4^+$

2. $HSO_4^- \rightarrow H^+ + HSO_4^{2-}$

3. $[OH^-] = 3.89 \times 10^{-9}$ M

$pH = ?$

$pOH = -\log[OH^-]$
$= -\log[3.89 \times 10^{-9}]$
$= 8.41$

$pH + pOH = 14$
$pH + 8.41 = 14$
$pH = 5.59$

4. $[H_3O^+] = [H^+] = 1.94 \times 10^{-10}$ M

$pH = -\log[H^+]$
$= -\log[1.94 \times 10^{-10}]$
$= 9.71$

$pH + pOH = 14$
$9.71 + pOH = 14$
$pOH = 4.29$

5. $NH_3 + H_2O \rightleftharpoons NH_4^{1+} + OH^-$

$K_b = \dfrac{[NH_4^+][OH^-]}{[NH_3]} = \dfrac{x^2}{[NH_3]}$ $\quad x = [OH^-]$

$1.8 \times 10^{-5} = \dfrac{x^2}{15.0}$

$x = 0.0164$ M OH^-

5. continued

$pOH = -\log[OH^-]$
$= -\log[0.0164]$

$pOH = 1.79$

$pH + pOH = 14$
$pH + 1.79 = 14$
$pH = 12.21$

6. $1\ Ba(OH)_2 + 2HCl \rightarrow 2H_2O + BaCl_2$

1 mol $Ba(OH)_2$ = 2 mol HCl

$\underset{Ba(OH)_2}{2.5\ M} = \dfrac{n}{.012\ L}$

$n = 0.03$ mol $Ba(OH)_2$

$0.03 \text{ mol } Ba(OH)_2 \times \dfrac{2 \text{ mol HCl}}{1 \text{ mol } Ba(OH)_2} = 0.06$ mol HCl

M HCl $= \dfrac{0.06 \text{ mol}}{.034\ L}$

= 1.76 M HCl

7. $K_b = \dfrac{x^2}{[CH_3NH_2]}$ $\quad x = [OH^-]$

$4.37 \times 10^{-4} = \dfrac{x^2}{3.75}$

$x = 0.0405$

$pOH = -\log[0.0405]$
$= 1.39$

$pH + 1.39 = 14$
$pH = 12.61$

(8) $1\ HOCl + 1\ NaOH \rightarrow 1\ H_2O + NaOCl$

(a) Titration

$1.74\ M\ NaOH = \frac{n}{0.03423\ L}$ $\quad n = 0.0596$ mols NaOH

$0.0596\ mol\ NaOH \left| \frac{1\ mol\ HOCl}{1\ mol\ NaOH} \right. = 0.0596\ mol\ HOCl$

$M\ HOCl = \frac{0.0596\ mol}{0.025\ L} = 2.38\ M\ HOCl$

(b) Neutralization

0.0596 mol HOCl $\quad 1.74\ M = \frac{n}{0.02855\ L}$

$n = 0.0497$ mol NaOH

mols!

	HOCl	NaOH	NaOCl or OCl^-
I	0.0596	0.0497	0
C	-0.0497	-0.0497	+0.0497
E	0.0099	0	0.0497

excess weak acid → use Henderson-Hasselbalck

* convert mol to MOLARITY

$pKa = -\log Ka$

total volume in flask

$= 25\ mL + 28.55\ mL$

$= 53.55\ mL = 0.05355\ L$

$M\ OCl^- = \frac{0.0497}{0.05355} = 0.928$

$M\ HOCl = \frac{0.0099}{0.05355} = 0.185$

$pH = pKa + \log\left(\frac{[OCl^-]}{[HOCl]}\right)$

$pH = -\log(3.5 \times 10^{-8}) + \log\left(\frac{[0.928]}{[0.185]}\right)$

$pH = 7.46 + 0.700$

$= 8.16$

(9)

$1\ M\ HCl = \frac{n}{.05\ L}$ $\quad 0.7\ M\ NaOH = \frac{n}{.03\ L}$

$n = 0.05$ mol HCl $\quad n = 0.021$ mol NaOH

	HCl or H^+	NaOH or OH^-
I	0.05	0.021
C	-0.021	-0.021
E	0.029	0

$M\ HCl\ or\ H^+ = \frac{0.029\ mol}{0.08\ L} = 0.363\ M\ H^+$

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

$= -\log[0.363]$

$= 0.440$