CHM152/54 Quiz #4 25 Pts Fall 2009 Name: Key

Show all work.

1. (9 Pts) Determine the pH of each of the following:

a. A 0.0010 M HNO_3 solution

Strong acid so $[H_3O^+] = 0.0010$ $pH = 3.00$ 2 sig figs

b. A solution that is 2.9×10^{-2} M in HCl

Strong acid $pH = -\text{Log}\, 2.9 \times 10^{-2} = 1.54$ 2 sig figs

c. A solution that is prepared by mixing 10.0 mL of 0.100 M HBr with 20.0 mL of 0.200 M HCl.

Both strong acids, so find total moles of H_3O^+ and $[\ ]$ and pH

HBr: $10 \times 10^{-3}\,L \mid 0.100\,mol\,H^+ = 1.00 \times 10^{-3}$

HCl: $20 \times 10^{-3}\,L \mid 0.200\,mol\,H^+ = 4.00 \times 10^{-3}$

$pH = -\text{Log}\, \frac{5.00 \times 10^{-3}}{0.0300} =$

$pH = 0.778$

2. (6 Pts) Determine the pH of a solution formed by mixing 25.0 mL of 0.235 M nitric acid is reacted with 14.7 mL of 0.095 M of barium hydroxide.

$2HNO_3(aq) + Ba(OH)_2(aq) \rightarrow 2H_2O(l) + Ba(NO_3)_2$

Strong Acid Strong Base

moles H^+: $25.0 \times 10^{-3}\,L \mid 0.235\,mol\,HNO_3 \mid 1\,mole\,H^+ / 1\,mol\,HNO_3 = 0.005875$

moles OH^-: $14.7 \times 10^{-3}\,L \mid 0.095\,mol\,Ba(OH)_2 \mid 2\,mol\,OH / 1\,mol\,Ba(OH)_2 = 0.002793$

$0.003082\ mol \times 5\ H^+$

$pH = -\text{Log}\, \frac{0.003082}{0.0377}$

$pH = 1.11$

3. (5 Pts) Determine the pH of 50.0 mL of 0.12 M barbituric acid ($HC_4H_3N_2O_3$) ($K_a = 9.8 \times 10^{-5}$) (Show the chemistry first.)

$K_a = \frac{[H_3O^+][A^-]}{[HA]}$

$9.8 \times 10^{-5} = \frac{x^2}{0.12 - x}$ drop??

$HC_4H_3N_2O_3 + H_2O \rightleftharpoons H_3O^+ + C_4H_3N_2O_3^-$

		0	0
I.	0.12		
C.	$-x$	$+x$	$+x$
E.	$0.12 - x$	x	x

$x = [H_3O^+] = 0.00343$ $pH = 2.46$

4. (5 Pts) Determine the pH of a 50.0 mL solution of 0.12 M trimethylamine, $(CH_3)_3N$, ($K_b = 7.4 \times 10^{-5}$). (Show the chemistry first.)

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

$7.4 \times 10^{-5} = \frac{x^2}{0.12 - x}$ Drop?

$(CH_3)_3N + H_2O \rightleftharpoons (CH_3)_3NH^+ + OH^-$

		NA	0	0
I	0.12			
C.	$-x$		$+x$	$+x$
E.	$0.12 - x$		x	x

$x = [OH^-] = 0.00298$

$pOH = 2.53$ $pH = 11.47$