CHM152 Quiz #6b 25 Pts Spring 2005 Name: Key

*******SHOW ALL WORK TO RECEIVE CREDIT*******

1. (3 Pts) A 0.18 M HNO_2 solution is 5.7% ionized. Calculate the H^+ ion concentration.

$HNO_2 \rightleftharpoons H^+ + NO_2^-$ $[H^+] = 0.18 \times 0.057 = 0.01026\,M$

0.18M 5.7%

2. (6 Pts) 50.00 mL of 0.10 M HNO_2 (nitrous acid) was titrated with 0.10 M NaOH solution. Determine the pH in the titration flask after 25.00 mL of NaOH solution was added. (Given $K_a = 4.5 \times 10^{-4}$) Initial Rxn: $HNO_2 + NaOH \rightarrow H_2O + NaNO_2 + ?\,XS$

① moles Acid (weak) $50.00\,mL \left| \frac{0.10\,mol\,HNO_2}{1000\,mL} \right. = 5.0 \times 10^{-3}\,mol\,HNO_2$

② moles Base (strong) $25.00\,mL \left| \frac{0.10\,mol\,NaOH}{1000\,mL} \right. = 2.5 \times 10^{-3}\,mol\,OH^-$

③ subtraction 2.5×10^{-3} mol XS wk Acid (HNO_2) and 2.5×10^{-3} mol NO_2^- ion formed

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

	HNO_2	H_2O	H_3O^+	NO_2^-
I	$\frac{2.5\times10^{-3}}{0.075}$	NA	0	$\frac{2.5\times10^{-3}}{0.075}$
C	$-x$		$+x$	$+x$
E	$0.0333-x$		x	$0.0333+x$

$K_a = \frac{[x][0.0333+x]}{[0.0333-x]} = 4.5\times10^{-4}$

$K_a \cong x \equiv 4.5\times10^{-4} = [H^+]$

$pH = 3.35$

3. (6 Pts) Calculate the pH of a 0.13 M NH_3 solution. $K_b = 1.8 \times 10^{-5}$.

Weak Base: $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$

	NH_3	H_2O	NH_4^+	OH^-
I.	0.13	NA	0	0
C.	$-x$		$+x$	$+x$
E.	$0.13-x$		$+x$	$+x$

$K_b = \frac{x^2}{0.13-x}$ ← Drop?

$x = 1.53\times10^{-3} = [OH^-]$

$pOH = 2.82$ $pH = 11.18$

4. (6 Pts) Calculate the pH of 100.0 mL of 0.15 M benzoic acid ($HC_6H_5CO_2$) solution. Given Ka = 6.5×10^{-5} for benzoic acid.

Weak Acid: $HBz + H_2O \rightleftharpoons H_3O^+ + Bz^-$

	HBz	H_2O	H_3O^+	Bz^-
I	0.15	NA	0	0
C	$-x$		$+x$	$+x$
E	$0.15-x$		x	x

$K_a = \frac{x^2}{0.15-x}$ ← Drop?

$x = 0.00312 = [H^+]$

$pH = 2.51$

5. (4 Pts) Identify all acid–base conjugate pairs.

In the reaction: $CN^- + H_2O \rightleftarrows HCN + OH^-$

Base Acid Conj Acid Conj Base