AP Chem - Unit 10 - NMSI - Exam Problem - A&B

(1)

$$NH_{3(aq)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)} \quad K_b = 1.80 \times 10^{-5}$$

A)

$$K_b = \frac{[OH^-][NH_4^+]}{[NH_3]}$$

B) pH? of 0.150 M NH_3

NH_3	+ H_2O	$\rightleftharpoons$ NH_4^+	+ OH^-
.150	–	0	0
$-x$		x	x
.150 − x		x	x

Assume 5%

$$K_b = \frac{(x)(x)}{.150}$$

$$(1.80 \times 10^{-5})(.150) = x^2$$

$$x = .00164 = [OH^-]$$

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

$$pOH = 2.79$$

$$pH = 14 - pOH$$

$$\boxed{pH = 11.21}$$

a) % ionization of weak Base NH_3 (same as checking 5%)

$$\% \text{ ion} = \frac{x}{[NH_3]_0} \times 100$$

$$= \frac{.00164}{.150} \times 100$$

$$\boxed{= 1.09\%}$$

① $[H_3O^+] = ?$ SAME AS $[H^+]$

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

d) $[H_3O^+][OH^-] = 1\times10^{-14}$

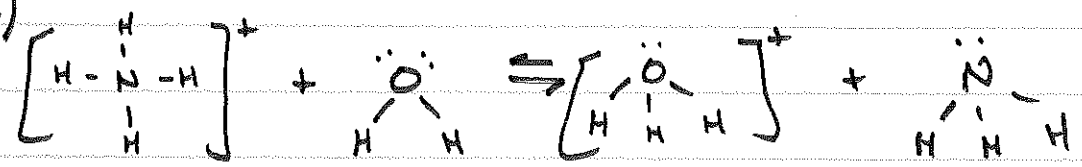
$11.21 = -\log [H^+]$ (10^{-x})

$[H_3O^+] = \frac{1\times10^{-14}}{.00164}$

or $\boxed{[H^+] = 6.17\times10^{-12}\ M}$

$\boxed{[H_3O^+] = 6.10\times10^{-12}\ M}$

e) $NH_4^+ + HOH \rightleftharpoons H_3O^+ + NH_3$ $pH = 4.827$



f) ? M of NH_4^+

$NH_4^+ + HOH \rightleftharpoons H_3O^+ + NH_3$ $K_b = 1.80\times10^{-5}$

	NH_4^+	HOH	H_3O^+	NH_3
I	? M	-	0	0
C	-x		x	x
	M - x		x	x

$pH = 4.827$

Assume 5%

$K_a = \frac{[H_3O^+][NH_3]}{[NH_4^+]}$ $K_a = ?$

$K_aK_b = K_w$

$K_a = \frac{K_w}{K_b} = \frac{1\times10^{-14}}{1.80\times10^{-5}}$

$K_a = 5.6\times10^{-10}$

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

$4.827 = -\log [H^+]$ (10^{-x})

$[H^+] = 1.489\times10^{-5}$ $[H^+] = [NH_3]$

$5.6\times10^{-10} = \frac{(1.489\times10^{-5})(1.489\times10^{-5})}{[NH_4^+]}$

$\boxed{[NH_4^+] = .396\ M}$

AP Chem - Unit 10 - NMSI - SP - Acids Bases

ii) ? # moles NH_4^+ in 250 mL

$$\text{Molarity} = \frac{\text{moles}}{L}$$

$$\text{moles} = \text{Molarity} \cdot L$$

$$= (.396\ M)(.250\ L)$$

$$\boxed{= .099 \text{ moles } NH_4^+}$$