Acid-Base #2
(K calculations – bases & salts)

Write your response in the space provided. Express answer in correct sig figs & units where appropriate.

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1. **(5 marks)**

Calculate the pH of a 0.60 M LiF salt solution. Begin by writing the equation for the predominant equilibrium reaction.

0.60M 0.60M

$LiF \rightarrow Li^{+} + F^{-}$

$F^{-} + H_2O \rightleftharpoons HF + OH^{-}$

$K_b = \frac{[HF][OH^-]}{[F^-]} = \frac{1.00 \times 10^{-14}}{3.5 \times 10^{-4}}$

K_a for HF

$= 2.857... \times 10^{-11}$

	F^-	H_2O	$\rightleftharpoons$	HF	$+$	OH^-
I	0.60M			0		0
C	$-x$			$+x$		$+x$
E	$0.60M - x$			x		x

$$\frac{(x)(x)}{(0.60-x)} = 2.857... \times 10^{-11}$$

$$x^2 + 2.857... \times 10^{-11} x - 2.85... \times 10^{-11}(0.60) = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$x = [OH^-] = 4.14.. \times 10^{-6} M$

$pOH = -\log(4.14... \times 10^{-6} M)$

$pOH = 5.382...$

$pH = 14 - 5.382...$

$pH = 8.62$

2. Calculate the initial concentration of a solution of NH_3 which has a pH = 11.33 and $K_b = 1.8 \times 10^{-5}$. Begin by writing the equation for the predominant reaction. base

(5 marks)

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

$$K_b = \frac{[NH_4^+][OH^-]}{[NH_3]} = 1.8 \times 10^{-5}$$

	NH_3	$\rightleftharpoons$	NH_4^+	+	OH^-
I	x		0		0
C	$-2.13.. \times 10^{-3}M$		$+2.13.. \times 10^{-3}M$		$+2.13.. \times 10^{-3}M$
E	$x - 2.13.. \times 10^{-3}M$		$2.13... \times 10^{-3}M$		$2.137... \times 10^{-3}M$

pH = 11.33

pOH = 14 − 11.33

= 2.67

$[OH^-] = 10^{-2.67}$

$$\frac{(2.13... \times 10^{-3}M)(2.13... \times 10^{-3}M)}{x - 2.13.. \times 10^{-3}} = 1.8 \times 10^{-5}$$

$$(2.13... \times 10^{-3}M)^2 + (2.13... \times 10^{-3})(1.8 \times 10^{-5}) = 1.8 \times 10^{-5}x$$

$$x = 0.2560....$$

$$[NH_3]_i = x = 0.26M$$