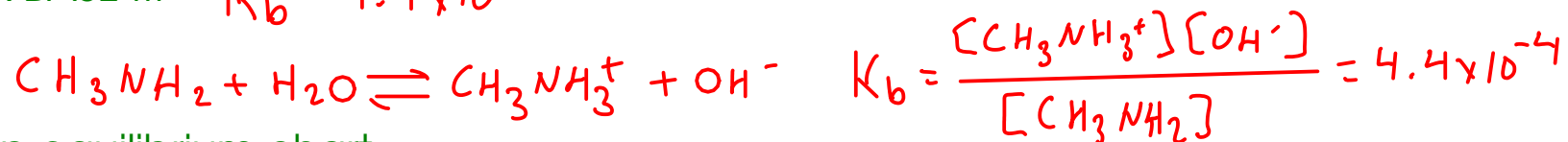


Find the pH of 0.17 M methylamine.

On page A-14, we find a BASE ionization constant for methylamine. It's therefore a WEAK BASE ... $K_b = 4.4 \times 10^{-4}$



Set up equilibrium chart ...

| Species | [Initial] | Δ | [Equilibrium] |
|----------------------------|-----------|----------|---------------|
| CH_3NH_3^+ | 0 | +x | x |
| OH^- | 0 | +x | x |
| CH_3NH_2 | 0.17 | -x | 0.17-x |

Let "x" equal the change in methylammonium ion concentration ...

$$\frac{[\text{CH}_3\text{NH}_3^+][\text{OH}^-]}{[\text{CH}_3\text{NH}_2]} = \frac{(x)(x)}{(0.17-x)} = 4.4 \times 10^{-4}$$

$$\frac{x^2}{0.17-x} = 4.4 \times 10^{-4}$$

\downarrow $x \ll 0.17$, so $0.17-x \approx 0.17$

$$\frac{x^2}{0.17} = 4.4 \times 10^{-4}$$

$$x = 0.0086486993 = [\text{OH}^-]$$

$$\text{pOH} = -\log_{10} [\text{OH}^-] = 2.06$$

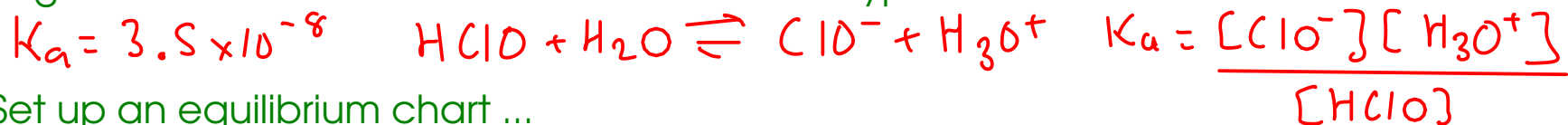
Since $\text{pH} + \text{pOH} = 14.00$

$$\text{pH} + 2.06 = 14.00$$

$$\text{pH} = 11.94$$

2 Find the pH of 0.11 M hypochlorous acid

Page A-13 lists an acid ionization constant for hypochlorous acid. It's a WEAK ACID.



Set up an equilibrium chart ...

| Species | [Initial] | Δ | [Equilibrium] |
|------------------------|-----------|----------|---------------|
| ClO^- | 0 | +x | x |
| H_3O^+ | 0 | +x | x |
| HClO | 0.11 | -x | 0.11 - x |

Let "x" equal the change in hypochlorite ion concentration ...

$$\frac{[\text{ClO}^-][\text{H}_3\text{O}^+]}{[\text{HClO}]} = \frac{(x)(x)}{0.11 - x} = 3.5 \times 10^{-8}$$

$$\frac{x^2}{0.11 - x} = 3.5 \times 10^{-8}$$

$x \ll 0.11, \text{ so}$
 $0.11 - x \approx 0.11$

$$\frac{x^2}{0.11} = 3.5 \times 10^{-8}$$

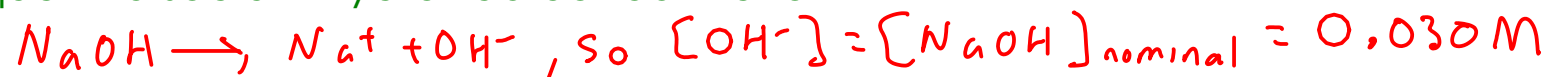
$$x = 6.204836823 \times 10^{-5} = [\text{H}_3\text{O}^+]$$

$$\text{pH} = -\log_{10} [\text{H}_3\text{O}^+] = 4.21$$

³ Find the pH of 0.030 M sodium hydroxide.

Sodium hydroxide is a Group IA hydroxide ... a common STRONG BASE

Since the STRONG base COMPLETELY ionizes, the hydroxide concentration will simply equal the sodium hydroxide concentration...



$$[\text{OH}^-] = 0.030 \text{ M}$$

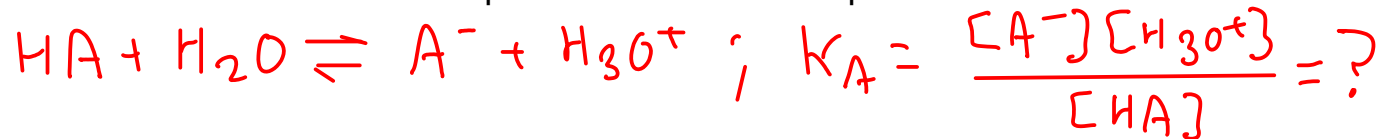
$$\text{pOH} = -\log_{10}(0.030) = 1.52$$

$$\text{pH} + \text{pOH} = 14.00$$

$$\text{pH} + 1.52 = 14.00$$

$$\text{pH} = 12.48$$

4 An 0.15 M solution of monoprotic acid has a pH of 2.80 at 25 C. Find the K_a of the acid



Write an equilibrium chart to reduce the number of variables ...

| Species | [Initial] | Δ | [Equilibrium] |
|----------|-----------|----------|---------------|
| A^- | 0 | +x | x |
| H_3O^+ | 0 | +x | x |
| HA | 0.15 | -x | 0.15 - x |

Let "x" equal the change in A^- concentration...

$$\frac{[A^-][H_3O^+]}{[HA]} = \frac{x^2}{0.15 - x} = K_a$$

We still have two variables. "x", and K_a . To solve the problem, we must get "x" another way.

We can use the pH to find hydronium ion concentration, which is equal to "x" (see the equilibrium chart above!)

$$pH = 2.80$$
$$[H_3O^+] = 10^{-pH}$$

$$[H_3O^+] = 10^{-2.80} = 0.0015848932 = x$$

Plug value of "x" into the equilibrium expression...

$$\frac{(0.0015848932)^2}{0.15 - 0.0015848932} = 1.7 \times 10^{-5} = K_a$$