

6.3 - Ionization of water and Kw.notebook

6.3 Ionization of Water Assignment

1. The concentration of either the H^+ ion or OH^- ion is given for 3 aqueous solutions at 298K. For each solution, calculate $[H^+]$ or $[OH^-]$. State whether solution is acidic, basic or neutral.

a) $[H^+] = 1.0 \times 10^{-13} M$

$$K_w = [H_3O^+][OH^-]$$

$$1.0 \times 10^{-14} = (1.0 \times 10^{-13} M)[OH^-]$$

$$[OH^-] = 1.0 \times 10^{-1} M$$

$$[OH^-] > [H^+] \therefore \text{basic}$$

b) $[OH^-] = 1.0 \times 10^{-7} M$

$$K_w = [H_3O^+][OH^-]$$

$$1.0 \times 10^{-14} = [H_3O^+](1.0 \times 10^{-7} M)$$

$$[H_3O^+] = 1.0 \times 10^{-7} M$$

$$\therefore \text{neutral}$$

c) $[OH^-] = 1.0 \times 10^{-3} M$

$$K_w = [H^+][OH^-]$$

$$1.0 \times 10^{-14} = [H^+](1.0 \times 10^{-3} M)$$

$$[H^+] = 1.0 \times 10^{-11} M$$

$$[H^+] < [OH^-] \therefore \text{basic}$$

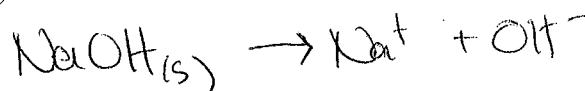
2. What is the $[H_3O^+]$ in a 0.025M solution of NaOH. Is this solution acidic, basic or neutral?

$$K_w = [H_3O^+][OH^-]$$

$$1.0 \times 10^{-14} = [H_3O^+](0.025 M)$$

$$[H_3O^+] = 4.0 \times 10^{-13}$$

$$[H_3O^+] < [OH^-] \therefore \text{basic}$$



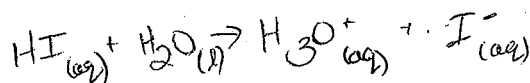
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$$HI = 1.01 + 126.904 = 128 \text{ g/mol}$$

6.3 Ionization of Water Assignment

3. A 2.5L solution contains 5.6 g of hydroiodic acid. What is the concentration of hydroxide ions in this solution? Is this solution acidic, basic or neutral?

$$M = \frac{wt}{mm \cdot V} = \frac{5.6g}{(128g/mol)(2.5L)} = 0.0175M$$



$$K_w = [H_3O^+][OH^-]$$

$$1.0 \times 10^{-14} = (0.0175M)[OH^-]$$

$$[OH^-] = 5.7 \times 10^{-13}$$

∴ acidic

4. Potassium hydroxide is a very strong base. If 6 mols are found in an 8L solution, what is the hydronium ion concentration in this solution? Is this solution acidic, basic or neutral?

$$M = \frac{6 \text{ mol}}{8L} = 0.75M$$

$$K_w = [OH^-][H^+]$$

$$1.0 \times 10^{-14} = (0.75M)[H^+]$$

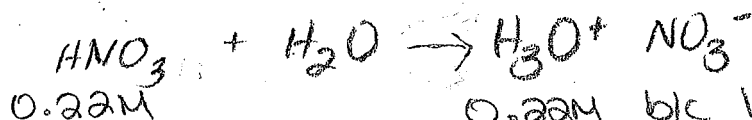
$$[H^+] = 1.3 \times 10^{-14}$$

∴ basic

5. 10.4 g of nitric acid are found in 750 mL of water. What is the hydronium concentration of this solution?

$$\begin{array}{r} 14.01 \\ 1.01 \\ \hline 15.02 \\ 0.16 \times 3 \\ \hline 63.02 \end{array}$$

$$M = \frac{wt}{mm \cdot V} = \frac{10.4g}{(63.02g/mol)(.750L)} = 0.2200M$$



0.22M

0.22M

b/c 1:1 ratio in strong

acid

6. A 500mL (0.50M) solution of sodium hydroxide is diluted with 250mL of water. What are the final concentrations of $[H^+]$ and $[OH^-]$ in this solution? Is this solution acidic, basic or neutral?

$$M_1V_1 = M_2V_2$$

$$(0.50M)(0.5L) = M_2(0.75L)$$

$$M_2 = 0.33M$$

$$= [OH^-]$$

$$K_w = [OH^-][H_3O^+]$$

$$[H_3O^+] = 3.0 \times 10^{-14} M < 1.0 \times 10^{-7}$$

$$1.0 \times 10^{-14} = [H_3O^+](0.33M) = 3.0 \times 10^{-14}$$

∴ basic