

Chemistry 30

Unit 5: Acids & Bases

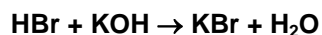
Assignment 3 – Neutralization and Titration

16 max

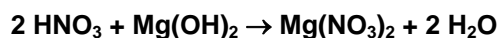
- 3 1. The substances listed in the chart below were tested with indicators methyl red, phenol red, and thymol blue. Complete the chart indicating what colors would be seen with each indicator.

	methyl red	phenol red	thymol blue
acid rain (pH = 6.3)	yellow	yellow	yellow
ammonia water (pH = 11.2)	yellow	red	blue

- 3 2. Write **balanced** neutralization reactions for the following:
- a. the reaction between hydrobromic acid, HBr, and potassium hydroxide, KOH.



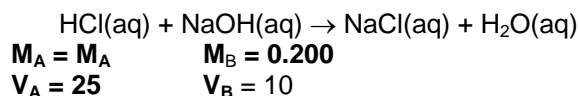
- b. the reaction between nitric acid, HNO₃ and magnesium hydroxide, Mg(OH)₂



- c. the reaction between phosphoric acid, H₃PO₄ and sodium hydroxide, NaOH



- 2 3. What is the molarity of a 25 mL solution of HCl that is titrated to an end point by 10 mL of a 0.200 M solution of NaOH?



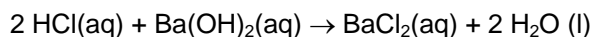
$$M_A V_A = M_B V_B$$

$$M_A (25) = (0.200) (10)$$

$$M_A = 0.0800 \text{ M} = [\text{HCl}]$$

$$\text{answer: } [\text{HCl}] = 0.0800 \text{ M}$$

- 2 4. What is the molar concentration of a 50-mL solution of $\text{Ba}(\text{OH})_2$ that is titrated to an end point by 15 mL of a 0.00300 M solution of HCl?



$$\begin{array}{ll} \mathbf{M_A = 0.00300} & \mathbf{M_B = M_B} \\ \mathbf{V_A = 15} & \mathbf{V_B = 50} \end{array}$$

$$\mathbf{M_A V_A = 2 M_B V_B}$$

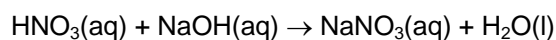
$$\mathbf{(0.00300) (15) = 2 (M_B) (50)}$$

$$\mathbf{M_B = 4.5 \times 10^{-4} \text{ M}}$$

answer

$$\mathbf{[\text{Ba}(\text{OH})_2] = 4.5 \times 10^{-4} \text{ M}}$$

- 2 5. What is the molarity of a 21 mL nitric acid solution that completely neutralizes 25.0 mL of a 0.300 M solution of NaOH?



$$\begin{array}{ll} \mathbf{M_A = M_A} & \mathbf{M_B = 0.300} \\ \mathbf{V_A = 21} & \mathbf{V_B = 25.0} \end{array}$$

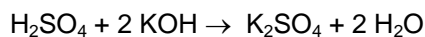
$$\mathbf{M_A V_A = M_B V_B}$$

$$\mathbf{(M_A) (21) = (0.300) (25.0)}$$

$$\mathbf{M_A = 0.357 \text{ M}}$$

Answer: $[\text{HNO}_3] = 0.357 \text{ M}$

- 2 6. What is the molar concentration of a 45.0 mL solution of KOH that is completely neutralized by 15.0 mL of a 0.500 M H_2SO_4 solution?



$$\begin{array}{ll} \mathbf{M_A = 0.500} & \mathbf{M_B = M_B} \\ \mathbf{V_A = 15} & \mathbf{V_B = 45} \end{array}$$

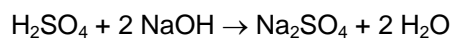
$$\mathbf{M_A V_A = 2 M_B V_B}$$

$$\mathbf{(0.500) (15) = 2 (M_B) (45)}$$

$$\mathbf{M_B = 0.333 \text{ M}}$$

Answer: $[\text{KOH}] = 0.333 \text{ M}$

- 2 7. A neutral solution is produced when 42.00 mL of a 0.150 M NaOH solution is used to titrate 50.00 mL of a sulfuric acid (H_2SO_4) solution. What is the concentration of the sulfuric acid solution before titration?



$$\begin{array}{ll} \mathbf{M_A = M_A} & \mathbf{M_B = 0.150} \\ \mathbf{V_A = 50.00} & \mathbf{V_B = 42.00} \end{array}$$

$$\mathbf{2 M_A V_A = M_B V_B}$$

$$\mathbf{2 (M_A) (50) = 2 (0.150) (42.00)}$$

$$\mathbf{M_A = 0.063 \text{ M}}$$

Answer: $[\text{H}_2\text{SO}_4] = 0.063 \text{ M}$