**Chemistry 11**

# Titrations

Name: Key
Date:

1. Balance the following neutralization equation:

$$\_\_ H_2SO_4 + \underline{2} NaOH \rightarrow \underline{2} H_2O + \_\_ Na_2SO_4$$

2. Write the balanced equation for the reaction between aluminum hydroxide and hydrobromic acid, HBr, to form aluminum bromide and water.

$$3HBr + Al(OH)_3 \rightarrow AlBr_3 + 3H_2O$$

3. Complete and balance the following equation:

$$\underline{2} NH_4OH + \_\_ H_2SO_4 \rightarrow \underline{2H_2O} + \underline{(NH_4)_2SO_4}$$

4. If 14.7 mL of 0.102 M NaOH is required to titrate 25.00 mL of a hydrochloric acid, HCl, solution, what is the molarity of the hydrochloric acid?

$$HCl + NaOH \rightarrow H_2O + NaCl$$

$$14.7\,mL\,NaOH \times \frac{1\,L}{1000\,mL} \times \frac{0.102\,mol\,NaOH}{1\,L} \times \frac{1\,mol\,HCl}{1\,mol\,NaOH} = 0.00150\,mol\,HCl$$

$$\frac{0.00150\,mol\,HCl}{25.00\,mL} \times \frac{1000\,mL}{1\,L} = \boxed{0.0600\,M\,HCl}$$

3sf

5. If 36.2 mL of 0.152 M NaOH is required to neutralize 25.00 mL of an acetic acid, $CH_3COOH$, solution, what is the molarity of the acetic acid?

$$NaOH + CH_3COOH \rightarrow H_2O + CH_3COONa$$

$$36.2\,mL\,NaOH \times \frac{1\,L}{1000\,mL} \times \frac{0.152\,mol\,NaOH}{1\,L} \times \frac{1\,mol\,CH_3COOH}{1\,mol\,NaOH} = 0.00550\,mol\,CH_3COOH$$

$$\frac{0.00550\,mol\,CH_3COOH}{25.00\,mL} \times \frac{1000\,mL}{1\,L} = \boxed{0.220\,M\,CH_3COOH}$$

3sf

6. If 7.3 mL of 1.25 $HNO_3$ is required to neutralize 25.00 mL of a potassium hydroxide solution, what is the molarity of the potassium hydroxide?

$$HNO_3 + KOH \rightarrow H_2O + KNO_3$$

$$7.3\,mL\,HNO_3 \times \frac{1\,L}{1000\,mL} \times \frac{1.25\,mol\,HNO_3}{1\,L} \times \frac{1\,mol\,KOH}{1\,mol\,HNO_3} = 0.0091\,mol\,KOH$$

$$\frac{0.0091\,mol\,KOH}{25.00\,mL} \times \frac{1000\,mL}{1\,L} = 0.36\,M\,HNO_3$$

2sf

7. If 8.6 mL of 0.0994 M $HNO_3$ is required to neutralize 25.00 mL of a strontium hydroxide solution, what is the molarity of the strontium hydroxide?

$$2HNO_3 + Sr(OH)_2 \rightarrow 2H_2O + Sr(NO_3)_2$$

$$8.6\,mL\,HNO_3 \times \frac{1\,L}{1000\,mL} \times \frac{0.0994\,mol\,HNO_3}{1\,L} \times \frac{1\,mol\,Sr(OH)_2}{2\,mol\,HNO_3}$$

$$= 0.00043\,mol\,Sr(OH)_2$$

$$\frac{0.00043\,mol\,Sr(OH)_2}{25.00\,mL} \times \frac{1000\,mL}{1\,L} = 0.017\,M\,Sr(OH)_2$$

2sf

8. If 46.2 mL of 2.50 M NaOH is required to neutralize 1.54 M phosphoric acid, $H_3PO_4$, solution, what volume of phosphoric acid was needed to reach the equivalence point?

$$3NaOH + H_3PO_4 \rightarrow H_2O + Na_3PO_4$$

$$46.2\,mL\,NaOH \times \frac{1\,L}{1000\,mL} \times \frac{2.50\,mol\,NaOH}{1\,L} \times \frac{1\,mol\,H_3PO_4}{3\,mol\,NaOH}$$

$$\times \frac{1\,L\,H_3PO_4}{1.54\,mol\,H_3PO_4} \times \frac{1000\,mL}{1\,L} = 25.0\,mL\,H_3PO_4$$

3sf

1. $H_2SO_4 + 2NaOH \rightarrow 2H_2O + Na_2SO_4$ 2. $Al(OH)_3 + 3HBr \rightarrow AlBr_3 + 3H_2O$ 3. $NH_4OH + H_2SO_4 \rightarrow (NH_4)_2SO_4 + 2H_2O$. 4. 0.0600M HCl
5. 0.220M $CH_3COOH$ 6. 0.37M KOH 7. 0.017M $Sr(OH)_2$ 8. 25.0mL $H_3PO_4$