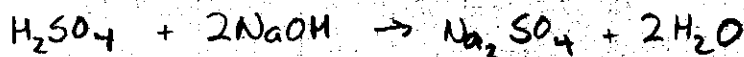


$\frac{17}{17} = 1$

Name: _____

SCH 4U Titration Quiz

1. Determine the volume of 0.05 M sodium hydroxide (NaOH) that is required to neutralize 45 mL of 2.0 M sulphuric acid (H₂SO₄).



$$2n_A = n_B \quad \checkmark$$

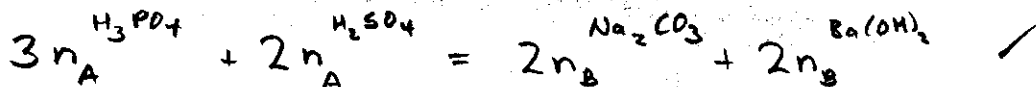
$$2C_A V_A = C_B V_B \quad \checkmark$$

$$V_B = \frac{2C_A V_A}{C_B}$$

$$V_B = \frac{2 \times 2.0 \text{ mol/L} \times 0.045 \text{ L}}{0.05 \text{ mol/L}}$$

$$V_B = 3.6 \text{ L or } 3600 \text{ mL} \quad \checkmark$$

2. A mixture of phosphoric acid (H₃PO₄) and sulphuric acid (H₂SO₄) is neutralized by sodium carbonate (Na₂CO₃) and barium hydroxide (Ba(OH)₂). If 5 L of 3 M phosphoric acid and 2 L of 18 M sulphuric acid has been treated with 3 kg of barium hydroxide, what mass in kilograms of sodium carbonate is required to finish the job?



$$3C_A^{\text{H}_3\text{PO}_4} V_A^{\text{H}_3\text{PO}_4} + 2C_A^{\text{H}_2\text{SO}_4} V_A^{\text{H}_2\text{SO}_4} = 2n_B^{\text{Na}_2\text{CO}_3} + 2n_B^{\text{Ba(OH)}_2} \quad \checkmark$$

$$n_B^{\text{Na}_2\text{CO}_3} = \frac{3C_A^{\text{H}_3\text{PO}_4} V_A^{\text{H}_3\text{PO}_4} + 2C_A^{\text{H}_2\text{SO}_4} V_A^{\text{H}_2\text{SO}_4} - 2n_B^{\text{Ba(OH)}_2}}{2}$$

$$3 \text{ kg Ba(OH)}_2 \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mol}}{171.36} = 17.5 \text{ mol Ba(OH)}_2 \quad \checkmark$$

$$n_B^{\text{Na}_2\text{CO}_3} = \frac{3 \times 3 \text{ mol/L} \times 5 \text{ L} + 2 \times 18 \text{ mol/L} \times 2 \text{ L} - 2 \times 17.5 \text{ mol}}{2}$$

$$n_B^{\text{Na}_2\text{CO}_3} = 41.0 \text{ mol} \quad \checkmark$$

$$41.0 \text{ mol} \times \frac{105.99 \text{ g}}{1 \text{ mol}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 4.35 \text{ kg} \quad \checkmark$$

3. A mixture of KHSO_4 and NaCl is 45.8% potassium bisulphate by mass. What volume of 0.1 M HCl would you expect to add if 2.000 g of the mixture has already been treated with 50 mL of 0.5 M NaOH ?

$$2.000 \text{ g} \times \frac{45.8}{100.0} = 0.916 \text{ g } \text{KHSO}_4 \quad /$$

$$0.916 \text{ g} \times \frac{1 \text{ mol}}{136.17 \text{ g}} = 0.00673 \text{ mol } \text{KHSO}_4 \quad /$$

$$n_A^{\text{KHSO}_4} + n_A^{\text{HCl}} = n_B \quad /$$

$$n_A^{\text{KHSO}_4} + C_A^{\text{HCl}} V_A^{\text{HCl}} = C_B V_B \quad /$$

$$V_A^{\text{HCl}} = \frac{C_B V_B - n_A^{\text{KHSO}_4}}{C_A} \quad /$$

$$V_A^{\text{HCl}} = \frac{0.5 \text{ mol/L} \times 0.050 \text{ L} - 0.00673 \text{ mol}}{0.1 \text{ mol/L}} \quad /$$

$$V_A^{\text{HCl}} = 0.183 \text{ L} \quad \text{or } 183 \text{ mL} \quad /$$