17 = 90

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 ($H_2SO_4$).

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$ ✓

$2n_A = n_B$ ✓

$2C_AV_A = C_BV_B$ ✓

$V_B = \frac{2C_AV_A}{C_B}$

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

$V_B = 3.6\,L$ or $3600\,mL$ ✓

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2. A mixture of phosphoric acid ($H_3PO_4$) and sulphuric acid ($H_2SO_4$) is neutralized be sodium carbonate ($Na_2CO_3$) 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?

$3n_A^{H_3PO_4} + 2n_A^{H_2SO_4} = 2n_B^{Na_2CO_3} + 2n_B^{Ba(OH)_2}$ ✓

$3C_A^{H_3PO_4}V_A^{H_3PO_4} + 2C_A^{H_2SO_4}V_A^{H_2SO_4} = 2n_B^{Na_2CO_3} + 2n_B^{Ba(OH)_2}$ ✓

$n_B^{Na_2CO_3} = \frac{3C_A^{H_3PO_4}V_A^{H_3PO_4} + 2C_A^{H_2SO_4}V_A^{H_2SO_4} - 2n_B^{Ba(OH)_2}}{2}$

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

$n_B^{Na_2CO_3} = \frac{3 \times 3\,mol/L \times 5\,L + 2 \times 18\,mol/L \times 2\,L - 2 \times 17.5\,mol}{2}$

$n_B^{Na_2CO_3} = 41.0\,mol$ ✓

$41.0\,mol \times \frac{105.99\,g}{1\,mol} \times \frac{1\,kg}{1000\,g} = 4.35\,kg$ ✓

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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?

$$2.000\,g \times \frac{45.8}{100.0} = 0.916\,g\ KHSO_4 \quad \checkmark$$

$$0.916\,g \times \frac{1\,mol}{136.17\,g} = 0.00673\,mol\ KHSO_4 \quad \checkmark$$

$$n_A^{KHSO_4} + n_A^{HCl} = n_B \quad \checkmark$$

$$n_A^{KHSO_4} + C_A^{HCl} V_A^{HCl} = C_B V_B \quad \checkmark$$

$$V_A^{HCl} = \frac{C_B V_B - n_A^{KHSO_4}}{C_A} \quad \checkmark$$

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

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

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