

# Year 12 Chemistry Mini-Assignment Term 1 Week 10

[22 marks]  
21

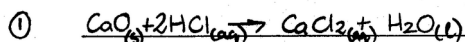
Name: SOLUTIONS

## Question 1

Calculate the mass of lime, calcium oxide, which will react completely with 250.0 mL of 1.50 mol L<sup>-1</sup> hydrochloric acid.

(4 marks)

$$① \quad n(\text{HCl}) = cV = 0.250 \times 1.50 = 0.375$$



$$① \quad n(\text{CaO}) = \frac{n(\text{HCl})}{2} = \frac{0.375}{2} = 0.1875$$

$$① \quad m(\text{CaO}) = nM = 0.1875 \times 56.08 = 10.515 \text{ g}$$

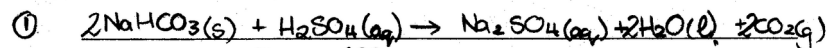
Mass of lime: 10.5 g (3 sig figs)

## Question 2

A fire extinguisher produces carbon dioxide by the reaction between sodium hydrogencarbonate and sulfuric acid. If a fire extinguisher is designed to hold 600.0 g of sodium hydrogencarbonate, calculate

- (a) the mass of sulfuric acid required to react with the sodium hydrogencarbonate, and  
(b) the volume of 12.0 mol L<sup>-1</sup> sulfuric acid required to react with the sodium hydrogencarbonate.

5  
(6 marks)



$$① \quad n(\text{NaHCO}_3) = \frac{m}{M} = \frac{600}{84.008} = 7.14218 \text{ mol}$$

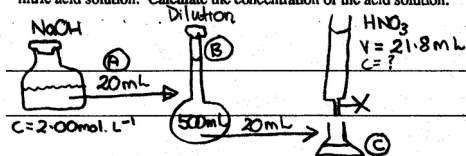
$$① \quad n(\text{H}_2\text{SO}_4) = \frac{n(\text{NaHCO}_3)}{2} = \frac{7.14218}{2} = 3.5711$$

$$① \quad m(\text{H}_2\text{SO}_4) = nM = 3.5711 \times 98.086 = 350.3 \text{ g (4 sig figs)}$$

$$① \quad V(\text{H}_2\text{SO}_4) = \frac{n}{c} = \frac{3.5711}{12.0} = 0.298 \text{ L (3 sig figs)}$$

## Question 3

20.0 mL of 2.00 mol L<sup>-1</sup> sodium hydroxide solution was diluted to 500.0 mL in a volumetric flask. A 20.0 mL aliquot of the dilute solution was neutralised by 21.8 mL of nitric acid solution. Calculate the concentration of the acid solution.

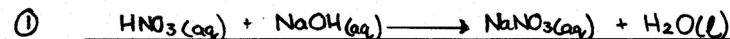


(6 marks)

$$① \quad n(\text{NaOH at (A)}) = cV = 2.00 \times 0.020 = 0.04 \text{ mol}$$

$$① \quad c(\text{NaOH at (B)}) = \frac{n}{V} = \frac{0.04}{0.5} = 0.08 \text{ mol L}^{-1}$$

$$① \quad n(\text{NaOH at (C)}) = cV = 0.08 \times 0.020 = 1.6 \times 10^{-3}$$

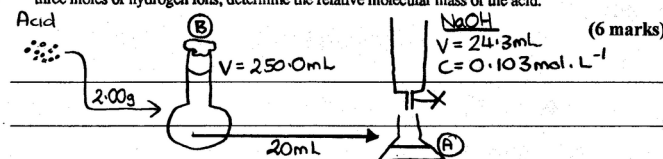


$$① \quad n(\text{HNO}_3) = n(\text{NaOH}) = 1.6 \times 10^{-3}$$

$$① \quad c(\text{HNO}_3) = \frac{n}{V} = \frac{1.6 \times 10^{-3}}{0.0218} = 0.0734 \text{ mol L}^{-1} \text{ (3 sig figs)}$$

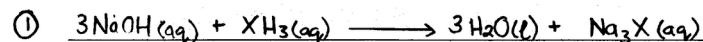
## Question 4

2.00 g of an acid was dissolved in water and made up to 250.0 mL of solution in a volumetric flask. 20.0 mL of this acid solution required 24.3 mL of 0.103 mol L<sup>-1</sup> sodium hydroxide solution for complete neutralisation. If one mole of the acid can release three moles of hydrogen ions, determine the relative molecular mass of the acid.



(6 marks)

$$① \quad n(\text{NaOH}) = cV = 0.103 \times 0.0243 = 2.5029 \times 10^{-3}$$



$$① \quad n(\text{XH}_3 \text{ at (A)}) = \frac{n(\text{NaOH})}{3} = \frac{2.5029 \times 10^{-3}}{3} = 8.343 \times 10^{-4}$$

$$① \quad c(\text{XH}_3 \text{ at (B)}) = \frac{n}{V} = \frac{8.343 \times 10^{-4}}{0.020} = 0.041715 \text{ mol L}^{-1}$$

$$① \quad n(\text{XH}_3 \text{ at (B)}) = cV = 0.041715 \times 0.250 = 0.01043 \text{ mol}$$

$$① \quad M(\text{XH}_3) = \frac{m}{n} = \frac{2.00}{0.01043} = 192 \text{ g mol}^{-1}$$

$$\therefore \text{Relative Molecular Mass} = 192$$