MOLE CONCEPT

1. Zinc metal and hydrochloric acid react according to the following equation

$$Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{(aq)} + H_{2(g)}$$

1.96g of zinc were reacted with $100cm^3$ of 0.2M Hydrochloric acid,

(a) Determine the reagent that was in excess

(2mks)

(b) Calculate the total volume of hydrogen gas that was liberated at S.T.P conditions (Zn = 65.4, molar gas volume = 22.4 litres at S.T.P)

(2mks)

2. Calculate the mass of nitrogen (IV) oxide gas that would occupy the same volume as 10g of hydrogen gas at the same temperature and pressure. (H = 1.0, N = 14.0, O = 16.0)

(2mks)

3. Urea, $(NH_2)_2CO$ is prepared by the reaction between ammonia and carbon(IV) oxide

$$2NH_{3(g)} + CO_{2(g)} \longrightarrow (NH_2)_2CO_{(aq)} + H_2O_{(l)}$$

In one process, 340kg of ammonia were reacted with excess carbon (IV) oxide.
Calculate the moles of urea that were formed. (H = 1.0, C = 12. 0, N = 14.0, O = 16.0)

(2mks)

4. In a filtration experiment 25cm^3 of solution of sodium hydroxide containing 8g per litre was required for complete neutralization of 0.245g of a dibasic acid. Calculate the relative molecular mass of the acid. (Na = 23.0, O = 16, H = 1)

(3mks)

5. 12.0 cm^3 of methane and 48cm^3 of oxygen were exploded together. The final volume measured under the original conditions was 36.0 cm^3 neglecting the water formed. 24.0cm^3 of this was unused oxygen. **Show** the ratio of reacting volume of the gases referred to and gaseous products formed.

(2marks)

6. 4. 9 g a tribasic acid was dissolved in water and the solution made up to 500cm^3. If the concentration of the hydrogen ions in the solution is 0.3M, **calculate** the relative molecular mass of the acid.

(3marks)

7. The mass of 1 dm^3 of gas **X** at room temperature and pressure is 2.667g. **Determine** the relative molecular mass of the gas (molar gas volume at r.t.p =24dm^3).

(2marks)

8. A solution was made by dissolving 7.5g of sodium hydroxide containing inert impurities in water and making it to 250cm^3 of solution. If 20cm^3 of this solution is neutralized exactly by 13cm^3 of 1M hydrochloric acid, calculate the percentage purity of sodium hydroxide.
(Na=23; O=16; H=1) (3mks)

9. a) An oxide of nitrogen contains 30.4% nitrogen. Its density at s.t.p is 4.11g/dm^3. Determine the molecular formula of the compound.
(N=14; O=16; moles gas volume = 22.4dm^3) (2mks)

b) Magnesium ribbon was burnt in a gas jar of nitrogen. A few drops of water were added to the solid formed in the jar. Write an equation for the second reaction. (1mk)

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10. In a experiment, 10.6g of a mixture of Anhydrous Sodium Carbonate and Sodium Chloride were dissolved in water to make 100cm^3 of a solution required 20.0cm^3 of 0.5M Hydrochloric acid solution for complete neutralization. **What** is the mass of Sodium Carbonate in the mixture?
(Na = 23.0, C = 12.0, O = 16.0, Cl = 35.5) (3mks)

11. For the reaction

$Na_2SO_{3(s)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + SO_{2(g)} + H_2O_{(l)}$

Given that 25.2g of Na_2SO_3 were made to react with $700cm^3$ of 0.5M HCl, which reagent was in excess? (3mks)

12. 9.42g of an organic acid RCOOH is dissolved in $600cm^3$. $25.0cm^3$ of this solution was found to require of 0.207M potassium hydroxide solution for complete neutralization.
(C = 12.0, O = 16.0, H = 1.0)

i) Determine the formula mass of the acid

(2mks)

ii) Hence the value of R

(1mk)

13. $25.0cm^3$ of 0.12M potassium hydroxide solution required $30.0cm^3$ of a solution of a dibasic acid (H_2Y) for complete neutralization. The acid contained 3.15g per $500cm^3$ solution.

Calculate:

(a) The molarity of the acid solution (1½mks)

(b) The relative formula mass of the acid.

(1½mks)

14. Zinc Sulphate can be used as a dietary supplement in cases of suspected zinc deficiency. The compound crystallizes as anhydrated salt and is readily water soluble.

(b) In a simple experiment to **determine** the extent of hydration, a technician carefully heated 3.715g of crystals to a moderate temperature until no further loss in mass occurred. The anhydrous zinc had a mass of 2.08g.

(i) **How many** moles of zinc are there in 2.08g of anhydrous zinc Sulphate? **(Zn = 65, O = 16, S = 32, H = 1)**
(2mks)

(ii) **How many** moles of water were lost? (2mks)

(iii) **Determine** the value of n in the formula $ZnSO_4$. nH2O. (2mks)

(c) The daily intake of zinc in Kenya is 15mg per adult person.

(i) **What** mass of zinc Sulphate crystals would need to be taken to obtain this intake? (2mks)

(ii) If this is taken via a 5ml dose of aqueous zinc Sulphate, calculate the concentration of this solution in $molcm^{-3}$ of the hydrated salt. (2mks)