The Mole Questions and Answers - Chemistry Form 3 Topical Revision

Questions

1. In an experiment magnesium ribbon was heated in air. The product formed was found to be heavier than the original ribbon. Potassium manganate (VII) was on the other hand, heated in air and product formed was found to be lighter. Explain the differences on the observation made
2. In a filtration experiment 25cm^3 of a 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)
3. D grams of Potassium hydroxide were dissolved is distilled water to make 100 cm^3 of solution. 50cm^3 of the solution required 50cm^3 of 2.0M nitric acid for complete neutralization. Calculate the mass D of Potassium hydroxide (RFM of KOH = 56)
   $KOH_{(aq)} + HNO_{3(aq)} \rightarrow KNO_{3(aq)} + H_2O_{(l)}$
4. When excess dilute hydrochloric acid was added to sodium sulphite, 960cm^3 of sulphuric (IV) Oxide gas was produced. Calculate the mass of sodium sulphate that was used.
   (Molar gas volume = 24000cm^3 and Molar mass of sulphite = 126g)
5. The equation of the formation of iron (III) chloride is
   $2Fe_{(s)} + 3Cl_{2(g)} \rightarrow 2FeCl_3$
   Calculate the volume of chlorine which will react with iron to form 0.5g of Iron (III) chloride.
   (Fe = 56 Cl=35.5). Molar gas volume at 298K = 24dm^3)
6. 15.0cm^3 of ethanoic acid (CH_3COOH) was dissolved in water to make 500cm^3 of solution. Calculate the concentration of the solution in moles per litre [C=12, H = 1, O = 16, density of ethanoic acid is 1.05g/cm^3]
7. When 1.675g of hydrated sodium carbonate was reacted with excess hydrochloric acid, the volume carbon (IV) oxide gas obtained at room temperature and pressure was 150cm^3. Calculate the number of moles of water of crystallization in one mole of hydrated sodium carbonate:- (Na=23, H =1, C=12, O=16, MGV at R.T.P = 24000cm^3)
8. How many chloride ions are present in 1.7g of magnesium chloride crystals? (Avogadro's constant = 6.0 x 10^{23}, Mg = 24, Cl = 35.5)
9. Calculate the volume of oxygen gas used during the burning of magnesium (O = 16, molar gas volume = 24,000cm^3 at room temperature)
10. A hydrated salt has the following composition by mass. Iron 20.2 %, oxygen 23.0%, sulphur 11.5%, water 45.3%
    i. Determine the formula of the hydrated salt (Fe=56, S=32, O=16, H=11)
    ii. 6.95g of the hydrated salt in (i) above were dissolved in distilled water and the total volume made to 250cm^3 of solution. Calculate the concentration of the resulting salt solution in moles per litre. (Given that the molecula mass of the salt is 278)
11.
    i. Lead (II) ions react with iodide ions according to the equation;
    $Pb^{2+}_{(aq)} + 2I^-_{(aq)} \rightarrow PbI_{2(s)}$
    300cm^3 of a 0.1m solution of iodide ions was added to a solution containing excess lead (II) ions. Calculate the mass in grams of lead II iodide formed
    ii. Identify the colour of the product formed in (i)
12.
    a. The diagram below represents part of the structure of sodium chloride crystal

33. An unknown mass, x, of anhydrous potassium carbonate was dissolved in water and the solution made up to 200cm^3. 25cm^3 of this solution required 18cm^3 of 0.22M nitric (V) acid for complete neutralization. Determine the value of x. (K=39.0, C =12.0, O =16.0)

Answers

1. When a magnesium ribbon is heated in air it combines with oxygen forming magnesium oxide. When potassium manganate (VII) is heated it decomposes giving off oxygen which escapes in air
2. RFM of NaOH = 40
   Moles of NaOH = $^8/_{40}$ = 0.2M ✓
   Moles of NaOH in 25cm^3

   $\frac{25 \times 0.2}{1000} = 0.005$

   Mole ratio 1:2
   Moles of acid = $^{0.005}/_2$
   = 0.0025
   $\frac{1 \times 0.245}{0.0025} = 98$
3. No. Of moles of HNO_3 acid
   $\frac{50 \times 2}{1000} = 0.1$moles
   Mole ratio 1:1
   The KOH will have 0.1moles; $\frac{0.1 \times 100}{50} = 0.2$moles
   Then D grams is 0.2 × 56
   = 11.2g
4. Number of moles of Q = $\frac{960\ cm^3 \times 1\ mole}{24000\ cm^3}$

   = 0.04moles

   Equation:
   $Na_2SO_{3(s)} + 2HCl(aq) \rightarrow 2NaCl_{(aq)} + SO_{2(g)} + H_2O_{(l)}$
   Mole ratio $Na_2SO_3 : SO_2$ is 1:1
   ∴No. of moles of Na_2SO_3 = 0.04moles
   Mass of Na_2SO_3 = 126gmol^{-1} x 0.04
   = 5.04g
5. From the equation
   - (3x24) litres of chlorine react with iron to produce [(56 x 2) + (35.5 X3)] g of $FeCl_3$.
   325 g of Fecl3 is produced by 72 litres of Cl_2
   Then 0.5g of $Fecl_3$ is produced by:
   $\frac{0.5 \times 72}{325}$ =0.11078 litres
   = 110.78 cm^3
6. RMM (CH_3OOH) = 60
   Mass of 15cm^3 and = 1.05 x 15 = 15.75g
   Moles in 500cm^3 solution = $\frac{15.75}{60} = 0.2625$
   Molarity = $\frac{1000 \times 0.2625}{5000}$
   = 0.525M