Chemistry

Cambridge University Examinations

General Certificate of Education Ordinary Level
O – LEVEL 5070. Notes, P1, P2 and P4

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Chapter

The Mole Concepts

Work Sheet
Paper *4*

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Worksheet Paper 4

Moles

1 A student was asked to make a sample of barium sulphate, $BaSO_4$. She added 100 cm^3 of 0.20 mol/dm^3 sulphuric acid to 60 cm^3 of 0.25 mol/dm^3 barium nitrate.
The equation for the reaction is

$$Ba(NO_3)_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HNO_3$$

(a) Describe the appearance of barium sulphate in the resulting mixture.

.....[1]

(b) Calculate

(i) the number of moles of sulphuric acid used in the experiment,

..... moles [1]

(ii) the number of moles of barium nitrate used in the experiment.

..... moles [1]

(c) Using your answers to **(b)(i)** and **(ii)** calculate the maximum mass of barium sulphate that could be produced in the reaction.
[A_r: Ba, 137; S, 32; O, 16]

..... g [1]

The barium sulphate was removed from the solution by filtration. It was dried and weighed.

(d) The mass of barium sulphate obtained was 3.35 g. Calculate the percentage yield of barium sulphate.

..... % [1]

Another student, doing the same experiment and using the same quantities of barium nitrate and sulphuric acid, obtained 3.60 g of product.

(e) Suggest a reason for this increased mass of product.

.....[1]

(f) Suggest a different barium salt that could have been used instead of barium nitrate to produce barium sulphate.

.....[1]

[Total: 7]

2 A student did an experiment to decompose hydrogen peroxide.

Some manganese(IV) oxide, MnO_2, was added to increase the rate of reaction.

$$2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$$

100 cm^3 of 0.050 mol/dm^3 hydrogen peroxide was allowed to decompose until no more oxygen was produced.

One mole of a gas at 25 °C occupies a volume of 24 dm^3.

The volume of oxygen produced was

(a) 12 cm^3. ☐

(b) 60 cm^3. ☐

(c) 120 cm^3. ☐

(d) 600 cm^3. ☐ [1]

3 A student added 30 cm^3 of 1.5 mol/dm^3 aqueous silver nitrate to a beaker containing 50 cm^3 of 1.0 mol/dm^3 aqueous sodium bromide.

A precipitate of silver bromide was produced.

(a) (i) What colour was the precipitate?

.....

(ii) Name the method by which this precipitate was separated from the mixture.

.....

[2]

(b) (i) Calculate the number of moles of silver nitrate contained in 30 cm^3 of 1.5 mol/dm^3 aqueous silver nitrate.

..... moles

(ii) Calculate the number of moles of sodium bromide contained in 50 cm^3 of 1.0 mol/dm^3 aqueous sodium bromide.

..... moles

[2]

Sodium bromide reacts with silver nitrate according to the equation below.

$$AgNO_3 + NaBr \longrightarrow AgBr + NaNO_3$$

(c) Using this equation and your answers to **(b)**, calculate the mass of silver bromide produced in this experiment.

[A_r: Ag, 108; Br, 80]

..... g [2]

(d) The student repeated the experiment using 40 cm^3 of 1.5 mol/dm^3 aqueous silver nitrate with 50 cm^3 of 1.0 mol/dm^3 sodium bromide.

Calculate the mass of silver bromide produced in this experiment.

..... g [2]

4 A student was given some hydrated sodium carbonate crystals, $Na_2CO_3.xH_2O$, where x is a whole number. They were placed in a previously weighed container, which was reweighed.

mass of container + sodium carbonate crystals	= 9.87 g
mass of container	= 5.83 g

(a) Calculate the mass of sodium carbonate crystals used in the experiment.

.....g [1]

The container and crystals were heated to remove the water of crystallisation and then reweighed. This process was repeated until there was no further change in mass.

(b) Describe the appearance of the sodium carbonate crystals after heating.

.....

.....[2]

mass of container + sodium carbonate after heating = 7.35 g

(c) **(i)** Calculate the mass of sodium carbonate which remained after heating.

.....g [1]

(ii) Calculate the mass of water which was lost from the crystals.

.....g [1]

(d) **(i)** Calculate the relative formula mass of sodium carbonate, Na_2CO_3, and the relative formula mass of water.
[A_r: Na, 23; C, 12; O, 16; H, 1]

relative formula mass of sodium carbonate .....

relative formula mass of water .....
[1]

(e) Using your answers to **(c)** and **(d)**, calculate

(i) the number of moles of sodium carbonate which remained after heating,

..... [1]

(ii) the number of moles of water which were lost on heating.

..... [1]

(f) Using your answers to **(e)** calculate the value of x in the formula $Na_2CO_3.xH_2O$.

x =..... [2]

[Total: 10]

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