Q1. The following two-stage method was used to analyse a mixture containing the solids magnesium, magnesium oxide and sodium chloride.

Stage 1
A weighed sample of the mixture was treated with an excess of dilute hydrochloric acid. The sodium chloride dissolved in the acid. The magnesium oxide reacted to form a solution of magnesium chloride. The magnesium also reacted to form hydrogen gas and a solution of magnesium chloride. The hydrogen produced was collected.

(a) Write equations for the two reactions involving hydrochloric acid.

(b) State how you would collect the hydrogen. State the measurements that you would make in order to calculate the number of moles of hydrogen produced. Explain how your results could be used to determine the number of moles of magnesium metal in the sample.

(8)

Stage 2
Sodium hydroxide solution was added to the solution formed in **Stage 1** until no further precipitation of magnesium hydroxide occurred. This precipitate was filtered off, collected, dried and heated strongly until it had decomposed completely into magnesium oxide. The oxide was weighed.

(c) Write equations for the formation of magnesium hydroxide and for its decomposition into magnesium oxide.

(d) When a 2.65 g sample of the mixture of the three solids was analysed as described above, the following results were obtained.

Hydrogen obtained in **Stage 1** 0.0528 mol

Mass of magnesium oxide obtained in **Stage 2** 6.41 g

Use these results to calculate the number of moles of original magnesium oxide in 100 g of the mixture.

(7)
(Total 15 marks)

Q2. Compound **A** is an oxide of sulphur. At 415 K, a gaseous sample of **A**, of mass 0.304 g, occupied a volume of 127 cm^3 at a pressure of 103 kPa.

State the ideal gas equation and use it to calculate the number of moles of **A** in the sample, and hence calculate the relative molecular mass of **A**.
(The gas constant R = 8.31 J K^{-1} mol^{-1})

Ideal gas equation .....

Calculation .....

.....

.....

.....

.....

(Total 5 marks)

Q3. Which one of the following solutions would **not** give a white precipitate when added to barium chloride solution?

A silver nitrate solution

B dilute sulphuric acid

C sodium sulphate solution

D sodium nitrate solution

(Total 1 mark)

Q4. An aqueous solution of a sodium salt gave no precipitate when treated with either silver nitrate solution or barium chloride solution. Which one of the following could be the formula of the sodium salt?

A NaI

B Na_2SO_4

C NaBr

D NaF

(Total 1 mark)