FORM FOUR KCSE 2018

CHEMISTRY PAPER 3 QUESTIONS

1. You are provided with:

• 0.30 g solid A, magnesium metal

• Hydrochloric acid, solution B

• 0.15 sodium carbonate, solution C

• Methyl orange indicator

You are required to determine the:

• Enthalpy change, AH per mole, of the reaction between magnesium metal and excess hydrocholoric acid.

• Concentration in moles per litre of hydrochloric acid, solution B.

Procedure I

(i) Using a burette, measure 50.0 cm^3 of solution B and place it in a 100 ml plastic beaker.

(ii) Measure the temperature of solution B in the beaker after every 30 seconds and record it in Table 1.

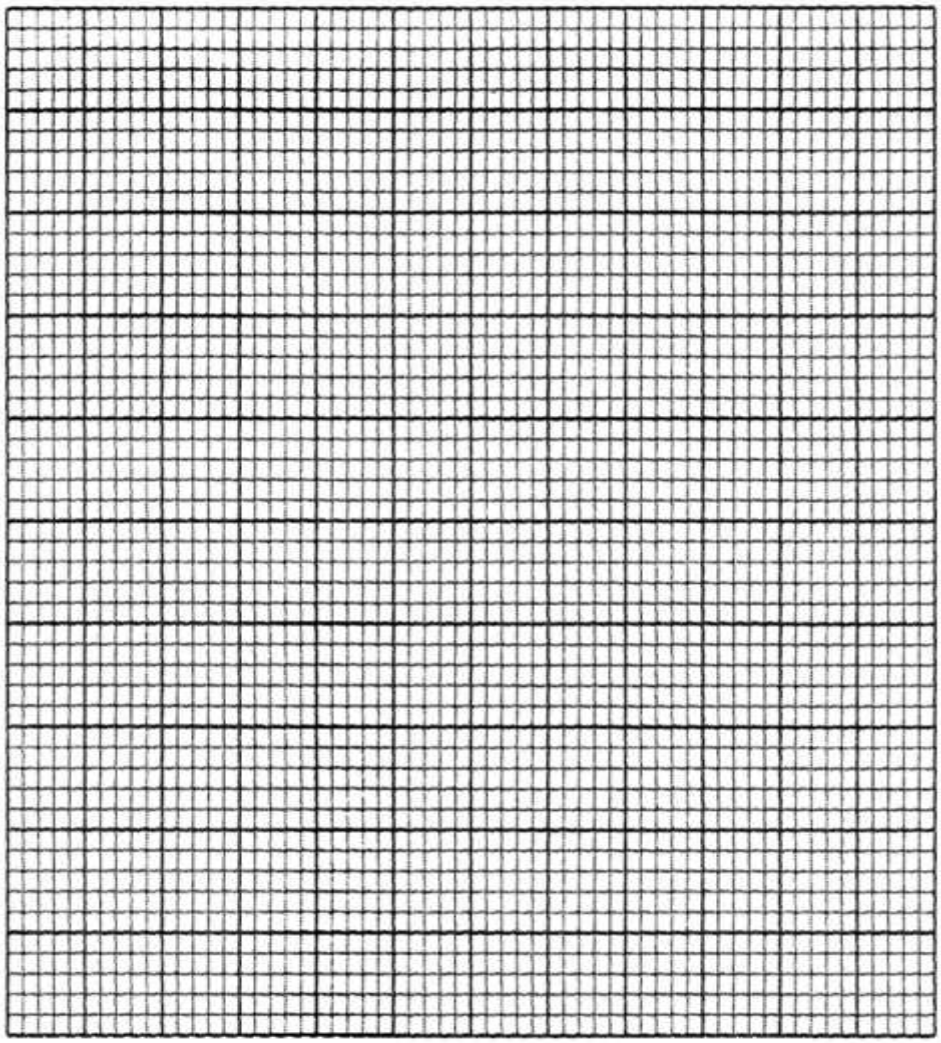
(iii) At the 90th second, add all of the solid A provided into the beaker, stir with the thermometer and continue measuring and recording the temperature after every 30 seconds. Complete Table 1. Retain the mixture in the beaker for use in procedure II.

Table 1

Time (seconds)	**0**	**30**	**60**	**90**	**120**	**150**	**180**	**210**	**240**	**270**
Temperature°C	x									

(3 marks)

(a) Plot a graph of temperature (vertical axis) against time on the grid provided. (3 marks)



(b) Determine the change in temperature, AT, for the reaction. Show the working on the graph.

AT . (1 mark)

(c) Calculate the heat change, in joules, for the reaction. Assume that for the solution, specific heat capacity is 4.2 Jg K 1 and density is 1.0gcm 3. (2 marks)

(d) The relative atomic mass of magnesium is 24.0. Calculate the enthalpy change, AH, of the reaction per mole of magnesium. Indicate the sign of AH. (1 mark)

Procedure H

(i) Fill a clean burette with the 0.15M sodium carbonate, solution C.

(ii) Place all of the mixture in the beaker from procedure I into a 250ml volumetric flask. Add distilled water to the mark and shake thoroughly. Label the mixture as solution D.

(iii) Using a pipette filler, pipette 25.0 cm^3 of solution D into a 250 ml conical flask and add 2 drops of methyl orange indicator.

(iv) Titrate solution D in the conical flask with the sodium carbonate, solution C and record the readings in Table 2.

(v) Repeat steps (iii) and (iv) and complete Table 2.

Table 2

Observations Inferences

(a) Determine the average volume of the 0.15M sodium carbonate, solution C, used. (1 mark)

(b) Calculate the number of moles of:

(i) sodium carbonate used.

(ii) hydrochloric acid in the 25.0 cm^3 of solution D.

(iii) hydrochloric acid in the 250 cm^3 of solution D.

(iv) hydrochloric acid that reacted with magnesium metal.(1 mark)

(v) total number of moles of hydrochloric acid in the 50.0cm^3, solution B. (1 mark)

(c) Determine the concentration of hydrochloric aeid in moles per litre, in solution B. (1 mark)

2. You are provided with solid E. Carry out the following tests and record the observations and inferences in the spaces provided.

(a) Place about one-third of solid E in a dry test-tube. Heat the solid strongly and test any gas with both blue and red litmus papers.

Observations Inferences

(b) Place the remaining amount of solid E in a boiling tube. Add about 15 cm^3 of distilled water and shake. Divide the mixture into four test tubes each containing about 2 cm^3 .

(i) To the first portion, add three or four drops of dilute hydrochloric acid (1 mark)

(ii) To the second portion, add two or three drops of aqueous barium nitrate.

Observations Inferences

(iii) To the third portion, add aqueous sodium hydroxide dropwise until in excess.

Observations Inferences

(iv) To the fourth portion, add aqueous ammonia dropwise until in excess.

Observations Inferences

3. You are provided with solid F. Carry out the following tests and record the observations and inferences in the spaces provided.

(a) Place about one-third of solid F on a clean metallic spatula and burn it in a Bunsen burner flame.

Observations Inferences

(b) Place the remaining amount of solid F in a boiling tube. Add about 10 cm^3 of distilled water and shake. Use the mixture for tests (i) to (iii) below.

Observations Inferences

(i) Using about 2 cm^3 of the mixture in a test-tube, determine the pH using universal indicator paper and chart.

Observations Inferences

(ii) To about 2 cm^3 of the mixture in a test tube, add two or three drops of acidified potassium manganate(VII).

Observations Inferences

(iii) To about 2 cm^3 of the mixture in a test-tube add two or three drops of bromine

Observations Inferences