

233/3 -

CHEMISTRY
(PRACTICAL)

- Paper 3

Nov. 2018 - 2¼ hours

Name Index Number

Candidate's Signature Date

Instructions to candidates

- (a) Write your name and index number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) Answer **ALL** the questions in the spaces provided in the question paper.
- (d) You are **NOT** allowed to start working with the apparatus for the first 15 minutes of the 2¼ hours allowed for this paper. This time is to enable you to read the question paper and make sure you have all the chemicals and apparatus that you may need.
- (e) All working **MUST** be clearly shown where necessary.
- (f) KNEC mathematical tables and silent electronic calculators may be used.
- (g) **This paper consists of 8 printed pages.**
- (h) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- (i) **Candidates should answer the questions in English.**



For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1	20	
2	11	
3	09	
Total Score	40	



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, ΔH per mole, of the reaction between magnesium metal and excess hydrochloric acid.
- Concentration in moles per litre of hydrochloric acid, **solution B**.

PROCEDURE I

- Using a burette, measure 50.0 cm³ of **solution B** and place it in a 100 ml plastic beaker.
- Measure the temperature of **solution B** in the beaker after every 30 seconds and record it in **Table 1**.
- 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.**

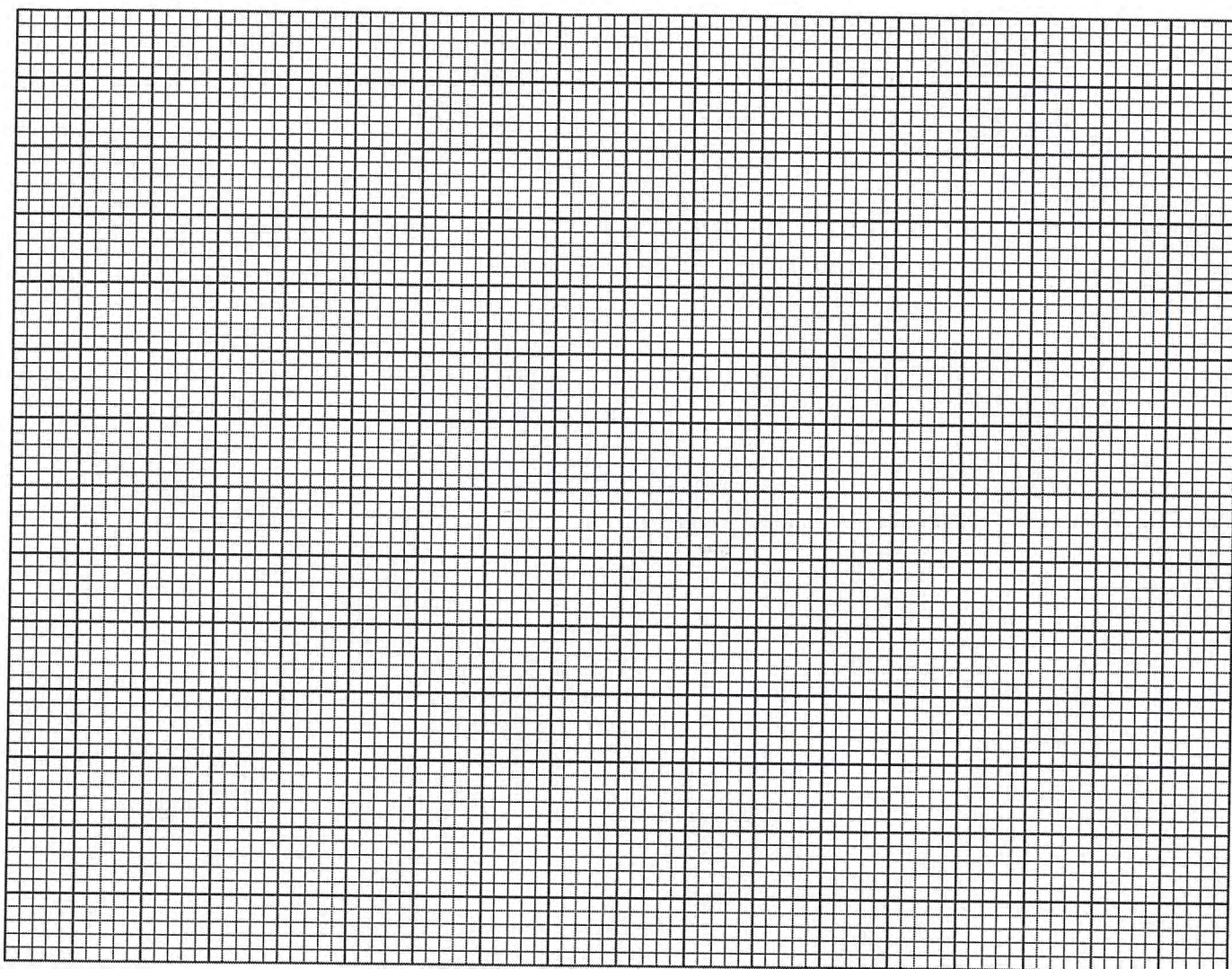
Table 1

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

(3 marks)

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

(3 marks)



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

$\Delta T =$ (1 mark)

- (c) Calculate the heat change, in joules, for the reaction. Assume that for the solution, specific heat capacity is $4.2 \text{ J g}^{-1} \text{ K}^{-1}$ and density is 1.0 g cm^{-3} . (2 marks)

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

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PROCEDURE II

- (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 250 ml 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 cm³ 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

	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution D used (cm ³)			

(3 marks)

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

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(b) Calculate the number of moles of:

(i) sodium carbonate used. (1 mark)

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(ii) hydrochloric acid in the 25.0 cm³ of **solution D**. (1 mark)

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(iii) hydrochloric acid in the 250 cm³ of **solution D**. (1 mark)

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

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(v) total number of moles of hydrochloric acid in the 50.0 cm³, **solution B**. (1 mark)

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

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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

(2 marks)

(1 mark)

- (b) Place the remaining amount of **solid E** in a boiling tube. Add about 15 cm³ of distilled water and shake. Divide the mixture into **four** test tubes each containing about 2 cm³.
- (i) To the first portion, add three or four drops of dilute hydrochloric acid.

Observations	Inferences

(1 mark)

(2 marks)

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

Observations	Inferences

(½ mark)

(½ mark)

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

Observations	Inferences

(1 mark)

(1 mark)

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

Observations	Inferences

(1 mark)

(1 mark)

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

(1 mark)

(1 mark)

- (b) Place the remaining amount of **solid F** in a boiling tube. Add about 10 cm³ of distilled water and shake. Use the mixture for tests (i) to (iii) below.

Observations	Inferences

(½ mark)

(½ mark)

- (i) Using about 2 cm³ of the mixture in a test-tube, determine the pH using universal indicator paper and chart.

pH	Inferences

(1 mark)

(1 mark)

- (ii) To about 2 cm³ of the mixture in a test tube, add two or three drops of acidified potassium manganate(VII).

Observations	Inferences

(1 mark)

(1 mark)

- (iii) To about 2 cm³ of the mixture in a test-tube add two or three drops of bromine water.

Observations	Inferences

(1 mark)

(1 mark)

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