



233/3 –

**CHEMISTRY**  
(PRACTICAL)  
Nov. 2017 – 2¼ hours

– Paper 3

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	19	
2	12	
3	9	
Total Score	40	



1. You are provided with:

- **Solution A**, 0.5 M copper(II) sulphate
- **Solid B<sub>1</sub>**, metal B<sub>1</sub> powder
- **Solid B<sub>2</sub>**, Iron powder
- **Solution C**, 0.02 M acidified potassium manganate(VII)

You are required to determine the:

- Enthalpy change for the displacement reaction between metal B<sub>1</sub> and copper(II) sulphate.
- Mass of iron that reacts with copper(II) sulphate in the displacement reaction.

### PROCEDURE I

- (a) (i) Using a pipette and a pipette filler, place 25.0 cm<sup>3</sup> of **solution A** into a 100 ml plastic beaker. Allow to stand for about 1 minute and then measure the temperature of the solution. Record the reading in **Table 1** as the initial temperature. Add all of **solid B<sub>1</sub>** to the solution. Stir the mixture carefully with the thermometer and measure the highest temperature reached. This will take about **5 minutes**. Record the reading in **Table 1** as maximum temperature reached.

**Table 1**

Maximum temperature reached (°C)	30.0
Initial temperature (°C)	20.0
Change in temperature, $\Delta T_1$ (°C)	10.0

(3 marks)

(ii) Calculate the:

I number of moles of copper(II) sulphate used.

(1 mark)

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II enthalpy change for the reaction of metal B<sub>1</sub> with one mole of copper(II) sulphate.

(Assume that for the mixture, specific heat capacity = 4.2 Jg<sup>-1</sup>K<sup>-1</sup> and density = 1.0 g cm<sup>-3</sup>)

(1 mark)

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- (b) Repeat **procedure I, (a) (i)** with all of **metal B<sub>2</sub>** (iron powder) in place of **metal B<sub>1</sub>**. The maximum temperature is reached after about 8 minutes. Record the temperature readings in **Table 2**. **Retain the mixture for use in PROCEDURE II.**

**Table 2**

Maximum temperature reached (°C)	27.0
Initial temperature (°C)	20.0
Change in temperature, ΔT <sub>2</sub> (°C)	7.0

(3 marks)

- (c) Compare the changes in temperature ΔT<sub>1</sub> and ΔT<sub>2</sub> and comment on the differences.

(2 marks)

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Maximum temperature reached (°C)	29.0
Initial temperature (°C)	22.0
Change in temperature, ΔT <sub>2</sub> (°C)	7.0

**PROCEDURE II**

- (i) Fill a burette with **solution C**.
- (ii) Filter the mixture obtained in **procedure I (b)** into a 250 ml volumetric flask. Wash the residue with distilled water and add into the flask. Add more distilled water to make up to the mark. Label this as **solution B<sub>2</sub>**.
- (iii) Using a pipette and a pipette filler, place 25.0 cm<sup>3</sup> of **solution B<sub>2</sub>** into a 250 ml conical flask. Titrate **solution B<sub>2</sub>** with **solution C** until a permanent pink colour just appears. Record the readings in **Table 3**.

Repeat step (iii) and complete **Table 3**.

- (d) **Table 3**

	<b>I</b>	<b>II</b>	<b>III</b>
Final burette reading	5.7	5.8	5.7
Initial burette reading	0.0	0.0	0.0
Volume of <b>solution C</b> used, cm <sup>3</sup>	6.7	6.8	6.7

(4 marks)

- (e) Calculate the average volume of **solution C** used.

(1 mark)

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- (f) The equation for the reaction between manganate(VII) and iron(II) ions is:



Calculate the number of moles of:

- (i) potassium manganate(VII) used. (1 mark)

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- (ii) iron (II) ions in 25.0 cm<sup>3</sup> **solution B** (1 mark)

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- (iii) iron that reacted with copper(II) sulphate. (1 mark)

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- (g) Determine the mass of iron that reacted. (RAM of Fe = 55.8) (1 mark)

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2. You are provided with:

- **Solid K**
- Aqueous ammonia
- Aqueous sodium sulphate
- Dilute nitric(V) acid
- Wooden splint

**Solid K** is suspected to be **lead(II) carbonate**.

- (a) From the reagents provided, select and describe **three** tests that could be carried out **consecutively** to confirm if **solid K** is lead(II) carbonate. Write the tests and expected observations in the places provided.

(i)

Test 1	Expected Observations

(1 mark)

(1 mark)

(ii)

Test 2	Expected Observations

(1 mark)

(1 mark)

(iii)

Test 3	Expected Observations

(1 mark)

(1 mark)

- (b) Carry out the tests described in (a) using **solid K** and record the observations and inferences in the spaces provided.

(i) Test 1

Observations	Inferences

(½ mark)

(½ mark)

(ii) Test 2

Observations	Inferences

(1 mark)

(2 marks)

(iii) Test 3

Observations	Inferences

(1 mark)

(1 mark)



3. You are provided with an organic compound **solid M**. Carry out the following tests. Record the observations and inferences in the spaces provided.

- (a) Place **all** of **solid M** in a boiling tube. Add about 10 cm<sup>3</sup> of distilled water and shake. Retain the solution for use in procedure (b) (i), (ii) and (iii).

Observations	Inferences

(1 mark)

(1 mark)

- (b) Use about 2 cm<sup>3</sup> portions of the mixture in a test tube for tests (i), (ii) and (iii).

- (i) To the first portion, add all the solid sodium carbonate provided.

Observations	Inferences

(1 mark)

(1 mark)

- (ii) To the second portion, add two drops of acidified potassium manganate(VII) and warm the mixture.

Observations	Inferences

(1 mark)

(2 marks)

- (iii) To the third portion, add about 2 cm<sup>3</sup> of acidified potassium dichromate(VI). Heat the mixture to boiling and allow to stand for about 2 minutes.

Observations	Inferences

(1 mark)

(1 mark)



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