Name……**Index No**……

School……**Candidate's Signature**…… **Date**……

233/3

CHEMISTRY

PAPER 3

PRACTICAL

MARCH / APRIL 2018

2 ¼ HOURS

INSTRUCTIONS TO CANDIDATES

(a) Write your name and index number in the spaces provided above.

(b) Answer all the questions in the spaces provided.

(c) Mathematical tables and silent electronic calculators many be used.

(d) All working must be clearly shown where necessary.

FOR EXAMINER'SUSE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	23	
2	12	
3	5	
TOTAL SCORE	**40**	

This paper consists of 8 printed pages

1. You are provided with:

- **1.5 g** of solid **P**, a metal hydrogen carbonate, **$MHCO_3$**.
- Hydrochloric acid, solution **Q**.
- Solution **R**, which was prepared by dissolving **10.5g** of $MHCO_3$ in about 100cm³ of distilled water and topping up to 250ml mark of the volumetric flask.

You are required to:

- Standardize solution Q using solution R.
- Determine the enthalpy change for the reaction between solution Q, hydrochloric acid and solution R, MHCO3(aq).

Procedure I

(i) Pipette exactly 25.0cm³ of solution R into a clean 250ml conical flask.
(ii) Add two drops of methyl orange indicator and shake.
(iii) Fill the burette with solution Q.
(iv) Titrate solution R with solution Q from the burette. Stop titrating when a permanent colour JUST appears, and record your results in the **table I** below.
(v) Repeat steps **(i)** to **(iv)** and complete **table I** below.

Table I

Titration Number	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution Q used **(cm³)**			

(4 marks)

a) Calculate the average volume of solution Q used. (1 mark)

b) Calculate the concentration of R in moles per litre (RFM of $MHCO_3$ = 84) (2 marks)

c) Calculate the number of moles of solution R in 25cm³ used. (1 mark)

d) Calculate the number of moles of solution Q in the average titre. (1 mark)

e) Calculate the molarity of solution Q. (1 mark)

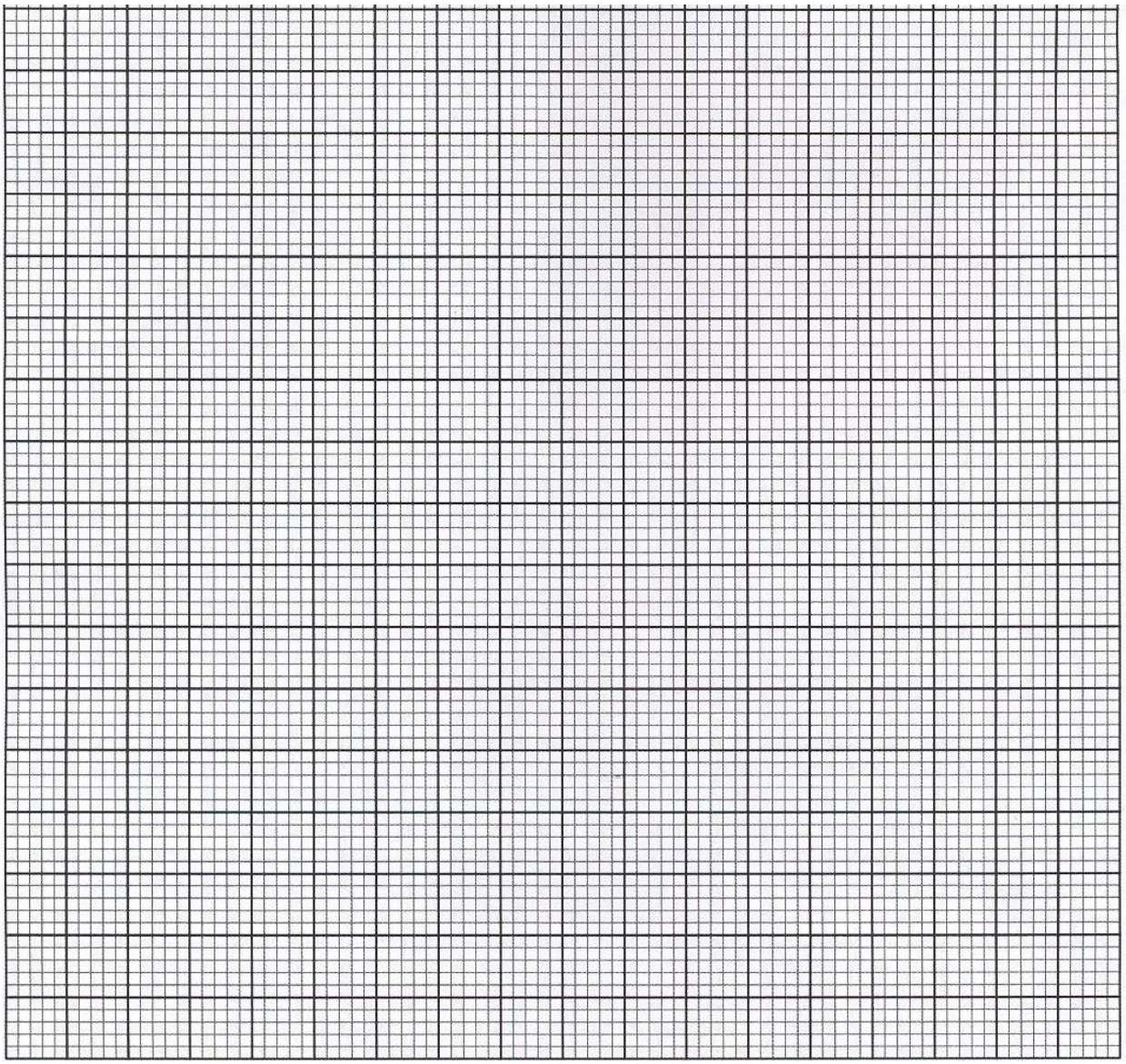
PROCEDURE II.

(i) Fill the burette with solution Q.
(ii) Measure exactly **35.0 cm³** of solution Q from the burette and place it in a clean 250cm³ plastic beaker.
(iii) Using a thermometer, stir and take the temperature of solution Q every 30 seconds.
(iv) Record the readings in **table II** below. At exactly 150 seconds add **ALL solid P** into the contents in the plastic beaker and stir gently. Continue taking the temperature every 30 seconds and complete the **table II** below.

Table II (5 marks)

Time (s)	0	30	60	90	120	150	180	210	240	270	300
Temp (^{0}c)											

a) On the grid provided, plot a graph of temperature (Y -axis) against time. (3 marks)



b) From your graph, determine the highest change in temperature. **(1½ marks)**

c) Calculate the;

(i) Enthalpy change in Joules for the reaction when 1.5g of solid P was used (specific heat capacity of the solution is $4.2Jkg^{-1}k^{-1}$, density of solution is $1.0gcm^{-3}$) **(2 marks)**

(ii) Molar enthalpy change for the reaction. **(1½ marks)**

2. You are provided with the following:

- Solid **A**
- Aqueous ammonia solution
- Distilled water
- Barium chloride solution
- Dilute nitric (V) acid

Solid A is suspected to be **zinc sulphate**.

(a) Describe **three consecutive tests** that can be carried out in the laboratory to confirm whether solid A is **zinc sulphate** or **not**. Write the test(s) and the expected observations in the spaces provided below.

Test 1	**Expected observations**
(1 mark)	(1 mark)

Test 2	Expected observations
(1 mark)	(1 mark)

Test 3	Expected observations
(1 mark)	(1 mark)

(b) Carry out the tests described in **(a)** above and record your observations and inferences in the spaces provided.

Test 1

Observations	Inferences
(1 mark)	(1 mark)

Test 2

Observations	Inferences
(1 mark)	(1 mark)

Test 3

Observations	Inferences
(1 mark)	(1 mark)

3. You are provided with an **organic** compound **solid B**. You are required to carry out the tests below. Write your observations and the inferences in the spaces provided.
Place a spatula-endfull of solid B into a clean boiling tube. Add about **15cm³** of distilled water and shake the mixture thoroughly.
Use **about 2cm³ portions** for the **tests (a)-(c)** below.

(a)Add 2 drops of acidified potassium manganate (VII) solution and shake.

Observations	**Inferences**
(1 mark)	(1 mark)

(b) Add 2 drops of acidified potassium dichromate (VI) solution and warm.

Observations	**Inferences**
(1 mark)	(1 mark)

(c) Add half spatula-endfull of solid sodium hydrogen carbonate.

Observations	**Inferences**
($^1/_2$ mark)	($^1/_2$ mark)