Name: …… **Index no** ……

School: …… **Candidate's sign** ……

Date: ……

233/3

CHEMISTRY

TERM 2 2019

TIME: 2 ¼ HOURS

INSTRUCTIONS TO CANDIDATES:

(a) Write your name and index number in the spaces provided.
(b) Sign and write the date of examination in the spaces provided
(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 2 ¼ 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 you may need.
(e) All working MUST be clearly shown where necessary.
(f) Mathematical tables and electronic calculators may be used.
(g) Candidates should check the questions to ascertain that all pages are printed as indicated and that no questions are missing.

For Examiner's Use Only:

Question	Maximum score	Candidates score
1	22	
2	8	
3	10	
Total score	40	

1. You are provided with:

- A monobasic acid HA, solution J.
- Sodium carbonate solution, solution Q, containing 1.325g in 250cm^3 of solution.
- Solution R, containing 15.75g of $M(OH).8H_2O$ per litre.
- Screened methyl orange indicator.

You are required to:

- Standardize solution J.
- Determine the relative atomic mass of element M in $M(OH)_2.8H_2O$.

Procedure 1

Fill the burette with solution J. Pipette 25cm^3 of solution Q into a clean 250ml conical flask and add 2 – 3 drops of screened methyl orange indicator. Titrate this solution with the solution in the burette and record your results in table 1 below. Repeat this procedure and complete the table. **Retain solution J in the burette for use in procedure II**.

Table 1

Titre	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of J used (cm^3)			

(4 marks)

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

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……

b) Determine the concentration of solution Q in moles per litre (Na=23, C=12, O=16 (1 mark)

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……

c) (i) Determine the number of moles of the monobasic acid solution, HA, that are in the

averaged value calculated in (b) above. (1 mark)

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(ii) Determine the concentration of solution J in moles per litre. (1 mark)

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Procedure 2

- Using a 25cm^3 measuring cylinder, transfer 25cm^3 of solution R into a clean 250ml conical flask. Using a 100ml measuring cylinder, transfer 75cm^3 of solution Q into the flask with solution R. Boil the mixture for about 5 minutes. After cooling filter into a conical flask and transfer the filtrate into a clean 100ml measuring cylinder and add distilled water to make exactly 100cm^3 of solution. Label this solution as solution S.

Pipette 25cm^3 of solution S into a conical flask and titrate it with solution J using 2 drops of screened methyl orange indicator. Record your results in table 2 below. Repeat this to complete the table.

Table 2

Titre	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **J** used (cm^3)			

(4 marks)

d) Calculate the average volume of solution J used. (1mark)

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……

e) Determine the number of moles of:

(i) The monobasic acid, HA, in the average volume. (1 mark)

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(ii) Sodium carbonate in $25cm^3$ of solution S. (1 mark)

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(iii) Sodium carbonate in $75cm^3$ of solution S. (1 mark)

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iv) Sodium carbonate in the original 75cm^3 of solution S. (1 mark)

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v) Sodium carbonate that reacted with solution R. (1 mark)

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vi) M $(OH)_2$. $8H_2O$ in 25cm^3 of solution R. (1 mark)

(1 mole of M $(OH)_2$. $8H_2O$ reacts with one mole of sodium carbonate)

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f) Determine

(i) the concentration of solution R in moles per litre. (1mark)

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(ii) the relative formula mass of $M(OH)_2.8H_2O$. (1 mark)

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(iii) the relative atomic mass of M (O=16.0, H=1.0) (1mark)

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2. You are provided with:
Solid P, 2.0 g of a dibasic acid H_2X.

You are required to determine the molar heat of solution of solid P.

PROCEDURE

Place $30cm^3$ of distilled water into a 100ml beaker. Measure the initial temperature of the water and record it in the table below. Add all the solid P at once and stir the mixture carefully with the thermometer until all the solid dissolves. Measure the final temperature reached and record it in table.

Final temperature (^oC)	
Initial temperature (^oC)	

(3 mks)

a) Determine the change in temperature, ΔT. (1 mk)

……

b) Calculate the:

i) heat change when H_2X dissolves in water. (Assume the heat capacity of the solution is 4.2 $Jg^{-1o}C^{-1}$ and density is $1g/cm^3$) (2 mks)

ii) number of moles of the acid that were used. (Relative formula mass of H_2X is 126) (1mk)

iii) molar heat of solution, ΔH, of the acid H_2X. (1mk)

3.You are provided with solid **G**.Place all solid **G** in a boiling tube.Add distilled water and shake.Divide the resulting solution into three portions.

Inferences	0bservations
(½ mk)	(½ mk)

i)To the first portion add drops of 2M sodium hydroxide.

Inferences	0bservations
(½ mk)	(½ mk)

ii)To the second portion dip a metallic spatula in the solution and burn it directly on a non-luminous flame.

Inferences	0bservations
(½ mk)	(½ mk)

iii)To the third portion add three drops of barium nitrate solution followed by $2cm^3$ of 2M hydrochloric acid.

Inferences	0bservations
(½ mk)	(½ mk)

iv) To the fourth portion add three drops of acidified potassium dichromate (VI) solution.

Inferences	0bservations
(½ mk)	(½ mk)

b)You are provided with solid **F.** Carry out the tests below and record your observations and inferences in the spaces provided

(i) Using a metallic spatula, heat half of solid F in a non-luminous bunsen burner flame .

Inferences	0bservations
(½ mk)	(½ mk)

(ii) Put a half spatula endful of solid **F** into a boiling tube. Add about 10cm^3 of distilled water and shake.

Inferences	0bservations
(½ mk)	(½ mk)

Divide the resulting solution from a(ii) above into two portions

(i) To the first portion,2 -3 drops of universal indicator and determine its pH.

Inferences	0bservations
(½ mk)	(½ mk)

(ii) To the second portion, add two drop of acidified potassium Manganate (VII) solution and shake.

Inferences	0bservations

(½ mk)	(½ mk)

(c) Put half spatula endful of solid **F** into a boiling tube and add 5 drops of ethanol followed by 2 drops of concentrated sulphuric (VI) acid.warm the mixture.

Inferences	0bservations
(½ mk)	(½ mk)