Name .... Index No. ....

School .... Candidates signature ....

Date ....

233/3
CHEMISTRY
Paper 3
July/August 2016
Time : 2¼ Hours

WESTLANDS SUB-COUNTY JOINT EXAMINATION
Kenya Certificate of Secondary Education

CHEMISTRY
Paper 3
July/August 2016
Time : 2¼ Hours

INSTRUCTIONS TO CANDIDATES

* Write your name and index number in the spaces provided.
* Sign and write the date of examination in the spaces provided.
* Answer **ALL** questions in the spaces provided in the question paper.
* 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 you may need.
* Mathematical tables and silent electronic calculators may be used.
* All working must be clearly shown where necessary.
* This paper has 7 printed pages.
* Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.

For Examiner's Use Only

Question	Maximum score	Candidate's score
1	13	
2	14	
3	13	
Total score	40	

1. You are provided with :
   - Solution Q, dilute hydrochloric acid
   - Solid R, 1.06g of anhydrous sodium carbonate
   - distilled water in a wash bottle

You are required to determine the concentration of solution Q.

PROCEDURE

Place all solid R in a 100ml volumetric flask and add distilled water to dissolve it completely. Top up with more distilled water to the mark and label it as solution R. Pipette 25.0cm³ of solution R into a 250ml conical flask.
Add 3 drops of phenolphthalein indicator and titrate it with solution Q from the burette.
Record your results in table I below and DO NOT POUR THE CONTENT OF THE CONICAL FLASK. To the contents of the conical flask, add 3 drops of methyl-orange indicator and continue titrating with solution Q from the burette. This time record your results in table II below.
Repeat the titrations to complete the two tables below.

Table 1

	1st	2nd
Final burette reading (cm³)		
Initial burette reading (cm³)		
Volume of solution Q used V_r (cm³)		

(3 marks)

a) Calculate the average volume of solution Q used, V_1. (½ mark)

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Table II

	1st	2nd
Final burette reading (cm³)		
Initial burette reading (cm³)		
Volume of solution Q used V_2 (cm³)		

(3 marks)

b) Calculate the average volume of solution Q used, V_2. (½ mark)

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Calculate :
i) The total volume of solution Q used during the titrations. (1 mark)

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ii) The number of moles present in 25.0cm³ of solution R. (Na = 23.0, O = 16.0, C = 12.0)   (1 mark)

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iii) The number of moles of hydrochloric acid, solution Q which reacted completely with solution R
    using a chemical equation.   (2 marks)

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iv) The concentration of solution Q in moles per litre.   (2 marks)

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2. You are provided with 2.85 g of solid S. You are required to determine the molar heat of solution of
    solid S.

    <u>PROCEDURE</u>
    Fill the burette with distilled water. Measure 28.5cm³ of distilled water from the burette into 100cm³
    plastic beaker. Using a thermometer carefully and gently stir the water as you measure its temperature
    after every half minute. Record your results in table III below. At exactly 90 seconds, add all solid S
    to the water at ONCE. Stir thoroughly and take the temperature of the mixture after every half minute
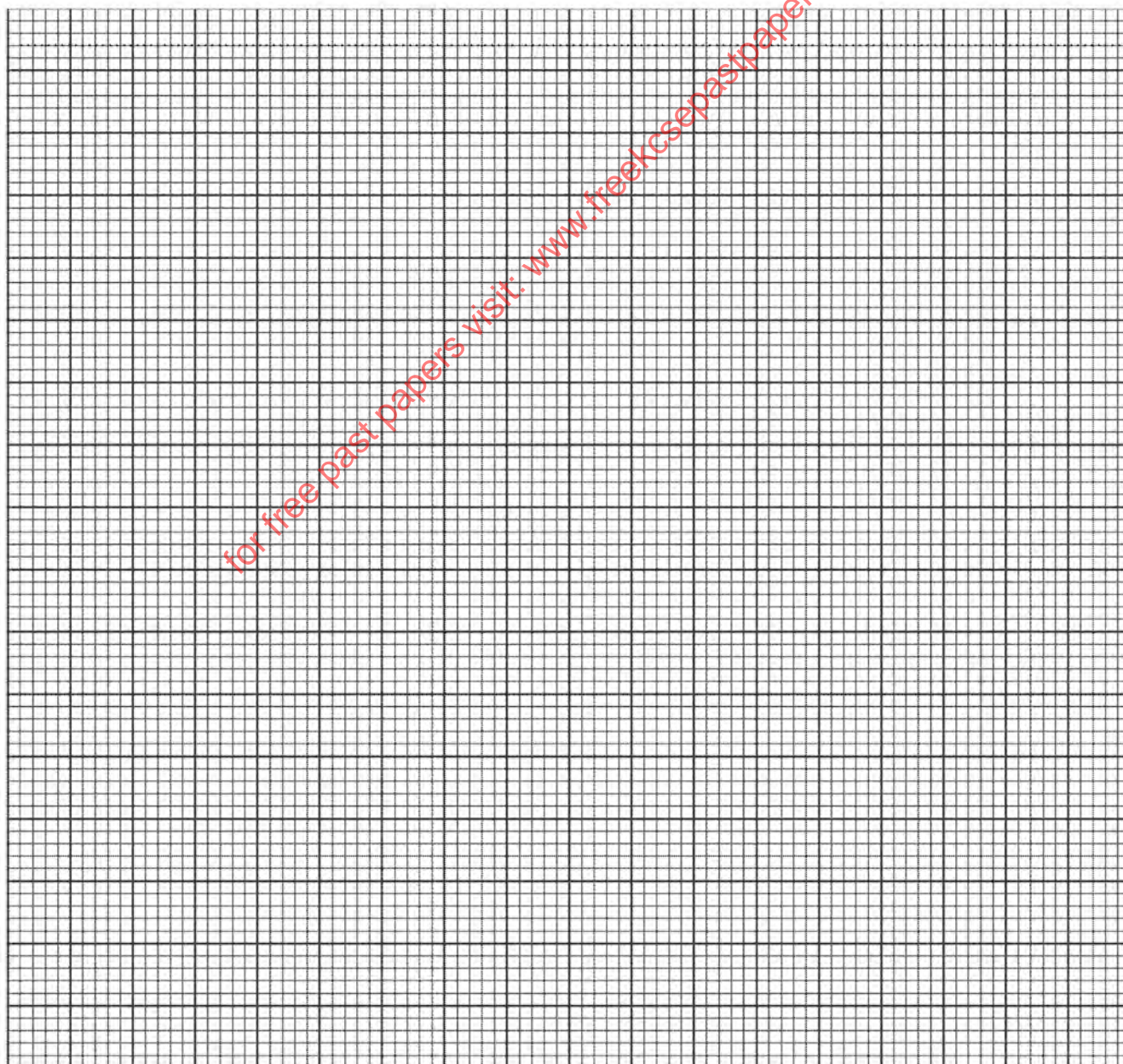   to complete the table III below.

I. Table III

(4 marks)

II. On the grid provided plot a graph of temperature (y-axis) against time (x-axis) (4 marks)

Time (sec)	0	30	60	90	120	150	180	210	240
Temperature (°C)									

III. On the graph show the change in temperature ΔT. (1 mark)

IV. Calculate the heat of solution. (Assume density of solution = $1.0 g/cm^3$, specific heat capacity of solution = $4.2 J/g/°C$) (2 marks)

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V. Calculate the number of moles of solid S used in the experiment.
   (molar mass of solid S = 96g/mol)   (1 mark)

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V. From the answers obtained in IV and V above, determine the molar heat of solution, $\Delta H_{soln.}$
                                                                        (2 marks)

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3. **a)** You are provided with solid T. Carry out the tests below and write down your observations and
        inferences in the spaces provided.

    i) Dissolve all the solid T provided in about 10cm^3 of distilled water in a boiling tube.
       Observations   Inferences

                            (½mk)   (½mk)

    ii) Divide the solution obtained in (i) above into four equal portions and use about 2cm^3 of each
        portion for the tests below.
    I. To the 1st portion, add about 2cm^3 of $BaCl_{2(aq)}$ solution.
        Observations   Inferences

                            (1mk)   (1mk)

    II. To the 2nd portion, add about 2cm^3 of $Pb(NO_3)_{2(aq)}$ solution and heat to boiling.
        Observations   Inferences

| | (1mk) | | (1mk) |

III.   To the 3rd portion, add $NH_{3(aq)}$ dropwise untill in excess.

Observations	Inferences
(1mk)	(1mk)

IV. To the 4th portion, test the solution using both red and blue litmus papers.

Observations	Inferences
(1mk)	(½mk)

iii) Write the formula of the cation present in solid.

T .... (½ mark)

b) You are provided with solid U. Carry out the tests below and write down your observations and inferences in the spaces provided.

i) Take about half spatula endful of the solid provided and put in a Bunsen burner flame.

Observations	Inferences
(½mk)	(½mk)

ii) Dissolve the remaining solid U in about 5cm^3 of distilled water in a boiling tube and divide the solution into two equal portions. Use the portions for the tests below.

I. To the 1st portion, add about 2cm^3 of acidified potassium manganate (VII)

Observations	Inferences

(1mk)	(1mk)

II. To the 2nd portion, test the solution using a pH paper.

Observations	Inferences
(½mk)	(½mk)