Name _____ Index No.

Kenya Certificate of Secondary Education

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SERIES 4

CHEMISTRY

PAPER 3

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	15	
2	12	
3	13	
TOTAL SCORE	**40**	

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1.   You are provided with"

        - Solution C_1 which is a solution of a dibasic acid, $H_2C_2O_4$. XH_2O containing 5.04g in 500cm^3

          of solution.

        - Solution C_2 which is a 0.2M solution of sodium hydroxide.

        You are required to:-

        -      Determine the value of X in the formula $H_2C_2O_4.XH_2O$ (H =1, C = 12, O = 16)

Procedure

Fill the burette with solution C_1. Pipette 25cm^3 of solution C_2 into a clean dry conical flask. Add 2 drops of phenolphthalein indicator and titrate against C_1 until the indicator just turns colourless.

Repeat the procedure two more times and complete the table below.

        (4 marks)

Titration	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution C_1 used (cm^3)			

(a) Calculate the average volume of C_1 used.   (1 mark)

(b) Calculate the moles of the acid, C_1 reacting. (3 marks)

(c) Calculate the concentration of the acid, C_1 in moles / liters. (2 marks)

(d) Calculate the relative formula mass of the acid. (3 marks)

(e) Hence determine the value of X in $H_2C_2O_4.XH_2O$. (2 marks)

2.   You are provided with:

   - 5g of solid K

   - Distilled water

You are required to determine solubility of solid K at different temperatures.

Procedure

Transfer solid K into a boiling tube. Using a 10ml measuring cylinder, measure $10cm^3$ of water into the boiling tube. Heat the mixture while stirring with the thermometer to about 90^0C. When all the solid has dissolved, allow the solution to cool while stirring with the thermometer. (Cooling of the solution can be speeded up by dipping the boiling tube in cold water in a glass beaker for a few seconds.)

Record the temperature at which the crystals of solid K first appear. In the table below.

Retain the boiling tube and its contents for further experiments.

Measure $5cm^3$ of distilled water and add to the mixture in the boiling tube. Heat until the crystals dissolve, then cool while stirring with a thermometer.

Record the temperature at which the crystals again start to reappear.

Repeat this procedure, each time adding more $5cm^3$ of distilled water, heating, cooling and recording the crystallization temperature until the table is completely filled.

Total volume of water added to 5g of solid K (cm^3)	10	15	20	25	30	35
Temperature at which crystals appear (^0C)						
Solubility of K in g/100g of water						

(a)   Complete the table and calculate the solubility of solid K in g/100g of water at

different temperatures.   (6 marks)

(b) On the grid provided, plot a graph of solubility of solid K against temperature.   (3 marks)

(c) From the graph determine:-

(i) The solubility of K at 25^0C.   (1 mark)

(ii) The temperature when the solution will contain 22g of K.   (1 mark)

(d) From your results calculate the mass of K that will crystallize out when a hot

solution at 52^0C is cooled to 37^0C.   (1 mark)

3.   You are provided with solid F and P. Carry out the tests below. Write your observations and

      inferences in the spaces provided.

      (a)   Using a clean spatula heat the solid F in a Bunsen burner flame.

Observations	Inferences
(½ mark)	(½ mark)

      (b)   Place the remaining portion of the solid F in a boiling tube. Add about 10cm^3 of distilled

             water. Stir and filter. Keep the residue for further tests. Divide the filtrate into four

             portions.

      (i)   To the first portion, add sodium hydroxide solution till in excess.

Observations	Inferences
(1mark)	(1 mark)

(ii)   To the second portion, add ammonium hydroxide solution till in excess.

Observations	Inferences
(1 mark)	(½ mark)

(iii)   To the third portion, add lead (II) nitrate solution then warm.

Observations	Inferences
(1 mark)	(½ mark)

(iv)   To the fourth portion, add barium chloride solution followed by hydrochloric acid.

Observations	Inferences

(½ mark)	(½ mark)

(c)   Dissolve the residue into about $5cm^3$ of 2M hydrochloric acid and record your observation

and make inferences.

Observations	Inferences
(½ mark)	(½ mark)

(d)   Carry out the following tests on P.

(i)   Using a clean metallic spatula heat solid P in a Bunsen burner flame.

Observations	Inferences
(½ mark)	(½ mark)

(ii)   Put two spatulafuls of P in a boiling tube. Add $10cm^3$ of distilled water. Warm the

        mixture to dissolve and divide the solution into three portions.

I)   To the first portion, add sodium hydrogen carbonate.

Observations	Inferences

(½ mark)	(½ mark)

II)   To the second portion add 3 drops of conc. H_2SO_4. Shake well and add $1cm^3$ of

ethanol and warm the mixture.

Observations	Inferences
(½ mark)	(½ mark)

III)   To the third portion, add 1-2 drops of acidified potassium manganate (VII) solution.

Observations	Inferences
(1 mark)	(1 mark)