Name……. **Index No**……/…….

School…… **Candidates Signature**……

Date ……..

Kenya Certificate of Secondary Education (K.C.S.E)

CHEMISTRY

Paper 3

PRACTICAL

2 ¼

Instructions to candidates

- Write your name and Index Number in the spaces provided above.
- Sign and write date of examination in the spaces provided above.
- 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 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 that you may need.
- All workings **MUST** be clearly shown where necessary.
- Mathematical tables and silent electronic calculators may be used.

For Examiners use only.

Question	Maximum Score	Candidates Score
1	12	
2	12	
3	16	
TOTAL SCORE	40	

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1 You are provided with 3.6 g of solid **P** in a boiling tube.

You are required to determine the solubility of solid **P** at different temperatures

Procedure

a) Using a burette, add 4 cm^3 of distilled water to solid **P** in the boiling tube. Heat the mixture while stirring with the thermometer to about 80^0C. When the entire solid has dissolved, allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid **P** first appear. Record this temperature in table one.

b) Using the burette, add 2cm^3 of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until the entire solid dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid **P** first appear.

c) Repeat procedure (b) two more times and record the temperatures in table 1.

d) Complete table 1 by calculating the solubility of solid **P** at the different temperatures. The solubility of a substance is the mass of that substance that dissolves in 100 cm^3 (100g) of water at a particular temperature.

Table 1

Volume of water In the boiling tube (cm^3)	Temperature at which Crystals of solid **P** first appear (^0C)	Solubility of solid **P** (g/100g water)
4		
6		
8		
10		

(ii) On the grid provided, plot a graph of the solubility of solid **P** (vertical axis) against temperature. (4mks)

Ask for Graph paper

(iii) Using your graph, determine the temperature at which 100g of solid **P** would dissolve in 100cm^3 of water. (1mk)

(iv) Using your graph determine the temperature at which 30 g of P dissolves in 60 g of water (1mk)

2. You are provided with

- Solution Y_1 containing 7.3gl^{-1} of hydrochloric acid
- Solution Y_2, containing 14.3g of hydrated sodium carbonate, $Na_2CO_3.XH_2O$ (washing soda) dissolved in 500cm^3 of water and diluted to 1 litre
- You are required to standardize Y_2 ($Na_2CO_3.XH_2O$) using Y_1 (HCl)
- Determine the number of moles of water of crystallization in hydrated sodium carbonate.

Procedure:

- Fill the burette with solution Y_2 ($Na_2CO_3.XH_2O$)
- Pipette 25.0cm^3 of solution Y_1 into 250cm^3 conical flask
- Add 2 – 3 drops of phenolphthalein indicator and titrate with Y_2. Record your readings in table 2 below.

(a)

	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution Y_2 Used (cm^3)			

(4mks)

(i) Determine the average volume of solution Y_2 used (1mk)

(ii) Write the chemical equation for the reaction between dilute hydrochloric acid and sodium carbonate

solution. (1mk)

(b) Calculate:

(i) The molar concentration of hydrochloric acid solution Y_1 (2mks)

(ii) The molar concentration of Na_2CO_3. xH_2O solution Y_2. (2mks)

(iii) The relative formula mass of $Na_2CO_3.XH_2O$ (1mk)

(iv) The value of X in $Na_2CO_3.xH_2O$ (1mk)

3. a) You are provided with the following solids:-

- Sodium Chloride, Potassium Chloride, Calcium Chloride, Barium Chloride and Solid G
Note: Solid G will also be required for question 3. b)
- You are required to carry out flame tests on the above solids to identify the flame colour of the cations present in each of them
Procedure:
Clean a metallic spatula and raise it with distilled water. Dry the spatula on the Bunsen burner flame for about 1minute. Allow it to cool, place a little of Sodium Chloride solid on the spatula and burn it strongly with a non-luminous Bunsen burner flame. Note the colour of the flame as the solid burns and record it in table III. Clean the spatula thoroughly using steel wool and repeat the procedure using each of the other solids and complete table III.

Table III

Solid	Colour of Flame
Sodium Chloride	(½ mk)
Potassium Chloride	(½ mk)
Calcium Chloride	(½ mk)
Barium Chloride	(½ mk)
Solid G	(½ mk)

What cation is present in solid G? (½mk)

……

……

b) You are provided with solid G
Carry out the tests below and record your observations and inferences in the spaces provided.
Identify any gases produced.

i) Place a little of solid G in a dry test tube and heat strongly

Observation	Inferences

(2mks)	(1mk)

ii) Place the remainder of solid G in a boiling tube. Add about $10cm^3$ of distilled water and shake well.

Observation	Inferences
(1mks)	(1mk)

iii) Divide the mixture into three portions for tests I to III below.

I To the first portion, add 2 – 3 drops of aqueous sodium hydroxide until in excess.

Observation	Inferences
(1mks)	(1mk)

II To the 2nd portion, add 2 – 3 drops of Barium Chloride solution followed by dilute hydrochloric acid solution F

Observation	Inferences
(1mks)	(1mk)

III To the 3rd portion, add about 1cm3 of acidified potassium Manganate (vii) solution.

Observation	Inferences
(1mks)	(1mk)