NAME: ……………………………………………… INDEX NO………….………..……

SCHOOL: ………………………………………… DATE: ………………....….………

CLASS ……………………ADM. NO…………………………SIGNATURE……………………

MUMIAS WEST SUB – COUNTY JOINT EVALUATION
Kenya Certificate of Secondary Education (K.C.S.E.)

233/3
CHEMISTRY
PAPER 3
JUNE/ JULY - 2022
TIME: $2^1/_4$ HRS

INSTRUCTIONS TO CANDIDATES:

- *Answer **all** the questions in the spaces provided.*
- *Write your **name** and **index number** in the spaces provided above.*
- *You are **not allowed** to start working with the apparatus for the first 15 minutes of the $2^1/_4$ 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 needed.*
- *Mathematical tables and electronic calculators may be used for calculations.*
- *All workings **must** be clearly shown where necessary*
- *This paper consists of **7** printed pages. Candidates should check 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	**22**	
2	**9**	
3	**9**	
Total Score	**40**	

1. *You are provided with:*

   - 4.5g of solid **P** in a boiling tube

   - 0.2M sodium hydroxide solution Q

   You are required to determine:

   I) the solubility of solid **P** at different temperatures

   II) The value of **'n'** in the formula of compound **P,** (HX)$_n$. $2H_2O$.
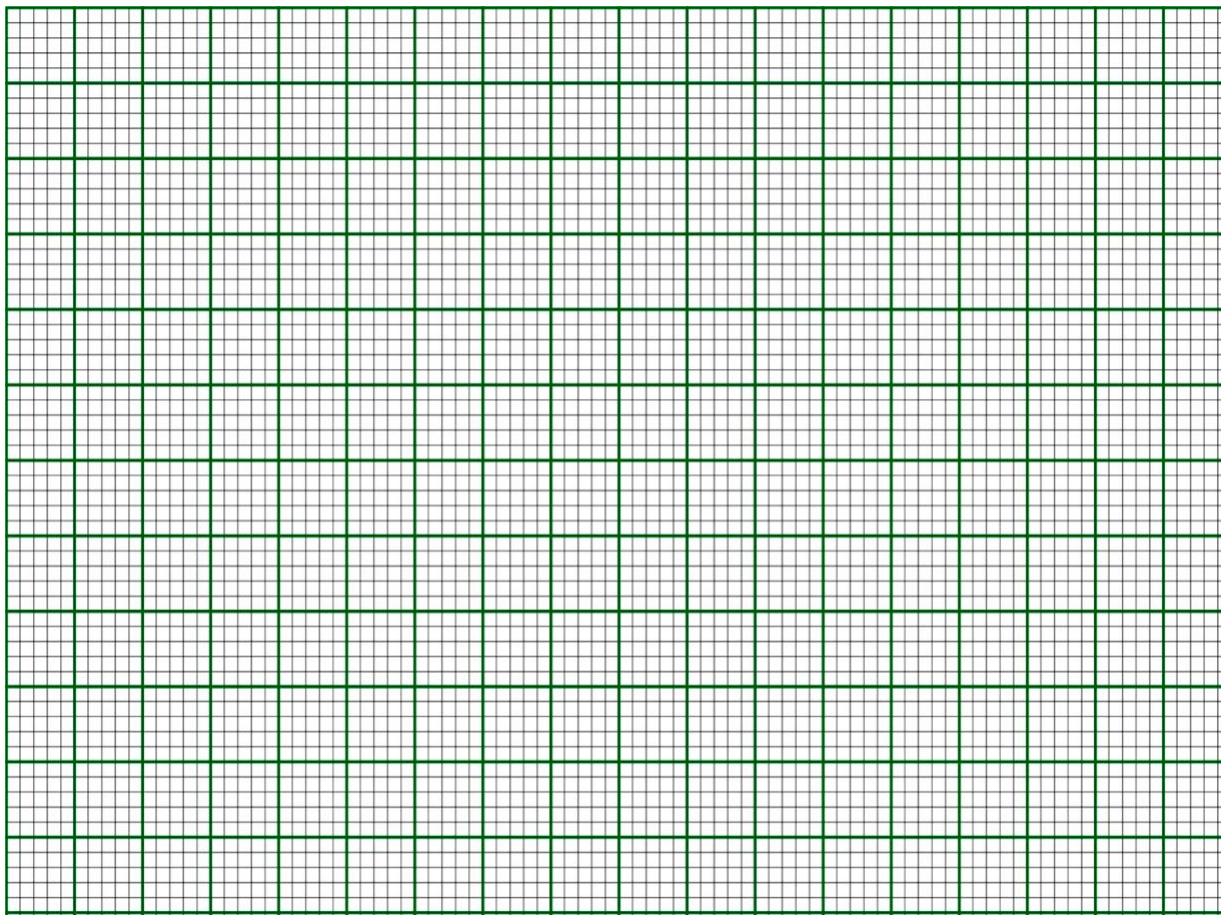
PROCEDURE I

    i) a)   Fill the burette with distilled water. Using the burette, add 4.0cm^3 of distilled water to solid **P** in a boiling tube. Heat the mixture in a water bath while stirring with a thermometer to about 70^{0}C until all the solid dissolves.

    b)   Allow the solution to cool while stirring with the thermometer and note the temperature at which crystals of solid **P** start to appear. Record this temperature in table **I**.

    c)   Using the burette, add 2.0cm^3 of distilled water to the contents of the boiling tube. Heat the mixture while stirring with the thermometer until all the solid dissolves while in the water bath.

    d)   Allow the mixture to cool while stirring and note the temperature at which crystals of solid **P** start to appear. **(FOR FATER COOLING PROCESS, USE COLD TAP WATER)**

    e)   Repeat the procedure (c) and (d) three more times, heating the solution in a water bath and record the temperature in the table. *Retain the contents of the boiling tube for use in procedure II*.

ii)   Complete the table 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 100cm^3(100g) of water at a particular temperature.

    Table I

Volume of water in the boiling tube (cm^3)	Temperature at which crystals of solid P first appear (^{0}C)	Solubility of solid P (g/100g) of water
4		
6		
8		
10		
12		

(6marks)

i)   On the grid provided plot a graph of the solubility of solid **P** against temperature   (3marks)

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

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iii) Determine the solubility of solid **P** at 55^{0}C   (1mark)

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PROCEDURE II

Transfer the contents of the boiling tube into a 250ml volumetric flask. Rinse the boiling tube and the thermometer with distilled water and add to the volumetric flask. Add more distilled water to make up

to the mark. Label this solution **P**.

Fill the burette with solution **P**. Using a pipette place 25.0cm^3 of solution **Q** into a conical flask. Titrate solution **Q** with solution **P** using phenolphthalein indicator.

Table II

	I	II	III
Final burette reading cm^3			
Initial burette reading cm^3			
Volume of solution **P** used cm^3			

(4 marks)

Calculate:

I) Average volume of solution **P** used in the experiment. (1mark)

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II) Number of moles of sodium hydroxide used in solution **Q**. (2marks)

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III) Number of moles of solution **P** in the average volume given that the relative formula mass

of **P**, (HX)$_n$. 2H$_2$O is 126. (2marks)

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IV) The number of moles of sodium hydroxide required to react with one mole of **P**. Hence find

the value of **n** in the formula (HX)$_n$ .2H$_2$O (2marks)

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2.   You are provided with **solid A**. Use it to carry out the following tests. Write the inferences and observations in the spaces provided.
a) Place all of **solid A** in a boiling tube. Add about 8cm^3 of distilled water and shake. Divide the solution formed into 4 portions.

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Observations	Inferences
(½ mark)	(½ mark)

b) To the first portion, add sodium hydroxide drop wise until in excess

Observations	Inferences
(1mark)	(1 mark)

c)   To the second portion, add ammonia solution drop wise until in excess.

Observations	Inferences
(1 mark)	(1mark)

d) To the third portion, add 3 drops of sodium chloride solution

Observations	Inferences
(1 mark)	(1mark)

e) To the fourth portion add about 3 drops of barium nitrate followed by 4 drops of dilute nitric (V) acid

Observations	Inferences

(1 mark)	(1mark)

3.   You are provided with an organic compound, **solid Q**. Use it to carry out the following tests
        a) Scoop about a third of the solid B using a metallic spatula and ignite it on the non-luminous flame of the Bunsen burner

Observations	Inferences
(1mark)	(1/2mark)

b) (i) Place the remaining solid B in a clean boiling tube, add about 10cm^3 of distilled water and shake. Divide the resulting solution into six (3) portions

Observations	Inferences
(1mark)	(1 mark)

ii)   To the first portion of the solution, add 2 drops acidified potassium manganite (vii) and warm

Observations	Inferences

(1 mark)	(1mark)

iii)   To the third portion of the solution, add 2 drops of acidified potassium dichromate (VI)

Observations	Inferences
(1 mark)	(1 mark)

iv)   To the fourth portion, add in the whole of solid sodium hydrogen carbonate provided

Observations	Inferences
(1mark)	($^{1}/_{2}$mark)