NAME: …… **INDEX NO: ……..……..……**

SCHOOL: …… **DATE: ……...…..……**

CANDIDATE'S SIGN ……..…..……..

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SERIES 34 EXAMS

233/3
CHEMISTRY
PAPER 3

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*

For Examiner's Use only:

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	**22**	
2	**10**	
3	**8**	
Total Score	**40**	

This paper consists of 6 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

1. ***You are provided with:***

- 4.5g of solid **P** in a boiling tube
- Solution **Q**, 0.2M sodium hydroxide
- Phenophthalein indicator.

You are required to determine:

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

II) The value of **n** in the formula $(HX)_n \bullet 2H_2O$ of solid **P.**

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 70^0C 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.

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(100gm) 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		

(6mks)

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

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

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

PROCEDURE II

1. 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 and pipette filler place 25.0cm^3 of solution **Q** into a conical flask. Titrate solution **Q** with solution **P**. Using phenolphthaline indicator.

Table II

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

(4mks)

Calculate the;

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

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

III) Number of moles of solution **P** given that the relative formula mass of **P**, $(HX)_n \bullet 2H_2O$ is 126. (2mks)

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 $(HX)_n \bullet 2H_2O$ (2mks)

2. You are provided with a solid labelled **D**. Carry out the following test, record the observation and make the correct inferences.

a) Place solid **D** in a boiling tube and add about $40cm^3$ of distilled water while shaking. Filter the mixture and divide the filtrate into four portions, keep the residue for part (b)

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

Observation	**Inferences**
(1mk)	(1mk)

ii) To the second portion, add a few drops of dilute sulphuric (vi) acid.

Observation	**Inferences**
(1mk)	(1mk)

(ii) To the third portion, add few drops of barium nitrate solution. Followed by few drops of dilute hydrochloric acid.

Observation	**Inferences**
(1mk)	(1mk)

b) Place the residue in (a) above in a boiling tube. Add dilute nitric (v) acid while shaking till the solid just dissolves. Divide the solution into two portions.

Observation	**Inferences**
(½mk)	(½mk)

i) To the first portion, add a few drops of sodium hydroxide solution drop wise till in excess.

Observation	**Inferences**

(1mk)	(1mk)

ii) To the second portion, add a few drops of ammonia solution then in excess.

Observation	**Inferences**
(½mk)	(½mk)

3. You are provided with liquid **F**. Carry out the following tests. Write your observations and inferences in the spaces provided.

a) Place about 1cm^3 of solution **F** on a watch glass. Place a burning splint to the solution on the watch glass.

Observation	**Inferences**
(1mk)	(1mk)

b) Place about 2cm^3 of solution **F** in a test tube, add two drops of potassium dichromate.

Observation	**Inferences**
(1mk)	(1mk)

c) Place about 2cm^3 of solution **F** in a 2nd test tube and add bromine water.

Observation	**Inferences**
(1mk)	(1mk)

d) To the 3rd portion of 2cm^3 of solution **F** add a spatula of sodium carbonate provided.

Observation	**Inferences**
(1mk)	(1mk)