233/3
CHEMISTRY
PAPER 3 (PRACTICAL)
Time: $2^{1}/_{4}$ hours

KCSE 2023 TOP PREDICTION MASTER CYCLE 9

Name ……..…… Index Number……/……

Signature ……..…….. Date ……/……/……

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 the 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 required.*
- *ALL working MUST be clearly shown where necessary*
- *Mathematical tables and electronic calculators may be used.*

FOR EXAMINER'S USE ONLY

QUESTION	Max Score	Candidate Score
1	10	
2	13	
3	17	
TOTAL	40	

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

- **Solution H; which is 0.02M Potassium Manganate (VII) which is acidified.**
- **Solution G; which is a mixture of Sodium Oxalate, $Na_2C_2O_4$ and oxalic acid, $H_2C_2O_4$**

You are required to:-

i) Determine the solubility of Sodium Oxalate at room temperature.

ii) Determine the effect of temperature on the rate of reaction of Potassium Manganate (VII) and oxalic acid.

Procedure I

i) Pipette 25.0cm^3 of solution H into a clean conical flask. Heat the contents to about 70^0c.

ii) Titrate the hot solution against solution G to a colourless end point.

Record your results in table I

iii) Repeat steps (i) and (ii) two more times to obtain consistent titres.

Keep the remaining solution G and H for procedure II

Table I

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

(3 marks)

(a) Work out the average volume of solution G used. (1 mark)

(b) (i) Calculate the number of moles of potassium manganate (vii) in 25.0 cm^3 of solution H.

(1 mark)

(ii) Given the following reactions:-

$Na_2C_2O_{4(aq)} \longrightarrow 2Na^+_{(aq)} + C_2O_4^{2-}{}_{(aq)}$

$C_2O_4^{2-}{}_{(aq)} + 2H^+_{(aq)} \longrightarrow H_2C_2O_{4(aq)}$

$2KMnO_{4(aq)} + 5H_2C_2O_{4(aq)} + 3H_2SO_{4(aq)} \longrightarrow K_2SO_{4(aq)} + 2MnSO_{4(aq)} + 8H_2O_{(l)} + 10CO_{2(g)}$

I. Calculate the number of moles of oxalic acid that reacted with Potassium Manganate (VII)

(1 mark)

II. Determine the mass of oxalic acid in the average volume used.

($H_2C_2O_4.2H_2O$) (H= 1.0, C= 12.0, O = 16.0) (1 mark)

(c) Given that solution G was prepared by dissolving 7.68 g of the mixture of oxalic acid and sodium oxalate in 1000cm^3 of a solution.

(i) Using your answer in b (ii) II work out the mass of oxalic acid in 1000 cm^3 of solution G.

(1 mark)

(ii) From your answer above, calculate the mass of sodium oxalate in 1000 cm^3 of the mixture. (1 mark)

(iii) Hence calculate the solubility of sodium oxalate in g/100g of water. (2 marks

Procedure II

i) Using a measuring cylinder, transfer 5.0 cm^3 of solution H into a clean boiling tube.

ii) Using the burette measure 5 cm^3 of oxalic acid, solution G into five test tubes labelled 1 – 5

iii) Heat solution H until it reaches 80^0C.

iv) To the hot solution in (iii) add 5.0 cm^3 of solution G from test tube 1 and start the stop watch at the same time. Stir the mixture using the thermometer and record time taken for the purple colour to disappear.

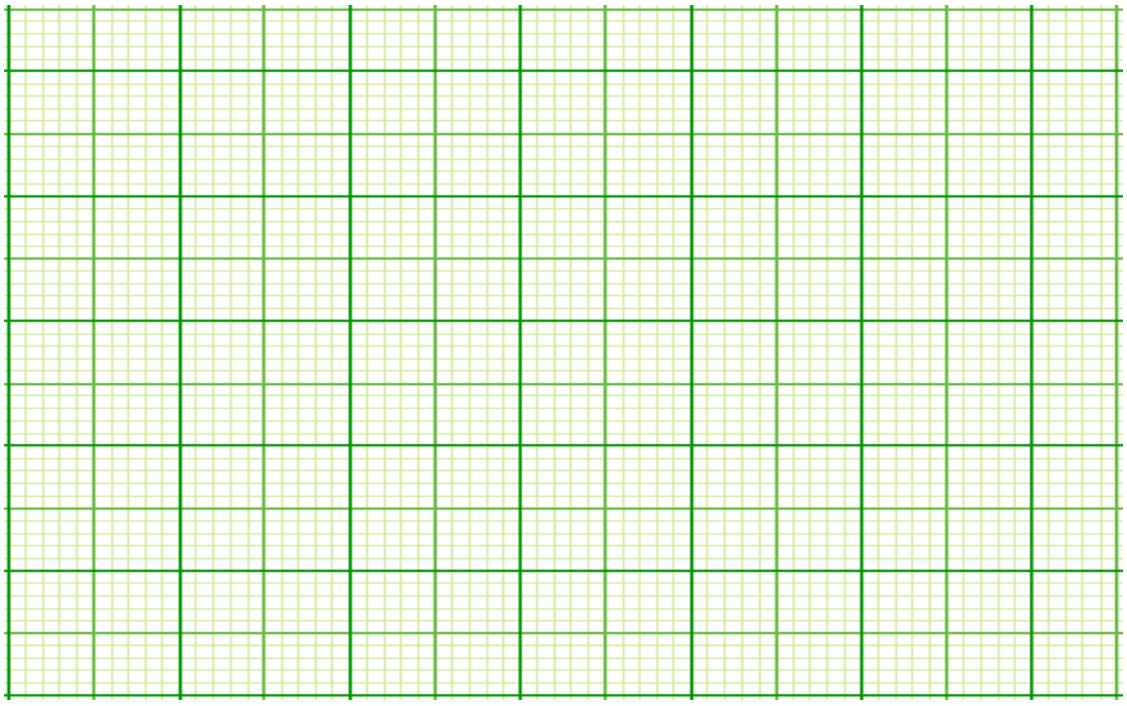
v) Repeat procedure (i) – (iv) at the temperatures shown using contents of test tubes 2, 3, 4 and 5 respectively.

Table II

Temperature before mixing 0^0c	80	70	60	50	40
Time taken for purple colour to disappear in (sec)					
$^1/_{time}(sec^{-1})$					

(4 marks)

(d) On the grid provided, plot a graph of $^1/_t$ (y – axis) against temperature at which time did the purple colour disappear (3marks)



(e) What does $^1/_t$ represent in this experiment. (1 mark)

……..

(f) From the graph:

i) Determine the time taken for the purple colour to disappear at 47.5^0C. (1mark)

……

ii) How does temperature change affect $^1/_t$ in this experiment? Explain. (1 mark)

……

……

2. You are provided with 10 cm^3 of solution J, which contains two cations and one anion. Carry out the tests below and record your observations and inferences in the spaces provided.

a) Add 20 $cm^3$of 2M aqueous sodium hydroxide to all of solution P provided. Shake well and filter the mixture into conical flask. Retain both the residue and filtrate.

Observations	**Inferences**
(1 mark)	(1 mark)

b) i) To about 2cm^3 of the filtrate, add 2M Nitric acid drop wise until in excess.
(i.e. about 1cm^3 of the acid).. Retain the mixture.

Observations	**Inferences**
(1 mark)	(1 mark)

Divide the mixture in b (i) above into two portions.

ii) To the first portion, add aqueous sodium hydroxide drop wise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

iii) To the second portion, add aqueous ammonia drop wise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

(c) To 2 cm^3 of the filtrate, add 3 drops of Potassium iodide

Observations	Inferences
(1 mark)	(1 mark)

(d) To 2 cm^3 of the filtrate, add 3 drops of acidified Barium nitrate solutions.

Observations	Inferences
(1 mark)	(1 mark)

(e) To the residue in (a), add 8 cm^3 of dilute nitric acid and allow it to filter into a boiling tube.

i) To 2 cm^3 of this filtrate, add aqueous ammonia drop wise until in excess.

Observations	Inferences

(1 mark)	(1 mark)

3. You are provided with solid K. Place all the solid K in the boiling tube. Add 10 cm^3 of distilled water and shake well. Divide the resulting mixture into four portions.

Observations	**Inferences**
(½ mark)	(½ mark)

a) To the first portion add 2 drops of universal indicator. Compare the result with the P^H chart.

Observations	**Inferences**
(½ mark)	(½ mark)

b) To the second portion add two drops of Bromine water.

Observations	**Inferences**
(½ mark)	(½ mark)

c) To the third portion add drops of acidified potassium manganate (VII) solution H.

Observations	**Inferences**
(1 mark)	(1 mark)

d) To the fourth portion add, a little amount of $NaHCO_3$

Observations	Inferences
(½ mark)	(½ mark)