SCHEME

Name.....Index No. .....ADM.....

School .....Date..... .....

233/3
CHEMISTRY
PAPER 3
PRACTICAL

MOKASA M S

JUNE, 2021
Time: 2 ¼ Hours

MOKASA I EXAMINATION

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

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.
- This paper has **7** printed pages. Check to confirm that it is so.

FOR EXAMINER'S USE ONLY

QUESTION	Max Score	Candidate Score
1	22	
2	10	
3	08	
TOTAL	40	

1(a) You are provided with:

- Solution A ,containing 39.2g/l of $FeSO_4(NH_4)_2SO_4.nH_2O$
- Solution B Containing 3.0g/l of $KMnO_4$.
  You are required to determine;
- The concentration of solution A in moles per litre
- The number of moles of (n) of water of crystallization in $FeSO_4(NH_4)_2SO_4.nH_2O$

Procedure

- Fill the burette with solution A.
- Using a pipette filler, pipette 25.0cm^3 of solution B into a conical flask and titrate with solution A until a pink colour just appears.
- Record thevolume of solution A used in the table below. Repeat the experiment twice and fill the table.

Table 1

Titrations	1	2	3
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A (cm^3)			

(4mks)

CT - 1
DP - 1
AC - 1
PA - 1
FA - 1
05

a) Calculate the average volume of solution A used (1mk)

b) Determine;
i) Concentration of solution B in moles per litre, (1mk)
(K=39,Mn=55,O=16)

$\frac{3.0}{168}$ ✓ ½ 0.01786 M ✓ ½

ii) Number of moles of solution B used. (1mk)

$\frac{25}{1000}$ x Ans (b) (i) ✓ ½

Ans. ½

c) Given that the ionic equation for the reaction is:
$MnO_4^-{}_{(aq)} + 8H^+{}_{(aq)} + 5Fe^{2+}{}_{(aq)} \rightarrow Mn^{2+}{}_{(aq)} + 5Fe^{3+}{}_{(aq)} + 4H_2O_{(l)}$

Determine the number of moles of solution A used. (1mk)

Ans. 6(ii) x 5 ✓ ½

Correct Ans(c) ✓ ½

Determine the;

i) Concentration of solution A in mole per litre (1mk)

$\frac{1000}{\text{Ans. (a)}} \times \text{Ans. (c)}$ ✓ ½

Correct answer ✓ ½

ii) Relative formula mass of $FeSO_4(NH_4)_2SO_4.nH_2O$ (1mk)

$RFM = \frac{39.2}{\text{Ans. c(i)}}$ ✓ ½

Ans (C_2) ✓ ½

iii) Number of moles of water of crystallization (n) in $FeSO_4(NH_4)_2SO_4.nH_2O$ (1mk)

$294 + 18n = \text{Ans}(C_2)$ ✓ ½

Correct Ans. ✓ ½

b. You are provided with 2.0g of solid **R** in a boiling tube.

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

Procedure

(i) Using a burette, add 3.0cm^3 of distilled water into the boiling tube with solid **R**.

(ii) Gently heat the boiling tube, while stirring the contents carefully with a thermometer until the crystals of R dissolve completely.

(iii) Remove the boiling tube from the flame and allow the contents to cool while stirring with the thermometer. Note the temperature at which crystals **just** appear and record it in Table II below.

(iv) Add 2.0cm^3 of distilled water from the burette into the boiling tube containing the mixture and repeat steps (ii) and (iii) above.

(v) Repeat step (iv) three more times.

(vi) Calculate the solubility of solid **R** in water at the different temperatures and complete table 2.

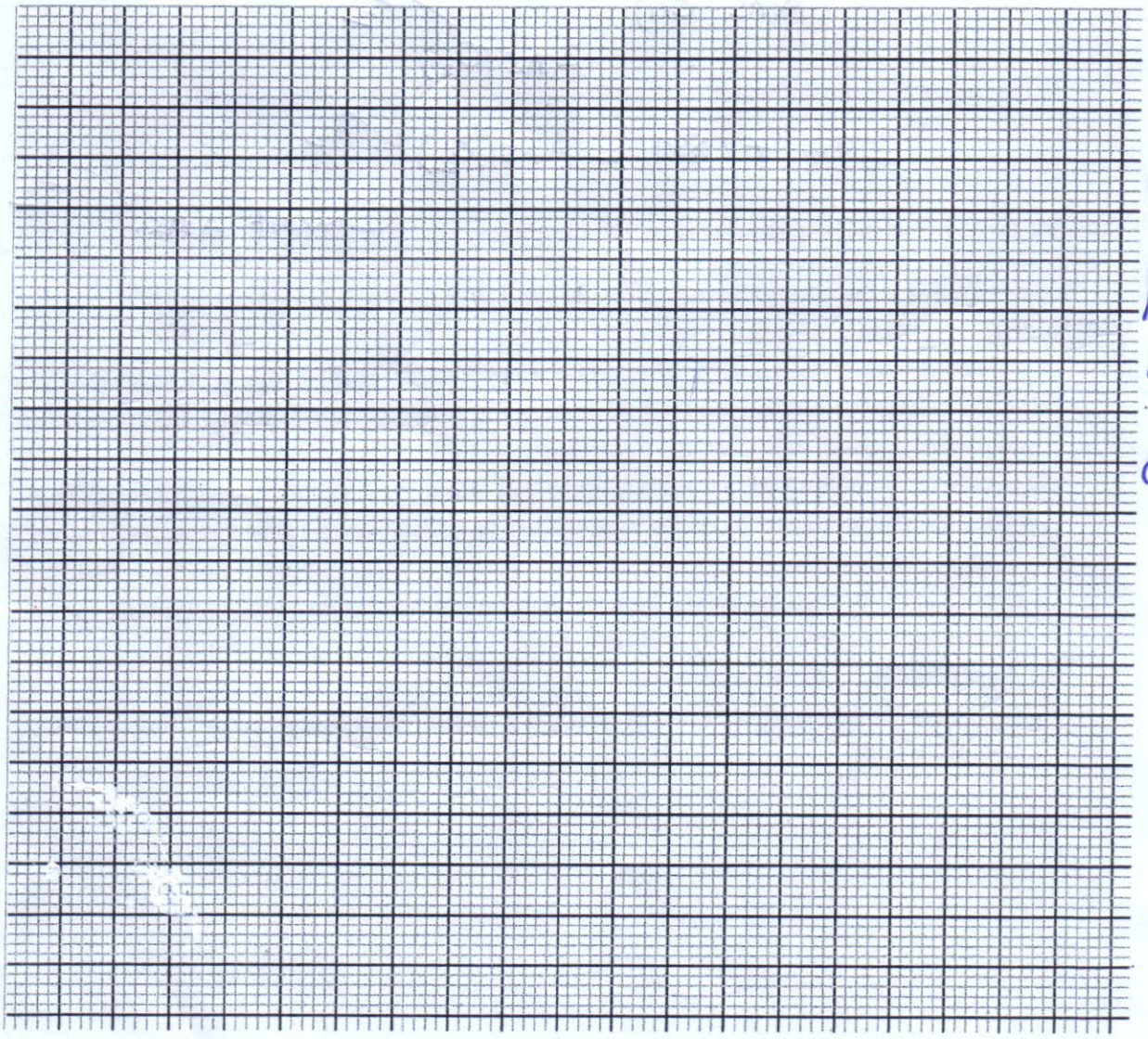
Table 2

Total volume of water added (cm^3)	Temperature at which crystals just appear(^oC)	Solubility of solid R in water (g/100g of water)
3		66.7 ✓
5		40.0 ✓
7		28.6 ✓ @ ½ for solubility
9		22.2 ✓
11		18.2 ✓

CT - 1
DP - ½
T - ½
AC - I
03

(5½ marks)

a) On the grid provided, plot a graph of solubility of solid R (vertical axis) against temperature(horizontal axis) (3 marks)



P - 1
A - ½
S - ½
C - 1
03

b) From your graph, determine

(i)The temperature at which 35g of solid **R** would dissolve in $100cm^3$ of water. (1mk)

Shown from graph ✓ ½

Value ✓ ½

(ii) The solubility of solid **R** at 50°C. (1mk)

From graph.

(iii) State how solubility varies with temperature. (½mk)

Solubility increases with increase in temperature.

2. You are provided with solid **F**. Carry out the tests below and record your observations and inferences in the spaces provided.

(a) Place all of solid **F** in a clean boiling tube. Add about $10cm^3$ of distilled water and shake. Divide the resulting solution into 4 equal portions.

Observations	Inference
Dissolves ½ to form colourless solution ½ (1mk)	– Soluble salt ✓ 1 or – Cu^{2+}, Fe^{2+}, Fe^{3+} absent. ✓ (1mk)

(i)To the 1st portion, add drops of sodium sulphate solution.

Observations	Inference
No white ppt ✓ 1 (1mk)	Pb^{2+}, Ba^{2+}, Ca^{2+} absent. (1mk)

3 ion – 1
2 – ½
1 – 0.
Penalize ½ for any contradictory

(ii) To the 2nd portion, add sodium hydroxide solution dropwise until excess.

Observations	Inference
White ppt ½ soluble ½ in excess ✓ (1mk)	Al^{3+} ✓, Zn^{2+} ✓ present. (1mk)

½ @
Penalize ½ for Pb^{2+} if present.

(iii) To a 3rd portion, add ammonia solution dropwise until in excess.

Observations	Inference
White ppt ½ insoluble in excess (1mk)	Al^{3+} ✓ (1mk)

Penalise ½ for any other ion.

(iv) To the fourth portion, add 2-3 drops of acidified barium nitrate solution.

Observations	Inference
White ppt ✓ (1) (1mk)	SO_4^{2-} present ✓ (1) (1mk)

Penalise ½ for any Contradictory ion.

3. You are provided with solid F. Carry out the tests and record your observations and inferences in the spaces provided.

(i) Place half a spatulaful of solid F in a non-luminous flame to ignite.

Observations	Inference
- Melt ½ - Burns with yellow sooty flame. (1mk)	$C=C$ ✓ ½ any or $-C\equiv C-$ ½ (1mk)

(ii) Place the rest of the solid in a test-tube. Add about $6cm^3$ of distilled water and shake the mixture well. Divide the solution into 3 portions.

Observations	Inference
Dissolves ✓ ½ to form uniform solution (½mk)	Polar solvent ✓ ½ (½mk)

(iii) To about $2cm^3$ of the solution, add a spatulaful of sodium hydrogen carbonate.

Observations	inference
Effervescence / Bubbles / Fizzing (1mk)	H^+, R-COOH, H_3O^+ present. (1mk)

(iv) To about $2cm^3$, add 2 drops of acidified potassium manganate (vii) solution.

Observations	Inference
Purple H^+, $KMnO_4$ decolourised	$-C\equiv C-$ or $C=C$ present. (½mk)

Reduces to R-OH

(v) To another $2cm^3$, add 2 drops of bromine water.

Observations	Inference
Yellow bromine water decolorised (1mk)	$C=C$ or $-C\equiv C-$ present (½mk)

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