

Name:.....Index no

Candidate's signDate:

233/3

CHEMISTRY

Paper 3

PRACTICAL

Time: 2 ¼ hours

MIS.

MOKASA II JOINT EXAMINATION - 2024

Kenya Certificate of Secondary Education

CHEMISTRY

Instructions to candidates

- (a) Write your name, index number, signature and date in the spaces provided above.
- (b) Answer ALL the questions in the spaces provided in the question paper.
- (c) 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.
- (d) All working MUST be clearly shown where necessary.
- (e) Mathematical tables and silent electronic calculators may be used.

For Examiner's Use Only

Questions	Marks	Candidate's Score
1	18	
2	12	
3	10	
TOTAL	40	

1. You are provided with: Solid
 - a) 3.15g of Dibasic Acid solid C ($\text{H}_2\text{C}_2\text{O}_4 \cdot n\text{H}_2\text{O}$)
 - b) Solution B; 0.2M sodium hydroxide

You are required to determine:

- (i) Molar enthalpy of solution of solid C
- (ii) Determine the value of n, water of crystallization in solid C ($\text{H}_2\text{C}_2\text{O}_4 \cdot n\text{H}_2\text{O}$)

Procedure I

- (i) Using a measuring cylinder, place 50cm^3 of distilled water in 100ml plastic beaker.
- (ii) Measure the initial temperature of water and record in table I below.
- (iii) Add all the solid C at once into the beaker containing water, stir the mixture with a thermometer and measure the temperature of the solution after every 30 seconds and record the results in table I below.

NOTE: Retain the solution formed for use in procedure II

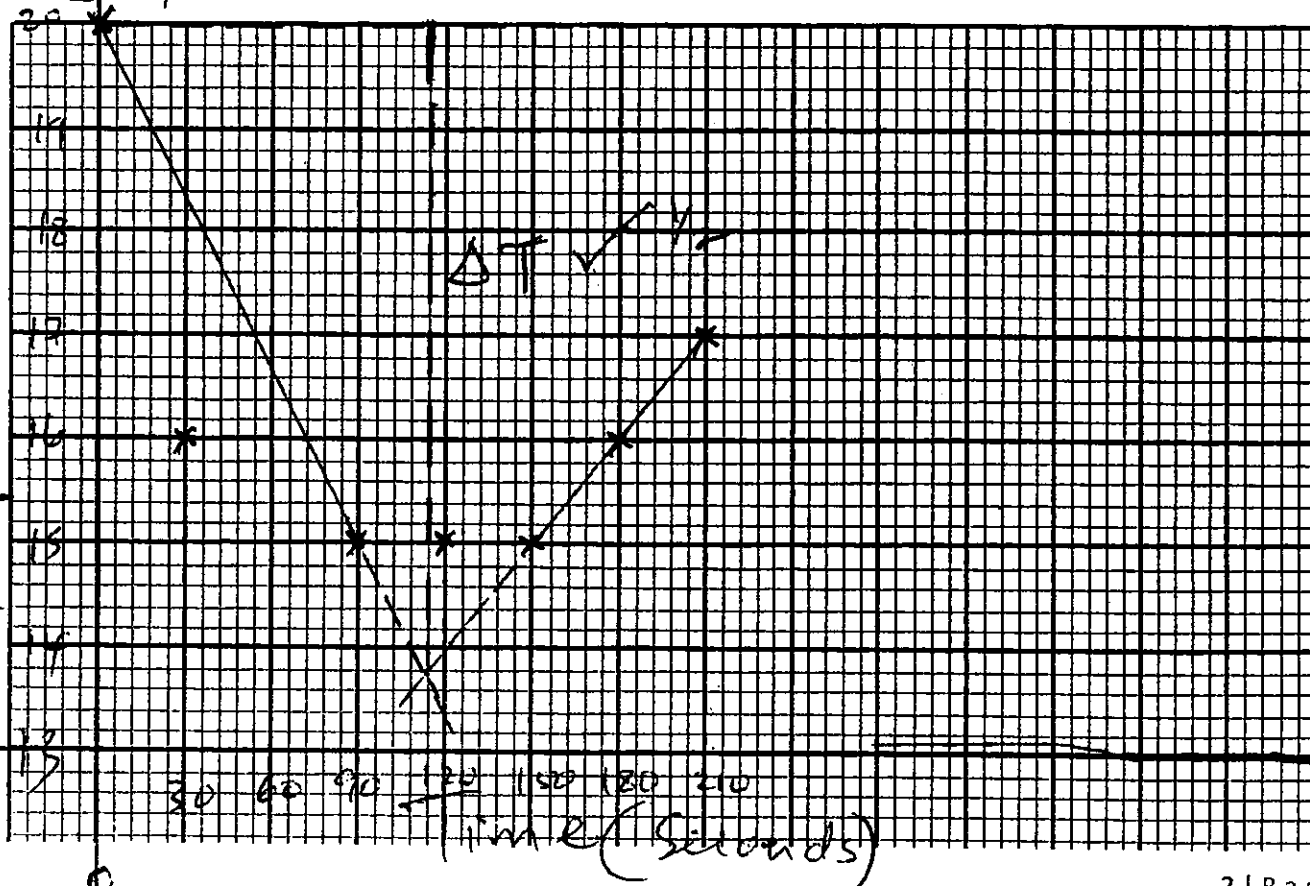
Table I

Time (seconds)	0	30	60	90	120	150	180	210
Temperature ($^{\circ}\text{C}$)	20	16	15	15	15	15	16	17

(3 marks)

On the grid provided, plot a graph of Temperature ($^{\circ}\text{C}$) against time (seconds)

(3 marks)



NOTE Accept continuous decreasing line

- c) From the graph, show and determine the temperature change (1 mark)

— Show — $\frac{1}{2}$ mc.
on graph

— Ans — $\frac{1}{2}$ mc

NB: Accept for $\frac{1}{2}$ mc Ans given but not shown on graph.

- d) Calculate the enthalpy change of solution for the above reaction (1 mark)
($C = 4.2 \text{ J/g/K}$, Density = 1 g/cm^3)

$$\Delta H = m C \theta$$

$$50 \times 4.2 \times \text{Ans} \quad \checkmark \frac{1}{2}$$

$$= \text{Ans in J or } [J \div 1000] \text{ kJ} \quad \checkmark \frac{1}{2}$$

NB: penalize $\frac{1}{2}$ for missing units and wrong sign

Procedure II

- (i) Transfer the contents of the beaker obtained in procedure I into a 250ml volumetric flask. Rinse both the beaker and thermometer with distilled water and add to the volumetric flask. Add more water upto the mark. Label this as solution C.
- (ii) Fill the burette with solution C upto 0.0 mark.
- (iii) Place 25 cm^3 of solution B using a pipette into a conical flask, add 3 drops of phenolphthalein indicator and titrate with solution C until the pink colour turns colourless, record readings in table 2 below.

- (iv) Repeat procedure (iii) two more times and complete table II below.

Table II	I	II	III
Final burette reading	→ Apply the rules of titration when marking the table		
Initial burette reading			
Volume of solution C (cm^3)			

CT — 1
D — 1
A — 1
FA — 1
FA — 1

OS

- a) Calculate the average volume of solution C used

→ use teachers value to avoid always and Final Accuracy (1 mark)

Correct working

$$\checkmark \frac{1}{2} = \text{Correct Ans} \quad \checkmark \frac{1}{2}$$

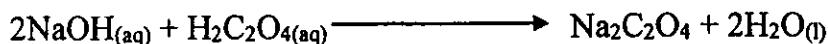
NB: Ans must be to at least 2 decimal places unless it is exact.

b) Calculate the number of moles of solution B used

(1 mark)

$$\frac{0.2 \times 25}{1000} \sqrt{2} = 0.005 \text{ moles} \sqrt{2}$$

c) 1 mole of Dibasic acid reacts with 2 moles of sodium hydroxide according to equation below.



Determine:

(i) The number of moles of the Dibasic acid, solution C used in the titration

$$\frac{0.005 \times 1}{2} \sqrt{2} = 0.0025 \text{ moles} \sqrt{2} \quad \text{(1 mark)}$$

(ii) Number of moles of the Dibasic acid in 250cm^3 of solution C (1 mark)

$$0.0025 \xrightarrow{\text{Average titre}} 250 \xrightarrow{\text{correct Ans}} \sqrt{2}$$

$$\frac{0.0025 \times 250}{1} \sqrt{2} = 0.625 \text{ moles} \sqrt{2}$$

(iii) The relative formula mass of the Dibasic acid

(1 mark)

$$\frac{3.15}{0.625} \sqrt{2} = 5.04 \text{ correct Ans} \sqrt{2}$$

Ans in c(ii)

(iv) The value of n, water of crystallization in the dibasic acid, $\text{H}_2\text{C}_2\text{O}_4 \cdot n\text{H}_2\text{O}$

(C = 12, O = 16, H = 1) $\text{H}_2\text{C}_2\text{O}_4 = 90$ (1 mark)

$$\frac{5.04 \times 90}{18} \sqrt{2} = 25.2 \text{ correct Ans} \sqrt{2}$$

penalize value of n below 1 and above 5

d) Calculate the molar heat of solution of the dibasic acid

(1 mark)

$$\frac{\text{Ans in procedure I d}}{\text{Ans in c(ii)}} \sqrt{2} = + \text{correct Ans} \sqrt{2}$$

NB - penalize missing/wrong sign/wrong

2. You are provided with:
- Solid M
 - Aqueous sodium hydroxide
 - Aqueous acidified Barium Nitrate
 - Water

Solid M is suspected to be magnesium sulphate

- a) From the reagents provided, select and describe three tests that could be carried out consecutively to confirm solid M is magnesium sulphate. Write the results and expected observations in the spaces provided.

(i)

Test 1 (1 mk)	Expected observation (1 mk)
To Solid M Add about 10cm ³ of H ₂ O and shake	Solid M dissolves to form a colourless solution

(ii)

Test 2 (1 mk)	Expected observation (1 mk)
To about 2cm ³ of solution, add 3 drops of Acidified Barium Nitrate	White precipitate is formed

Reject - white ppt soluble
Accept - white ppt Insoluble

(iii)

Test 3 (1 mk)	Expected observation (1 mk)
To about 2cm ³ of solution, add NaOH dropwise until in excess	White precipitate is formed Insoluble in excess

NOB:

— Realize fully if the three tests are not consecutive.

b) Carry out the tests described in (a) above using solid M and record the observations and inferences in the spaces provided.

(i) Test 1

Observations (1 mk)	Inferences (1 mk)
Solid <u>dissolves</u> to form <u>colourless</u> <u>solution</u> . $\checkmark \frac{1}{2}$	Soluble salt $\checkmark \frac{1}{2}$ Cu^{2+} Fe^{2+} Fe^{3+} Absent $\checkmark \frac{1}{2}$

(ii) Test 2

Observations (1 mk)	Inferences (1 mk)
white precipitate is formed Refect: white ppt soluble Accept: white ppt Insoluble	SO_4^{2-} $\checkmark$ penalize FULLY for contradiction.

(iii) Test 3

Observations (1 mk)	Inferences (1 mk)
white precipitate formed Insoluble in excess	Mg^{2+} present penalize FULLY for contradiction

— Accept part (b) If part (a) is corrected stated.
— Accept for $\frac{1}{2}$ mark part b (iii) Ba^{2+} Ca^{2+}
Absent

3. You are provided with an organic liquid N, carry out the tests below and record your observations and inferences in the spaces provided.

a) Place about 2cm³ of the liquid in a watch glass and ignite it.

Observations (1 mk)	Inferences (1 mk)
Blue flame is produced ✓ * Accept Non-luminous flame	-C=C- / -C≡C- Absent ✓

b) Place about 2cm³ of liquid into 4 test tubes.

(i) To the 1st portion and 2cm³ water and allow the mixture to stand for a minute.

Observations (1 mk)	Inferences (1 mk)
Liquid N is miscible with water / Does not form 2 layers / mixes uniformly ✓	Polar Compound. ✓

(ii) To the 2nd portion, add 2-3 drops of acidified potassium manganate VII.

Observations (1 mk)	Inferences (1 mk)
Purple colour of H ⁺ /KMnO ₄ decolorizes / changes to colourless ✓	-C=C- / -C≡C- and R-OH present ✓

(iii) To the 3rd portion, add 3 drops of acidified potassium dichromate VI and warm.

Observations (1 mk)	Inferences (1 mk)
Orange colour of H ⁺ /K ₂ Cr ₂ O ₇ changes to green ✓	R-OH present ✓ Accept -C=C- / -C≡C- Absent for 1/2 mk

(iv) To the 4th portion, add 3cm³ of the organic acid provided followed by 3 drops of sulphuric (VI) acid and warm the mixture.

Observations (1 mk)	Inferences (1 mk)
Pleasant smell produced ✓ * Accept fruity smell	R-OH present ✓

* Reject - Sweet
fruity
smell