

Signature:

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(Do not write your School/Centre Name or Number anywhere on this booklet.)

P525/3
CHEMISTRY
PRACTICAL
Paper 3
Nov./Dec. 2015
 $3\frac{1}{4}$ hours



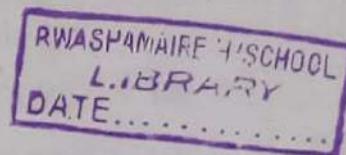
UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY PRACTICAL

Paper 3

3 hours 15 minutes



INSTRUCTIONS TO CANDIDATES:

Answer all questions.

Record your answers on this question paper in the spaces provided.

Mathematical tables and silent non-programmable calculators may be used.

Reference books (i.e. text books, books on qualitative analysis, etc) should **not** be used.

Candidates are **not** allowed to start working with the apparatus for the first 15 minutes.

This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.

For Examiners' Use Only			
Q.1	Q.2	Q.3	Total
25	26	16	67

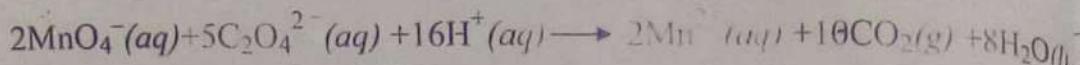
1. You are provided with the following

FA1, which is Potassium manganate (VII) solution.

FA2, which is a solution of ethanedioic acid in dilute sulphuric acid.

You are required to determine the activation energy, E, of the reaction between potassium manganate (VII) and ethanedioic acid in acidic medium.

Potassium manganate (VII) reacts with ethanedioic acid in acidic medium according to the following equation:



Completion of the reaction is indicated by the purple manganate (VII) solution becoming colourless.

The rate constant of a reaction, k, is related to its activation energy, E by the equation $k = A e^{-E/RT}$

Where A is a constant, R the molar gas constant, T, the absolute temperature and e the base of natural logarithm.

Procedure:

- Run 25.0 cm³ of FA2 from a burette into a conical flask and heat the solution to a temperature, x = 80°C.
- Add 25.0 cm³ of FA1 to the hot solution and simultaneously start the stop clock (watch).
- Shake to mix and leave to stand.
- Note and record the time, t, taken for the solution to turn colourless.
- Repeat procedures (a) to (d) for the temperature x = 70, 60, 50, 40°C and room temperature.
- Record your results in the table below.

Temperature, x (°C)	80	70	60	50	40	Room temperature = 24
Temperature T (K)	353	343	333	323	313	297.5
1/T (K ⁻¹) × 10 ³	2.85	2.92	3.00	3.10	3.19	3.36
Time, t (s)	12.0	18.0	24.5	42.0	74.0	171.0
Log ₁₀ t	1.08	1.26	1.39	1.62	1.87	2.28

Questions:

- (a) Calculate ~~for Mixed decimal place deny up to max of 3 places~~ for values of time recorded to one decimal place ~~deny marks up to a maximum of 3 places~~.
- T from $T = x + 273$
 - reciprocal of T.
 - $\log_{10} t$.

Record the values in the table above. Values of $\log_{10} t$.

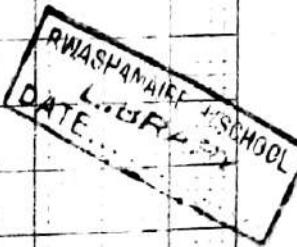
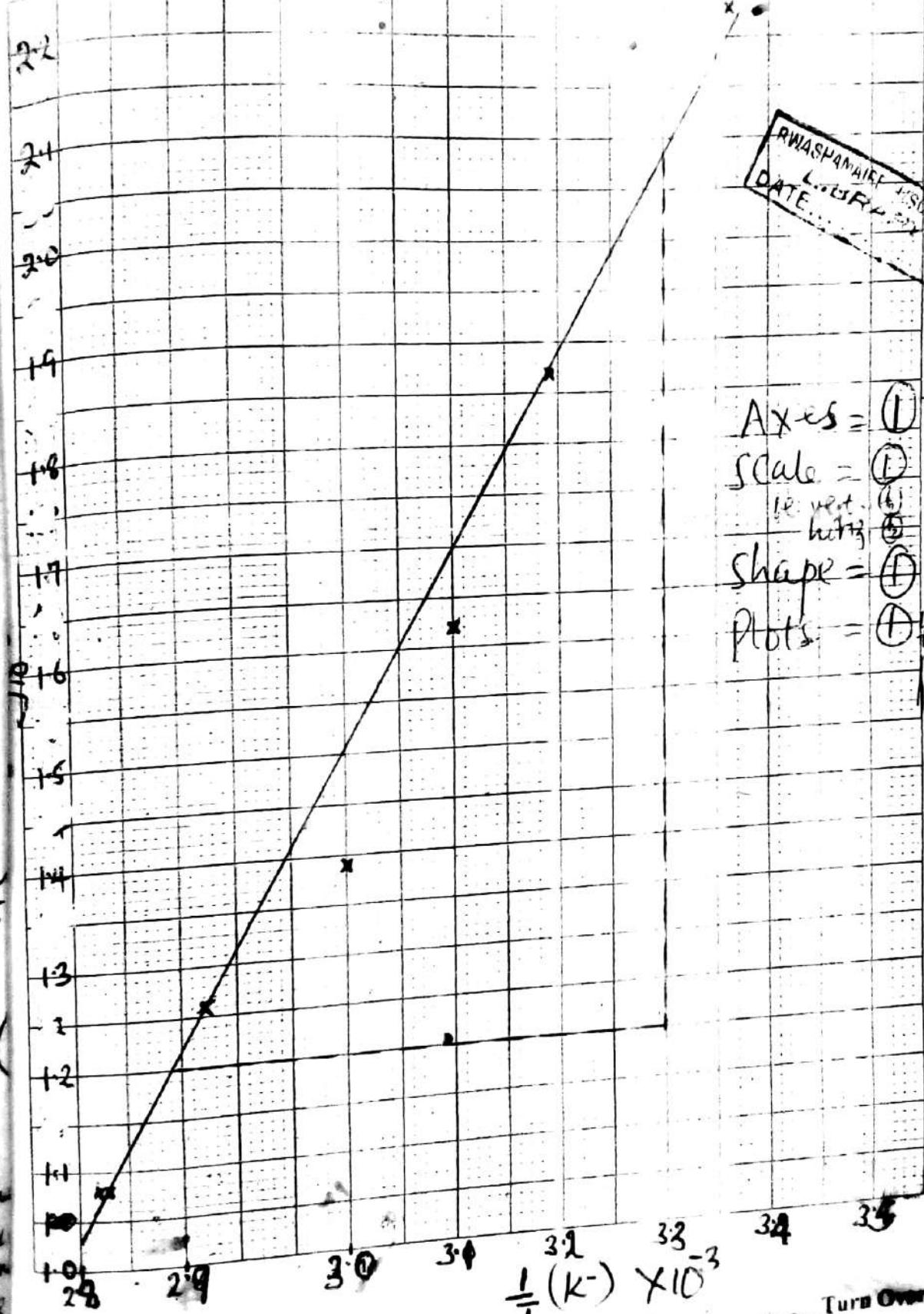
2

- Deny mark for room to above 40°C and the value of time less than

(b) Plot a graph of $\log_{10} t$ against $\frac{1}{k}$.

(4 marks)

A graph of $\log_{10} t$ against $\frac{1}{k}$.



Axes = (1)

Scale = (1)

i.e. vert. (1)
horiz. (1)

Shape = (1)

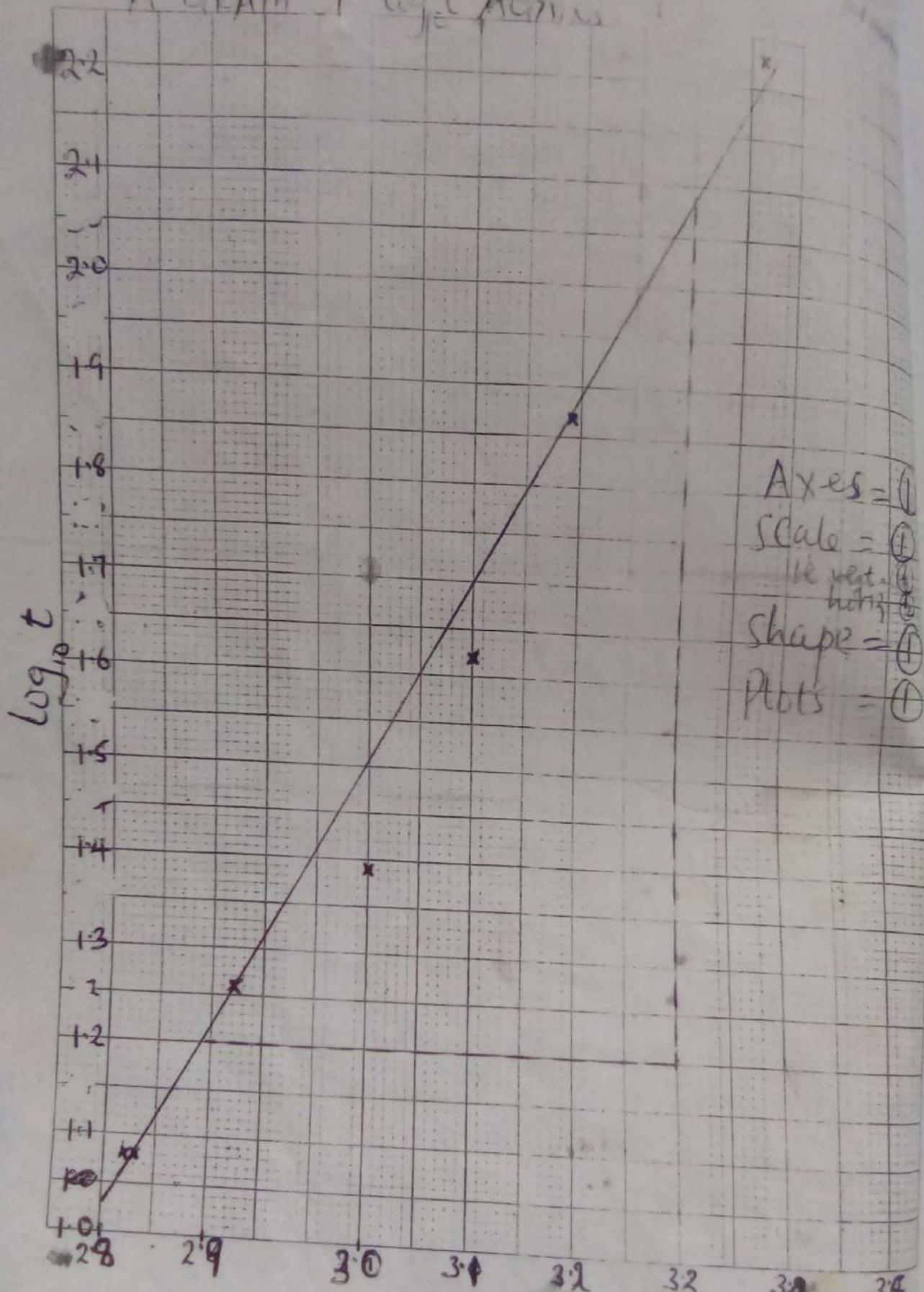
Plots = (1)

the curve
two correctly
plotted
points

Turn Over
Ignore unit if not given
Put paralel to wrong unit

(b) Plot a graph of $\log_{10} t$ against $\frac{1}{T}$

A GRAPH OF $\log_{10} t$ AGAINST $\frac{1}{T}$



Axes = ①

Scale = ①

16 points
both ends

Shape = ①

Plots = ①

$$\frac{1}{T} (K^{-1}) \times 10^{-3}$$

Ignore unit if not given
But write it

(c) Determine the slope, S, of the graph.

Showing the slope on the graph i.e. $E = 115 \text{ mJ}$

$$\text{Slope} = 2.08 - 1.20$$

$$= \frac{(3.30 - 2.84) \times 10^3}{(3.30 - 2.08)}$$

$$= 2.146 \times 10^3 \text{ K}$$

(d) Calculate the activation energy E, from the expression (02 marks)

$$S = \frac{E}{2.3R}, \text{ where, } R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$$

$$2.146 \times 10^3 = \frac{E}{2.3 \times 8.314}$$

$$E = 2.146 \times 10^3 \times 2.3 \times 8.314$$

$$= 41036.24 \text{ J mol}^{-1} \text{ or } 41.036 \text{ kJ mol}^{-1}$$

2. You are provided with substance, K, which contains two cations and two anions. Carry out the following tests on K and identify the cations and anions in it. Identify any gases evolved. Record your observations and deductions in the table below. (26 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat a spatula endful of K in a dry test tube.	Purple/violet vapour forms purple/black sublimate. Vapour turns blue litmus to red. Yellow residue when hot water treatment cold.	Iodine gas given off. I ⁻ present. ZnO formed.
(b) Shake three spatula endfuls of K with about 5 cm ³ of water and filter. Keep both the filtrate and the residue.	Colourless filtrate White residue	Non transition metal ions (or Zn ²⁺ , Ca ²⁺ , Mg ²⁺ , Ba ²⁺ , Al ³⁺ , Pb ²⁺)

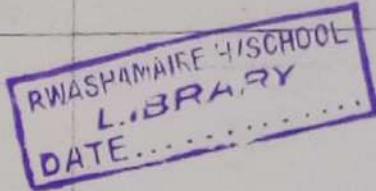
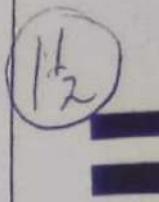
TESTS	OBSERVATIONS	DEDUCTIONS
(c) Divide the filtrate into seven parts.		
(i) To the first part of the filtrate, add dilute sodium hydroxide solution dropwise until in excess.	White precipitate insoluble in excess.	$Mg^{2+}, Ca^{2+}, Ba^{2+}$ probably present. (2)
(ii) To the second part of the filtrate, add dilute ammonia solution dropwise until in excess and allow to stand.	White precipitate Ba^{2+}, Mg^{2+} insoluble in excess.	Suspected. <small>Because Ca^{2+} was given</small> (1½)
(iii) To the third part of the filtrate add 2-3 drops of dilute sulphuric acid.	White precipitate Ba^{2+} suspected.	(01)
(iv) To the fourth part of the filtrate add 2-3 drops of potassium chromate (VI) solution followed by 2-3 drops of ethanoic acid. Allow the mixture to stand.	Yellow precipitate insoluble in ethanoic acid	Ba^{2+} confirmed. <small>No mark for deduction if insoluble is not mentioned</small> (1½)
(v) To the fifth part of the filtrate add copper turnings followed by 2-3 drops of concentrated sulphuric acid and heat the mixture.	Brown vapour / fumes; reddish-brown fumes Purple / violet vapour	NO_2 gas $\therefore NO_3^-$ present. (03)
(vi) To the sixth part of the filtrate add 2-3 drops of dilute nitric acid then 2-3 drops of silver nitrate solution followed by dilute ammonia solution dropwise until in excess.	Pale-yellow precipitate insoluble in excess ammonia solution	I^- suspected. <small>reject Br^- because it was not suspected in (v) above.</small> <small>→ No mark for deduction if insoluble is missing</small> (1½)

TESTS	OBSERVATIONS	DEDUCTIONS
(vii) To the seventh part of the filtrate add 2-3 drops of lead (II) nitrate solution.	Yellow precipitate	I- Confirmed (1/2)
d) Wash the residue with water and then dissolve it in dilute hydrochloric acid. Divide the acidic solution into three parts.	Residue dissolves to form a colourless solution.	Non transition metal cations (OR. $\text{Al}^{3+}, \text{Zn}^{2+}, \text{Ca}^{2+}, \text{Mg}^{2+}, \text{Ba}^{2+}, \text{Sn}^{2+}, \text{Sn}^{4+}$) Reject: Pb^{2+} b/c it doesn't dissolve in HCl
(i) To the first part of the acidic solution add dilute sodium hydroxide solution dropwise until in excess.	White precipitate soluble to form a colourless solution.	$\text{Al}^{3+}, \text{Zn}^{2+}$ (02)
(ii) To the second part of the acidic solution add dilute ammonia solution dropwise until in excess.	White precipitate soluble to form a colourless solution	Zn^{2+} NO Meure if soluble is missing. (1/2)
(iii) To the third part of the acidic solution add a small amount of solid ammonium chloride. Shake and add 2-3 drops of disodium hydrogen phosphate solution followed by dilute ammonia solution dropwise until in excess.	White precipitate soluble in excess ammonia to form a colourless solution	Zn^{2+} Confirmed. NO Meure if soluble in $\text{NH}_3(\text{aq})$ is missing (02)
(e) Cations in K are ... and the anions in K are ... Confirmed in C(V)	$\text{Ba}^{2+}, \text{Zn}^{2+}$ confirmed in (III) NO_3^- , I^- confirmed in C(VII)	(01) (01)

3. You are provided with an organic compound M. You are required to determine the nature of M. Carry out the following tests on M and record your observations and deductions in the table below.

(16 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of M on the tip of a dry spatula or dry porcelain.	White solid burns with a blue non-smoky flame.	Aliphatic saturated compound.
(b) (i) Shake a half spatula endful of M with about 2 cm^3 of dilute sodium hydroxide solution.	Dissolves to form a colourless solution	Acidic compound (or carboxylic acid alcohol). Acetone
(ii) Shake a half spatula endful of M with about 2 cm^3 of water and add 2-3 drops of litmus solution.	Dissolves to form a colourless solution. Solution turns litmus solution to Acid. Accept salt of acid.	Polar compound probably carbonyl. Acid. Accept salt of acid. Phenol
(c) Shake a spatula endful of M with about 5 cm^3 of water and divide the solution into three parts.		
(i) To the first part of the solution add 2-3 drops of sodium hydrogen carbonate solution.	Effervescence / Colourless gas bubbles given off.	Carboxylic acid probably present.
(ii) To the second part of the solution add 2-3 drops of 2 - 4 dinitrophenylhydrazine (Brady's) solution.	No observable change. OR. No yellow precipitate	Aldehyde, Ket absent. (Acc. carbonyl absent). Den Deny I mainly Ketone in aldehydes Turned

TESTS	OBSERVATIONS	DEDUCTIONS
(iii) To the third part of the solution add 2-3 drops of Iron (III) chloride solution and warm.	No observable change or No purple colouration	Phenol absent (02)
(d) Dissolve a spatula endful of M, in about 5 cm ³ of water. To the solution add about 1-2 cm ³ of dilute sodium hydroxide solution. Heat the mixture, cool, add 2-3 drops of silver nitrate solution and filter. Keep both the filtrate and residue.	White precipitate Accept; White residue	Cl ⁻ released.  
(e) To the residue add dilute ammonia solution dropwise until in excess.	Residue dissolves to give a colourless solution	Cl ⁻ present (01)
(f) To the filtrate add about equal volume of ethanol followed by 3-4 drops of concentrated sulphuric acid. Heat the mixture and cool.	Sweet fruity smell.	Ester formed/ Esterification occurs. ∴ Carboxylic acid confirmed. (2)

(g) State the nature of M.

M is aliphatic carboxylic acid with a chloro group / chlorine atom.
Reject chloride
or M is aliphatic compound with both a carboxyl / carboxylate group and chloro group

MAR L MIG C7/01

Candidate's Name: PS25/3/011
Signature: *[Signature]*

Random No.	Personal No.

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P525/3
CHEMISTRY
(PRACTICAL)
Paper 3
Nov./Dec. 2014
3½ hours.



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY PRACTICAL

Paper 3

3 hours 15 minutes



INSTRUCTIONS TO CANDIDATES:

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For Examiners' Use Only			
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29	24	16	67

- You are provided with the following:
FA1, which is a solution containing iodine.
FA2, which is a 0.1 M sodium thiosulphate solution.
Solid **X**, which is a reducing agent, molecular mass = 126.
Solid **Q**.

You are required to standardize **FA1**, and use it to determine the mole ratio for the reaction between iodine and **X**.

Iodine reacts with thiosulphate according to the following equation.



(a) Standardising FA1

PROCEDURE

Pipette 10.0 cm³ of **FA1** into a conical flask and titrate with **FA2** using starch as the indicator.

Repeat the titration until you obtain consistent results.

(i) Record your results in the table below.

(ii) Record the volume of pipette used.

For 10.00 ✓ cm³.

(½ mark)

Final burette reading (cm ³)	9.90 ✓	19.70 ✓	15.00 ✓
Initial burette reading (cm ³)	0.00 ✓	9.90 ✓	5.20 ✓
Volume of FA2 used (cm ³)	9.90 ✓	9.80 ✓	9.80 ✓

(4½ marks)

(iii) Record the titre values used to calculate average volume of **FA2** used... 9.80 ✓ 9.80 ✓ 9.80 ✓ cm³

(½ mark)

(iv) Work out the average volume of **FA2** used... 9.80 ✓ 9.80 ✓ = 9.80 cm³

(2½ marks)

(v) Calculate the concentration of iodine in moles per litre of **FA1**.

1000 cm³ of **FA2** solution contain 0.1 moles of $S_2O_3^{2-}$

9.8 cm³ of **FA2** solution contain $\frac{0.1 \times 9.8}{1000}$ moles of $S_2O_3^{2-}$

$$= 9.8 \times 10^{-4} \text{ moles}$$

2 moles of $S_2O_3^{2-}$ react with 1 mole of I_2

Thus No of moles of I_2 in 25 cm³ of **FA1** = $\frac{1}{2} \times 9.8 \times 10^{-4}$ mol

10 cm³ of **FA1** contain $\frac{1}{2} \times 9.8 \times 10^{-4}$ moles of I_2

1000 cm³ of **FA1** contain $\frac{1}{2} \times 9.8 \times 10^{-4} \times 1000$

(b) Determining the mole ratio for the reaction between iodine and X.
 PROCEDURE

Weigh accurately about 1.6 g of X into a 250 cm³ volumetric flask. Add some distilled water and shake to dissolve. Make the solution to the mark by adding distilled water. Label the solution FA3.

Pipette 10.0 cm³ of FA3 into a conical flask. Add 20 cm³ of FA1 using a measuring cylinder, followed by two spatula end-fuls of solid Q and shake the mixture well.

Titrate the excess iodine in the mixture with FA2 using starch solution as the indicator.

Repeat the titration until you obtain consistent results.

- (i) Record your results in the table below. (1)
- (ii) Record the mass of the weighing container + X 15.00 ✓ (2)
- (iii) Record the mass of the weighing container 14.40 g ✓ (½ mark)
- (iv) Record the mass of X used 1.60 g ✓ (½ mark)
- (v) Record the volume of pipette used 10.00 cm³ ✓ (½ mark)

Final burette reading (cm ³)	9.50 ✓ 18.90 ✓ 27.30 ✓
Initial burette reading (cm ³)	0.00 ✓ 9.50 ✓ 18.90 ✓
Volume of FA2 used (cm ³)	9.50 ✓ 9.40 ✓ 9.40 ✓

(4½ marks)

- (vi) Record the titre values used to calculate average volume of FA2 used 9.40, 9.40 cm³ ✓ cm³ (½ mark)
- (vii) Work out the average volume of FA2 used cm³. 9.40 + 9.40 = 9.40 cm³ ✓ (2½ marks)

- (c) Calculate the number of moles of:

- (i) excess iodine in FA1 that reacted with the thiosulphate ions in FA2. moles of S₂O₃²⁻ in 9.4 cm³ = 0.1 × 9.4 / 1000 (02 marks)
- (ii) iodine that reacted with X. mole ratio S₂O₃²⁻ : I₂ = 2 : 1
- (iii) original moles of I₂ = $\frac{20 \times 0.049}{1000} = 0.0098 \text{ mole}$ (2½ marks)
- (iv) moles of I₂ that reacted with X = $0.0098 - 0.0047 = 0.0051$ Turn Over

(d) Determine the:

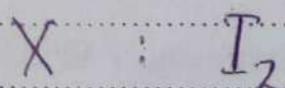
(i) number of moles of X that reacted.

$$\text{Moles of } X \text{ in } 250 \text{ cm}^3 = \frac{1.6}{121} = 0.0127 \quad (1 \text{ mark})$$

..... 250 cm^3 of FA₃ contains 0.127 mole ✓

..... 10.0 cm^3 of FA₃ contains $0.127 \times 10 = 1.27 \text{ mole}$ ✓

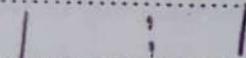
(ii) reaction mole ratio between X and iodine. 250 (01 mark)



$$\text{Moles} \quad 0.000508 : 0.00051$$

$$0.000508 : 0.00051$$

$$\underline{0.000508} : \underline{0.00051} \quad \checkmark$$



Mole ratio $X : I_2 = 1 : 1$ ✓

2. You are provided with substance Y, which contains two cations and two anions. You are required to carry out the following tests on Y and identify the anions and cations in it.

Record your observations and deductions in the table below.

(24 marks)

	TESTS	OBSERVATIONS	DEDUCTIONS
(a)	Heat two spatula end-fuls of Y strongly in a dry test tube.	Colourless liquid that turned anhydrous copper(II) sulphate blue Colourless gas that turns blue litmus red and lime water milky	Water or Crystallisation A hydrated CO_3^{2-} gas; $\text{CO}_3^{2-}, \text{HCO}_3^-$
(b)	To three spatula end-fuls of Y, add dilute nitric acid drop-wise until there is no further change and warm.	Yellow residue when hot and white when cold.	ZnO
(c)	To the solution from (b) add dilute sodium hydroxide solution drop-wise until there is no further change. Filter the mixture. Keep both the filtrate and the residue.	Effervescence of Colourless gas that turns blue litmus red and lime water milky White precipitate insoluble in excess	CO_3^{2-} CO_3^{2-} $\text{Mg}^{2+}, \text{Ba}^{2+}, \text{Ca}^{2+}$

	TESTS	OBSERVATIONS	DEDUCTIONS
(d)	To the filtrate, add dilute nitric acid until the solution is just acidic and divide the acidic filtrate into six parts.	White precipitate Soluble in excess to form colourless solution.	$\text{Pb}^{2+}, \text{K}^+, \text{Zn}^{2+}$ $\text{Sn}^{2+}, \text{Al}^{3+}$
(i)	To the first part of the acidified solution, add 2-3 drops of silver nitrate solution followed by dilute ammonia drop-wise until in excess.	Yellow precipitate insoluble in excess.	$\text{Br}^- \checkmark \text{I}^-$
(ii)	To the second part of the acidified filtrate, add 6 drops of concentrated sulphuric acid and warm. To the mixture add sodium thiosulphate solution.	Brown solution formed which turns to colourless on adding $\text{Na}_2\text{S}_2\text{O}_3$ dilution	I_2 given off \checkmark $\therefore \text{I}^-$
(iii)	To the third part of the acidified filtrate, add 2-3 drops of lead(II) nitrate solution.	Yellow precipitate	$\text{I}^- \checkmark$ Confirmed.
(iv)	To the fourth part of the acidified filtrate, add sodium hydroxide solution drop-wise until in excess.	White precipitate soluble in excess to form a colourless solution.	$\text{Pb}^{2+}, \text{Zn}^{2+}$ $\text{Al}^{3+}, \text{Sn}^{2+}, \text{Sn}^{4+}$
(v)	To the fifth part of the acidified filtrate, add ammonia solution drop-wise until in excess.	White precipitate insoluble in excess to form colourless solution.	$\text{Zn}^{2+} \checkmark$

	TESTS	OBSERVATIONS	DEDUCTION
(vi)	To the sixth part of the acidified solution, add a spatula end-ful of ammonium chloride, followed by 3-4 drops of disodium hydrogen phosphate followed by drop-wise addition of ammonia solution until in excess.	White precipitate Soluble in Excess ammonia forming a colorless solution	Zinc confirmed
(e)	Wash the residue and dissolve it in dilute hydrochloric acid and divide the solution into three parts.	Dissolves to give a colorless solution	Ba^{2+} , Ca^{2+} , Mg^{2+}
(i)	To the first part of the acidic solution, add dilute sodium hydroxide solution drop-wise until in excess.	White precipitate insoluble in excess.	Ba^{2+} , Mg^{2+} , Ca^{2+} .
(ii)	To the second part of the acidic solution, add ammonia solution drop-wise until in excess.	White precipitate insoluble	Ba^{2+} , Mg^{2+}
(iii)	To the third part of the acidified solution, add 2-3 drops of potassium chromate(VI) solution.	Yellow precipitate	Ba^{2+} Confirmed

- (I) (i) The anions in Y are: $\text{Cl}_3^{2-} \checkmark \text{I}^-$ (1)
- (ii) The cations in Y are: $\text{Ba}^{2+} \checkmark \text{Zn}^{2+}$ (1)
- You are provided with an organic compound Z. You are required to identify the nature of the compound. Carry out the following tests on the compound and record your observations and deductions in the table below. (16 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a spatula end-ful of Z on a porcelain dish (or at the end of a spatula).	Colourless that burns with a yellow sooty flame.	Aromatic compound or Aliphatic unsaturated comp. or Aliphatic Comp. with high C: H. 2
(b) Shake 1 cm ³ of Z with about 2 cm ³ of water and test with litmus paper. Divide the mixture into four parts.	Dissolves in water to give a colourless solution which has no effect on litmus.	Polar Aliphatic compound of low molecular mass. Neutral comp, alcohol, carbonyl, ester. 2
(i) To the first part of the mixture, add 2-3 drops of sodium carbonate solution.	No observable change / No effervescence	Carboxylic acid absent (1)
(ii) To the second part of the mixture, add 2-3 drops of neutral iron(III) chloride solutions.	No observable change.	Phenol absent. (1)
(iii) To the third part of the mixture, add 2-3 drops of 2,4-dinitrophenylhydrazine solution (Brady's reagent).	No observable change.	Ketone, aldehyde absent. (1)

	TESTS	OBSERVATIONS	DEDUCTION
(iv)	To the fourth part of the mixture, add 2-3 drops of acidified potassium dichromate(VI) solution and heat the mixture.	No blue shade change ✓	Primary -alcohol Secondary -alcohol Tertiary -alcohol Absent
(c)	To about 1 cm ³ of Z, add 4 drops of Lucas reagent.	Cloudy solution formed immediately ✓	Tertiary alcohol
(d)	To about 1 cm ³ of Z add about an equal volume of ethanoic acid followed by 4-5 drops of concentrated sulphuric acid. Heat the mixture and pour it into a beaker of water.	Sweet fruity smell ✓	Ester form ∴ tert. alcohol present
(e)	To about 1 cm ³ of Z add about 1 cm ³ of concentrated sulphuric acid. Heat the mixture and pass the gas produced through acidified potassium manganate(VII) solution.	Purple colour of potassium manganate(VII) turns to colourless ✓	Aldehyde form from any alcohol OR. Alcohol dehydrates to benzene
(f)	Comment on the nature of Z	Z is aliphatic ✓ tertiary ✓ alcohol ✓	Total

P525/3 Inst. Sch.
CHEMISTRY
Practical
Instructions
Nov./Dec. 2014



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY PRACTICAL INSTRUCTIONS

P525/3 Inst. Sch.

November/December, 2014

CONFIDENTIAL

Great care should be taken that the information given below does not reach the candidates either directly or indirectly.

INSTRUCTIONS FOR PREPARING APPARATUS AND CHEMICALS

N.B: The Headteacher must ensure that the teacher responsible for preparing the apparatus and chemicals, hands in his/her trial results properly sealed in a separate envelope and **firmly** fastened (attached) to the candidates' scripts envelope(s).

1. The description of the reagents and chemicals specified below does not necessarily correspond with the description in the question paper. Candidates must not be informed of the differences.
2. Candidates are **not** allowed to use reference books (i.e. text books, booklets on qualitative analysis etc.) during the examination.
3. In addition to the fittings and substances ordinarily contained in a chemistry laboratory, each candidate will require:
 - 1 burette (50 cm^3)
 - 1 pipette (10.0 cm^3)
 - 1 volumetric flask (250 cm^3)
 - 1 measuring cylinder (25 cm^3 or 50 cm^3 or 100 cm^3)
 - 2 conical flasks
 - 8 test tubes
 - 1 piece of filter paper
 - 100 cm^3 of FA1
 - 100 cm^3 of FA2
 - 3.0 g of Q
 - 2.0 g of X
 - 2.0 g of Y
 - 5.0 cm^3 of Z
 - Starch indicator (freshly prepared)

Easy access to:

- heat source
- a weighing balance reading to at least one decimal place.
- common reagents for identifying gases, cations, anions and organic compounds.

FA1 is prepared by dissolving 21.2 g of potassium iodide in 500 cm^3 of distilled water and adding 12.8 g of iodine crystals and diluting with distilled water to make one litre of solution.

FA2 is prepared by dissolving 24.8 g of W in distilled water to make one litre of solution.

Substances Q, W, X, Y and Z will be provided by UNEB.

P525/3

CHEMISTRY
(PRACTICAL)

Paper 3

Nov. / Dec. 2013

3½ hours



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education
CHEMISTRY PRACTICAL

Paper 3

3 hours 15 minutes

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25	27	15	67

1. You are provided with the following:

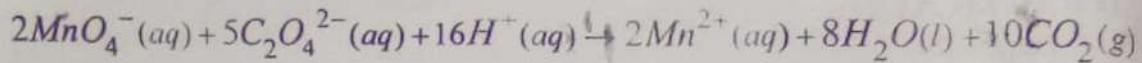
FA1, which is a solution containing 3.2 g of sodium hydroxide per litre.

FA2, which is a solution containing 3.5 g of potassium manganate(VII) per litre.

Solid **Q**, which is an acid salt of ethanedioic acid, $MH_x(C_2O_4)_y$.

You are required to determine the ratio of x to y ($x:y$) in the formula of **Q**.

Manganate(VII) ions react with ethanedioate ions according to the following equation.



(Where necessary use: H = 1, C = 12, O = 16, Na = 23, K = 39, Mn = 55)

Procedure A:

Weigh accurately about 1.5 g of **Q** and dissolve in minimum amount of distilled water. Transfer the solution into a 250 cm³ volumetric flask and add distilled water to make a 250 cm³ solution. Label the solution **FA3**.

Results:

Mass of container + Q	11.50	✓	1	g	(½ mark)
Mass of empty container.....	10.00	✓	1	g	(½ mark)
Mass of Q used.....	1.50	✓	1	g	(½ mark)

Procedure B:

Pipette 20.0 (or 25.0 cm³) of **FA3** into a conical flask. Add 2-3 drops of phenolphthalein indicator and titrate the mixture with **FA1** from the burette.

Repeat the titration until you obtain consistent results.

Record your results in the table below.

Results:

Volume of pipette used.....	25.0	✓	1	cm ³	(½ mark)
-----------------------------	------	---	---	-----------------	----------

Table I

Final burette reading (cm ³)	20.00	21.60	139.70
Initial burette reading (cm ³)	0.00	1.70	19.90
Volume of FA1 used (cm ³)	20.00	19.90	19.80

Volumes of **FA1** used in calculating average volume. (03 marks)
19.90, 19.80 ✓

Average volume of **FA1** used..... 19.90 + 19.80 cm³. (½ mark)

$$\frac{2}{2} = 19.85 \text{ cm}^3 \quad \checkmark$$

Questions:

(a) Calculate the

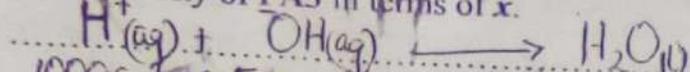
(i) molarity of FA1.

Relative formula mass of NaOH = $23 + 16 + 1 = 40$ (1½ marks)

$$\text{Molarity} = \frac{3.2}{40} \times 1000 = 0.08 \text{ M}$$

1½

(ii) molarity of FA3 in terms of x.



1000 cm³ of FA1 solution contain 0.08 moles

19.85 cm³ of FA1 solution contain $0.08 \times \frac{19.85}{1000}$

Reaction mole ratio H⁺: OH = 1:1

No. of moles of H⁺ in 25 cm³ = $0.08 \times 19.85 \times \frac{25}{1000}$

1 mole of H⁺ reacts with $0.08 \times 19.85 \times \frac{1000}{1000}$ mol of NaOH

Procedure:

Pipette 20.0 (or 25.0 cm³) of FA3 into a conical flask. Add equal volume of 2M sulphuric acid and heat the mixture to almost boiling. Titrate the hot solution with FA2. Repeat the titration until you obtain consistent results.

Record your results in the table below.

Results:

Volume of pipette used... 25.0 cm³. (½ mark)

½

Table II

Final burette reading (cm ³)	19.30	38.50	19.80
Initial burette reading (cm ³)	0.00	19.30	0.70
Volume of FA2 used (cm ³)	19.30	19.20	19.10

(03 marks)

Volume of FA2 used in calculating average volume

19.20, 19.10 cm³.

(½ mark)

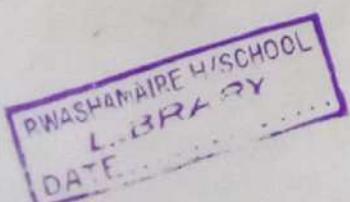
½

Average volume of FA2 used... $\frac{19.20 + 19.10}{2}$ cm³.

(2½ marks)

$$= 19.15 \text{ cm}^3$$

2½



Questions:

(b) Calculate the

(i) molarity of solution FA3 in terms of x.

$$\text{Molarity of FA2 R.F.M. of KMnO}_4 = \frac{31 + 55 + (16 \times 4)}{1L} = 158 \quad (4\frac{1}{2} \text{ marks})$$

$$\text{Molarity of FA2} = \frac{3.5}{158} = 0.0222 M$$

$$\text{Moles of FA2 that reacted} = 0.022 \times 19.15 \quad \checkmark$$

$$\text{Reaction ratio } \text{MnO}_4^- : \text{C}_2\text{O}_4^{2-} = 2 : 5 \quad \checkmark$$

$$\text{No. of moles of C}_2\text{O}_4^{2-} \text{ in } 25 \text{ cm}^3 = \frac{5}{2} \times 0.022 \times 19.15$$

$$\text{1 mole of Q gives } \frac{3}{2} \text{ moles of C}_2\text{O}_4^{2-}$$

$$\text{(ii) No. of moles of Q in } 25 \text{ cm}^3 = \frac{1}{2} \times \frac{5}{2} \times 0.022 \times 19.15 \quad (2 \frac{1}{2} \text{ marks})$$

$$\text{Molarity of Q in (a) (i)} = \text{Molarity of Q in b}$$

$$\frac{0.06352}{x} = \frac{0.0422}{y} \quad \frac{x}{y} = \frac{0.06352}{0.0422} \quad \frac{x}{y} = 1.5 \quad y = 3 : 2$$

2. You are provided with substance W which contains ~~two~~ cations and ~~two~~ anions. You are to identify the cations and anions in W. Carry out the tests below on W and record your observations and deductions in the table. Identify any gas(es) evolved. (27 marks)

TESTS	OBSERVATIONS	DEDUCTION
(a) Heat one spatula end-ful of W strongly in a dry test tube until there is no further change.	Colourless liquid / Condensate that turns anhydrous Copper (II) sulphate to blue. Colourless gas that turns blue litmus red and lime water milky. Reddish-brown residue when hot and yellow when cold. Black residue.	Hydrate salt. CO_2 gas CO_3^{2-} , HCO_3^{2-} or $\text{C}_2\text{O}_4^{2-}$ PbO_2 or Fe_2O_3 MnO
(b) To a spatula end-ful of W, add 2-3 drops of concentrated sulphuric acid and warm.	Effervescence of colourless gas that turns blue litmus to red and lime water milky.	CO_2 gas CO_3^{2-} , HCO_3^{2-} Reject $\text{C}_2\text{O}_4^{2-}$

TESTS	OBSERVATIONS	DEDUCTIONS
(c) To two spatula end-fuls of W, add dilute nitric acid until there is no further change. Add sodium hydroxide drop-wise until in excess. Filter and keep the filtrate.	Effervescent gas bubbles of colourless gas that turns lime water milky. White precipitate insoluble in excess; turns brown. Colourless filtrate Brown residue	CO_2 gas CCl_4 confirmed Reject: HCO_3^- Mn^{2+} $\text{Pb}^{2+}, \text{Al}^{3+}, \text{Zn}^{2+}, \text{Sn}^{2+}, \text{Sn}^{4+}$ Reject: $\text{Ca}^{2+}, \text{Ba}^{2+}, \text{Mg}^{2+}$
(d) To the filtrate add dilute nitric acid until the solution is just acidic. Divide the resultant solution into four parts.	White precipitate soluble in excess to form a colourless solution.	$\text{Pb}^{2+}, \text{Al}^{3+}, \text{Zn}^{2+}, \text{Sn}^{2+}, \text{Sn}^{4+}$ probably present
(i) To the first part of the acidic solution, add sodium hydroxide solution drop-wise until in excess.	White precipitate soluble in excess to form a colourless solution.	$\text{Pb}^{2+}, \text{Al}^{3+}, \text{Zn}^{2+}, \text{Sn}^{4+}, \text{Sn}^{2+}$ probably present
(ii) To the second part of the acidic solution, add aqueous ammonia drop-wise until in excess.	White precipitate insoluble in excess.	$\text{Pb}^{2+}, \text{Al}^{3+}$ Accept: $\text{Sn}^{2+}, \text{Sn}^{4+}$
(iii) To the third part of the acidic solution add dilute sulphuric acid.	White precipitate	Pb^{2+} probably present
(iv) Use the fourth part of the acidic solution to carry out a test of your choice to confirm one of the cations in W. Add 3 drops of Potassium Iodide solution.	Yellow precipitate	Pb^{2+} confirmed
Add potassium Chromate (VI) followed by sodium hydroxide		Yellow ppt.
		Turn Over

Q1. Add a soluble chloride to HCl and heat

Table Continues...

white ppt (stable) ammonia

TESTS	OBSERVATIONS	DEDUCTIONS
(e) To two spatula end-fuls of W, add about 5 cm^3 of water, shake and filter. Divide the filtrate into five parts.	Colorless filtrate White residue	Pb^{2+} Non-transition metal ions present $\text{Al}^{3+}, \text{Pb}^{2+}, \text{Zn}^{2+}, \text{Mg}^{2+}, \text{Ba}^{2+}$ in both residue & filtrate Mn^{2+} probably present ND name for ded if insoluble is not
(i) To the first part of the filtrate add sodium hydroxide drop-wise until in excess.	White precipitate insoluble in excess, turns brown	
(ii) To the second part of the filtrate, add aqueous ammonia drop-wise until in excess.	White precipitate, turns brown Insoluble in excess, turns brown	Mn^{2+} probably present ND name for ded if insoluble is not
(iii) Use the third part of the filtrate to carry out a test of your own choice to confirm one of the cations in W. Add concentrated nitric acid followed by solid sodium bisulfite.	- Insist on order of addition of reagents. - Reagent sodium bisulfite solution. - If PbO_2 is used, insist on heat.	Mn^{2+} Confirmed
(iv) To the fourth part of the filtrate, add 2-3 drops of lead(II) nitrate solution and heat.	Purple Solution	
(v) Use the fifth part of the filtrate to carry out a test of your own choice to confirm one of the anions in W. Add barium nitrate solution followed by dilute nitric acid.	White precipitate insoluble on heating. Name none if insoluble is missing	Cl^- absent; $\text{SO}_4^{2-}, \text{SO}_3^{2-}$ probably present
(f) Identify the	If acid is added first, give full name for white ppt White precipitate insoluble in the acid	SO_4^{2-} Confirm
(i) cations in W	$\text{Mn}^{2+}, \text{Pb}^{2+}$	(01 mark)
(ii) anions in W	$\text{SO}_4^{2-}, \text{CO}_3^{2-}$	(01 mark)

3. You are provided with an organic substance T. You are required to determine the nature of T. Carry out the following tests on T and record your observations and deductions in the table below. (15 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of T on a spatula end or on a crucible lid.	White solid / crystals burn with a yellow sooty flame.	Aromatic compound. Accept: Aliphatic. Unsaturated / Compd with high C:H ratio.
(b) To a spatula end-ful of T in a test tube, add 3 cm ³ of sodium hydroxide solution, followed by dilute sulphuric acid.	Dissolves in sodium hydroxide to form a colourless solution. On adding dilute sulphuric acid a white ppt of solid is formed.	Acidic compound probably phenol Carboxylic acid.
(c) To a spatula end-ful of T in a test tube, add about 4 cm ³ of water, warm the mixture and test the solution with litmus. Divide the solution into five parts.	Insoluble in cold water, but dissolves on warming forming a colourless solution that turns blue litmus to red.	High molecular mass compound probably phenol Carboxylic acid.
(i) To the first portion of the solution, add a half a spatula end-ful of sodium carbonate.	No effervescence/ No observable change.	Carboxylic acid absent.
(ii) To the second portion of the solution; add neutral iron(III) chloride solution.	Purple / violet solution formed.	Phenol confirmed present.

Table Continues...

TESTS	OBSERVATIONS	DEDUCTIONS
(iii) To the third portion of the solution add 3-4 drops of acidified potassium manganate(VII) solution and warm.	Purple colour of potassium manganate (vii) turns to colourless.	Primary alcohol Secondary alcohol or aldehyde probably present
(iv) To the fourth portion of the solution, add 2-3 drops of 2, 4-dinitrophenyl hydrazine.	Orange precipitate is formed.	Aldehyde probably present.
(v) To the fifth portion of the solution add, Fehling's solution and heat.	Red precipitate / Reddish-brown / brown precipitate.	Aldehyde present.
(d) To about 3 cm ³ of silver nitrate solution, add 2 drops of sodium hydroxide solution, followed by ammonia solution until the precipitate just dissolves. Add a spatula end-ful of T, shake and heat in a water bath for about five minutes.	Silver mirror formed	Aldehyde confirmed present.

(e) Comment on the nature of T.

T is an aromatic compound with phenol and aldehyde group.

OR: T is an aromatic aldehyde with a phenol group.

OR: T is phenol with an aldehyde group.

L A L INSTR.

PS 2 & / 3 2013 - L.E.P

In addition to the fittings and substances ordinary considered in a Chem. laboratory, each candidate will require:

1 Volumetric flask (50cm³)
1 burette (50cm³)
1 pipette 25 cm³ (or 20cm³)
2 conical flasks
8 test tubes

100cm³ of 2M sulphuric acid
Phenolphthalein Indicator

100cm³ of FA1

100cm³ of FA2

2 g of Q

3 g of W

2 g of T

2 pieces of filter paper

Easy access to

- Heat source

- Weighing balance reading to at least one decimal point

- Reagents for identifying cations, anions and organic compounds

FA1 is prepared by dissolving 3.2 g of substance P in distilled water to make 1 litre of solution.

FA2 is prepared by dissolving 3.5 g of substance R in distilled water to make 1 litre of solution.

Substances P, Q, R, T and W will

30
25

PS25 /3
CHEMISTRY
(PRACTICAL)
Paper 3
Nov. / Dec. 2012
3 ½ hours



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer all questions.

Record your answers on this question paper in the spaces provided.

Mathematical tables and silent non-programmable calculators may be used.

Reference books (i.e. text books, books on qualitative analysis, etc) should not be used.

Candidates are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.

For Examiners' Use Only			
Q.1	Q.2	Q.3	Total
27	26	14	67

1. You are provided with the following

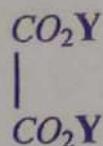
GA1, which is potassium manganate(VII) solution of unknown concentration.

2

GA2, which is a 0.05 M solution of diammonium iron(II) sulphate

3

Solid, **X**, which is an ethanedioate (oxalate) with the formula;



You are required to standardise **GA1** and use it to determine the atomic mass of **Y**.

In acid medium, manganate(VII) ions oxidises iron(II) to iron(III) and ethanedioate ($C_2O_4^{2-}$) ions to carbon dioxide.

The manganate(VII) ions are reduced to manganese(II) ions and

Procedure A:

Weigh accurately about 1.0 g of **X** and dissolve it in about 100 cm³ water in a 250 cm³ volumetric flask. Make the solution to the mark adding distilled water. Label this solution **GA3**. (02)

Results:

Mass of weighing container + **X** = 2.60 g ✓ (6)

Mass of weighing container = 1.70 g ✓ (6)

Mass of **X** used = 0.90 g ✓ Accept (6)

Deny marks if masses are to no decimal place

Procedure B:

Pipette 25.0 cm³ (or 20.0) cm³ of **GA2** into a conical flask and add equal volume of 2M sulphuric acid. Titrate the mixture with **GA1**.

Repeat the titration until you obtain consistent results.

Record your results in Table I. (6%)

Results:

Volume of pipette used ...

25.00

cm³

(1)

Table I

Final burette reading (cm ³)	10.50	20.90	31.20	1
Initial burette reading (cm ³)	0.00	10.50	20.90	3
Volume of GA1 used (cm ³)	10.50	10.40	10.30	3
→ 2 decimal places with correct subtraction = (3) → 1 decimal place with correct subtraction = (3) → No decimal place.				
Titre values used for calculating average volume of GA1 used				
$10.30, 10.40$ ✓ (only in the range ± 0.1 cm ³) (3)				
(and \$ no decimal pl. = 0)				
Average volume of GA1 used				
$\frac{10.30 + 10.40}{2} = 10.35$ cm ³ ✓ (2)				

Procedure C:

Av. vol for pipette of 25cm³

$$= 12.9 \text{ cm}^3$$

± 0.1

(2)

Pipette 25.0 cm³ (or 20.0) cm³ of GA3 into a conical flask and add an equal volume of 2M sulphuric acid. Warm the mixture to about 60 °C and titrate the warm solution with GA1.

Repeat the titration until you obtain consistent results.

Record your results in Table II.

(6½ marks)

Results:

Volume of pipette used

20.00

cm³

(2)

Table II

Final burette reading (cm ³)	12.20	24.20	12.30	1
Initial burette reading (cm ³)	0.00	12.20	10.40	3
Volume of GA1 used (cm ³)	12.20	12.00	11.90	3
As for table I				

Titre values used for calculating average volume of GA1 used.

$$12.00, 11.90$$

cm³

(2)

Average volume of GA1 used $\frac{12.00 + 11.90}{2} = 11.95$ cm³ (2)

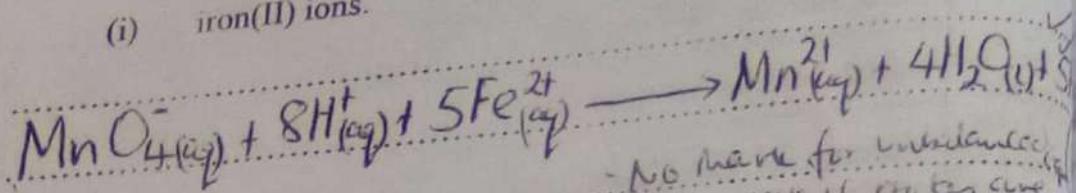
Turn Over As for table I

Av. vol. for pipette of 25cm³ = 14.9cm³

Questions:

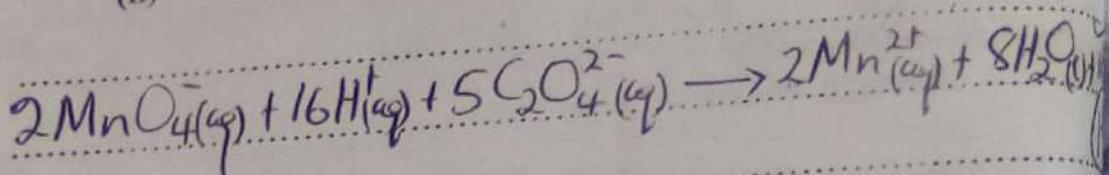
(a) Write the overall ionic equation for the reaction between manganate(VII) ions and

(i) iron(II) ions.



- No mark for imbalance
- Deny 1/2 mark if states are wrong or missing (1 1/2 mark)

(ii) ethanedioate (oxalate) ions.



(b) Determine the:

(i) number of moles of manganate(VII) ions that reacted with the iron(II) ions.

1000 cm³ of GA2 solution contain 0.05 moles of Fe²⁺

20 cm³ of GA2 solution contain $\frac{0.05 \times 20}{1000}$ +

Reaction mole ratio MnO₄⁻ : Fe²⁺ = 1 : 5

No of moles of MnO₄⁻ that reacted = $\frac{1}{5} \times \frac{0.05 \times 20}{1000}$

$$= 2 \times 10^{-4} \text{ moles}$$

(ii) molar concentration of GA1.

(02 mark)

10.35 cm³ of GA1 solution contain 2×10^{-4} moles

1000 cm³ of GA1 solution contain $\frac{2 \times 10^{-4} \times 1000}{10.35}$

$$= 0.01932 \text{ M}$$

(c) Calculate the:

(i) concentration of the ethanedioate (oxalate) in GA3 in moles per dm³.

1000 cm³ of GA1 solution contains C 0.1932 mol/dm³ of MnO₄⁻ (03 marks)

11.95 cm³ of GA1 solution contains C 0.1932 × 11.95 mol/dm³ of MnO₄⁻

Mole ratio MnO₄⁻ : C₂O₄²⁻ = 2 : 5

No. of moles of C₂O₄²⁻ in 20 cm³ = $\frac{5}{2} \times \frac{0.1932 \times 11.95}{1000}$ (2 marks)

20 cm³ of GA3 contains $\frac{5}{2} \times \frac{0.1932 \times 11.95}{1000}$ mol/dm³ of C₂O₄²⁻

1000 cm³ of GA3 contains $\frac{5}{2} \times \frac{0.1932 \times 11.95}{1000} \times 1000 = 0.0291$ mol/dm³ of C₂O₄²⁻ (02 marks)

(ii) molar mass of X.

250 cm³ of GA3 contains 0.9 g

→ 0.0291 mol/dm³ of GA3 contains 0.9 g (02 marks)

$\frac{0.0291 \times 1000}{250} = 3.6$ g

weigh 0.9 g 0.029 mol/dm³ of X weighs 3.6 g (2)

weigh 1 mol/dm³ of X weighs $\frac{3.6}{0.029} = 124$ accept answer (02 marks)

= 124 $\frac{1}{2} C_2O_4 = 124$ relative atomic mass of Y. [C = 12; O = 16] (02 marks)

Y = 18

$2Y + (12 \times 2) + (16 \times 4) = 124$ Reject answer with units

$2Y + 88 = 124$

$2Y = 124 - 88$

$Y = \frac{36}{2} = 18$

Total
27 M

2. You are provided with substance W which contains two cations and two anions. You are required to carry out the following tests on W and to identify the anions and cations in W. Record your observations and deductions in the table below. $(CH_3COO)_2Ni \xrightarrow{\text{heat}} NiO + CH_3COCH_3$ (02 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat two spatula endfuls of W strongly in a dry test tube. Colourless condensate liquid turned anhydrous copper blue.	R.W. DATE: _____	Iodine given off from a hydrated compound. Max 5
(b) Sulphate blue. Colourless gas turned blue litmus red and acidified K ₂ Cr ₂ O ₇ solution turns orange to green. Liquids with sweet smell. Solid turned from green to yellow.	✓ Reject for fruity smell	Sulphur dioxide gas given off SO ₂ , SO ₃ fit. Propene vapour gives Turf over Acetyl ion.

Table Continues...

TESTS	OBSERVATIONS	DEDUCTIONS
(b) To two spatula endfuls of W in a dry test tube, add 5 drops of concentrated sulphuric acid and warm.	Colorless gas turned blue & limous red, Sweet, Vinegar smell Reject fruity smell.	Potentially acetate ion CH_3COO^-
(c) Dissolve three spatula endfuls of W in about 5 cm^3 of water to make a solution. (i) Use 1 cm^3 of the solution of W to carry out a test of your own choice to confirm one of the anions in W. To the solution, add aqueous Iron(III) chloride solution and heat Add few drops of conc. sulphuric acid followed by ethanol and heat further (ii) To the remaining solution of W add dilute sodium hydroxide solution drop-wise until there is no further change. Filter and keep both the filtrate and the residue.	Dissolves to give a green solution Reddish-brown solution gives forms a brown precipitate. Sweet - fruity smell Green precipitate insoluble in excess Colourless filtrate Green residue	CH_3COO^- Confirmed $\text{Ni}^{2+}, \text{Fe}^{2+}$ Reject Cu^{2+} $\text{Al}^{3+}, \text{Pb}^{2+}, \text{Zn}^{2+}$ Reject $\text{Ca}^{2+}, \text{Ba}^{2+}$ $\text{Ni}^{2+}, \text{Fe}^{2+}$ Reject Cu^{2+}
(d) Add dilute hydrochloric acid drop-wise to the filtrate until the solution is just acidic. Divide the solution into four portions. (i) To the first portion of the acidified filtrate, add dilute sodium hydroxide solution drop-wise until in excess.	White precipitate dissolving in the hydrochloric acid to form a colourless soln. White precipitate dissolved to form a colourless solution.	$\text{Al}^{3+}, \text{Zn}^{2+}$ Reject Pb^{2+} $\text{Al}^{3+}, \text{Zn}^{2+}$ Reject Pb^{2+} It forms a ppt with HCl

TESTS	OBSERVATIONS	DEDUCTIONS
(ii) To the second portion of the acidified filtrate, add potassium iodide solution.	No observable change.	Pb^{2+} absent. reject Al^{3+} present (1)
(iii) To the third portion of the acidified filtrate, add 5 drops of litmus solution followed by dilute ammonia solution drop-wise until in excess.	Blue solution/blue lake.	Al^{3+} confirmed (1½)
(iv) To the fourth portion of the acidified filtrate, add 5 drops of barium nitrate solution.	White precipitate	SO_4^{2-} confirmed (1)
(e) Wash the residue with water and dissolve in dilute hydrochloric acid. Divide the acidic solution into three portions.	Dissolved to give a green solution	Ni^{2+} , Fe^{2+} probably present reject Cu^{2+} , Cr^{3+} but the green ppt in (c)(ii) was insoluble in NaOH (1)
(i) To the first portion of the acidic solution, add sodium hydroxide solution drop-wise until in excess.	Green precipitate insoluble in excess.	Ni^{2+} , Fe^{2+} probably present. Deny Cr^{3+} , Cu^{2+} aqueous (2½)
(ii) To the second portion of the acidic solution, add dilute ammonia solution drop-wise until in excess.	Green precipitate dissolves to give a light green/blue solution.	Ni^{2+} probably present. (2)
(iii) Use the third portion of the acidic solution to carry out a test of your own to confirm one of the cations in W.	Red precipitate	Ni^{2+} confirmed (2)
(f) (i) The cations in W are ... Add excess ammonia solution followed by dimethyl glycine solution	Ni^{2+} , Al^{3+}	(01 mark) (1)
	CH_3COO^- , SO_4^{2-}	(01 mark) (1)
7		Turn Over $\frac{1}{2} \times 26 = 13$ $\frac{1}{2} \times 26 = 26$ m.e.

3. You are provided with an organic substance T. You are required to identify the nature of substance T. Carry out the following tests on T and record your observations and deductions in the table below. (12 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a spatula endful of T in a porcelain dish or at the end of a spatula.	White Crystalline solid after burns with a yellow softy flame.	Aromatic compound OR Unsaturated aliphatic compound OR Aliphatic compound with high C : H ratio.
(b) Shake two spatula endfuls of T with about 5cm^3 of water. Warm and test with litmus.	Insoluble in cold water but slightly soluble in warm. Litmus has no effect on litmus.	High molecular compound probably carbonyl.
(c) Dissolve two spatula endfuls of T in about 5cm^3 of methanol and divide the solution into four parts.		
(i) To the first part of the solution, add 2 – 3 drops of iron (III) chloride solution.	No observable change. Accept: no violet/purple colouration.	Phenol absent
(ii) To the second part of the solution add 2 – 3 drops of Brady's reagent.	Yellow (orange) precipitate.	Carbonyl compound present or Ketone, aldehyde.
(iii) To the third part of the solution, add about 1cm^3 of Fehlings solution and boil.	No observable change. Accept: No reddish-brown ppt.	Alkanal (aldehyde) absent. Ketone present
(iv) To the fourth part of the solution, add about 1cm^3 of iodine solution, followed by drop-wise addition of sodium hydroxide solution until the solution is pale yellow and warm.	No observable change or No yellow precipitate	No methyl group attached to the Carbonyl group
(d) Comment on the nature of T.	T is Aromatic Ketone without a methyl group attached to the carbon carrying the functional group.	(03 marks)

END

P525 / 3 Inst. Sch.
CHEMISTRY
Practical
Instructions
Nov / Dec. 2012



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY PRACTICAL INSTRUCTIONS

P525/3 Inst. Sch.

November / December, 2012

CONFIDENTIAL

Great care should be taken that the information given below does not reach the candidates either directly or indirectly.

NB: The headteacher **must** ensure that the teacher responsible for preparing the apparatus hands in his/her trial results properly sealed in a separate envelope and firmly fastened (attached) to the candidates' scripts envelope(s).

1. The description of the reagents and chemicals specified below does not necessarily correspond with the description in the question paper. Candidates must not be informed of the difference.
2. Candidates are not allowed to use reference books (i.e. text books, booklets on qualitative analysis etc.) during the examination.
3. In addition to the fittings, apparatus and substances ordinarily contained in a Chemistry laboratory, each candidate will require:
 - 1 burette (50 cm^3)
 - 1 pipette (25.0 cm^3 or 20.0 cm^3)
 - 1 volumetric flask (250 cm^3)
 - 1 thermometer ($-10 - 110^\circ\text{C}$)
 - 2 conical flasks.
 - 8 test tubes

200 cm^3 of 2.0 M sulphuric acid.
100 cm^3 of **GA1**
100 cm^3 of **GA2**
1.2 g of **X**
3.0 g of **W**
2.0 g of **T**

Easy access to:

- heat source.
- weighing balance reading, to at least one decimal point.
- common reagents for identifying gases, cations, anions and organic compounds..

GA1 is prepared by dissolving 3.10g of potassium manganate(VII) in water to make one litre of solution.

GA2 is prepared by dissolving 19.6g of **F** in water to make one litre of solution.

Substances; **F**, **T**, **W** and **X** will be provided by UNEB.

Signature:

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(Do not write your School / Centre Name or Number anywhere on this booklet.)

P525/3
CHEMISTRY
(PRACTICAL)
Paper 3
Nov. / Dec. 2011
3½ hours.



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer all questions.

Record your answers on this question paper in the spaces provided.

Mathematical tables and silent non-programmable calculators may be used.

Reference books (i.e. text books, books on qualitative analysis, etc) should not be used.

Candidates are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.

For Examiners' Use Only			
Q.1	Q.2	Q.3	Total
26	27	14	67

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Turn Over



- I. You are provided with solids F and G.

You are required to determine the:

- (i) depression in the freezing point of F
- (ii) freezing point depression constant, K_f per kg of F.

Procedure:

- (a) Pour about 200 cm^3 of water into a 250 cm^3 beaker.
Heat the water to boiling on a tripod stand.

In the meantime, weigh separately and accurately about 5.0g of F and 1.0g of G. Record the results of your measurements in the space provided below.

(03 marks)

Results:

Mass of container + F = 5.95 g ✓

Mass of empty container = 0.95 g ✓

Mass of F = 5.00 g ✓

Mass of container + G = 1.60 g ✓

Mass of empty container = 0.60 g ✓ (3M)

Mass of G = 1.00 g ✓

- (b) *Deny masses if masses are recorded to no decimal places*
Transfer the whole of F into a clean dry boiling tube. Immerse the boiling tube containing F into the beaker of hot water and continue heating the water until the whole of F melts.

Insert a thermometer in the liquid formed and heat to about 87°C . Remove the boiling tube from the hot water and start the stop clock when its temperature drops to 85°C .

Allow the liquid to cool while stirring with the thermometer and record its temperature after every half a minute for three minutes. Enter your results in the table on page 3.

- (c) Transfer the whole of G into the boiling tube containing F. Immerse the boiling tube into the beaker of hot water and continue heating the water until the mixture melts. Continue heating until the temperature of the molten mixture is about 87°C . Remove the boiling tube from the hot water and start the stop clock when the temperature of mixture drops to 85°C .

While stirring gently with the thermometer, allow the mixture to cool and record its temperature after every half a minute for three minutes.

Enter your results in the table below. (07 marks)

Time (minutes)	0.0	0.5	1.0	1.5	2.0	2.5	3.0
Temperature of Pure F ($^{\circ}\text{C}$)	85.0	81.0	77.0	78.5	78.5	78.5	78.5
Temperature of mixture of F and G ($^{\circ}\text{C}$)	85.0	79.5	76.0	72.0	70.5	70.0	69.0

Questions:- Values recorded to no decimal place deny 2 marks (1 mark for a row)
Values recorded to 1 decpl and no decpl. deny 1 mark (1/2 for a row)

(a) Plot on the same axes, a graph of temperature of F against time. If values for F are not constant after 1.5 min deny 1/2 mark.

- (i) pure F against time. If values for F & G constant, deny 1 mark.
- (ii) mixture of F and G against time. Deny 3 marks if values of F & G are higher than those of pure F.

Use graph paper next page → page 4. (06 marks)

(b) Describe the shapes of the graphs you have drawn. (05 marks)

Both graphs are curves;

The graph of pure F is higher than that of mixture of F and G. ③

The graph of pure F becomes constant after some time; Graph of mixture keeps dropping or continues to drop.

(c) From your graphs, read off the temperature after 2.5 minutes of

78.5 $^{\circ}\text{C}$

①

(01 mark) from the graph.

(i) pure F

70.0 $^{\circ}\text{C}$

①

(ii) mixture of F and G

(01 mark)

(d) Use the temperatures you have obtained in (c) above to determine the depression in the freezing point of F. (01 mark)

$$78.5 - 70.0 = 8.5 ^{\circ}\text{C}$$

①

If temp. of F is lower than that of mixture, award for subtraction and -ve value but if values are interchanged and forces the answer to be +ve value, deny marks. Turn Over

While stirring gently with the thermometer, allow the mixture to cool and record its temperature after every half a minute for three minutes. (07 marks)

Enter your results in the table below.

Time (minutes)	0.0	0.5	1.0	1.5	2.0	2.5	3.0
Temperature of Pure F ($^{\circ}\text{C}$)	85.0	81.0	74.0	78.5	78.5	74.5	78.5
Temperature of mixture of F and G ($^{\circ}\text{C}$)	85.0	79.5	76.0	72.0	70.5	70.0	69.0

Questions:- Values recorded to no decimal place deny 2 marks (1 mark for if values for F are not constant after 1.5 min deny 2 marks)

- (a) Plot on the same axes, a graph of temperature of pure F against time. Deny 3 marks if values of F & G are than those of pure F.

(i) pure F against time.

(ii) mixture of F and G against time.

(06 marks)

- (b) Describe the shapes of the graphs you have drawn. (05 marks)

Both graphs are curves; ✓
The graph of pure F is higher than that of mixture of F and G. ✓
The graph of pure F becomes constant after some time; Graph of mixture keeps dropping or continues to drop.

- (c) From your graphs, read off the temperature after 2.5 minutes of

(i) pure F 78.5°C ✓ (01 mark) for obtain

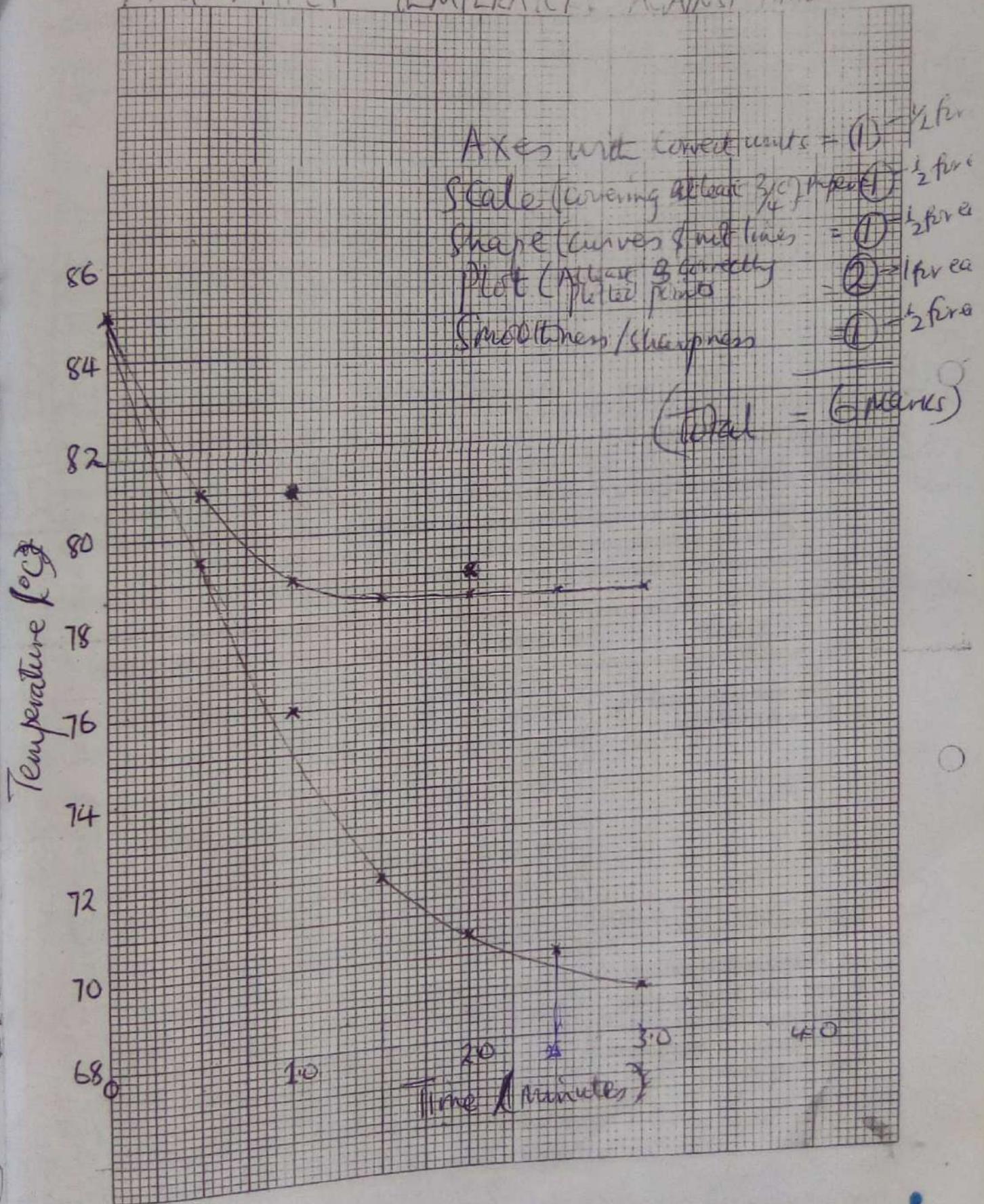
(ii) mixture of F and G 70.0°C ✓ (01 mark)

- (d) Use the temperatures you have obtained in (c) above to determine the depression in the freezing point of F.

$$78.5 - 70.0 = 8.5^{\circ}\text{C} \quad (01 \text{ mark})$$

If temp of F is lower than that of mixture, award for subtraction and -ve value but if values are interchanged and incorrect answers to be +ve value then, mark Turn Over

A GRAPH OF TEMPERATURE AGAINST TIME



- (e) Calculate the freezing point depression constant, K_f per kg of F.
 (Relative molecular formula of solid G is 152.) (04 marks)

500g of F dissolve in 1000g of water
 $\therefore 200\text{g of F dissolve in } 1000\text{g}$

$200\text{g of G cause a depression of } 8.5^\circ\text{C}$
 $152\text{g of G cause a depression of } \frac{8.5 \times 152}{1000} = 6.46^\circ\text{C}$

Freezing point depression constant = 6.46°C molar
 formula is used, award maximum of 2 marks
 (Accept values from $3.46 - 9.4$ except answers without units i.e. ± 3)

2. You are provided with substance P which contains two cations and two anions. You are required to identify the cations and the anions in P. Carry out the following tests on P and record your observations and deductions in the table below. Identify any gas(es) evolved. (25 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat one spatula end-ful of P in a dry test tube.	Colorless liquid / Condensate turns anhydrous copper(II) Sulphate blue Colorless gas turns blue litmus red and lime water milky. White fumes; colourless gas which turns acidified potassium dichromate(VI) solution green <i>insist on acidified</i>	Hydrated salt / water of crystallisation CO_2 , HCO_3^- , $\text{C}_2\text{O}_4^{2-}$ or CH_3COO^- SO_3^{2-} , SO_2 , SO_4^{2-} & SO_3 <i>acidified</i>
(b) To two spatula end-fuls of P, add about 5 cm^3 of water. Shake vigorously and filter. Divide the filtrate into 5 parts. Keep the residue.	Green solid turns black/brown residue Green filtrate Reject: green solution Green residue Reject: green solid, $\xrightarrow{5}$ green ppt Green suspension	Residue probably CuO , FeO , NiO and Fe_2O_3 (for brown) Transition metal ion Possibly Cu^{2+} , Fe^{2+} , Ni^{2+} or Cr^{3+} in both filtrate and residue

Turn Over

TESTS

(i) To the **first** part of the filtrate, add dilute sodium hydroxide solution drop-wise until in excess.

(ii) To the **second** part of the filtrate, add dilute ammonia solution drop-wise until in excess.

(iii) To the **third** part of the filtrate, add 3 – 4 drops of concentrated nitric acid followed by 2 – 3 drops of potassium thiocyanate.

(iv) To the **fourth** part of the filtrate, add 2 – 3 drops of lead(II) nitrate solution. Heat and allow to cool.

(v) Use the **fifth** part of the filtrate to carry out a test of your own choice to confirm one of the anions in P.

Add barium nitrate solution followed by dilute nitric acid.

Accept BaCl_2/HCl

(c) Wash the residue with water and dissolve it in dilute hydrochloric acid. Divide the resultant solution into **three** portions.

OBSERVATIONS

Green precipitate
insoluble in
excess
Ignore: turns to brown

Green precipitate
insoluble in
excess; turns
brown
Ignore reddish-

Green solution
turns yellow
then blood-red
on addition of
 $\text{KSCN}(\text{aq})$.

reject reddish-brown
White precipitate
insoluble in
heating

White precipitate SO_4^{2-} confirmed.
insoluble in the
acid if acid is added first, white ppt

Effervescence bubbles Gas is CO_2
of colourless gas
which turns blue
fibrous red and
lime water milky
green solution formed

DEDUCTIONS

Possibly $\text{Ni}^{2+}, \text{Fe}^{2+}$

(1½)

Fe^{2+}

(2)

Fe^{2+} oxidised to
 Fe^{3+} (for yellow soln)

$\therefore \text{Fe}^{2+}$ confirmed
reject Fe^{2+} confirmed if
yellow soln is not mentioned

Cl^- absent;
or $\text{SO}_4^{2-}, \text{SO}_3^{2-}$

suspected.
reject CO_3^{2-}

(1½)

(1)

(2)

(3½)

TESTS	OBSERVATIONS	DEDUCTIONS
(i) To the first portion of the solution, add dilute sodium hydroxide solution drop-wise until in excess.	Green precipitate insoluble in excess.	Possibly Ni^{2+} ; Fe^{2+} suspected.
(ii) To the second portion of the solution, add dilute ammonia solution drop-wise until in excess.	Green precipitate soluble in excess giving a pale-blue solution.	Possibly Ni^{2+} Present Award 3, even if observation is incomplete
(iii) Use the third portion of the solution to carry out a test of your own choice to confirm one of the cations in P.	Red precipitate	Ni^{2+} confirmed. If order Add aqueous silver nitrate followed by 2 drops of dimethyl amine gaseous solution (d) Identify the: - Negt Nitroen - blue ppt, (i) - red elevation (ii) - Deny nitro for leaving peeling off. See it cations in P Ni^{2+} and Fe^{2+} confirmed in (ii) anions in P SO_4^{2-} and CO_3^{2-} confirmed in (ii) In b(v) confirmed in (C)

You are provided with an organic substance W. You are required to determine the nature of W.

Carry out the following tests on W and record your observations and deductions in the table below.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of W on a spatula end or on a crucible lid.	White solid burns with a yellow sooty flame	Aromatic or aliphatic unsaturated compound. Car aliphatic compd with high C:H ratio

TESTS	OBSERVATIONS	DEDUCTIONS
(b) Add a spatula end-ful of W to about 5 cm^3 of dilute sodium hydroxide solution and shake.	Readily soluble to form a colourless solution.	Potentiely acidic compound. Q2. Aromatic carboxylic acid, Phenol suspected.
(c) To a spatula end-ful of W in a test tube add about 5 cm^3 of water. Shake vigorously and warm. Test the solution with litmus paper and divide into three equal portions.	Slightly soluble in cold water and soluble on warming. Solution formed turns blue litmus red.	Phenol, aromatic carboxylic acid - Suspected.
(i) To the first portion of the solution add 2-3 drops of 2,4 dinitro phenyl hydrazine. 25 pink solution turns yellow, orange.	No observable change. OR No yellow/orange ppt.	Carbonyl compound absent OR Ketone, aldehyde absent.
(ii) To the second portion of the solution, add 2-3 drops of iron(III) chloride solution.	Violet/purple colouration	Phenol present.
(iii) To the third portion of the solution, add a spatula end-ful of solid sodium hydrogen carbonate.	Effervescent bubbles of colourless gas.	Carboxylic acid present.
(d) To 2 cm^3 of ethanol, add a spatula end-ful of W and shake. Add 3-4 drops of concentrated sulphuric acid and warm the mixture.	Sweet-fruity smell.	Esterification occurs Carboxylic acid confirmed.

- (e) Comment on the nature of W. Aromatic compound with a hydroxy group attached to benzene ring.
Also contains the $-\text{COCH}_3$ group. Confirmed in C III order (02 marks)
- OR: Aromatic carboxylic acid with a hydroxy group.

8

or phenol with a carboxylic acid group

END

TESTS	OBSERVATIONS	DEDUCTIONS
(b) Add a spatula end-ful of W to about 5 cm^3 of dilute sodium hydroxide solution and shake.	Readily soluble to form a colourless solution	P. Carboxylic acid compound. OR. Aromatic carbonyl compound suspected.
(c) To a spatula end-ful of W in a test tube add about 5 cm^3 of water. Shake vigorously and warm. Test the solution with litmus paper and divide into three equal portions.	Slightly soluble in cold water and soluble on warming. Solution formed turns blue litmus red.	Phenol, aromatic carboxylic acid suspected.
(i) To the first portion of the solution add 2-3 drops of 2,4 dinitro phenyl hydrazine. 25 pink feject solution turns yellow, orange.	No observable change. OR No yellow/orange ppt.	Carboxylic compound absent OR. Ketone, aldehyde absent.
(ii) To the second portion of the solution, add 2-3 drops of iron(III) chloride solution.	Violet/purple colouration	Phenol present.
(iii) To the third portion of the solution, add a spatula end-ful of solid sodium hydrogen carbonate.	Effervescent bubbles of colourless gas.	Carboxylic acid present
(d) To 2 cm^3 of ethanol, add a spatula end-ful of W and shake. Add 3-4 drops of concentrated sulphuric acid and warm the mixture.	Sweet-fruity smell.	Esterification occurs Carboxylic acid confirmed.
(e) Comment on the nature of W. Aromatic ... a hydroxyl group attached to benzene ring. Also contains the -COCH_3 group. OR: Aromatic carboxylic acid with a hydroxyl group.	8 OR Phenol with a carboxylic acid group.	Scanned by CamScanner

P525/3 Inst. Sc.
CHEMISTRY
Practical Instructions
Paper 3
Nov. / Dec. 2010



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY PRACTICAL INSTRUCTIONS

(P525/3 Inst. Sc.)

November / December, 2010

CONFIDENTIAL

Great care should be taken that the information given below does not reach the candidates either directly or indirectly.

INSTRUCTIONS FOR PREPARING APPARATUS AND CHEMICALS

[NB: The head teacher must ensure that the teacher responsible for preparing the apparatus hands, in his/her trial results properly sealed in a separate envelope and **firmly** fastened (attached) to the candidates' scripts envelope(s).]

1. The description of the reagents and chemicals specified below does not necessarily correspond with the description in the question paper. Candidates must not be informed of the difference.

2. Candidates are not allowed to use reference books (i.e. text books, booklets on qualitative analysis etc.) during the examination.

3. In addition to the fittings and substances ordinarily contained in a chemistry laboratory, each candidate will require:

1 burette (50 cm^3)

1 pipette (25 cm^3 or 20 cm^3)

2 conical flasks.

1 measuring cylinder (100 ml).

1 beaker (250 ml)

8 test tubes

50 cm^3 of 2M hydrochloric acid labelled FA3

100 cm^3 of FA1

100 cm^3 of FA2

Phenolphthalein indicator

2g of T

2g of W

3 cm^3 of P

Easy access to:

- Heat source.
- Common reagents for identifying gases, cations, anions and organic compounds.

FA1 is prepared by diluting 50 cm^3 of F to make one litre of solution.

FA2 is prepared by diluting 45.5 cm^3 of G to make one litre of solution.

Substances F, G, P, T and W will be provided by UNEB.

Name ... ILMUSUME IGNATIUS Centre/Index No. PS 25 Q11.....
Signature 

PS25/3
CHEMISTRY
(PRACTICAL)
Paper 3
Nov. / Dec. 2010
3½ hours.



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY
PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer all questions.

Record your answers on this question paper in the spaces provided.

Mathematical tables and silent non-programmable calculators may be used.

Reference books (i.e. text books, books on qualitative analysis, etc) should not be used.

Candidates are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.

For Examiners' Use Only			
Q.1	Q.2	Q.3	Total
26	27	14	67

1. You are provided with the following

FA1, which is a 0.1 M hydrochloric acid

FA2, which is approximately a 0.1 M sodium hydroxide solution

FA3, which is a 2M hydrochloric acid.

Solid **W**, which is an impure metal carbonate

You are required to standardize **FA2** and use it to determine the percentage of the impurity in **W**.

Procedure:

- (a) Pipette 20 (or 25 cm³) of **FA2** into a conical flask.

Titrate with **FA1** using phenolphthalein as the indicator.

Repeat the titration until you obtain consistent results.

Record your results in table 1 below.

Table 1

Volume of pipette used ... 20.00 cm³. (1/2 mark)

Final burette reading (cm ³)	19.80 ✓	39.50 ✓	19.70 ✓
Initial burette reading (cm ³)	0.00 ✓	19.80 ✓	0.00 ✓
Volume of FA1 used (cm ³)	19.80 ✓	19.70 ✓	19.70 ✓

- Table filled to 2 d.p., with correct subtraction award (4½ mark)
- Any value obtained with 1 d.p. during +, make up to next 1/2 mark
- Titre values used for calculating the average volume of **FA1** used.
19.70, 19.70 ✓ (Any two values within ± 0.1) (1/2 mark)

Average volume of **FA1** used. 19.70 ± 0.1 ✓ cm³. (2½ mark)

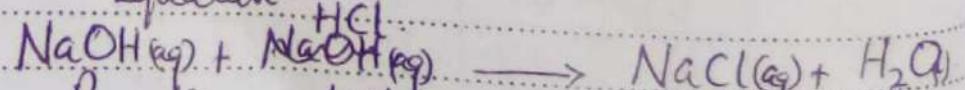
For pipette of 25mls; Avg. = 24.68 cm³ ± 0.2 ✓

Question:

Calculate the concentration in moles per litre of solution **FA2**. (02 marks)

$$\text{No. of moles of } \text{FA1} \text{ that reacted} = \frac{0.1 \times 19.70}{1000}$$

Equation:



Reaction mole ratio NaOH : HCl = 1 : 1

$$\therefore \text{No. of moles in } 20 \text{ cm}^3 \text{ of FA2} = \frac{0.1 \times 19.70}{1000}$$

200 cm³ of FA2 solution contains $\frac{0.1 \times 19.70}{1000}$

1000 cm³ of FA2 soln. contains $\frac{0.1 \times 19.70}{1000}$

Molarity of FA2 = $0.0985 \approx 0.099$

- (b) Weigh 1.5g of W and dissolve it in 20.0 cm³ of FA3 in a beaker. Add 80 cm³ of distilled water and label this solution FA4. Pipette 20 (or 25 cm³) of FA2 into a conical flask and titrate it with FA4 using phenolphthalein as the indicator. Record your results in Table 2 below.

Results:

Mass of container + W =	11.50	(½ mark)
Mass of empty container =	10.00	(½ mark)
Mass of W used =	1.50	(½ mark)
Volume of pipette used	20.00 cm ³	(½ mark)

Table 2

Final burette reading (cm ³)	11.50 ✓	23.00 ✓	34.50 ✓
Initial burette reading (cm ³)	0.00 ✓	11.50 ✓	23.00 ✓
Volume of FA4 used (cm ³)	11.50 ✓	11.50 ✓	11.50 ✓

As in Table 1:

(4½ marks)

4t

Titre values used for calculating the average volume of FA4 used.

11.50, 11.50, 11.50 ✓ (½ mark) ①

Average volume of FA4 used ... 11.50 cm³. (2½ marks) ②

Questions: For 25 ml. ppt Average

(a) Calculate the $= 14.4 \text{ cm}^3$ (02 marks)

(i) number of moles of hydrochloric acid that was in 100 cm³ of FA4. FA2 that reacted = 20 cm³ (02 marks)

No. of moles of HCl in 11.50 cm³ = $\frac{0.099 \times 20}{1000}$

Reaction mole ratio NaOH : HCl = 1 : 1

No. of moles of HCl in 11.50 cm³ = $\frac{0.099 \times 20}{1000}$

∴ No. of moles of HCl in 100 cm³ of FA4;

11.5 cm³ of HCl in FA4 contain $\frac{0.099 \times 20}{1000}$

100 cm³ of HCl in FA4 contain $\frac{0.099 \times 20 \times 100}{1000 \times 11.5}$

3

$= 0.0172 \text{ moles}$

Turn Over

- (ii) number of moles of the metal carbonate that reacted. (the metal carbonate reacts with hydrochloric acid in the ratio; 1:2)

$$\text{Original no. of moles of HCl added} = \frac{26.4}{1000} = 0.0264 \quad (02 \text{ marks})$$

$$\therefore \text{No. of moles of HCl that reacted with the carbonate} \\ = 0.04 - 0.0172 = 0.0228 \text{ moles}$$

$$\therefore \text{No. of moles of Metal Carbonate that reacted} = \frac{1}{2} \times 0.0228$$

(b) Determine the percentage of the impurity in W. = 0.0114M

$$\begin{aligned} \text{Mass of metal carbonate} &= 0.0114 \times 100 \\ \text{Mass of Impurity} &= 1.5 - 1.14 = 0.36 \text{ g} \\ &= 0.36 \times 100 / 1.14 \times 100 \quad (2\frac{1}{2} \text{ marks}) \end{aligned}$$

$$= 76\% \text{ Percentage Impurity} = \frac{\text{Mass of Impurity}}{\text{Mass of given carbonate}} \times 100$$

$$\text{Imp} = 100 - 76 \\ = 24\% \quad (2\frac{1}{2} \text{ marks})$$

2. You are provided with substance T which contains three cations and one anion. You are required to carry out the following tests on T to identify the cations and anion in it. Identify any gases evolved.

Record your observations and deductions in the table below. (27 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat a spatula end-ful of T in a dry test tube until there is no further change.	Melts to form a blue solution. Colourless vapour condenses to colourless liquid that turns amphidorous Copper (II) sulphate blue. White fumes which turn blue litmus red and a pale $\text{K}_2\text{Cr}_2\text{O}_7$ green.	Water of crystallisation or hydrated salt SO_3^{2-} gas $\therefore \text{SO}_3^{2-}, \text{SO}_4^{2-}$ Probably CuO_2
(b) Shake two spatula end-fuls of T with about 3 cm^3 of water. Add dilute sodium hydroxide solution to the mixture drop-wise until in excess. Warm and filter. Keep both the filtrate and the residue.	Blue solution. Blue precipitate turns black on heating. Colourless gas turned red litmus blue. Fumes with conc. HCl . Colourless filtrate. Black residue.	$\text{Cu}^{2+} \quad \text{NH}_3(\text{g}) \therefore \text{NH}_4^+$ Dense smoke if conc. HCl used. $\text{Al}^{3+}, \text{Pb}^{2+}, \text{Sn}^{4+}, \text{Zn}^{2+}$

Reject dil HCl

TESTS	OBSERVATIONS	DEDUCTIONS
(c) To the filtrate, add dilute nitric acid drop-wise until the solution is just acidic. Divide the acidic solution into six parts.	White precipitate soluble to excess Colorless gas at solution	$\text{Al}^{3+}, \text{Pb}^{2+}, \text{Zn}^{2+}, \text{Sn}^{2+}, \text{Sn}^{4+}$ suspected A pale greenish colour
(i) To the first part of the acidic solution, add dilute sodium hydroxide solution drop-wise until in excess. Warm the mixture.	White precipitate soluble in excess to give a colorless solution. Colorless gas which turns red litmus blue and forms dense white fumes with conc. HCl .	$\text{Al}^{3+}, \text{Pb}^{2+}, \text{Zn}^{2+}, \text{Sn}^{2+}, \text{Sn}^{4+}$ rejected Ammonia found. Any extra strong colour can be the error. NH_3 gas $\therefore \text{NH}_4^+$ confirmed by flame test on NH_4^+
(ii) To the second part of the solution, add dilute ammonia solution drop-wise until in excess.	White precipitate insoluble in excess	$\text{Pb}^{2+}, \text{Al}^{3+}, \text{Sn}^{2+}, \text{Sn}^{4+}$ probably present
(iii) To the third part of acidic solution, add 2-3 drops of potassium iodide solution.	No observable change Accept: No yellow ppt, Soln remains colourless. Reject: No change, no observation.	Pb^{2+} absent! Insist on Pb^{2+} absent
(iv) To the fourth part of the acidic solution, add 2-3 drops of litmus solution, followed by ammonia solution drop-wise until in excess.	Pink solution. Blue precipitate soluble to form a blue lake blue solution.	Al^{3+} confirmed

TESTS	OBSERVATIONS	DEDUCTIONS
(v) To the fifth part, add 2-3 drops of lead(II) ethanoate solution.	White precipitate probably Cl^- ; SO_4^{2-} probably present.	Cl^- present SO_4^{2-} present Lead(II) ethanoate from the solution - in acid
(vi) Use the sixth part to carry out a test of your own choice to confirm the anion in T. Add Barium nitrate solution to Barium chloride solution. If AgCl is given, ignore it.	White precipitate	SO_4^{2-} confirmed
(d) Wash the residue with water and dissolve it in dilute hydrochloric acid and divide the solution into three parts.	Dissolves to give a blue solution Accept: greenish	Cu^{2+} suspected. $\rightarrow \text{Ni}^{2+}, \text{Cu}^{2+}, \text{Cr}^{3+}, \text{Fe}^{2+}$
(i) To the first part of the acidic solution, add dilute sodium hydroxide solution dropwise until in excess.	Blue precipitate insoluble in excess.	Cu^{2+} suspected.
(ii) To the second part of the acidic solution, add dilute ammonia solution dropwise until in excess.	Blue precipitate dissolves to give a deep-blue solution	Cu^{2+} probably present.
(iii) To the third part of the acidic solution, add 2-3 drops of potassium hexacyanoferrate (II) solution.	reddish brown brown precipitate Accept: reddish-brown Reject: brownish-red	Cu^{2+} confirmed

- (c) (i) The anion in T is SO_4^{2-}
(ii) The cations in T are Al^{3+} , NH_4^+ , Cu^{2+}

3. You are provided with an organic substance P. You are required to determine the nature of P.

Carry out the following tests on P and record your observations and deductions in the table below. (14 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of P on a spatula end or in a porcelain dish.	Colourless liquid Burns with a yellow non-smoky flame.	Saturated aliphatic compound. (low C : H ratio)
(b) To about 1 cm^3 of P, add about 2 cm^3 of water, shake and test the mixture with litmus. Divide the mixture into three parts.	Miscible / soluble / dissolves in water to give a colourless solution which has no effect on litmus	Neutral compd with moderate solv. power Alkanes / alkanes probably present.
(i) To the first part of the mixture, add 2-3 drops of Brady's reagent.	No observable change: Accept: No yellow / orange ppt.	Carbonyl Compound absent. Accept: Reme, aldehyde
(ii) To the second part of the mixture, add 2-3 drops of iron(III) chloride solution.	No observable change Accept: Colour of FeCl_3 remains.	Phenol or Benzonic acid absent.
(c) To the third part of the mixture from (b) above, add 2-3 drops of acidified potassium dichromate(VI) solution. Heat the mixture and divide the solution into two parts.	Orange solution turned green.	Primary, secondary alkanol probably present. Reject aldehyde (if green remains).

(i) To the first part of the solution, add 2 - 3 drops of Brady's reagent.	Yellow precipitate	In primary or secondary alkanol oxidized to carbonyl compound
(ii) To the second part of the solution , add 2-3 drops of Tollen's reagent and warm.	No observable change. Accept: No silver mirror formed.	Secondary alkanol oxidized to alkanone reject: Primary alkanoles silver mirror absent
(d) To about 0.5 cm^3 of P , add 2 - 3 drops of Lucas reagent.	Cloudiness after a short time Accept: turbid Reject: two layers of soln, at hds ppt	Secondary alkanol present.
(e) To about 0.5 cm^3 of P, add 2 - 3 drops of sodium hydroxide solution followed by iodine solution until the solution is pale yellow. Warm the mixture and allow to stand.	Yellow/orange precipitate	Contains a methyl radical adjacent to the carbon carrying the functional group $\text{R}-\overset{\text{CH}}{\underset{\text{OH}}{\text{CH}_3}}$

(f) Comment on the nature of P.
 P is an aliphatic secondary alkanol with the structure: $\text{R}-\overset{\text{CH}}{\underset{\text{OH}}{\text{CH}_3}}$

P525/3
CHEMISTRY
(PRACTICAL)
Paper 3
Nov./Dec. 2009
3½ hours



UGANDA NATIONAL EXAMINATIONS BOARD
Uganda Advanced Certificate of Education
CHEMISTRY PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer all questions.

Record your answers on this question paper in the spaces provided.

Mathematical tables and silent non-programmable calculators may be used.

Reference books (i.e. text books, Books on qualitative analysis, etc) should not be used.

Candidates are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.

For Examiners' Use Only			
Q. 1	Q. 2	Q. 3	Total
25½	29½	15	70

I. You are provided with the following:

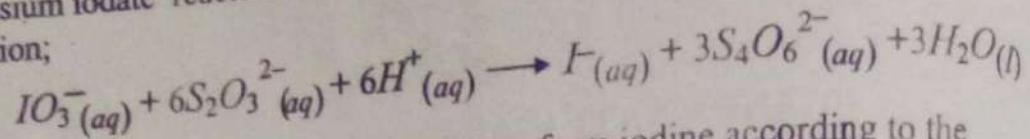
FA1, which is a 0.012 M potassium iodate solution.

W, which is sodium thiosulphate, $Na_2S_2O_3 \cdot 5H_2O$.

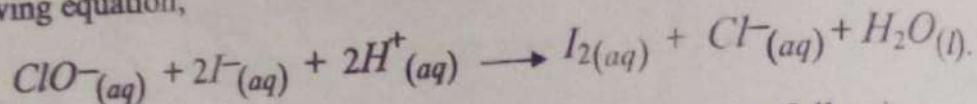
Z, which is a liquid bleaching agent containing chlorate(I).

You are required to prepare and standardise a solution of sodium thiosulphate and use it to determine the mass of chlorine required to produce 1 dm³ of the bleaching agent.

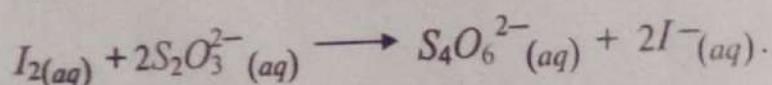
Potassium iodate reacts with sodium thiosulphate according to the following equation;



Chlorate(I) reacts with potassium iodide to form iodine according to the following equation;



And iodine reacts with sodium thiosulphate according to the following equation;



Procedure:

- (a) Weigh about 6.0 g of **W** and dissolve it in about 100 cm³ of distilled water. Transfer the solution to a 250 cm³ volumetric flask and make it up to the mark with distilled water. Label the solution **FA2**.

Pipette 25.0 (or 20.0) cm³ of **FA1** into a conical flask. Add 20 cm³ of 1M sulphuric acid, followed by 20 cm³ of 0.5 M potassium iodide solution. Titrate the mixture with **FA2** until the brown colour changes to yellow. Add 1 cm³ of starch indicator and continue the titration until the solution turns colourless.

Repeat the titration until you obtain consistent results.

- (i) Record your results in Table A.

Results:

Accept Volume of pipette used 20.00 ✓ cm³
Average for Volume of pipette recorded to 1 decimal 25 cm³; convert ie

Table A - Burette Readings

Final burette reading (cm ³)	18.10	136.10	36.70
Initial burette reading (cm ³)	0.30	118.10	19.00
Volume of FA2 used (cm ³)	17.80	18.00	17.70

Volumes of FA2 used in calculating average volume

- Taking best readings which differ by $\pm 0.1 \text{ cm}^3$.
 Average volume of FA2 used = $17.8 + 17.70 = 17.75 \text{ cm}^3$

Question:

(ii) Calculate the morality of FA2.

Moles of IO_3^- in $1000 \text{ cm}^3 = 0.012$

Moles of IO_3^- in $20.00 \text{ cm}^3 = 0.012 \times 20$

Moles of $\text{S}_2\text{O}_3^{2-}$ in $17.75 \text{ cm}^3 = \frac{6 \times 0.012 \times 20}{1000}$

Molarity of FA2 = $\frac{6 \times 0.012 \times 20 \times 1000}{17.75 \times 1000}$

= 0.08 M

(b) Measure 10 cm^3 of Z into a 250 cm^3 volumetric flask. Add distilled water up to the mark. Label the solution FA3.

Pipette 25.0 (or 20.0) cm^3 of FA3 into a conical flask. Add 10 cm^3 of 0.5 M potassium iodide solution, followed by 10 cm^3 of 1 M sulphuric acid. Titrate the mixture with FA2 until the mixture turns yellow. Add 1 cm^3 of starch indicator and continue with the titration until the solution turns colourless.

Repeat the titration until you obtain consistent results.

Record your results in Table B below

Results:

Volume of pipette used: 20 cc (cm³)

Table B

Final burette reading (cm ³)	8.10	16.20	24.3
Initial burette reading (cm ³)	0.00	8.10	16.2
Volume of FA2 used (cm ³)	8.10	8.10	8.1

Volumes of FA2 used for calculating average volume

8.10, 8.10, 8.10

Average volume of FA2 used $\frac{8.1 + 8.1 + 8.1}{3} = 8.1$ cm³

Questions:

(c) Calculate:

(i) the number of moles of iodine liberated.

$$\text{Moles of FA2 used} = \frac{8.10 \times 0.08}{1000}$$

$$\therefore \text{Moles of Iodine liberated} = \frac{1}{2} \times 0.08 \times \frac{8.10}{1000} = 3.24 \times 10^{-4}$$

(ii) the number of moles of chloride ions that would be liberated from 10 cm³ of Z.

$$\text{Ratio } I_2 : Cl^- = 1 : 1$$

$$\therefore \text{No of moles of } Cl^- \text{ liberated by } 20 \text{ cm}^3 = 3.24 \times 10^{-4}$$

$$\text{Moles of FA3 in } 250 \text{ cm}^3 =$$

$$\frac{250 \times 3.24 \times 10^{-4}}{20}$$

$$= 0.00405$$

These moles are in 10 cm³ = 0.00405

(iii) the number of moles of chlorine required to produce 1 dm^3 of Z.

$$\text{Moles of } \text{Cl}_2 \text{ in } 1\text{ cm}^3 = 0.00405$$

$$\text{So Moles in } 1000\text{ cm}^3 = \frac{1000 \times 4.05}{10}$$

$$= 0.405 \text{ moles}$$

1 mole of Cl_2 gives 2 moles of Cl^-

$$\therefore \text{No of moles of } \text{Cl}_2 = \frac{1}{2} \times 0.405 \quad \text{1} \\ \text{2}$$

$$= 0.2025 \text{ moles} \quad \text{1} \\ \text{2}$$

(iv) Determine the mass of chlorine required to produce 1 dm^3 of Z.

$$[\text{Cl} = 35.5]$$

$$\text{Relative molecular mass of } \text{Cl}_2 = 35.5 \times 2 = 71 \quad \text{1} \\ \text{2}$$

$$\text{Mass of Chlorine} = 0.2025 \times 71 \quad \text{1} \\ \text{2}$$

$$= 14.38 \text{ g} \quad \text{1} \\ \text{2}$$

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2. You are provided with substance, Y, which contains two cations and two anions. Carry out the following tests on Y and identify the cations and anions in it. Identify any gases evolved. Record your observations and deductions in the table below.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat one spatula endful of Y strongly in a dry test tube.	Colorless vapour condensed to colourless liquid which turns blue when copper(II)sulphate blue.	Water or crystallised hydrate. $\text{CuSO}_4 \cdot n\text{H}_2\text{O}$
(b) To two spatula endfuls of Y in a test tube, add about 5 cm^3 of water, shake and filter. Keep both the residue and the filtrate. Divide the filtrate into five parts.	Colourless filtrate Reagent: White precipitate white solution Green residue Reagent: Green solid 5 gatin ppt	Carbon dioxide. $\text{CaCO}_3 \rightarrow \text{HCO}_3^-$ CaCO_3 is not present $\text{Fe}_2(\text{O})_3$ is present MnO_2 , CuO , Fe_2O_3 , NiO Non-transition metal ions probably Pb^{2+} , Zn^{2+} , Al^{3+} Mg^{2+} , Mn^{2+} Transition metal ion probably Cu^{2+} , Ni^{2+} , Cr^{3+} , Fe^{2+} Turn Over

(i) To the first part of the filtrate, add dilute sodium hydroxide solution drop-wise until in excess.	White precipitate insoluble in excess; turns brown on standing	Precipitate Mn^{2+} present
(ii) To the second part of the filtrate, add dilute ammonia solution drop-wise until in excess.	White precipitate insoluble in excess, turns brown on standing	Probably Mn^{2+} present. If insoluble is not mentioned, may be Ag^+
(iii) Use the third part of the solution to carry out a test of your own choice to confirm one of the cations present in Y.		
Add concentrated nitric acid followed by dilute sodium permanganate.	Purple solution	Mn^{2+} confirmed.
(iv) To the fourth part of the filtrate, add 2-3 drops of lead (II) nitrate solution.	White precipitate	SO_4^{2-} , Cl^- , CO_3^{2-} , SO_3^{2-}
(a) Use the fifth part of the filtrate to carry out a test of your own choice to confirm one of the anions present in Y.	if order is reversed Give further info. white ppt	
Add Barium Chloride followed by dilute hydrochloric acid or $Ba(NO_3)_2$ followed by dil. HNO_3 .	White precipitate insoluble in the acid	SO_4^{2-} confirmed
(c) Wash the residue and dissolve it in dilute hydrochloric acid. Divide the solution into four parts.	Effervescence Chlorides of which turns blue forms red and lime water milky	Carbon dioxide: CO_3^{2-} confirmed
(i) To the first part of the solution, add dilute sodium hydroxide solution drop-wise until in excess.	A greenish-blue solution remains Acceptable Cu^{2+} , Fe^{2+} , Cr^{2+} , Ni^{2+} , Ca^{2+} , Fe^{3+} , Cr^{3+}	Pale-blue precipitate which does not dissolve in excess Probably Cu^{2+} present

(ii) To the second part of the solution, add dilute ammonia solution drop-wise until in excess.	Blue precipitate Soluble in excess to form a deep-blue suspected solution.	Cu^{2+}
(iii) To the third part of the solution, add 2-3 drops of potassium thiocyanate.	A greenish-brown solution Acceptable Dense white precipitate Dense white precipitate	Cu^{2+} suspected
(iv) Use the fourth part of the solution to carry out a test of your own choice to identify one of the cations in Y. Add Potassium iodide solution or Potassium hexacyanoferrate (II) solution.	White precipitate and brown soln. Ppt Marrow/dark brown	Cu^{2+} confirmed
(d) (i) The cations present in Y are (ii) The anions present in Y are	Mn^{2+} and Cu^{2+} SO_4^{2-} and CO_3^{2-}	2 $\frac{7}{2}$

3. You are provided with an organic substance K. You are required to identify the nature of K. Carry out the following tests on K and record your observations and deductions in the table below.

29 1/2

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a spatula endful of K on a porcelain dish or at the end of a spatula.	Burns with a yellow sooty flame smoky - Acceptable	Aromatic compound Acceptable - high C/H ratio or unsaturated carbonyl group
(b) Transfer two spatula endfuls of K to a test tube containing 5 cm ³ of water, warm the mixture and test with litmus. Divide the warm solution into four parts	Sparingly soluble in water. Sulphur tinted blue tannin red	Phenol or Carboxylic acid probably present Acceptable - colour change
To the first part of the warm solution add 2-3 drops of sodium carbonate solution.	Slight effervescence	Carboxylic acid probably present Dense white if phenol is present

(ii) To the second part of the solution add 2-3 drops of iron(III) chloride solution.	No observable change or No solution in 4	Phenol absent
(iii) To the third part of the solution add 2-3 drops of potassium dichromate(VI) solution and warm.	No observable change Acceptable Excess	Aldehyde, Primary / Secondary alcohol absent or Reducing agent absent Ignore ketone if
(c) Dissolve one spatula endful of K in 2 cm ³ of methanol and add 2-3 drops of Brady's reagent.	No observable change or No yellow brown precipitate Accept: Orange Reject: Orange yellow or aldehyde like form of product reagent	Carboxyl Compound absent
(d) To a spatula endful of K, add about 5 drops of ethanol followed by 2-3 drops of concentrated sulphuric acid. Heat the mixture and pour it into a small beaker of cold water. Allow to stand.	Sweet / fruity Smelling liquid	Carboxylic acid present
(e) To a spatula endful of K in a test tube, add 3 cm ³ of water, warm and add 2-3 drops of acidified potassium manganate(VII) solution.	Purple solution turns to Colorless Accept: Silver decolorized turns to colourless	Compound unsaturated Accept: $\text{C}=\text{C}$, $\text{C}\equiv\text{C}$

Comment on the nature of K

K is Aromatic Unsaturated Carboxylic acid

Name Centre / Index No.
Signature

P525 / 3
CHEMISTRY
(PRACTICAL)
Paper 3
Nov. / Dec. 2008
3½ hours



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY

PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer all questions.

Record your answers on this question paper in the spaces provided.

Mathematical tables, slide rules and silent non-programmable calculators may be used.

*Reference books (i.e. text books. Books on qualitative analysis, etc.) should **not** be used.*

*Candidates are **not** allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.*

For Examiners' Use Only			
Q.1	Q.2	Q.3	Total
24	30	15	69

I. You are provided with the following:

FA1, which is aqueous ammonia.

FA2, which is trichloromethane.

FA3, which is 0.5 M hydrochloric acid.

FA4, which is 0.05 M hydrochloric acid.

You are required to determine the distribution (partition) coefficient of ammonia between water and trichloromethane.

Procedure:

Add 10 cm³ of FA1 to 50 cm³ of FA2 in a conical flask. To this mix add 50 cm³ of distilled water. Shake the mixture vigorously for about 5 min and then allow it to stand for about 10 minutes.

Carefully decant the upper (aqueous) layer into a boiling tube (or small conical flask / beaker). Transfer the lower (organic) layer into another boiling tube (or small flask / beaker) and cover.

Read and record room temperature in the results.

(i) Pipette 10 cm³ of the aqueous layer into a clean conical flask.

Add 2 to 3 drops of phenolphthalein indicator and titrate with FA3.

Repeat the titration until you obtain consistent results. Record your results in table 1.

Results:

Room temperature 30.0 ✓ °C.

Table 1

Final burette reading (cm ³)	32.50 ✓	42.50 ✓
Initial burette reading (cm ³)	0.00 ✓	10.00 ✓
Volume of FA3 used (cm ³)	32.50 ✓	32.50 ✓
Values used	= 32.50, 32.50 cm ³ ✓	

- Average volume of FA3 used $\frac{32.50 + 32.50}{2}$ cm³ ✓
- Deduct $\pm \frac{1}{2}$ ml for every wrong subtraction up to $\frac{1}{2}$ ml. ± 0.2
 - Values recorded to no decimal place are only $\pm \frac{1}{2}$ ml for correct subtraction.
 - Any value above 50 ml, deduct $\pm \frac{1}{2}$ ml and = 32.50 ✓ ± 0.2
 - Deduct $\pm \frac{1}{2}$ ml for every table recorded ± 0.4
 - Deduct $\pm \frac{1}{2}$ ml for every table recorded ± 0.6
 - Taking best readings which differ by ± 0.1 , award $\pm \frac{1}{2}$ ml
 - Expression for average vol. awarded $\pm \frac{1}{2}$ ml

- (ii) Pipette 10cm^3 of the organic layer into a clean conical flask.
Add 2 to 3 drops of phenolphthalein and titrate it with FA4. Repeat the titration until you obtain consistent results.

Record your results in table 2.

Table 2

Final burette reading (cm^3)	5.50 ✓	11.50 ✓	
Initial burette reading (cm^3)	0.00 ✓	6.00 ✓	③
Volume of FA4 used (cm^3)	5.50 ✓	5.50 ✓	④

Values used = 5.50, 5.50 cm^3

Average volume of FA4 used $\frac{5.50 + 5.50}{2} \text{ cm}^3$

* Same as in table 1

$$= 5.50 \text{ cm}^3 \checkmark \quad \begin{matrix} \pm 0.2 \\ \pm 0.4 \\ \pm 0.6 \end{matrix}$$

Questions:

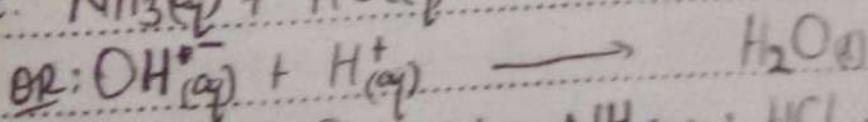
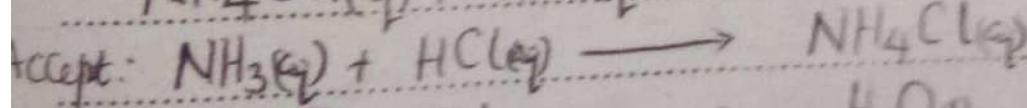
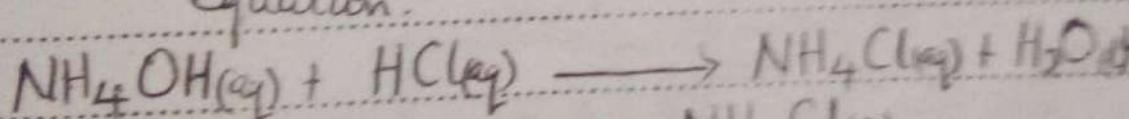
- (a) Calculate the molar concentration of ammonia in the aqueous layer.

1000 cm^3 of FA3 contain 0.5 moles

32.50 cm^3 of FA3 contain $\frac{0.5 \times 32.50}{1000}$ moles

$$= 1.625 \times 10^{-3} \text{ moles}$$

Equation:



Reaction mole ratio $\text{NH}_3_{(\text{g})} : \text{HCl}_{(\text{g})} = 1:1$

∴ No. of moles of FA1 in 10cm^3 = 1.625×10^{-3} moles

10 cm^3 of FA1 contain 1.625×10^{-3} moles

1000 cm^3 of FA1 contain $\frac{1.625 \times 10^{-3} \times 1000}{10}$

$$= 1.625$$

$$\therefore \text{molarity} = \frac{1.625}{1.625 \text{ mol dm}^{-3}}$$

Turn Over

- (b) Calculate the molar concentration of ammonia in the organic layer

Molarity of FAI

100 cm³ of FAI

5.6 cm³ of FAI contains 0.0275 mol

$$\frac{0.0275}{100} = 0.000275 \text{ mol}$$

No. of mols of FAI in 10 cm³ = 0.000275 mol

reaction ratio of NH₃(aq) : HCl = 1:1

100 cm³ of FAI contain 0.000275 mol.

100 cm³ of FAI contain $0.000275 \times 10 = 0.00275 \text{ mol}$

Molarity of FAI = 0.0275 mol

- (c) Determine the value of the distribution coefficient of ammonia between water and trichloromethane at the temperature you have recorded.

Distribution Coefficient = $\frac{\text{Concentration of ammonia in water}}{\text{Concentration of ammonia in CHCl}_3}$

$$\text{Hence } K_D = \frac{1.625}{0.0275}$$

$$= 59.09$$

$$K_D = 59.09$$

$$\text{Accept } K_D = \frac{[\text{NH}_3\text{(aq)}] \text{ in water}}{[\text{NH}_3\text{(aq)}] \text{ in CHCl}_3}$$

Reject () to mean square brackets.

24

You are provided with substance Y which contains two cations and two anions. You are required to carry out the following tests on Y to identify the cations and anions in it. Identify any gases evolved.

Record your observations and deductions in the table below.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat strongly one spatula endful of Y in a dry test tube.	White residue turned yellow (hot), white (cold). Colourless condensate / liquid which turns anhydrous Copper(II) Sulphate blue. Colourless gas turns blue litmus red and lime water milky. Yellow residue turned white on cooling.	Transition metal ions absent for non transition metal ions or may be Zn^{2+} . Water of Crystallisation hydrate. $\text{CO}_3^{2-}, \text{HCO}_3^{-}, \text{C}_2\text{O}_4^{2-}$ ZnO formed $\therefore Zn^{2+}$
(b) To one spatula endful of Y in a test tube, add 2 to 3 drops of concentrated sulphuric acid.	Effervescence / misty fumes with a choking smell turned wet blue litmus red, formed dense white fumes with ammonia gas.	Hydrogen Chloride gas. Acidic gas probably Cl^- present
(c) To two spatula endfuls of Y, add about 5cm^3 of water. Shake vigorously and filter. Keep both residue and filtrate.	Partly dissolves to form a colourless filtrate and white residue. Filter: Clear solution, white ppt, white solid	Transition metal ion absent or Non-transition metal ions present. Accept a list of non-transition metal ions e.g. $Mg^{2+}, \text{Ca}^{2+}, \text{Al}^{3+}, \text{Zn}^{2+}, \text{Pb}^{2+}$ etc.

Table continues...

TESTS	OBSERVATIONS	DEDUCTIONS
(d) Divide the filtrate into six portions. (i) To the first portion of the filtrate, add dilute sodium hydroxide solution dropwise until in excess.	White precipitate insoluble in excess	Mg^{2+} , Ca^{2+} , Ba^{2+} suspected, Am
(ii) To the second portion of the filtrate, add aqueous ammonia dropwise until in excess.	White precipitate insoluble in excess	Mg^{2+} , Ba^{2+} suspected, reject Ca^{2+} it shows no colour change
(iii) To the third portion of the filtrate, add a spatula endful of solid ammonium chloride, followed by 3 to 4 drops of disodium hydrogen phosphate solution and then ammonia solution dropwise until in excess.	White precipitate insoluble in excess ammonia Insoluble must be mentioned	Mg^{2+} , Ba^{2+} suspected. reject soda AgN
(iv) To the fourth portion of the filtrate, add 2 to 3 drops of potassium chromate(VI) solution followed by 2 to 3 drops of dilute sodium hydroxide solution	Yellow precipitate insoluble in excess alkali Reject orange ppt	Ba^{2+} Confirmed if insoluble in alkali Murexide for Ba^{2+}

Table Continues...

TESTS	OBSERVATIONS	DEDUCTIONS
(v) To the fifth portion of the filtrate, add 2 to 3 drops of lead(II) nitrate solution, followed by dilute nitric acid.	White precipitate insoluble in the acid	$\text{SO}_4^{2-}, \text{Cl}^-$ Suspected
(vi) Use the sixth portion of the filtrate to carry out a test of your own choice to confirm one of the anions in Y	OR Add dilute AgNO_3 followed by dilute HNO_3 and white ppt ✓	Cl^-
Add Silver nitrate solution followed by dilute nitric acid <u>OR:</u> Add AgNO_3 and wash followed by dilute nitric acid and then aqueous ammonia	White precipitate insoluble in the acid White precipitate soluble in nitric acid but soluble in aqueous ammonia (precipitation)	Cl^- confirmed
(e) Wash the residue with a little water. Transfer the residue into a test tube and dissolve in dilute nitric acid. Divide the solution into three portions.	Effervescence Colourless gas which turned lime water milky and effervescent A Colourless Solution formed.	Carbon dioxide gas $\therefore \text{CO}_3^{2-}$ Reject HCO_3^- or $\text{C}_2\text{O}_4^{2-}$ OR $\text{Ba}^{2+}, \text{Mg}^{2+}$, $\text{Al}^{3+}, \text{Zn}^{2+}$, Ca^{2+}

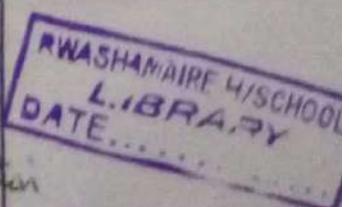
Table Continues....

TESTS	OBSERVATIONS	DEDUCTIONS
(i) To the first portion of the solution, add dilute sodium hydroxide solution dropwise until in excess.	White precipitate soluble in excess to form a colourless solution	Zn^{2+} , Al^{3+} Al^{3+} suspected
(ii) To the second portion of the solution, add aqueous ammonia dropwise until in excess.	White precipitate soluble in excess to form a colourless solution	Zn^{2+} suspected
(iii) Use the third portion of the solution to carry out a test of your own choice to confirm one of the cations in the solution. Add solid ammonium chloride followed by disodium hydrogen phosphate and aqueous ammonia. Order of addition of reagents matter.	White precipitate soluble in aqueous ammonia	Zn^{2+} confirmed
(f) Identify: (i) the cations in Y (ii) the anions in Y	Ba^{2+} , Zn^{2+} Cl^- , CO_3^{2-}	

3. You are provided with an organic substance Z. You are required to determine the nature of Z.

Carry out the following tests on Z and record your observations and deductions in the table below.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of Z on a crucible lid or spatula end.	Colourless liquid burns with a yellow non-luminous flame Reject: orange flame, non-luminous flame	Alephatic + Saturated compound (or with low C:H) Accept: low Carbon Content for C:H Reject: low upto mean low C:H
(b) To about 1 cm^3 of Z, add about 1 cm^3 of dilute sodium hydroxide solution	No observable change OR Readily soluble / soluble in water to form a colourless solution.	Probably Carboxylic acid, Ketone, aldehyde, alcohol
(c) To about 1 cm^3 of Z, add 2 to 3 drops of neutral iron(III) chloride solution and warm. Accept: No brown ppt - CH_3COO^- absent	No observable change No ppt/purple colouration Accept: the brown colour of neutral Fe^{3+} (III) Chloride remains/persists OR Z acquires brown colour of neutral Chloride Reject: Brown / brown solution formed - Reject: Orange solution to yellow colour - FeCl ₃	Phenol ✓ or CH_3COO^- absent



Turn Over

5

TESTS	OBSERVATIONS	DEDUCTIONS
(d) To about 1 cm^3 of Z, add about 1 cm^3 of water. Shake and allow to stand. Test the resultant solution with litmus paper and divide the solution into two portions.	Misable solid water is from a colourless solution that turns blue litmus red. Reject: white沉淀	Carboxylic acid present Acid of carboxylic acids
(i) To the first portion of the solution, add 1 cm^3 of sodium hydrogen carbonate solution.	Effervescence; Colourless gas that turned lime water milky and blue litmus red Colourless solution remained	Carboxylic acid ✓ Confirmed
(ii) To the second portion of the solution, add 2 to 3 drops of 2,4 dinitrophenyl hydrazine solution (Brady's reagent).	Yellow Orange precipitate	Methanoic (HCOOH) acid Confirmed $\text{CH}_3\text{C}\overset{\text{O}}{\underset{\text{H}}{\text{O}}}$
(e) To about 0.5 cm^3 of Z, add about 1 cm^3 of Tollen's reagent, warm and allow the mixture to stand.	Immediate Cloudiness followed by a silver mirror on warming Reject: grey precipitate Reject: black ppt, white ppt	Methanoic acid ✓ Confirmed Reject carboxylic acid

(i) From your results above, deduce the nature of compound Z

Saturated... aliphatic
acid / methanoic acid

15

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CHEMISTRY
Paper 3
Nov. / Dec. 2006
3½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY
(PRACTICAL TEST)
Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

Answer all questions.

Record your answers on this question paper in the spaces provided.

Mathematical tables, slide rules and silent non-programmable calculators may be used.

Reference books (i.e. text books. Books on qualitative analysis, etc.) should not be used.

Candidates are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.

For Examiner's Use Only			
Q.1	Q.2	Q.3	Total
25	28	16	

1. You are provided with the following:

FA1, which is approximately a 1.0 M sodium hydroxide solution.

FA2, which is a 1.0 M hydrochloric acid.

FA3, which is a 0.02 M hydrochloric acid.

Q, which is an acidic solid.

You are required to determine the percentage of the acid in **Q**.

Procedure A:

Pipette 25.0 (or 20.0) cm³ of **FA1** into a conical flask and titrate it with **FA2** using phenolphthalein indicator. Repeat the titration until you get consistent results.

Record your results in **Table A** below.

Results:

Volume of pipette used 20.00 ✓ cm³. (3)

Table A

Final burette reading (cm ³)	18.30 ✓	33.90 ✓
Initial burette reading (cm ³)	2.70 ✓	18.30 ✓
Volume of FA2 used (cm ³)	15.60 ✓	15.60 ✓

Average volume of **FA2** used

Volumes of **FA2** used for calculating the average titre 15.60, or 15.60 ✓ cm³. (1)

Average titre value 15.60 ± 0.1 ✓ (2) (for 25.00 cm³ pipette)

- For each 1 d.c.p. deny ½ m.c.

± 0.2 ✓ (2) (1)

- For no d.c.p. award zero

± 0.3 ✓ (1) (1)

- Deny ½ mark for each

wrong subtraction up to maximum of 1 m.c. ± 0.4 ✓ (1) (1)

- 3 metres for table filled to 2 d.p.

± 0.5 ✓ (1) (1)

and correct subtraction

± 0.5 ✓ (1) (1)

- ½ for table filled to 1 d.c.p. & 2 d.c.p.

> 0.5 = (0)

Calculate the molar concentration of sodium hydroxide in FA1.

$$\text{Moles of HCl in FA2} = \frac{1.0 \times 15.60}{1000}$$

$$\text{Concentration of NaOH in FA1} = \frac{1.0 \times 15.60 \times 1000}{1000 \times 20} \approx 0.78 \text{ M}$$

(Deny the last 2 marks if was outside the accuracy range)

Procedure B:

Weigh accurately 1.5 g of Q and transfer it to a conical flask containing about 25 cm^3 of distilled water. Add 25 cm^3 of FA1 and boil the mixture gently for about 15 minutes (add more water during the boiling to maintain the volume nearly constant if necessary.)

Cool and transfer the mixture into a 250 cm^3 volumetric flask. Dilute with distilled water to the mark. Label the solution FA4.

Pipette 25.0 (or 20.0) cm^3 of FA4 into a conical flask and titrate with FA3, using phenolphthalein indicator.

Repeat the titration until you obtain consistent results. Record your results in table B below.

Results:

Volume of pipette used

20.00 cm^3 ✓ (Accept for 1 dep't
no dep't) cm^3

Table B

Final burette reading (cm^3)	12.50	25.80 ✓	39.10 ✓
Initial burette reading (cm^3)	0.00	12.50 ✓	25.80 ✓
Volume of FA3 used (cm^3)	12.50	13.30 ✓	13.30 ✓

Average titre value

$$= 13.30 \pm 0.20$$

± 0.40 ✓ ① ②
 ± 0.60 ✓ ② ③
 ± 0.80 ✓ ①
 ± 1.0 ✓ ①

Volume of FA3 used for calculation of the average titre values.....

$$13.30, 13.30 \text{ cm}^3$$

$$\text{Average volume of FA3 used } 13.30 \pm 0.20 \text{ cm}^3$$

Questions:

(a) Calculate:

(i) the number of moles of excess sodium hydroxide that did not react with the acid in Q.

$$\text{Moles of HCl in } 13.30 \text{ cm}^3 = \frac{13.3 \times 0.02}{1000}$$

$$\text{Moles of NaOH in } 20 \text{ cm}^3 \text{ of FA4}$$

$$= \frac{13.3 \times 0.02}{1000}$$

$$\therefore \text{In } 250 \text{ cm}^3 = \frac{250 \times 13.3 \times 0.02}{1000}$$

$$\text{Moles of excess NaOH} = 3.325 \times 10^{-3} \text{ mole}$$

(Deny last 2 marks if was outside accuracy range)

(ii) the number of moles of sodium hydroxide that reacted with the acid in Q

$$\text{No. of moles of NaOH used} = \frac{0.78 \times 25}{1000}$$

$$= 1.95 \times 10^{-2} \text{ mole}$$

(Deny 1 mark above; if was outside accuracy range)

$$\text{No. of moles of NaOH that reacted with the acid in Q} = 1.95 \times 10^{-2} - 3.325 \times 10^{-3}$$

$$= 1.62 \times 10^{-2} \text{ moles}$$

To get this, must have original moles -

* excess moles in 250 cm^3)

Determine:

- (i) the mass of the acid in Q that reacted with sodium hydroxide
(Relative molecular mass of the acid in Q is 126, 1 mole of the acid in Q reacts with 2 moles of sodium hydroxide).

No. of moles of acid in Q

$$= \frac{1}{2} \times 1.62 \times 10^{-2} \quad (1)$$

$$= 8.1 \times 10^{-3} \text{ moles} \quad (2)$$

Mass of acid in Q = $8.1 \times 10^{-3} \times 126 \quad (1)$

$$= 1.02 \text{ g} \quad (2)$$

- (ii) the percentage of the acid in Q.

% acid in Q = $\frac{1.02 \times 100}{1.5} \quad (1)$

$$= 68.0\% \quad (2)$$

(Deny last 1/2 mark for % if was outside accuracy range)

7 25

Turn Over

2.

You are provided with substance **R**, which contains two cations and two anions. You are required to identify the cations and anions in **R**.

Carry out the following tests on **R** and record your observations and deductions in the table below. Identify any gases evolved.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat one spatula end-ful of R in a dry test tube.	Green solid turned black on heating. Colourless condensate turned anhydrous Copper (II) sulphate blue. Misty vapour turned blue litmus red and lime water milky Black residue	Titanium(IV) ions probably $\text{Ni}^{2+}, \text{Cu}^{2+}, \text{Fe}^{2+}$ Deduct by me & H ₂ O Water of crystallisation hydrate CO_2 gas CO_3^{2-} suspected $\therefore \text{CuC}_2\text{NiO}_2\text{FeO}_2$ Reject CrO_3
(b) To one spatula end-ful of R in a dry test tube, add 2-3 drops of concentrated sulphuric acid and warm gently.	Effervescence; bubbles of gas turned lime water milky Gas has a sharp Vinegar smell Accept acetic acid smell. Deny H_2 mark in absence of vinegar smell	Gas is CO_2 (test with lime water) $\therefore \text{CO}_3^{2-}$ suspected Probably ethanoic acid vapour $\therefore \text{CH}_3\text{COO}^-$ suspected
(c) Put two spatula end-fulls of R , in a test tube. Add about 5 cm ³ of water, shake well and filter. Keep both filtrate and residue.	Residue was green Filtrate was green	$\text{Fe}^{2+}, \text{Ni}^{2+}, \text{Cu}^{2+}, \text{Cr}^{2+}$ Suspected in residue and filtrate (for each wrong cm^3) deduct by me

TESTS	OBSERVATIONS	DEDUCTIONS
(i) Divide the filtrate into four portions. (ii) To the first portion of the filtrate, add 5 drops of neutral iron(III) chloride solution and heat gently to boiling.	Green precipitate Reddish brown Solution Accept yellow brown Reddish brown precipitate on heating boiling Deny for red ppt	CH_3COO^- Confirmed
(iii) To the second portion of the filtrate, add dilute sodium hydroxide solution drop-wise until in excess. Heat the mixture.	Green precipitate formed insoluble in excess. No observable change on heating	Probably Ni^{2+} for each wrong ans, deny $\frac{1}{2}$. Reject Fe^{2+} because Fe(OH)_2 changes.
(iv) Use the fourth portion of the filtrate, to carry out a test of your own choice to confirm one of the cations in R.	Green ppt dissolved in excess forming a pale- blue solution Reject purple	Ni^{2+}
Add ammonia solution (until alkaline), followed by 2 drops of dimethyl glyoxime solution (Deny if ammonia solution is not mentioned)	Red precipitate (Accept precippt) Reject pink ppt	Ni^{2+} Confirmed

Table Continues...

TESTS	OBSERVATIONS	DEDUCTIONS
(e) Wash the residue with a little water. Transfer into a test tube and dissolve in dilute hydrochloric acid. Divide the solution into three portions.	Dissolved with effervescence Colourless gas evolved turned blue litmus pink and hence + water milky A greenish tint was found	$\text{gas} \rightarrow \text{CO}_2$ CO_3^{2-} present Reject HCO_3^- $\text{Fe}^{2+}, \text{Cu}^{2+}, \text{Ni}^{2+}$ suspected
(i) To the first portion of the solution, add dilute sodium hydroxide solution drop-wise until in excess and heat the mixture.	Blue precipitate insoluble in excess turned black on heating	Cu^{2+} CuO
(ii) To the second portion of the solution, add ammonia solution drop-wise until in excess.	Blue precipitate dissolved in excess to form a deep-blue solution Dense if deep is not mentioned	Cu^{2+} present $[\text{Cu}(\text{NH}_3)]^{2+}$ formed
(iii) Use the third portion of the solution to carry out a test of your own choice to confirm the cation in the residue.	Add 3 drops of potassium hexacyanoferrate (II) ($\text{K}_4[\text{Fe}(\text{CN})_6]$) OR Add potassium iodide solution OR KI followed by $\text{Na}_2\text{S}_2\text{O}_3$ Reject ammonium salts	Chocolate brown / Maroon / dark-brown ppt white ppt and brown solution white ppt

(b) Determine:

- (i) the mass of the acid in Q that reacted with sodium hydroxide
(Relative molecular mass of the acid in Q is 126, 1 mole of the acid in Q reacts with 2 moles of sodium hydroxide).

No. of moles of acid in Q

$$= \frac{1}{2} \times 1.62 \times 10^{-2} \quad (1)$$

$$= 8.1 \times 10^{-3} \text{ moles} \quad (2)$$

Mass of acid in Q = $8.1 \times 10^{-3} \times 126$ ✓ (1)

$$= 1.02 \text{ g} \quad \checkmark \quad (2)$$

- (ii) the percentage of the acid in Q.

$$\% \text{ of acid in Q} = \frac{1.02 \times 100}{1.5} \quad (1)$$

$$= 68.0\% \quad \checkmark \quad (2)$$

(Deny last $\frac{1}{2}$ mark if % was outside accuracy range.)

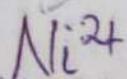
7 25

2. You are provided with substance R, which contains two cations and two anions. You are required to identify the cations and anions in R.
 Carry out the following tests on R and record your observations and deductions in the table below. Identify any gases evolved.

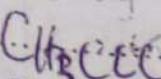
TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat one spatula end-ful of R in a dry test tube.	Green solid turned black on heating. Colourless condensate turned anhydrous Copper (II) Sulphate blue. Misty vapour turned blue litmus red and lime water milky Black residue	Transition metal ions probably Ni ²⁺ , Cu ²⁺ , Fe ²⁺ or Cr ³⁺ deduct 1/2 mark for any wrong Water of crystallisation · hydrate CO ₂ gas · CO ₃ ²⁻ suspected · CuO, NiO, FeO Reject CrO ₃
(b) To one spatula end-ful of R in a dry test tube, add 2-3 drops of concentrated sulphuric acid and warm gently.	Effervescence; colourless gas turned lime water milky. Gas has a sharp Vinegar smell Accept acetic acid smell. Deny 1/2 mark in absence of Vinegar smell.	Gas is CO ₂ (test with lime water carried) · CO ₃ ²⁻ Probably ethanoic acid vapour · CH ₃ COO ⁻ suspected
(c) Put two spatula end-fulls of R, in a test tube. Add about 5 cm ³ of water, shake well and filter. Keep both filtrate and residue.	Residue was green Filtrate was green	Fe ²⁺ , Ni ²⁺ , Cu ²⁺ , Cr ³⁺ Suspected in residue and filtrate (for each wrong deduct 1/2 mark)

(f) Identify:

- (i) the cations in R.
- (ii) the anions in R



(If only confirmed)



(Confirmed in (i))

3 - Confirmed

Q

28

You are provided with an organic substance W. You are required to identify the nature of W.

Carry out the following tests on W and record your observations and deductions in the table below.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of W on a crucible lid or spatula end.	Colourless liquid that burns with a blue non-luminous flame.	saturated; Aliphatic Compd with low molecular mass (or with C:H ratio or saturated aliphatic Compd).
(b) To 5 drops of W, add about 1 cm ³ of water and shake. Test the mixture with litmus.	Dissolved to form a colourless soln. The solution has no effect on litmus (reject neutral). (Reject neutral) to litmus	Neutral, polar compd with low molecular mass. Probably alkanol, or carbonyl neg. Compounds Accept ester, etc. to litmus
(c) To 5 drops of W, add 2-3 drops of acidified potassium manganate (VII) solution and warm.	Purple solution turns to colourless. Give only 3 min for decolorised or discharged	W is a reducing agent probably 1, 2 alkanol or alkene. Manganese(VII) has been reduced to Manganese(IV) (35)

Table Continues...

TESTS	OBSERVATIONS	DEDUCTIONS
(d) To 5 drops of W, add 1 cm ³ of iodine solution, followed by dilute sodium hydroxide drop-wise until the mixture is pale yellow. Warm, then cool under running tap.	Pale-yellow precipitate	Alkene? of type $\text{C}_2\text{H}_5\text{C}_2\text{H}_5$ Or ethanal (or CH_3CHO) Yellow ppt in CH_2Cl_2
(e) To 5 drops of W, add 2 – 3 drops of Brady's reagent.	No observable change Reagent yellow soln formed.	Carbonyl compound absent
OR Add conc. H_2SO_4 and heat	Colourless gas that turns acidified KMnO_4 from purple to colourless	
(f) Carry out a test of your own choice to confirm the functional group in W.	Colourless soln with pleasant fruity (sweet) smell	Ester formed Ethylic confirmed
To a few drops of W, add 3 drops of ethanoic acid followed by 2 drops of conc. sulphuric acid and warm	White fumes of HCl which form dense white fumes	
Add PCl_5 a strong metal	not ammonia Effervescence which burns in the colourless gas a pop sound	
(g) Comment on the nature of W.	W is aliphatic primary or secondary alcohol of the type $\text{C}_2\text{H}_5\text{CH}_2\text{OH}$	Give it a try
	Total	69

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Uganda Advanced Certificate of Education
CHEMISTRY

PRACTICAL TEST

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer all questions.

Record your answers on this question paper in the spaces provided.

Mathematical tables, slide rules and non-programmable calculators may be used.

Reference books (i.e. text books, books on qualitative analysis, etc) should not be used.

Candidates are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.

Where necessary, use (Na = 23 ; Cl = 35.5 ; O = 16) Fe = 56, S = 32) + = 1) C = 12

For Examiner's Use Only			
Q.1	Q.2	Q.3	Total
30	20	20	70

1. You are provided with the following:
FA1 which is approximately 0.02 M potassium manganate(VII) solution;
FA2 which is a solution containing 6.6 g of sodium ethanedioate, $\text{Na}_2\text{C}_2\text{O}_4$ per litre;
FA3 which is a 2M sulphuric acid;
Solid **T**, which is hydrated iron(II) sulphate.

You are required to determine the:

- concentration of potassium manganate(VII) in **FA1**.
- number of moles of water of crystallisation in **T**.

Potassium manganate(VII) reacts with sodium ethanedioate in the ratio of 2:5

Procedure:

- (a) Pipette 25.0 (or 20.0) cm^3 of **FA2** into a conical flask. Add an equal volume of **FA3** and heat the mixture to about 60°C .

Titrate the hot mixture with **FA1** until a permanent faint pink colouration is obtained.

Repeat the titration until you obtain consistent results.
Record your results in the table below.

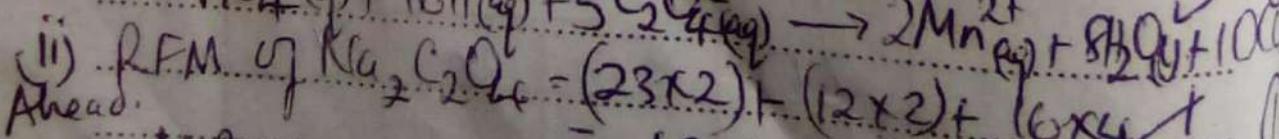
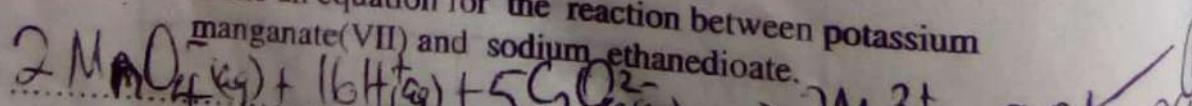
Results:

Volume of pipette used 25.00 cm^3

Final burette reading (cm^3)	21.90	43.90	27.00	49.00
Initial burette reading (cm^3)	0.00	21.90	5.00	27.00
Volume of FA1 used (cm^3)	21.90	22.00	22.00	22.00
Average volume of FA1 used			22.00 <small>cm³</small>	22.00 <small>cm³</small>

Questions:

- (a) (i) Write an equation for the reaction between potassium manganate(VII) and sodium ethanedioate.



$$\text{Mole, of } \text{Na}_2\text{C}_2\text{O}_4 \text{ in } 6.60\text{g} = \frac{6.6}{134}$$

$$1000\text{cm}^3 \text{ of } \text{C}_2\text{O}_4^{2-} \text{ soln} = \frac{134}{1000} = 0.134 \text{ mol}$$

$$25\text{cm}^3 \text{ of } \text{C}_2\text{O}_4^{2-} \text{ soln} \text{ contain } \frac{0.05}{1000} = 0.0005 \text{ mol}$$

Ratio MnO₄⁻ : Cl₂ = 1 : 2

✓ (1)

- (ii) Calculate the molar concentration of potassium manganate(VII) in FA1.

$$\text{No. of Mols. in } 22.0 \text{ cm}^3 = \frac{2/5 \times 0.05 \times 25}{1000} \quad (1)$$

$$\therefore \text{In } 100 \text{ cm}^3 \text{ there are } \frac{2/5 \times 0.05 \times 25 \times 100}{1000} \quad (1)$$

$$= 0.0227 \text{ Mols.} \approx 0.023 \quad (1)$$

- (b) Weigh out accurately about 8.8g of T and dissolve it in about 50cm³ of FA3. Transfer the solution quantitatively to a 250cm³ volumetric flask and make it up to the mark with distilled water. Label the solution as FA4.

Pipette 25.0 (or 20.0)cm³ of FA4 into a conical flask. Add the same volume of FA3 and titrate the mixture with FA1. Repeat the titration until you obtain consistent titre values.

Results:

Mass of T and bottle 27.30 ✓ g.

Mass of bottle 18.50 ✓ g.

Mass of T 8.80 ✓ g.

Volume of pipette used 25.00 ✓ cm³.

(k)

Final burette reading (cm ³)	27.60	37.00	42.50
Initial burette reading (cm ³)	0.00	9.50	15.00
Volume of FA1 used (cm ³)	27.60	27.50	27.50

(3)

Average volume of FA1 used $\frac{27.5 + 27.5}{2} \text{ cm}^3$

$$(27.5 + 27.5) \text{ cm}^3$$

$$= 27.50 \text{ cm}^3 \quad (2)$$

(2)

$$\begin{array}{r} 18.5 \\ 4.4 \\ \hline 22.9 \end{array}$$

Questions:

- (a) Calculate the molar concentration of iron(II) sulphate in FA4.

1000 cm³ of FA4 solution contains 0.023 mole
27.5 cm³ of FA4 contain $\frac{0.023 \times 27.5}{1000} = 7.1$

Eqn: $MnO_4^- + Fe^{2+} + H^+ \rightarrow Mn^{2+} + Fe^{3+} + H_2O$
Reaction ratio Fe²⁺: MnO₄⁻ = 5 : 1
No. of Moles in 25 cm³ = $\frac{5 \times 27.5 \times 0.023}{1000}$

∴ In 1000 cm³ there are $\frac{5 \times 0.023 \times 27.5 \times 1000}{1000 \times 25} = 0.127$ mole

- (b) Determine the number of molecules of water of crystallisation in T.

250 cm³ of T dissolved 8.8 g.
1000 cm³ of T dissolved $\frac{8.8 \times 1000}{250} = 35.2$ g.
RFM of FeSO₄ · xH₂O = $\frac{35.2}{0.127} = 277$

FeSO₄ · xH₂O = 277
56 + 32 + (16 × 4) + 18x = 277
152 + 18x = 277
18x = 277 - 152
18x = 125
 $x = \frac{125}{18}$

$x = 6.9427$
Formula is FeSO₄ · 7H₂O. 30

You are provided with substance **Z**, which contains two cations and two anions.

You are required to identify the cations and the anions in **Z**. Carry out the following tests on **Z** and record your observations and deductions in the table below. Identify any gas(es) evolved.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat one spatula endful of Z in a dry test tube.	Colourless liquid that turned blue and then Copper(II)sulphate blue. Colourless gas turned blue (brownish red) + sulphuric acid + $K_2Cr_2O_7$ solution.	Water of crystallisation A hydrated salt SO_2 gas SO_4^{2-} suspected
(b) Dissolve three spatula-endfuls of Z in water. Divide the solution into four parts.	green White fume Yellow sublimate Reddish-brown residue	Fe_2O_3 Fe^{2+} suspected
(i) To the first part of the solution, add dilute hydrochloric acid.	No observable change	Pb^{2+} , Ag^{+} , Hg^{2+} absent
(ii) To the second part of the solution, add iron (III) chloride.	No observable change	
(iii) To the third part of the solution, add barium nitrate solution.	White precipitate	SO_4^{2-} , CO_3^{2-} or SO_3^{2-} suspected
(iv) To the fourth part of the solution, add dilute sodium hydroxide solution drop-wise until in excess and filter. Keep both the filtrate and the residue.	Dirty green gelatinous precipitate persist in excess White precipitate dissolved in excess	Fe^{2+} suspected Fe^{2+} , Zn^{2+} , Sn^{2+} suspected

TESTS	OBSERVATIONS	DEDUCTIONS
(e) Acidify the filtrate with dilute hydrochloric acid and divide it into three portions. (i) To the first portion of the acidified filtrate, add dilute sodium hydroxide solution drop-wise until in excess.	No observable change. ✓	Al(OH)_4^- , Zn(OH)_4^{2-} formed.
(ii) To the second portion of the acidified filtrate, add dilute ammonia solution drop-wise until in excess.	No observable change. ✓	Al(OA)_4^- , Zn(OH)_4^{2-} formed.
(iii) To the third portion of the acidified filtrate, add 2 - 3 drops of potassium iodide.	No observable change. ✓	Pb^{2+} absent.
(d) Wash the residue and dissolve it in dilute hydrochloric acid. Divide the resultant solution into two parts. (i) To the first part of the resultant solution, add dilute sodium hydroxide solution until in excess. (ii) To the second part of the resultant solution, add dilute ammonia solution drop-wise until in excess.	Dirty green gelatinous precipitate insoluble in excess.	Fe^{2+} suspected.
	Dirty green gelatinous precipitate insoluble in excess	Fe^{2+}

(f) Identify the ions in substance Z.

(i) Cations $\text{Fe}^{2+}, \text{Al}^{3+}$

(ii) Anions $\text{SO}_4^{2-}, \text{Cl}^-$

- (ii) Calculate the molar concentration of potassium manganate(VII) in FA1.

$$\text{No. of Mols. in } 22.00 \text{ cm}^3 = \frac{2/5 \times 0.05 \times 25}{1000} \quad \checkmark$$

In 1000 cm³ there are $\frac{2/5 \times 0.05 \times 25 \times 1000}{1000} = 0.0227 \text{ Mols.} \quad \checkmark$

Molarity of FA1 = $0.023 \text{ Mols.} \quad \checkmark$

- (b) Weigh out accurately about 8.8g of T and dissolve it in about 50cm³ of FA3. Transfer the solution quantitatively to a 250cm³ volumetric flask and make it up to the mark with distilled water. Label the solution as FA4.

Pipette 25.0 (or 20.0)cm³ of FA4 into a conical flask. Add the same volume of FA3 and titrate the mixture with FA1.

Repeat the titration until you obtain consistent titre values.

Results:

Mass of T and bottle	27.30	g.
Mass of bottle	18.50	g.
Mass of T	8.80	g.
Volume of pipette used	25.00	cm ³ .

(1)

Final burette reading (cm ³)	27.60	37.08	42.56
Initial burette reading (cm ³)	0.00	9.50	15.00
Volume of FA1 used (cm ³)	27.60	27.50	27.50

(2)

(true values = 27.50, 27.50 cm³)

Average volume of FA1 used

$$\frac{27.5 + 27.5}{2} = 27.50 \text{ cm}^3 \quad \checkmark$$

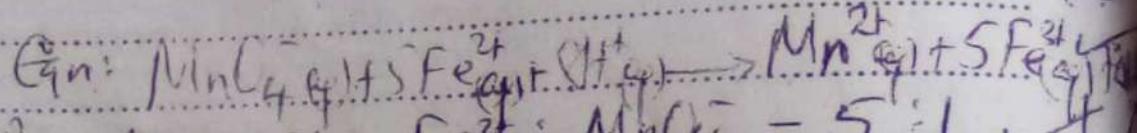
(2)

$$\frac{18.5 - 4.4}{22.9}$$

Questions:

- (a) Calculate the molar concentration of iron(II) sulphate in FA4.

1000 cm³ of FA4 solution contains 0.023 moles
27.5 cm³ of FA4 contains $\frac{0.023 \times 27.5}{1000} = 0.00023$ moles



Reaction ratio Fe²⁺: MnCl₄ = 5 : 1

No. of moles in 25 cm³ = $5 \times 0.00023 = 0.0115$ moles

∴ In 1000 cm³ there are $5 \times 0.023 = 0.115$ moles
Molarity of FA4 = 0.115 M

- (b) Determine the number of molecules of water of crystallisation in T.

250 cm³ of T dissolved 8.8 g

1000 cm³ of T dissolved $\frac{8.8 \times 1000}{250} = 35.2$ g

R.F.M of FeSO₄ · xH₂O = 35.2
= 277

FeSO₄ · xH₂O = 277

56 + 32 + (16 × 4) + 18x = 277

152 + 18x = 277

18x = 277 - 152

18x = 125

x = $\frac{125}{18}$

x = 6.94 ≈ 7

Formula is FeSO₄ · 7H₂O.

30

You are provided with substance **Z**, which contains two cations and two anions.

You are required to identify the cations and the anions in **Z**.

Carry out the following tests on **Z** and record your observations and deductions in the table below. Identify any gas(es) evolved.

TESTS	OBSERVATIONS	DEDUCTIONS
i) Heat one spatula endful of Z in a dry test tube.	Colourless liquid that turned blue colour. Copper(II)sulphate blue Colourless gas formed blue/greenish red and acidic pink $K_2Cr_2O_7$ soln.	Water of Crystallisation Cu^{2+} A hydrated salt SO_3^{2-} gas + SO_4^{2-} suspected
ii) Dissolve three spatula-endfuls of Z in water. Divide the solution into four parts.	green White fume Yellow sublimate Reddish-brown residue	Fe^{2+} Fe_2O_3 ✓ 6h
(i) To the first part of the solution, add dilute hydrochloric acid.	No observable change ✓	Pb^{2+} , Ag^+ , Hg^{2+} absent.
(ii) To the second part of the solution, add iron (III) chloride.	No observable change ✓	1/2
(iii) To the third part of the solution, add barium nitrate solution.	White precipitate	SO_4^{2-} , CO_3^{2-} or SO_3^{2-} suspected. 1/2
(iv) To the fourth part of the solution, add dilute sodium hydroxide solution drop-wise until in excess and filter. Keep both the filtrate and the residue.	dirty green gelatinous precipitate persist in excess white precipitate dissolved in excess.	Fe^{2+} suspected. Al^{3+} , Zn^{2+} , Sn^{2+} suspected. 3/2

continued ...

TESTS	OBSERVATIONS	DEDUCTIONS
(c) Acidify the filtrate with dilute hydrochloric acid and divide it into three portions. (i) To the first portion of the acidified filtrate, add dilute sodium hydroxide solution drop-wise until in excess.	No observable change. ✓	$\text{Al}(\text{OH})_3^-$, $\text{Zn}(\text{OH})_4^{2-}$ formed.
(ii) To the second portion of the acidified filtrate, add dilute ammonia solution drop-wise until in excess.	No observable change. ✓	$\text{Al}(\text{OAc})_4^-$, $\text{Zn}(\text{OH})_4^{2-}$ formed.
(iii) To the third portion of the acidified filtrate, add 2 - 3 drops of potassium iodide.	No observable change. ✓	Pb^{2+} absent.
(d) Wash the residue and dissolve it in dilute hydrochloric acid. Divide the resultant solution into two parts. (i) To the first part of the resultant solution, add dilute sodium hydroxide solution until in excess.	Dirty green-gelatinous precipitate insoluble in excess.	Fe^{2+} suspect
(ii) To the second part of the resultant solution, add dilute ammonia solution drop-wise until in excess.	Dirty green gelatinous precipitate insoluble in excess	Fe^{2+}

(f) Identify the ions in substance Z

(i) Cations ... Fe^{2+} , Al^{3+}

(ii) Anions SO_4^{2-}

You are provided with an organic substance, K. You are required to determine the nature of substance K.

Carry out the following tests on K and record your observations and deductions in the table below. Identify any gas(es) evolved.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of K on a spatula end or in a porcelain dish.	Colourless liquid that burns with a blue non-luminous flame	Aliphatic, saturated compound with low molecular mass or with less
(b) Add 6 drops of K to about 3cm^3 of water, shake and allow to stand. Divide the solution into three parts:	Miscible with water / dissolves to form a colourless solution that has no effect on litmus. Dissolves without effervescence	Polar, neutral Compound probably alcohol, aldehyde, ketone or ester Carboxylic acid absent
(i) To the first part of the solution, add 2 - 3 drops of sodium hydrogen carbonate solution.	No observable change	Carbonyl Compound absent Phenol absent/ $\& \text{CH}_3\text{COO}$ absent
(ii) To the second part of the solution, add 2 - 3 drops of iron(III) chloride solution.	No observable change for no yellow ppt	Carbonyl Compound absent
(iii) To the third part of the solution, add 2 - 3 drops of Brady's reagent.	Solution turned from orange to green	* is a reducing agent Primary & tertiary Secondary alcohol Oxidised to Carbonyl Compound
(c) Add 2 - 3 drops of acidified potassium dichromate(VI) solution to 2cm^3 of K in a test tube and then heat. Divide the resultant Solution into two parts:		

Continued ...

TESTS	OBSERVATIONS	DEDUCTIONS
(i) To the first part of the resultant solution, add Brady's reagent.	Orange/yellow precipitate ✓	Carbonyl compound present Hence primary, secondary alcohol susp.
(ii) To the second part of the resultant solution, add Tollen's reagent and warm.	No observable change ✓	Aldehyde absent ∴ K is not a primary alcohol.
(d) To about 0.5 cm^3 of K, add about 4 cm^3 of iodine solution followed by sodium hydroxide drop-wise until the colour of the iodine disappears. Heat and allow to stand.	Yellow precipitate	CHI_3 formed from an alcohol ∴ Secondary alcohol of the type: $\text{R}-\text{C}(\text{OH})-\text{CH}_3$
(e) To about 1 cm^3 of K, add about 5 drops of Lucas' reagent.	Cloudy solution formed within 5-10 minutes OR No immediate cloudy solution	Secondary alcohol present or not tertiary alcohol.

(f) Comment on the nature of K.

K is a saturated aliphatic secondary alcohol with the structure: $\text{R}-\text{C}(\text{OH})-\text{CH}_3$

END.

MARKING SCHEME

MINISTRY OF EDUCATION
NATIONAL GIRLS SEC SCHOOL
P.O BOX 52
RUKUNGIRI, NORTHERN UGANDA

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY

(PRINCIPAL SUBJECT)

PRACTICAL TEST

Paper 3

3 hours 15 minutes

INSTRUCTIONS:

Answer all questions.

Hand your answers on this question paper in the spaces provided.

Mathematical tables, slide rules and non-programmable calculators may be used.

Reference books (i.e. text books, books on qualitative analysis, etc) should not be used.

Candidates are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all the apparatus and chemicals that they may need.

Where necessary, use ($\text{Na} = 23$; $\text{Cl} 35.5$; $\text{O} = 16$).

For Examiner's Use Only			
Q1	Q2	Q3	Total

1. You are provided with the following:

FA1 which is a commercial bleach solution.

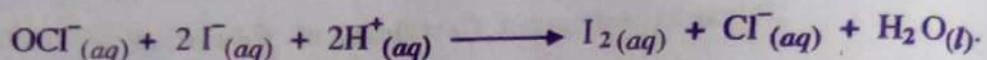
FA2 which is a 0.1 M sodium thiosulphate solution.

10% potassium iodide solution.

2.0 M sulphuric acid.

You are required to determine the sodium hypochlorite content of the commercial bleaching agent.

Sodium hypochlorite reacts with potassium iodide according to the following equation:



The iodine liberated can be titrated with sodium thiosulphate solution.

Procedure

Pipette 15.0 cm³ of **FA1** into a 250 cm³ volumetric flask and dilute with water to the mark. Pipette 25 cm³ of the diluted **FA1** into a conical flask, add about 15 cm³ of the 2M sulphuric acid and about 15 cm³ of the potassium iodide solution. Titrate the iodine liberated with **FA2** using starch indicator. Repeat the titration until you obtain consistent results. Record your results in the table below.

Volume of pipette used

2500cm³ 25.00 ✓ cm³

Burette reading

Final burette reading (cm ³)	11.60	23.20 ✓	34.60 ✓
Initial burette reading (cm ³)	0.00	11.60 ✓	23.10 ✓
Volume of FA2 used (cm ³)	11.60	11.50 ✓	11.50 ✓

Average volume of **FA2** used

To find the values to calculate average
Volume = 11.50, 11.50, 11.50

11.50 + 11.50

$$\frac{2}{2} = 11.50 \text{ cm}^3$$

Reference to accuracy

- ± 0.1 (2)
- ± 0.2 (2)
- ± 0.3 (1)
- ± 0.4 (1)
- ± 0.5 (1)
- > ± 0.6 (1)

date the:

(a) number of moles of FA2 used.

1000cm^3 of FA2 solution contains 0.1 mole.

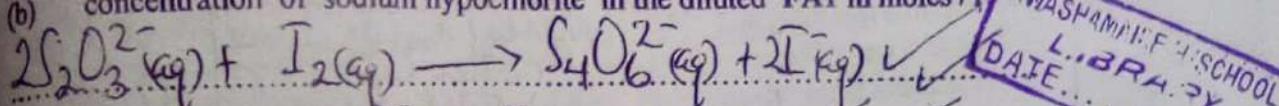
11.50cm^3 of FA2 solution contains 0.1×11.50

1000

(02)

$$= 0.00115 \text{ moles}$$

(b) concentration of sodium hypochlorite in the diluted FA1 in moles/l.



Molar ratio $\text{S}_2\text{O}_3^{2-} : \text{I}_2 = 2 : 1$

Moles of FA2 I_2 liberated = $\frac{1}{2} \times 0.00115$

$$= 0.000575 \text{ moles}$$

(08)

1 mole of I_2 is liberated by 1 mole of OCl^-

0.000575 moles I_2 will be liberated by 0.000575 moles of OCl^-

No of moles of OCl^- in 25cm^3 of FA1 = 0.000575 moles

250cm^3 of NaOCl solution contain 0.000575 moles

1000cm^3 of NaOCl solution contain 0.000575×1000

(c) concentration of sodium hypochlorite in FA1 in g/l.

[Na = 23, Cl = 35.5, O = 16]

$$= 0.023 \text{ mol l}^{-1}$$

25cm^3 of diluted FA1 contained 0.000575 moles of OCl^-

250cm^3 of FA1 contains $0.000575 \times \frac{250}{25}$

N.B. When a 50g is diluted to 250g it changes its concentration.
Thus in 250cm^3 of original FA1 contained 0.00575 moles of OCl^-

1000cm^3 of FA1 contains 0.00575×1000

$$= 0.383 \text{ mol l}^{-1}$$

(08) of NaOCl

RFM of NaOCl = $23 + 16 + 35.5$

$$= 74.5$$

1 mole of NaOCl weighs 74.5g

Turn Over

25 cm³ moles of NaOCl weigh 74.5×0.383

$$= 28.534 \text{ g l}^{-1}$$

(08)

Scanned by CamScanner

2.

You are provided with a substance Y which contains two anions and two cations. You are required to identify the cations and the anions in Y. Carry out the following tests on Y and record your observations and deductions in the table below. Identify any gases evolved.

TEST	OBSERVATIONS	DEDUCTIONS
(a) Heat a spatula end-full of Y strongly in a dry test tube.	Y is a green solid. Colourless liquid or that turned sulphuric Copper(II) sulphate blue. Water of Crystal Colourless gas that turned lime water milky and turns blue Another colourless gas that turned acidified potassium dichromate from orange to green (CuO, NO black residue remained.	Transition metal Cu is probably Cu ²⁺ , Cr ³⁺ , NC ²⁻ . Water of Crystal CO ₂ gas. CO ₂ or SO ₂ gas SO ₄ ²⁻ ✓
(b) Place two spatula end-fulls of Y in a test tube, add about 5 cm ³ of water, shake and filter. Keep both the filtrate and the residue. Divide the filtrate into five portions.	Green-blue filtrate brown residue Effervescence of lime water milky Ammonia gas that turned CO ₂ into CO ₃ ²⁻	Cu ²⁺ , Fe ²⁺ , NC ²⁻ Fe(OH) ₃ , MnO ₂ lime water milky
(i) To the first portion of the filtrate, add dilute sodium hydroxide dropwise until in excess.	Blue ppt insoluble Cu ²⁺ , ✓ In excess	
(ii) To the second portion of the filtrate, add dilute ammonia solution dropwise until in excess.	Blue precipitate + soluble to form a deep-blue solution.	Cu(NH ₃) ₄ ²⁺ , Cu ²⁺
(iii) To the third portion of the filtrate, add few drops of hexacyanoferrate (II) solution.	Dark-brown precipitate ✓	Cu ²⁺ Confirmed
(iv) To the fourth portion of the filtrate, add 2 drops of lead (II) nitrate solution and warm.	White precipitate insoluble in warming	Cl ⁻ absent SO ₄ ²⁻ , CO ₃ ²⁻ SO ₃ ²⁻
(v) Use the fifth portion of the filtrate to confirm one of the anions in Y.	Add dilute nitric acid followed by barium nitrate solution or dil HCl/BaCl ₂	White precipitate insoluble in dilute nitric acid
		SO ₄ ²⁻ ✓ Confirmed

TEST	OBSERVATIONS	DEDUCTIONS
(c) Wash the residue with water. Heat a small portion of the residue strongly in a dry test tube.	Brown residue remains	Fe(OH)_3 ; Fe_2O_3 ; MnO_2
(d) Transfer the rest of the residue to a test tube and dissolve it in dilute hydrochloric acid. Divide the solution into three parts.	Residue dissolved to give green-yellow	Fe^{3+}
(i) To the first part of the solution, add dilute sodium hydroxide solution dropwise until in excess.	Brown precipitate insoluble in excess	Fe^{3+}
(ii) To the second part of the solution, add dilute ammonia solution dropwise until in excess.	Brown precipitate insoluble in excess	Fe^{3+}
(iii) To the third part of the solution, add 2-3 drops of potassium thiocyanate solution.	Blood-red soln	Fe^{3+} confirmed

Identify the ions in substance Y.

cations: Cu^{2+} , Fe^{3+} .

anions: CO_3^{2-} , SO_4^{2-} .

2

2

6

3. You are provided with substance Z which is an organic compound. You are required to determine the nature of Z. Carry out the following tests and identify any gases evolved. Record your observations and deductions in the table below.

TEST	OBSERVATIONS	DEDUCTIONS
(a) Add 2 cm ³ of distilled water to 1 cm ³ of Z. Test the mixture with litmus paper.	Z dissolved in water to form a colourless liquid solution. The solution had no effect on litmus.	Polar, neutral Composed with low molecular mass aldehyde, ketone, or ketone + aldehyde.
(b) Burn a small amount of Z on a watch glass.	Colourless liquid burnt with a blue non-sooty flame.	Aliphatic, Saturated Composed with low molecular mass (or) ketone.
(c) To 3 cm ³ of Brady's reagent add 2 drops of Z.	Yellow precipitate	aldehyde, ketone or C=O functional
(d) To 4 cm ³ of saturated sodium hydrogen sulphite solution add 2 cm ³ of Z.	White precipitate	Aldehyde, or Ketone Ketone + CH ₃ or R ^H C=O ; R ^H C=O
(e) To 5 drops of Z add 4 cm ³ of iodine solution followed by dropwise addition of dilute sodium hydroxide solution until the brown iodine colour just disappears. Warm the mixture gently.	Yellow precipitate	Ketone of the type CH ₃ -C(=O)-R Ethanal Yellow ppt is CH ₃
(f) To 3 cm ³ of Z add 1 cm ³ of acidified potassium dichromate and warm the mixture.	No observable change	Ethanal absent Ketone present
(g) To 3 cm ³ of silver nitrate solution add 2 drops of dilute sodium hydroxide. Then add ammonia solution dropwise until the precipitate just dissolves. Add 5 cm ³ of Z and warm.	No observable change. or No silver mirror formed	Alkanal absent Alkanone present

From your results above, deduce the nature of compound Z.

Z is an aliphatic, saturated ketone with R^HC(=O)R^H
the low molecular mass and structure CH₃C(=O)CH₃

1 ACE

- PS 25 / 3
" "
- 1 pipette 25 cm^3 or 20 cm^3
 - 1 burette 50 cm^3
 - 17 cm^3 FA 1 (on 8 small beakers)
 - 100 cm^3 FA 2 (8 medium sized beakers)
 - 6.0 cm^3 of $2.0 \text{ M H}_2\text{SO}_4$ (8 beakers)
 - 1% Starch solution
 - 60 cm^3 of 10% Potassium Iodide (8 beakers)
 - 4g of Y (8 pieces of paper)
 - 2 conical flasks (3 conical flasks)
 - 5 cm^3 Z (on 8 small beakers)
 - 6 testtubes (12 testtubes, 2 boiling tubes)

Accessories:

- Reagents for identifying Cations, anions and organic Compounds

- Source of heat

~~FA 1 is to be issued as it is untaught~~

further dilution

~~FA 2 is made by dissolving 24.8g of~~

~~to make 1 litre of soln.~~

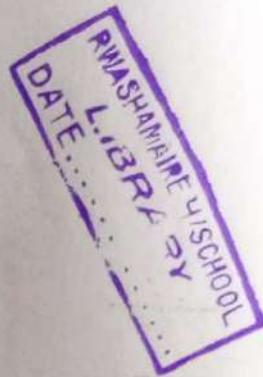
~~Substances FA 1, II, Y & Z will be~~

~~provided by UNEB.~~

$\text{H}_2\text{O}/\text{H}^+$ - Distilled H_2O (2 beakers)	- Dimethyl gly
amine HO - Lime H_2O	- Na_2CO_3 - NH_4Cl .
Neutral - Brandy's reagent	- NaHCO_3 - $\text{NH}_3(\text{aq})$
iron(II) chloride	- AlCl_3 - conc. H_2SO_4
NaOH (aq)	- $\text{AgNO}_3(\text{aq})$ - conc. H_2O_2
Tollen's reagent	- Sodium Bi-sulfite
Copper(II) sulfate	- Dimethyl sulphate
Cadmium	

20/10/13

- 10cm^3 BA 1
- 10cm^3 BA 2
- 3g of Y
- Methyl orange indicator
- burette 50cm^3
- 1 pipette 25cm^3 or 20cm^3
- 6 test tubes
- Filter paper



Access to reagents for identifying Cations and anions

BA 1 is made by dissolving 14.39g of Nitric acid in water

BA 2 is 0.1M HCl acid 8.6ml in 100ml water
Substances Y and P will be provided
UNBB

NaOH (aq)
Na₂CO₃ (aq)
K₂CO₃ (aq)
Pb(NO₃)₂
Ba(NO₃)₂
BaCl₂
dil. HCl
dil. H₂SO₄
dil. HNO₃
Conc. NH₃
Conc. HCl
Acidified K₃Fe(CN)₆

14.39

BA 1 | Medium sized beaker
BA 2 |
- Methyl orange
- Y on a piece of paper
- Potassium ferric (II)
- Acidified ferric (III)
- AgNO₃(aq)