

MBOONI EAST SUB - COUNTY JOINT EXAMINATION 2014

233/3

CHEMISTRY

PAPER 3

CONFIDENTIAL INSTRUCTIONS TO SCHOOLS

The information contained in this paper is to enable the head of the school and the teacher in charge of chemistry to make adequate preparations for this year's mock exams. NO ONE ELSE should have access to this paper or acquire knowledge of its contents. Great care MUST be taken to ensure that the information herein does not reach the candidates either directly or indirectly. The teacher in charge of chemistry should NOT perform any of the experiments in the same room as the candidates nor make the results of the experiments available to the candidates or give any other information related to the experiments to the candidates. Doing so will constitute an examination irregularity which is punishable.

In addition the apparatus and fittings found in a chemistry laboratory, each candidate will require the following;

- 150cm³ of solution A
- 100cm³ of solution B
- A burette
- A 25cm³ pipette
- A pipette filler
- A stand and a clamp
- 2 conical flasks (250 mls)
- Phenolphthalein indicator supplied with a dropper
- Filter funnel
- 500cm³ of distilled water in a washing bottle
- Thermometer (0⁰C – 110⁰C)
- Exactly 2.4g of solid V
- Source of heat
- About 1g of solid E
- A spatula
- Boiling tube
- 10cm³ measuring cylinder
- 2 filter papers
- 6 test tubes in a test -tube rack
- About 1g of solid K
- About 0.5g of sodium carbonate
- Test – tube holder

ACCESS TO

- 2M Sodium hydroxide
- 2M Ammonia Solution
- 0.5M Lead (II) Nitrate
- 0.25M Acidified Barium Nitrate
- 1M Nitric (V) acid
- Acidified Potassium dichromate VI
- Bromine water

} Each supplied with a dropper

NOTES

1. Solid E is a mixture of 0.5g Iron (III) Chloride (FeCl₃) and 1g of Copper (II) Oxide (CuO)
2. Solid V is Potassium Chlorate (KClO₃)
3. Solid K is Butanic acid
4. Solid A is Oxalic acid
5. Solution A is prepared by dissolving 8.9g of Oxalic acid in 500cm³ of distilled water and diluting to one litre of solution.
6. Solution B is prepared by dissolving 4.72g of Sodium Hydroxide in 500cm³ of distilled water and diluting to one litre of solution.
7. Acidified Barium Nitrate is prepared by dissolving 67.75g of Barium Nitrate in 200cm³ of 2M Hydrochloric acid and diluting to one litre of solution using distilled water.

NAME DATE

INDEX NO. SIGNATURE

233/3
CHEMISTRY
PRACTICAL
PAPER 3
JULY/AUGUST, 2014
TIME: 2¼ HOURS.

MBOONI EAST SUB - COUNTY JOINT EVALUATION TEST

Kenya Certificate of Secondary Education.

233/3
CHEMISTRY
PAPER 3
PRACTICAL
TIME: 2¼ HOURS.

INSTRUCTIONS TO CANDIDATES.

- Write your name and index number in the spaces provided above.
- Sign and write the date of exam in the spaces above.
- Answer **ALL** the questions in the spaces provided.
- You are not allowed to start working with the apparatus for the first 15 minutes of the 2¼ hours allowed time for the paper.
- Use the 15 minutes to read through the question paper and make sure that you have all the chemicals and apparatus that you may require.
- Mathematical tables and electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.
- This paper consists of 8 printed pages. Candidates should check to ensure that all pages are printed as indicated and no questions are missing

FOR EXAMINER'S USE ONLY.

Question	Maximum score	Candidate's score
1	12	
2	11	
3	17	
Total score	40	

1. (12 Marks)

You are provided with:-

- A Dibasic acid (H_2A) solution, A containing 8.9g per litre of solution.
- Sodium hydroxide solution B, containing 2.36g in 500cm^3 of solution.

You are required to determine

- Relative molecular mass of the dibasic acid (H_2A)
- The value of A in the formula of the dibasic acid.

PROCEDURE

Fill the burette with solution A. Pipette 25cm^3 of Sodium Hydroxide solution B into a clean conical flask and add 2 drops of Phenolphthalein indicator and titrate with the Dibasic acid (H_2A) solution A until the pink colour just disappears. Record your results in table I below. Repeat the titration two more times to complete the table below.

TABLE I

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

- (a) Determine the average volume of the Dibasic acid solution A used. (4marks)
(1mark)

.....

- (b) Calculate the,
 (i) Molarity of Sodium Hydroxide solution B used. (2 marks)

.....

- (ii) Moles of Dibasic acid (H_2A) solution A used. (2 marks)

.....

- (iii) Molarity of solution A. (1 mark)

(iv) Relative molecular mass of the dibasic acid (H_2A) solution A. (1 mark)

(v) Value of A in the formula of the dibasic acid. (1 mark)

2. **(11 MARKS)**

(a) You are provided with 2.4g of solid V. Using a burette add 4cm^3 of distilled water to solid V in the boiling tube. Heat the mixture while stirring with the thermometer to about 70°C . When all the solid has dissolved allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid V first appear. Record this temperature in table 2.

(b) Using the burette add 2cm^3 of distilled water to the contents in the boiling tube. Warm the mixture while stirring with the thermometer until all the solid dissolves. Allow the mixture to cool while stirring and record the temperature at which crystals start to appear.

(c) Repeat the procedure in (b) above three more times and record the temperature in the table 2.

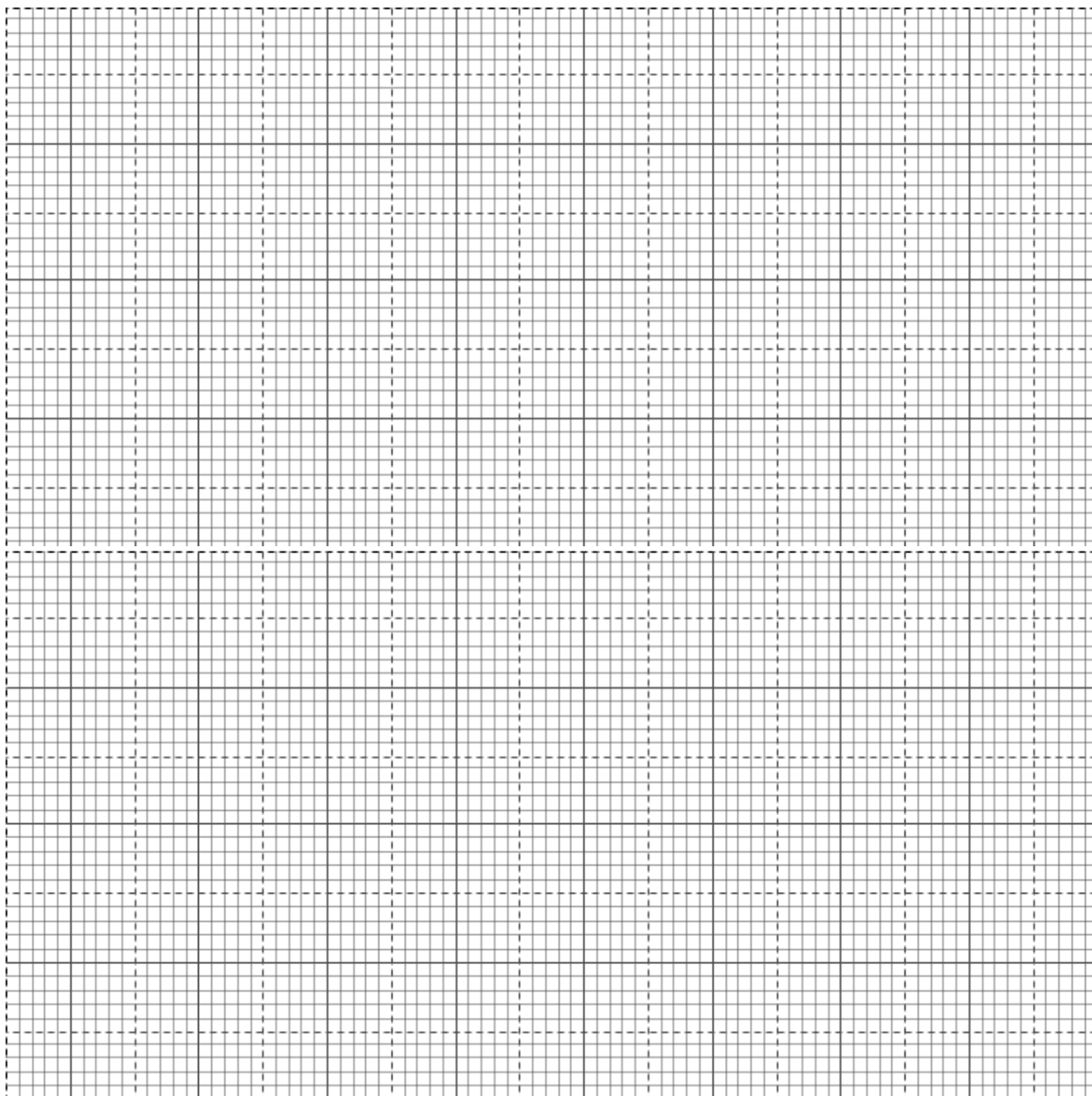
(i) Complete table 2 by calculating the solubility of solid V at different temperatures.

The solubility of a substance is the mass of that substance that dissolves in 100cm^3 (100g) of water at a particular temperature.

TABLE 2

Volume of water in the boiling tube (cm^3)	Temperature at which crystals of V first appears ($^\circ\text{C}$)	Solubility of solid Vg/100g of water
4		
6		
8		
10		
12		

(ii) On the grid provided plot a graph of solubility of solid V (vertical axis) against temperature. (4 marks)



(iii) Using your graph determine the temperature at which 100g of solid (V) would dissolve in 100cm³ of water. (1 mark)

.....

.....

.....

(iv) Using your graph, calculate the solubility of solid V at 30°C. (1 mark)

.....

.....

3. I (17 MARKS)

You are provided with solid E. Carry out the following tests on E and record your observations and inferences in the spaces provided. Identify any gas (es) evolved.

- (a) Place a spatula of solid E into a boiling tube and add 10cm³ of distilled water. Shake the mixture thoroughly. Filter the mixture and divide the filtrate into four portions. Keep the residue for use in part (b).

Observations	Inferences
(½ mark)	(½ mark)

- (ii) To portion one, add Sodium Hydroxide solution dropwise until in excess.

Observations	Inferences
(1mark)	(½ mark)

- (ii) To portion 2, add Ammonia solution dropwise until in excess.

Observations	Inferences
(1 mark)	(½ mark)

(iii) To portion three, add four drops of Lead (II) Nitrate solution.

Observations	Inferences
(½ mark)	(1 mark)

(iv) To portion four, add four drops of acidified Barium Nitrate solution.

Observations	Inferences
(½ mark)	(½ mark)

(b) Place the residue in a boiling tube and add dilute Nitric (V) acid little by little until all the solid dissolves. Divide the solution into two parts.

Observations	Inferences
(½ mark)	(½ mark)

(i) To part one, add Sodium Hydroxide solution dropwise until in excess.

Observations	Inferences
(1 mark)	(½ mark)

(ii) To part two, add Ammonia solution dropwise until in excess.

Observations	Inferences
(1 mark)	(½ mark)

3. (II) You are provided with substance K. Carry out the tests below and record your observations and inferences in the table below.

(a) Scoop a little of solid K with a clean metallic spatula and place it at the hottest part of a non-luminous flame.

Observations	Inferences
(½ mark)	(½ mark)

(b) Add about 10cm^3 of distilled water to the remaining solid K in a boiling tube. Divide the resulting mixture into 4 portions.

(i) To the first portion add 3 drops of acidified K_2CrO_7 .

Observations	Inferences
(1 mark)	(½ mark)

(ii) To the second portion add 3 drops of Bromine water and warm.

Observations	Inferences
(1 mark)	(½ mark)

(iii) To the 3rd portion add 2 – 3 drops of universal indicator and determine the PH of the solution.

Observations	Inferences
(½ mark)	(½ mark)

(iv) To the 4th portion add Sodium Carbonate.

Observations	Inferences
(1 mark)	(½ mark)

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MARKING SCHEME

1. 12 Marks
 Table I 5 Marks distributed as follows
- I. Complete table ✓1
 (i) Complete table with 3 titrations done and consistent ✓1
 (ii) Incomplete table with 2 consistent titrations done ✓1
 (iii) Incomplete table with one titration done ✓0
 (iv) Complete table with 3 titrations done but inconsistency

PENALTIES

- i. Wrong arithmetic/subtraction
 ii. Inverted table
 iii. Burette readings beyond 50cm³ unless where explained
 iv. Unrealistic titre values i.e. below 1cm³ or above 50cm³.
 NB: Penalize ½ Mark each to a maximum of ½ Mark.

(II) Use of decimals ✓1 Tied to 1st and 2nd rows.

Conditions

- (i) 1 D.P used consistently ✓1
 (ii) 2 D.P used consistently, the 2nd D.P must be 0 or 5 ✓1 Penalize fully if any of the conditions is NOT met.

(III): Accuracy..... ✓1 Compare any of the candidates' titre values with the school's titre values (Teacher's titre

values)

- (i) If any is within ± 0.1 of Teacher's titre value.
 (ii) If any within ± 0.2 of Teacher's titre value ✓ ½ (If condition 1 is not met)
 (iii) None within ± 0.2 ✓0

NB: If there is wrong arithmetic in the table, compare the school value with the correct titre and award accordingly.

(IV) Principles of averaging ✓1 values averaged must be consistent with ± 0.2 cm³ of each other.

Conditions

- i. If three consistent values are averaged.
 ii. If three titrations are done and only two are possible and averaged. } ✓1
 iii. If only two titrations are done, consistent and averaged.
 iv. Two inconsistent titrations averaged. }
 v. Three inconsistent titrations are done and averaged. } ✓0
 vi. If three consistent titrations are done and only two averaged. }

(V): Final answer ✓1 compared to school average titre.

Conditions

- i. Candidate's average titre within ± 0.1 cm³ of the school's average titre. ✓1
 ii. Candidate's average titre within ± 0.2 cm³ of the school's average titre. ✓ ½
 iii. If candidate's average titre is beyond ± 0.2 cm³ of the school average titre ✓0

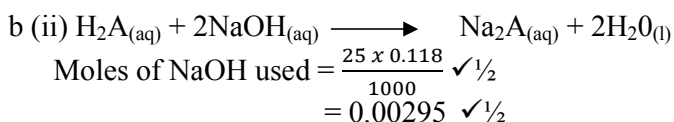
NB: Accept answer to 2 d.p otherwise penalise fully unless the answer works out to an exact figure.

CALCULATIONS

$$\begin{aligned} \text{(b) (i) Grams per litre of NaOH} &= \frac{1000 \times 2.36g}{500} \checkmark^{1/2} \\ &= 4.72g \checkmark^{1/2} \\ \therefore \text{Molarity of NaOH} &= \frac{4.72}{40} \\ &= \frac{\text{RmmNaOH}}{40} \text{M} \checkmark^{1/2} \\ &= 0.118\text{m/moles per litre} \end{aligned}$$

Conditions

- Penalise $\frac{1}{2}$ m for wrong units used.
- Ignore if units are omitted.



Acid : Base = 1 : 2

$$\begin{aligned} \therefore \text{Moles of dibasic (H}_2\text{A) used} &= \frac{1}{2} \times 0.00295 \checkmark^{1/2} \\ \text{H}_2\text{A} &= 0.001475 \checkmark^{1/2} \end{aligned}$$

NB: Penalize $\frac{1}{2}$ mark for wrong transfer of answer. b.i)

$$\begin{aligned} \text{(b) (iii) Molarity of solution A} &= \frac{1000 \times \text{Ans b (ii)}}{\text{Ans (a)}} \checkmark^{1/2} \\ &= \text{Correct answer} \checkmark^{1/2} \end{aligned}$$

Penalize $\frac{1}{2}$ mk once for wrong transfer of answers in b (ii) and a)

$$\begin{aligned} \text{b (iv) Rmm of H}_2\text{A} &= \frac{8.9}{\text{Ans b (iii)}} \checkmark^{1/2} \\ &= \text{Correct answer} \checkmark^{1/2} \end{aligned}$$

Penalties

- Penalise $\frac{1}{2}$ mark for wrong transfer of ans b (iii)
- Penalise $\frac{1}{2}$ mark for the answer if outside the range $100 \leq \text{Rmm} \leq 130$

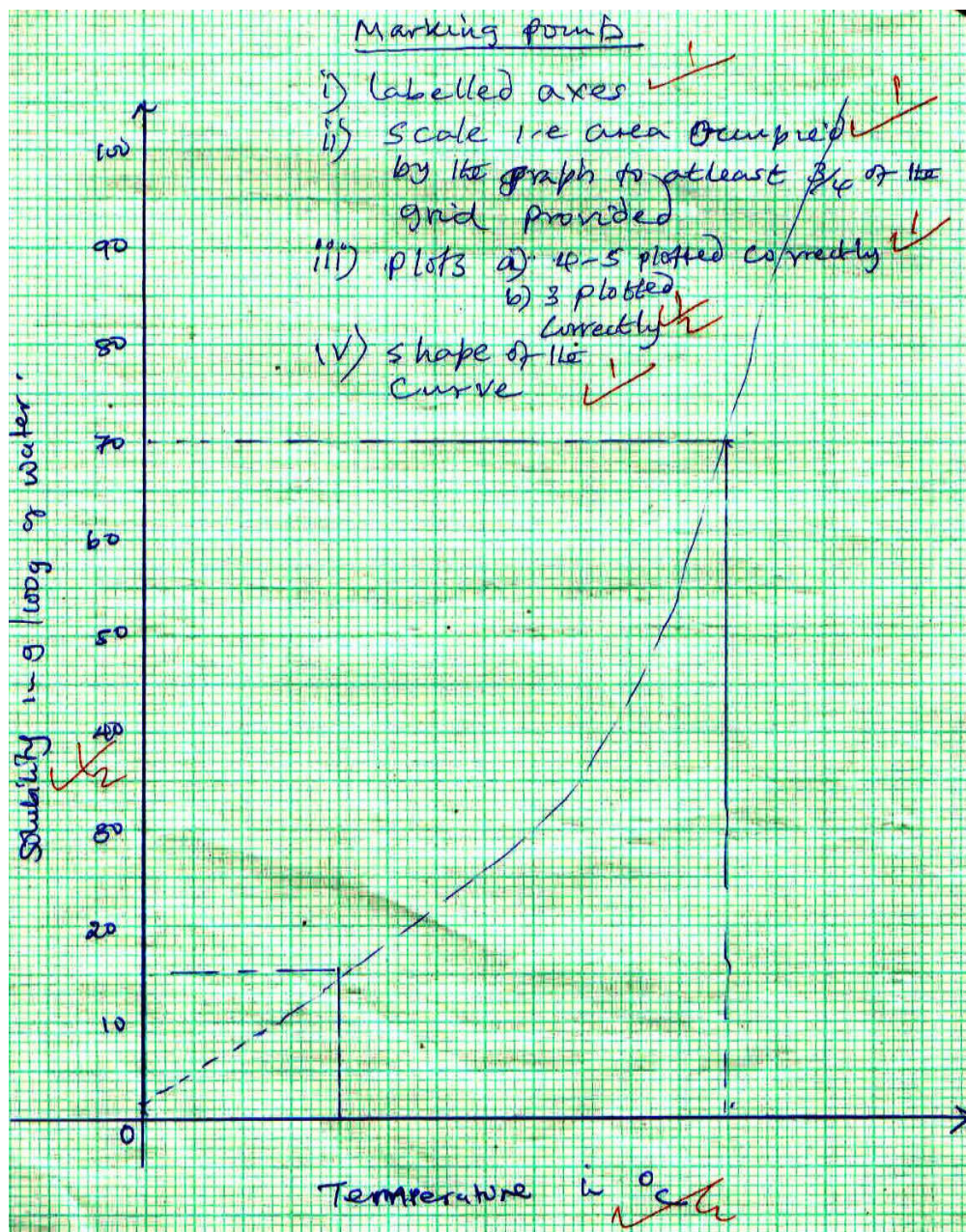
$$\begin{aligned} \text{(v) Rmm of H}_2\text{A} &= \text{Ans b (iv)} \\ 2 + \text{A} &= \text{Ans. B (iv)} \checkmark^{1/2} \\ \text{A} &= \text{Ans b (iv)} - 2 \\ &= \text{Correct answer} \checkmark^{1/2} \end{aligned}$$

2. (i)

Volume of water in the boiling tube (cm ³)	Temperature at which crystals form (°C)	Solubility of V in g/100g of water
4	$\checkmark^{1/2}$	$\checkmark^{1/2}$
6	$\checkmark^{1/2}$	$\checkmark^{1/2}$
8	$\checkmark^{1/2}$	$\checkmark^{1/2}$
10	$\checkmark^{1/2}$	$\checkmark^{1/2}$
12	$\checkmark^{1/2}$	$\checkmark^{1/2}$

→ Each blank space is $\frac{1}{2}$ of a mark.
Total marks 5 Marks

2.(ii)

(ii) $85^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ✓1(iii) $12.5\text{g}/100\text{g}$ of water $\pm 1\text{g}$ **Conditions must be indicated in the graph in broken line.****Marking points**

(i) Labelled axes ✓1

(ii) Scale i.e. area occupied by the graph to be at least $\frac{3}{4}$ of the grid provided.

(iii) Plots (a) 4-5 plotted correctly ✓1

(b) 3 plotted correctly ✓ $\frac{1}{2}$

(iv) Shape of the curve ✓1

3. I (17 MARKS)

	Observations	Inferences
(a)	Yellow/brown filtrate ✓ ½ OR Black residue	Fe ³⁺ present ✓ ½ OR Cu ²⁺ present
(i)	Brown precipitate ✓ ½ Insoluble in excess ✓ ½	Fe ³⁺ Present ✓ ½
(ii)	Brown precipitate ✓ ½ Insoluble in excess ✓ ½	Fe ²⁺ Present ✓ ½
(iii)	White precipitate formed ✓ ½	Cl ⁻ , SO ₄ ²⁻ , SO ₃ ²⁻ , CO ₃ ²⁻ Present NB: (i) 3 or 4 mentioned ✓ 1 (ii) 2 mentioned present ✓ ½ (iii) 1 mentioned present ✓ 0
iv)	No white precipitate formed ✓ ½	Cl ⁻ - Present ✓ ½
(b)	- Blue solution formed ✓ ½ OR - No effervescence bubbles	Cu ²⁺ present ✓ ½ OR SO ₃ ²⁻ /CO ₃ ²⁻ absent
(i)	Blue precipitate ✓ ½ insoluble in excess ✓ ½	Cu ²⁺ present ✓ ½
(ii)	Blue precipitate ✓ ½ soluble in excess to form a deep blue solution ✓ ½	Cu ²⁺ confirmed present ✓ ½

(II)

	Observations	Inferences
(a)	- Yellow/sooty flame ✓ ½/ Smoky flame	Either $\begin{array}{c} \diagup \\ \text{C} = \text{C} \\ \diagdown \end{array}$ ✓ ½ OR - C ≡ C - Present
(b) (i)	K ₂ Cr ₂ O ₇ is not decolourised ✓ 1	Either RCOOH ✓ ½ OR H ₃ O ⁺ present
(ii)	Bromine water ✓ 1 is not discoloured	- RCOOH present ✓ ½
(iii)	PH = 5 – 6.5 ✓ ½	- Weakly acidic - Either H ₃ O ⁺ , H ⁺ ✓ ½ OR RCOOH present
(iv)	Effervescence/bubbling/fizzling ✓ 1	RCOOH confirmed present ✓ ½