KCSE 2005

CHEMISTRY PRACTICAL

MARKING SCHEME

Time (min)	0	½	1	1 ½	2	2 ½	3	3 ½
Temperature (0c)	82	73	69	68	68	68	66	65

1 mk for the two axis
1 mk for all points correctly plotted
1 mk for plot occupying ¾ of the gird provided

b)68^0C

	I	II
Initial temperature of Solution K T_t (°c)	26	26
Initial temperature of Solution L T_2 (°c)	25	26
Highest temperature of Mixture T_3 (°c)	30.5	31
Average initial temperature (°c)	25.5	26
Change in temperature, < T (°c)	5	5

Table 1
½ mk for each entry 5mks

a)Average $\frac{5+5}{2}$ = 5
1mk

b)Heat change 5 x 4.2 x 5 (i)
=1050 Joules (1) 2mks

c) Number of moles of acid L
1050
143.4 x 1000
=0.0078125

D25cm = 0.0078125 moles
$\frac{0.0078125}{25}$ x 100

=0.3125M 2mks

e) Relative formula mass of acid L

60 = 0.3125-(1)
R.F.M

R.F.M = 192(1) 2mks

observation	**inferences**
3ai) cracking sound	Solid N is hydrated
colourless liquid	a basic gas is formed
gas with pumpent smell	
Colourless gas	(1/2) mk for each
gas turf red trumps	correct inference
paper blue	
2mks for four correct observation n	
ii)White Ppt (1/2)	Al^{3+} or Pb^{2+}
iii)White Ppt (1)	SO_4^{2-}, $S0_32-$, CO_32-
	1mk for two 2mks
iv)White Ppt	SO42- (1)
persists (1)	

observation	**inferences**
i)Clear solution (I)	salt is soluble (1)
No effervescence (1)	(H+ absent (1) 2 mks
III)White solid formed (1)	
slightly soluble in excess	
on addition of NaHCO3	acidc
There is effervescence (1/2)	solution is formed (1)
colourless gas (1/2)	
give max 2 mks for observation	

CHEMISTRY PAPER 233/3

K.C.S.E 2006 MARKING SCHEME

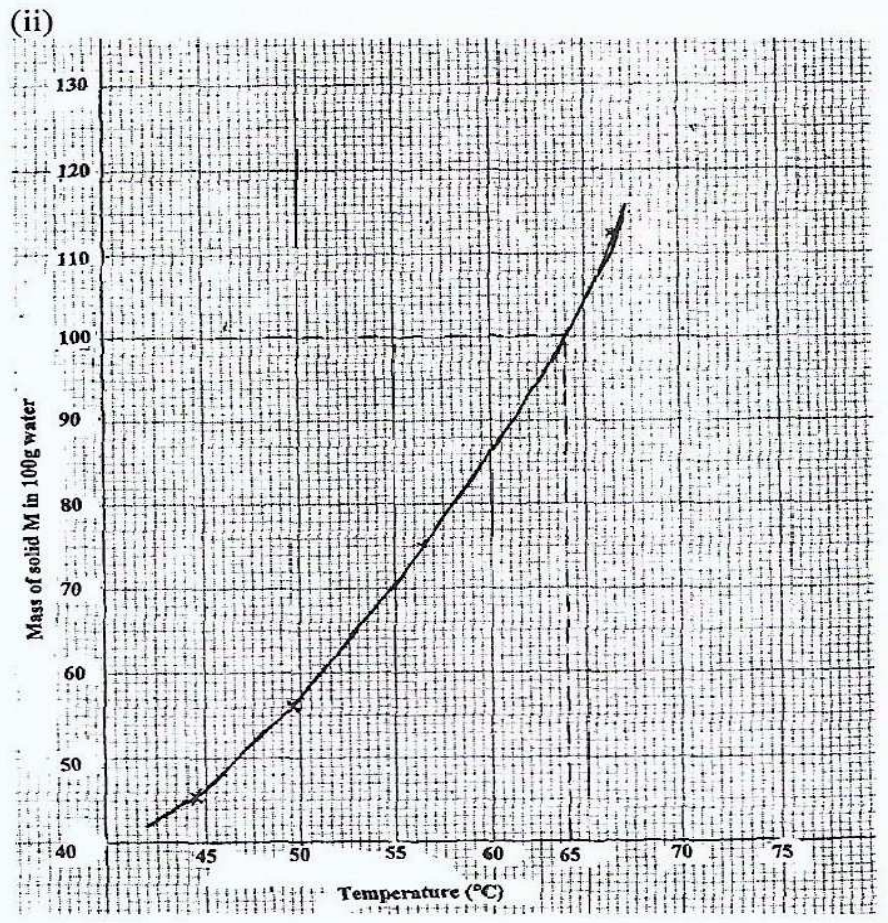
PRACTICAL

24.6.3 **Chemistry Paper** 3 (233/3)

1a) b) c) and d) i

Volume of water in the boiling tube (cm^3)	Temperature at which crystals of solid A	Solubility of solid A (g/lOOg water)
4	**66 - 67**	**112.5**
6	**56 - 57**	**75**
8	**49 - 50**	**56**
10	**44 - 45**	**45**

(ii)



iii) 63 ∓0.5 ^{0}C 3MKS

Ei)

	I	II	III
Final burette reading	24.40	48.6	26.20
Initial burette reading	0.00	24.4	2.00
Volume of solution B used	24.40	24.2	24.20

(3 mks)

ii)

Average $\frac{24.20+24.20+23.4}{3}$ 1mk

=24.20cm4

II $\frac{0.06 \times 24.20}{1000}$

= 1.45 x 10-3 moles 1mk

III

$\frac{1.45 \times 10-3 \times 5}{2}$

=3.63 x 10^{-3} moles 1mk

Iv 3.63 x 10-3 x 10

=3.63 x 10^{-2} moles

$\frac{4.5}{3.63 \times 10^{-2}}$. 3mks

= 124

iii) DxH_2O

90+18x = 124

X=34

18

=1.9

=2 2mks

observation	inferences	
colourless liquid condenses on cool parts of test tube white solid remains	probably hydrated salt/compound present	2mks
b)Colourless filtrate white residue	Compound sparingly soluble compound is basic	2mks

i)Solution turns pink	OH, HCO_3 or CO_3 Present	2mks
ii)No effervescence	OH Present or HCO_3 or CO_{2-3} absent	2mks
iii)White ppt formed	Ca^{2+}, Ba^{2+}, Pb^{2+} present	3mks
iv) No white PPt	Ba^{2+} present or Ca^{2+} or Pb^{2+} absent	2mks
3.Bruns with luminous (yellow, smoky) flame	unsaturated compound OR Long chain hydrocarbon	2mks
b)Potasisum manganate (VII) is doloursed (changes form purple to colourelss)	alkene or alcohol present	2mks
c)Bromine water is decoloursied (changes from red to colourless)	alkene present	2mks

CHEMISTRY PAPER 233/3

K.C.S.E 2007 MKING SCHEME

PRACTICAL

1A)

	I	U	III-
Final burette reading	21.8 0.0	21.6 0.0	43.6 22.0
Initial burette reading	0.0	0.0	22.0
Volume of solution D used *(cm)*	21.8 21.6	21.6	21.6

(3mks)

i) $\underline{21.6 + 21.6}$ = $21.6cm^2$ 1mk

2

ii) R.F. M of Na^2CO^3= 106

Conc. 8/106 = 0.075m 1mk

iii)Moles of Na^2Co^3= $\underline{25x0.075}$

1000

= 0.001875

Mole sof H^2SO^4 = $\underline{0.001875}$

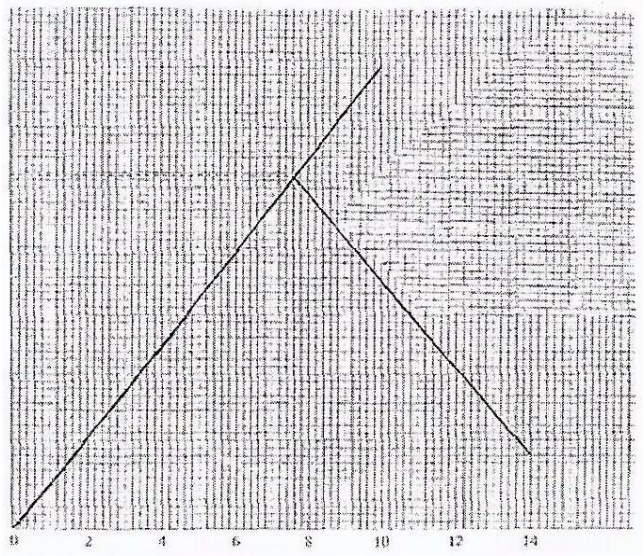
21.6 X 1000

= 0.0868 M 2mks

iv)0.0868 x 10 = 0.868 1mks

(B)

Test-tube number	1	2	3	4	5	6
Volume of solution A (cm^3)	2	4	6	8	6 .	4
Volume of solution C (cm^3)	14	12	10	8	10	12
Initial temperature of solution C (°C)	20.5	20.5	20.5	20.5	20	20
Highest temperature of mixture (°C)	23	25.5	28.0	29.5	26.5	24.5
Change in temperature A/[1]	2.5	5.0	7.5	9.0	6.5	4.5



ii) $\Delta T=9.5 \mp 0.1^0C$ 1mk

Maximum volume of A = 7.6 CM3 ∓ 1

iii) Moles of sulphuric acid $\frac{7.6x0.868}{1000}$

= 0.0066 moles 1mk

ii)Heat evolved 16 x 4.2 x 9.5

638.4 Joules

Molar heat $=\frac{638.4}{0.0066}$

$=96.727272$ Kj Mol $^{-1}$ 2mks

2/Observation	**Inferences**
Gas with a pungent/irritating /choking smell	
Colourless liquid formed on cool par to test tube	Hydrated salt
Blue litmus paper turns red	acidic gas evolved
Red litmus paper remains red	
Solid turns reddish brown.	
3mks	

Observations	inferences
i)Reddish brown solution	Strongly acidic
PH 1,2,3	(2mks)
ii-Brown precipitate insoluble in excess	Fe2+
iii)Brown/black solid formed or solution c hanged yellow to brown	iodine ions oxidised to iodine 2mks
iv)White precipitate settles at the bottom of the test tube	SO^{2}_{4} Present 2mks

3a)

Observation	Inferences
a)Clear blue flame	Saturated low carbon organic compound
b)No separation or forms a solution	Mixture is miscible or polar
two liquids are miscible	organic compound (1mk)
c)No effervescence	Liquid not acidic or absence of H+
d)Solution changes from orange to green	F is likely to be alcohol OR R – OH. (2mks)

CHEMISTRY PAPER 233/3

K.C.S.E 2008 MKING SCHEME

PRACTICAL

Procedure A

Table 1

time (min)	0	1/2	1.0	1.5	1.0	2.5	3.0	3.5	4.0	4.5	5.0
temperature 0C	19	18.5	18.0	18.0	18.0	X	13.0	12.0	13.5	13.5	14.0

5mks

ii) $\Delta T=6^0C$ 3mks

iii) ΔH = 20 x 4.2 x 6

504 joules

Procedures B

Table 2

	I	II	III
Final burette reading	16.5	32.20	32.20
initial burette reading	0.0	16.0	16.0
tire (cm3)	16.5	16,20	16.20

i) $\frac{16.2 + 16.2}{2}$ = $16.2cm^3$ 1mk

$\frac{16.2 \times 0.1}{1000}$ = 0.00162 1mk

II Moles of HCL = Moles of NaOH 1mk
0.00162

III 0.00162 X 10 = 0.0162M 1mk

iv. $\frac{20 \times 2}{1000}$ = 0.04 1mk

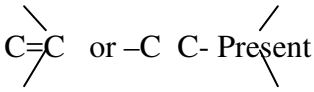
V 0.04-0.00162 = 0.00238 1mk

c)0.0228 moles = 504

1 mole = $\frac{504}{1}$ x

$$\frac{0.0238}{1000}$$

= +21.176 Kjmol-1 2mks

observations	inferences
• green solid turned black • colourless liquid condenses on cool part water of crystallization. • blue litmus paper turend pink • red litmus paper remains the same	Solid D is hydrated or contains water of crystallization acidic gas is produced 3mks
• no effervescence • black solid reacts to form a green solution	Black solid is basic coloured ion present ie Fe 2^{+} or Cu^{2+}
• blue precipitate formed • re-dissolves in excess to form a deep blue / royal blue solution	Cu2+ present 2mks
• effervescence occurs • brown solid deposited • colourles formed • green solution turns • Test tube gets warm	E is a metal more reactive than copper or E displaces Copper or E reduces Cu 2+ to Cu 2MKS
• Yellow smoky flames / sooty flame	F is along chain hydrocarbon or an unsaturated organic compound
• Dissolves to form a colouress	it is probably a soluble salt or polar organic compound
• Effervescence occurs • Colourles gas given out	compound is acidic –COOH or H+ or H2O 2mks
ci)Orange / yellow colour persists	Absence of Hydroxyl group 2mks
iii)KMnO4(aq) is decolourised	 or –C C- Present

CHEMISTRY PAPER 233/3

K.C.S.E 2009 MARKING SCHEME

PRACTICAL

1.

	1	II	III
Final burette reading	22.20	21.50	22.50
Initial burette reading	0.00	0.00	1.00
Volume of solution C used (cm)	22.20	21.50	21.50

a) i) Average volume of solution C used

$$\frac{21.50+21.50}{2}$$ ***(1 mark)***

(ii) Moles of sodium hydroxide in the average volume of solution C used.
1000 cm^3 of sodium contains 0.3 moles of NaOH.

.'. 21.50cm^3 of solution contains $\frac{0.3x21.5}{1000}$

= 0.00645 moles ***(1 mark)***

(iii) Moles of hydrochloric acid in 25.0 cm^3 of solution D.
= 0.00645 moles ***(1 mark)***

(iv) Molarity of hydrochloric acid in solution D.
25cm^3 of solution contains 0.00645 moles HCI

.'. 1000 cm of solution contains $\frac{0.00645 \times 1000}{25}$

0.258M ***(1 mark)***

Table 2

	I	II	III
Final burette reading	21.50	20.90	20.90
Initial burette reading	0.00	0.00	0.00
Volume of solution **1)** used (cm^J)	21.50	20.90	20.90

b) i) Average volume of solution D used

$\frac{20.90 + 20.90}{2}$ = 20.90cm^3

ii) Moles pf hydrochloric acid in average volume of solution **D** used 1000cm
of solution contains 0.258 moles HCI

$20.90cm^3$ of solution contains

$\frac{0.258 \times 20.90}{1000} = 20.93cm^3$

= 0.0054 moles

iii) Moles of the metal carbonate, solid A in $25.0cm^3$ of solution A

Mole ratio of acid to carbonate

½ x 0.0054

= 0.0027 moles

iv) The solubility of the metal carbonate in g/100g of solution

Mass of carbonate 0.0027 x 7 1

In $25.0cm^3$ of solution 0.1998g.

therefore $\frac{0.1998 \times 100}{25}$

100g of solution will contain $\frac{0.1998 \times 100g}{25}$ carbonate

= 0.7992 g/100g of solution

	Observations	**inferences**
2. a)	A colourless liquid condenses on the cooler parts of test tube	Hydrated salt/compound
	Gas produced forms white fumes with HCI.	Ammonia gas

b)

Observations	**inferences**
i) White ppt. insoluble in excess	Pb^{2+} or Al^{3+} present
(ii) No white ppt No effervescence	pb^{2+} or Al^{3+} present CO_3^{2-} Absent
iii) White ppt	SO_4^{2-}present

3. a) observations **inferences**

White Solid dissolves to form a Colourless solution A non polar compound ipresent.

Observations (i) $P^H = 7$ (1 mark)	**Inferences** Neutral solution. (1 mark)
Observations (ii) No effervescence (1 mark)	**Inferences** Solution not acidic (1 mark)
Observations (b) - Effervescence giving off a coloureless gas. - - Colourless solution formed. (1 mark)	**Inferences** Carboxylic/alkanoic acid preset Or - COOH present (1 mark)
Observations (ii) Does not turn green (1 mark)	**Inferences** Alcohol absent OH - absent (1 mark)
Observations (iii) Not decolourized (1 mark)	**Inferences** (1 mark)

CHEMISTRY PAPER 233/3

K.C.S.E 2010 MARKING SCHEME

PRACTICAL

Table 1

	I	II	III
Final burette reading	**13.80**	**27.80**	**40.70**
Initial burette reading	**0.00**	**13.80**	**27.30**
Volume of solution used (cm^3)	**13.80**	**13.50**	**13.40**

(4 mks)

13.50 + 13.40 „ 4C 3 Average volume used ——————— = 13.45cm

Mava = MbVb

2 x 25 = 250 x

$\frac{2x25}{250}$ = Vb = 0.20M

Moles of NaOH used = 0.2x $\frac{25}{100}$ = 0.005 moles

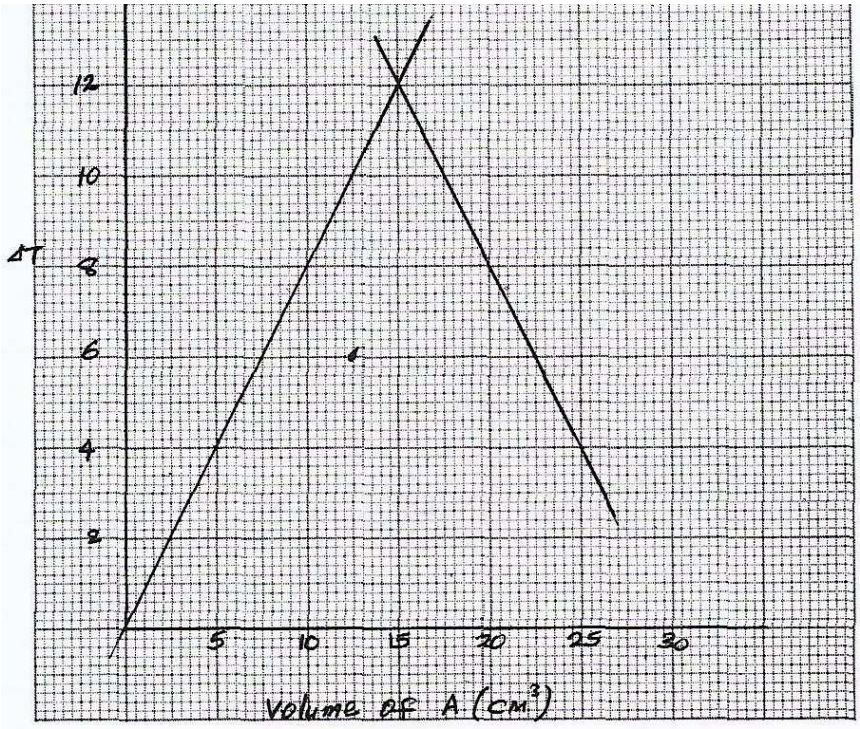
Moles of acid used = $\frac{1}{3}$ x 0.0005

$$\text{Concentration of acid} = \frac{0.005x100}{13.45x3} = 0.12\ M$$

Molar mass of acid = $\frac{25}{0.1}$ = 208.3

Volume of solution A (cm^3)	5	9	13	17	21	25
Volume of solution B (cm^3)	25	21	17	13	9	5
Maximum temperature (°C)	30.5	34.0	36.5	36.5	34.0	30.5
Initial temperature (°C)	26.5	26.5	26.5	26.5	26.5	26.5
AT change in temperature	4.0	7.5	10.0	10.0	7.5	4.0

Table 2



b)Cm^3 1MK

c)30-15=$15cm^3$ 1mk

di)15:15 = 1:1 1MK

II)MaVa=MbVb

$\frac{Max15}{2x15} = \frac{1}{1}$

$Ma = \frac{2 \times 5}{15} = 2$

Ma = 2M 1MK

Question 2

(a) (i)

OBSERVATIONS

White PPt formed (¹/₂) No effervescence (!/₂)

(ii) OBSERVATIONS

White PPt which 0/₂) Dissolves in excess (¹/2)

INFERENCES

$CO_3^{2''}$ and SO_3^{2} ions absent (1) Probably Pb^{2}~, Ba^{2+} or Ca^{2+}, may be present (1) (3 mks)

INFERENCES
Pb present (1)(2 mks)

Iii

observation	inferences
white Ppt formed (1)	Insoluble cpd of Pb2+ is formed (1) 2mks

Iv

observation	inferences
Yellow PPt (1)	Pb2+ ions confirmed or Pbl2 formed (1)

Bi)

observation	inferences
burns with a smoky flame(1)	Unsaturated organic cpd or long chain d (1) 2mks

observation	inferences
colourless solution, turn red Ph 1-2(1)	carboxylic acid present (1) 2mks

Iii

observation	inferences
effervescence colourless gas evolved oduorless gas (1)	confirm G was acid and F was a carbonate (1) 2mks

I

observation	inferences
Decolourised KMnO4 (1)	Unsaturated alkene or alcohol present (1) 2mks

II

observation	inferences
Bromine water decolourised (1)	Unsatruated alkene present or alkyne (1) 2mks

CHEMISTRY PAPER 233/3

K.C.S.E 2011 MARKING SCHEME

PRACTICAL

11.3Chemsitry paper 3 (233/3)

1. Table

	I	II	III
Final burette reading	29.70	33.40	44.60
Initial burette reading	0.00	4.00	15.30
Volume of solution A used (cm^3)	29.70	29.40	29.30

4mks

i)Average volume = $\frac{29.4+29.3}{2}$

= 29.36cm^3 (1/2 marks)

ii)Concentration of the dibasic acid A 2mks

conc = $\frac{1.6}{126}$ = 0.01269: 0,01269 x 4 = 0.05 M

iii)Moles of the dibasic acid used

= $\frac{29.35}{1000} \times 0.05$

= 0.0014675 moles (1mk)

iv)Moles of NaOH in 25.0 cm^3

=(0.0014657 x 2) = 0.002935 moles (1mk)

v)The concentration of NaOH in moles per litre

=25.0cm^3 of NaOH 0.002935

1000CM^3 = 0.1174M (2mks)

2. Table II

	1st conical flask	2nd conical flask
Final burette (cm^3)	21.20	33.60

Initial burette (cm^3)	9.70	22.20
Volume of solution A used (cm^3)	11.50	11.40

i)Average volume; = $\frac{11.4+11.5}{2}$

$=11.45cm^3$ (1/2 mks)

ii)Moels of the dibasic acid = $\frac{0.05 \times 11.45}{1000}$

= 0.0005725 moles (1mk)

iii)Moles of NaOH t hat reacted with the dibasic acid

=(0.0005725 x 2)

= 0.001145 moles (1mk)

iv)Moles of NaOH that reacted with 25.0 cm3 of salt B in solution B

= 0.0029314 – 0.001145

=0.0017864 Moles 2mks

v)

I. Moles of salt B in 25.0cm2 of solution B

0.0017884 x ½

6 = 0.00089 moles

II. Concentration in moles per litre of salt B in solution B

= 0.00089 x $\frac{1000}{25}$

=0.0357 M

III. Relative molecular mass of salt B

= $\frac{4.73}{0.0357}$

=133.0 (1mk)

2a)i)

Observations	**Inference**
gas which turns red litmus paper blue brown solid formed (2mks)	HN_4+ Present (1mk)

Observations	**Inference**
Yellow /brown solution Brown ppt (1mk)	Fe^{3+} formed (1mk)

Bi)

Observations	**Inference**
White ppt formed (2mks)	CO_3^{2}- SO_3^{2}, SO_4^{2} (2mk)
II Changes from orange to green 1mk	$SO_3$2 Present 1 mk 2mks

3a)

Observations	**Inference**
Burns with a blue flame (1mk)	Saturated compound or short chain hydrocarbon (1mk)

B

Observations	**Inference**
No effervescence (1mk)	Not acid (1mk)

C

Observations	**Inference**
Colour changes from orange to green (2mks)	R-on Present (1mk)

CHEMISTRY PAPER 233/3

K.C.S.E 2012 MARKING SCHEME

PRACTICAL

Table 1

	I	II	III
Final burette reading	17.45	32.90	36.05
Initial burette reading	2.10	17.45	20.60
Volume of solution B used (cm^3)	15.35	15.45	15.45

(a) - (i) Average volume (4 marks)

$= \frac{15.35 + 15.45 + 15.45}{3}$

$= 15.42cm^3$

(1 mark)

(ii) Moles of sodium thiosulphate used

$= \frac{0.05 \times 15.42}{1000}$

7.71×10^{-4} moles

(1 mark)

(b) (i) Number of moles of A in $25.0cm^3$

mole ratio A : $Na_2S_2O_3 . 5H_2O$
1:6

(1 mark)

(2 marks)

$7.71 \times 10^{-}/6 = 1.28 \times 10^{-4}$ moles (ii)

Concentration of solution A in mol dm^3

1.28 xl0-^{4} moles in 25cm^3

? moles in 1000cm^3

1.28 xl0-^{4}x 1000/25 (1)

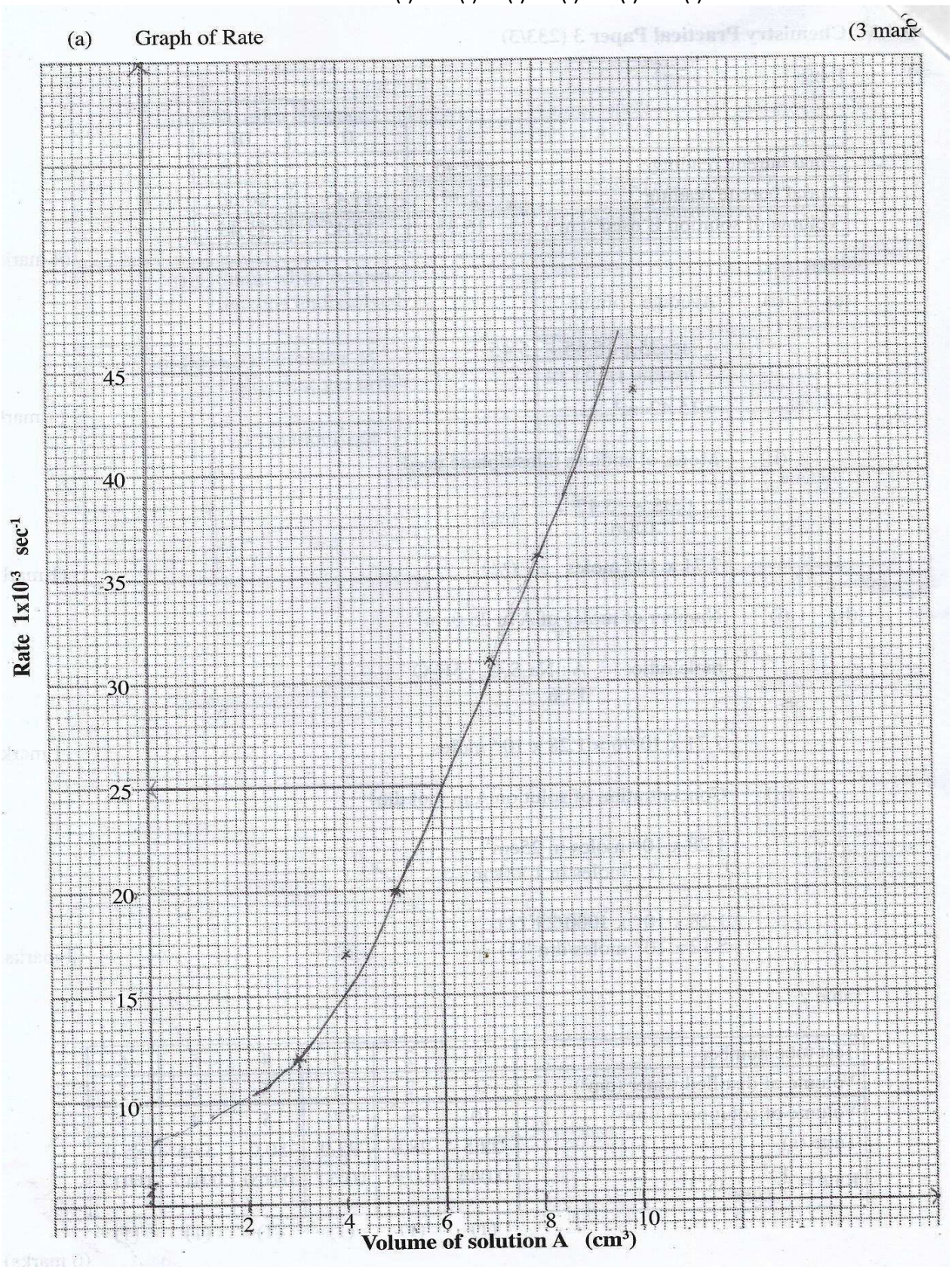
5.12xl0-^{3}moles/dm-^{3}(l)

Table 2

Test tube number	1	2	3	4	5	6
Volume of distilled water (cm^3)	0	2	3	5	6	7
Volume of solution A (cm^3)	10	8	7	5	4	3
Time (s)	22.5	28.0	32.0	50.0	57.5	85.0
Rate = *y* (s-$^{-}$) / *time*	0.044	0.036	0.031	0.020	0.017	0.012

(I) (I) (I) (I) (I) (I)

(a) Graph of Rate (3 mark



Time taken for $4cm^3$ of distilled water.

$6cm^3$ of solution A is added, from the graph = $25x10^{-3}$ sec^{-1} - 40 seconds

(a) (i)	(I)	A white precipitate (1)	Presence of Pb^{2+}, Ba^{2+} or Ca^{2+} (1) *1 mark for all the 3 ions ½ mark for 2 correct ions 0 mark for one or none*
	(II)	No white precipitate (1)	Absence of Pb^{2+} (1)
	(III)	No white precipitate (1)	SO_4^{2}% SO_3^{2}-, CO_3^{2}' ions absent (1) *1 mark all the 3 ½ mark for 2 ions correct 0 mark for one or none*
	(IV)	No white precipitate (1)	Cl" ions absent (1)
(ii)		Effervescence ½ Bubbles/Fizzing Colourless gas produced ½ Turns red litmus blue 1½ Blue litmus remained blue 1½ (2 marks)	NO_3 present (1)
			(Total 11 marks)

	observation	inferences
a)	no effervescent (1)	Compound/solution F not acidc H+ or R-COOH absent
bi)	Burns with a sooty / smoky ½ luminous / yellow flame ½	unsaturated cpd (1) C+C Long chain hydrocarbon or –C=C-
ii	some white suspension /solid remains un dissolved ½	Compound slightly / partially soluble in water ½
ci)	effervescence ½ colourless gas produced ½	mixture is acidic (1) RCOOH Present
ii)	not decoloursized (1)	C=C absent (1) -C=C- absent

CHEMISTRY PAPER 233/3

K.C.S.E 2013 MARKING SCHEME

PRACTICAL

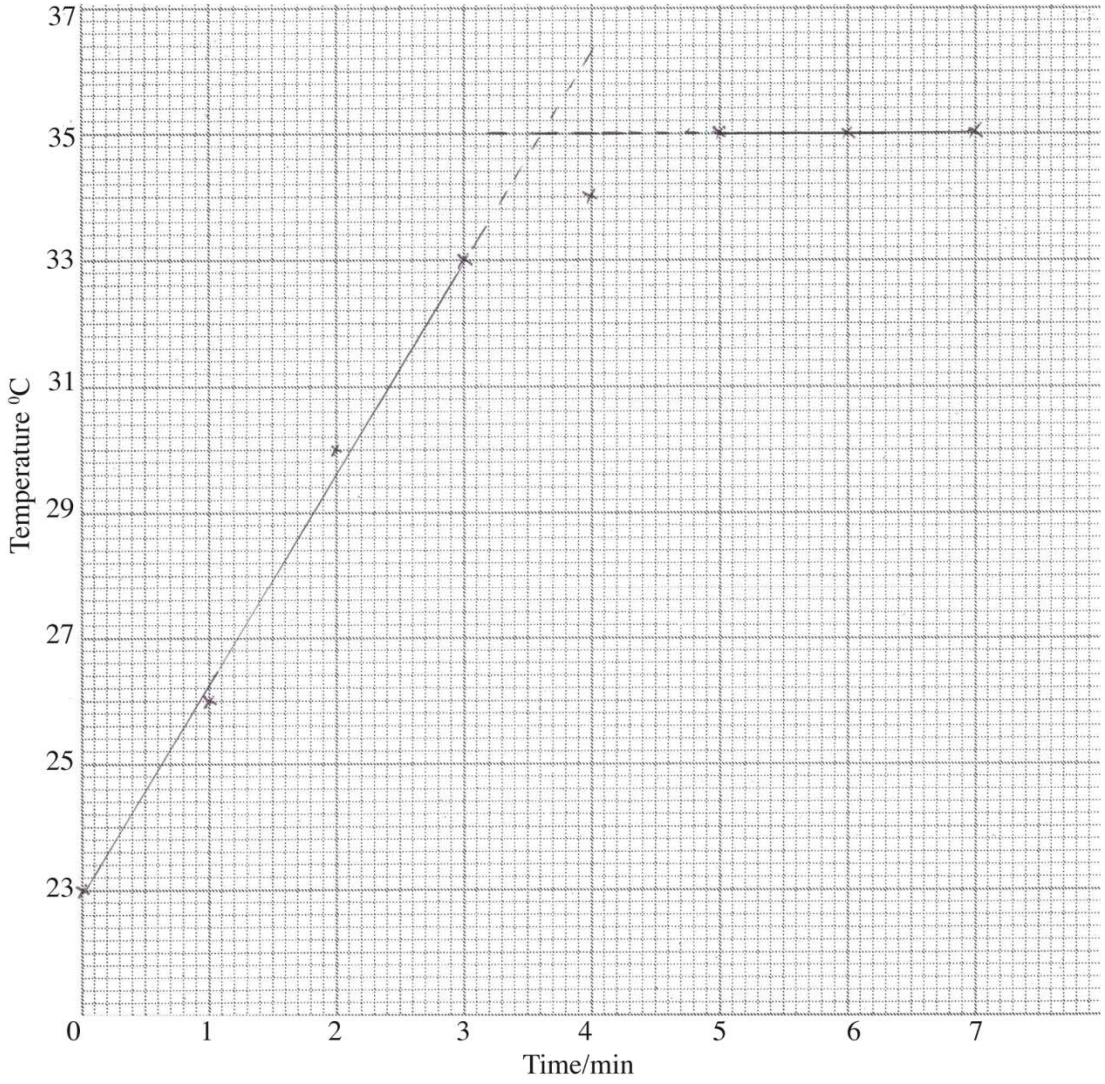
Procedure I

1. Table 1

Time (Min.)	0	1	2	3	4	5	6	7
Temperature (^{0}C)	23.0	26.0	30.0	33.0	34.0	35.0	35.0	35.0

$\frac{1}{2}$ mark for each correct entry, Maximum (3 marks)

(a) (i) (3 marks)



(ii) (I) $\Delta T = 35 - 23 = 12^0C$. (1 mark)

(II) 3 minutes 36 seconds. ($\frac{1}{2}$ mark)

(iii) $\Delta H = 50 \times 4.2 \times 12$
$= 2520$ joules. (2 marks)

Procedure II

Table 2

	I	II	III
Final burette reading	24.50	25.00	34.20
Initial burette reading	0.00	1.00	10.20
Volume of solution C (cm^3)	24.50	24.00	24.00

(4 marks)

(a) Average volume $= \frac{24.5 + 24.0 + 24.0}{3}$ √
$= 24.17\ cm^3$ √$\frac{1}{2}$ ($\frac{1}{2}$ mark)

(b) (i) Moles of MnO_4^- $= \frac{0.02 \times 24.17}{1000}$ √$\frac{1}{2}$
$= 4.83 \times 10^{-4}$ √$\frac{1}{2}$ (1 mark)

(ii) Moles of Fe^{2+} $= 5 \times 4.83 \times 10^{-4}$ √$\frac{1}{2}$
$= 2.417 \times 10^{-3}$ √$\frac{1}{2}$ (1 mark)

(iii) Moles of Fe^{2+} in 250 $cm^3 = 2.417 \times 10^{-3} \times 10$ √$\frac{1}{2}$
$= 2.417 \times 10^{-2}$ √$\frac{1}{2}$ (1 mark)

(c) Molar heat of displacement $= \frac{2520}{2.417 \times 10^{-2}}$ √(1) (1 mark)

$= 104261.48$ Joules √(1) (1 mark)

2 (a)

(i)

Observations	**Inferences**	
- White solid turns yellow - Splint extinguished - On cooling solid is white - Colourless, odourless gas. (max. 1 mark)	Probably CO_2 gas given off. $\therefore CO_3^{2-}$ or HCO_3^-, ZnO formed (max. 1 mark)	(2 marks)

(ii)

Observations	**Inferences**	
- effervescence/bubbles - colourless, odourless gas (1 mark)	CO_3^{2-} present (1 mark)	(2 marks)

(iii)

Observations	**Inferences**	
- White ppt soluble in excess (1 mark)	Zn^{2+} present (1 mark)	(2 marks)

(b) (i)

Observations	**Inferences**	
White ppt insoluble in excess (1 mark)	Pb^{2+} or Al^{3+} Mg^{2+} (1 mark)	(2 marks)

(ii)

Observations	**Inferences**	
- No effervescence - No white ppt (1 mark)	CO_3^{2-} SO_3^{-2} absent Pb^{2+} absent **or** Al^{3+} and Mg^{2+} present (1 mark)	(2 marks)

(iii)

Observations	**Inferences**	
White ppt (1 mark)	SO_4^{2-} present (1 mark)	(2 marks)

3. (a)

Observations	**Inferences**
Melts and then burns with a sooty/ smoky/Luminous flame/yellow flame. (1 mark)	Long chain organic compound or  or H - C ≡ C - H (1 mark)

(2 marks)

(b) (i)

Observations	**Inferences**
Not decolourised (1 mark)	ROH  or absent (1 mark)

(2 marks)

Observations	**Inferences**
Effervescence/bubbling Colourless gas (1 mark)	Carboxylic acid present. H^+ or H_3O^+ or RCOOH (1 mark)

(2 marks)

Method used	**Inferences**
- Add 2 drops of universal indicator to solution. - Match the colour of solution to the pH chart paper - Read off pH. (2 marks)	- pH is 1 or 2 - Solution is strongly acidic (1 mark)

(3 marks)

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K.C.S.E 2014 MARKING SCHEME

PRACTICAL

ii) Moles of sodium thiosulphate used 1mk

$$\frac{\textbf{0.1x Av. Vol (titre)}}{\textbf{1000}}$$

Correct ans

ii)Concentration in moles per litre of copper (II) ions in solution J given that the number of moles of copper (II) ions in 25.0cm^3 of solution J_2 are the same as the moles of sodium thiosulphate used (2 ½ mks)

Moles of Cu^{2+} in 25.0cm^3 of J_2= Ans (ii)

Moles of Cu^{2+} in 250cm^3 J_2= ans (ii) $\frac{\textbf{above x 260}}{\textbf{25}}$

Correct answer.

Or

Ans (i) x 10

Correct answers

$\frac{\textbf{Moles of } Cu^{2+} \textbf{ in 25cm}^3 \textbf{ of J}}{}$ **= Ans. Above**

Moles of cu^{2+} in 1000cm^3 of J = Ans. $\frac{\textbf{Above x 1000}}{\textbf{25}}$

Correct answer

Or moles of Cu^{2+} in 1000cm^3 of J=

= Ans (ii) x $\frac{250}{25} \times \frac{1000}{25}$

= Correct ans

PROCEDURE II

a. Using a clean burette, place 5.0 cm^3 of solution N into each of six (6) test-tubes.
b. Using a 100 ml measuring cylinder, place 20 cm^3 of solution J in a 100 mi plastic beaker. Measure the temperature of solution J and record it in Table 2 below.
c. To solution J in the beaker, add sodium hydroxide, solution N from one of the test-tubes. Stir the mixture with the thermometer and record in **Table** 2, the maximum temperature reached. Continue with step (d) **IMMEDIATELY.**
d. Add the sodium hydroxide, solution N from another test-tube to the mixture obtained in (c) above, stir and record the maximum temperature reached in **Table** 2. Continue adding the sodium hydroxide, solution N from each of the other four test-tubes, stirring the mixture and recording the maximum temperature each time and complete **Table 2.**

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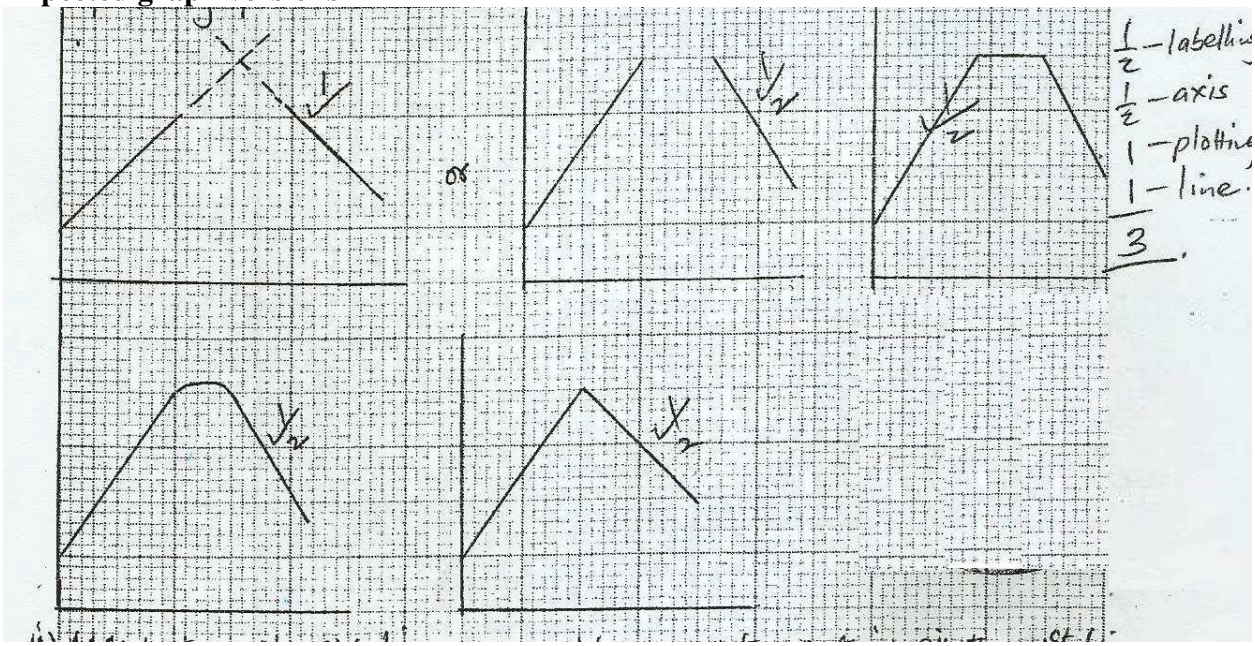
Volume of sodium hydroxide solution N added (cm^3)	0	5	10	15	20	25	30
Maximum temperature (^0C)							

Table 2 trends

i)On the grid provided, plot a graph of temperature (vertical axis) against volume of sodium hydroxide solution N added (3mks)

Expected graph versions



Accept two straight lines intersecting on extraporation with the 1st line passing through the initial temp for….1mk
Accept two lines NOT extrapolated whether joined or NOT 1.2 mk
if the 1st line passes through the initial temp
NB Accept liens of best fit .

ii) Using the graph, determine the

i) Volume of sodium hydroxide, solution N that reacted completely 20cm3 of solution J; 2mks

ii) Temperature change, ΔT, for the reactin 1mk

iii) Enthalpy change of the reaction per mole of copper (II) ions.
(Heat capacity = 4.2 J $^{g-}$1k-1, density of the mixture = 1.0gm^{-3} 3mks

ΔH=MCΔ*T*
(20 + Ans I)x 42 x Ans II
= Ans (x)

Moles of cu^{2+} used = $\frac{20 \times \text{Ans (iii) of procedure I}}{1000}$

= Ans (y)

ΔH for 1 mole of Cu^{2+} = $\frac{\text{Ans (x)}}{\text{Ans (Y)}}$

= Correct answer (J/mol)

OR ΔH for 1 mole of Cu^{2+}

= $\frac{\text{Ans (x)}}{\text{Ans (Y)}} \times \frac{1}{1000}$

= Correct ans (KJ /mol

2. You are provided with substance P. Carry out the tests below and write your observations and inferences in the spaces provided

a) Describe the appearance of substance P. 1mk

White / colourless crystalline solid
Or white / colourless crystals

b) Place about one third of substance P in a dry test tube and that it strongly

Observation	Inferences
Colourless gas / vapour condenses on the cooler parts of the t.t **White residue / solid / powder** **Accept: colourless liquid forms on cooler parts of the t.t** **Reject; liquid condenses /moisture (forms , steam /vapour forms**	**Hydrated salt /cpd or contains water of crystallization** **(Tied to colourless vapour condenser**

c) Place the remaining amount of substance P in a boiling tube. Add about $10cm^3$ of distilled water and shake well. Retain the mixture for test in (d) below

Observation	Inferences
Solid dissolves to form a colourless solution **Accept: colourless soln form**	**Soluble cpd/salt** **Absence of coloured ions** **Accept:** **Fe^{2+}, Fe^{3+}, Cu^{2+} absent (all mentioned for ½ mk (tied to colourless soln**

d) Use about $2cm^3$ portions of the mixture obtained in (c) for tests (i) to (iii) below
i)Add two to three drops of aqueous barium nitrate to the mixture

Observation	Inferences
White ppt /suspension formed	**SO_3^{2-}, SO_4^{2-}, CO_3^{2-} present**
Accept	**All 3 – 2mks**
White solid formed	**Only 2- 2 mks**
Penalize fully	**Ony 2 – 1 mk**
White ppt dissolved	**Only 1 -1/2 mk**

NB: For any contradiction, mk out of 1 ½ mk and penalize 1/2mk for each contradictory ion to a max. of 1 ½ mks
iii) Add five drops of dilute nitric (V) acid to the mixture

Observation	Inferences
No effervescent /bubbles /fizzing	**SO_4^{2-} Present**
Reject: no hissing / fizzling / sizzing	**(Must have been inferred in d(i) above**
Penalize fully if white ppt is mentioned	**Accept for ½ mk**
	SO_3^{2-}, $C0_3^{2-}$ absent (must have been mentioned above)

iii) Add to the mixture, aqueous sodium hydroxide drop wise until in excess

Observation	Inferences
White ppt /suspension insoluble in excess	**Mg^{2+} present**
NOTE	**Penalize fully for any contradictory ion**
Accept ions written in words or correct formula for (c) and (d)	

e) Give the formula of the cation and anion present in substance P.
Cation: m^{2+} **½ mk**
Anion: SO_4^{2-} **½ mk**
For the ions to be credited they must have been correctly inferred in d(ii) and d(iii) respectively.

3. You are provided with an organic substance Q. carry out the following tests and record your observations and inferences in the spaces provided

a)Place about one third of substance Q on a metallic spatula and ignite it with a Bunsen burner flame

Observation	Inferences
Yellow Sooty/smoky flame	**Organic cpd with high C;H ratio**
Accept	**Long chain organic cpd**

Yellow/luminous flame (accepted credit fully the correct inference)	**Unsaturated organic cpd** **Aromatic cpd**

b) Place the remaining amount of substance Q in a boiling tube and add about $10cm^3$ of distilled water. Heat the mixture and allow it to boil for about 30 seconds. Divide the mixture while still hot into two portions

i)To the first portion, add solid sodium hydrogen carbonate provided

Observation	Inferences
Effervescence / bubbling /fizzing **<u>Reject</u>** **Hissing /fizziling** **1mk**	**R-C00H/-COOH/Carboxylic acid / alkanol acid** **<u>Accept</u>** **H^+/H_30^+/Soln is acidic for ½ mk** **<u>Reject</u>** **Soln is an acid 1mk**

ii)To the second portion, add two or three drops of acidified potassium manganate (VII)

Observation	Inferences
$KM_nO_{4(g)}$ is decolourised / purple **Colour of $KM_nO_{4(g)}$ tuns coloureless** **<u>Reject</u>** **It turns coloruless** **Soln tuns colourless** **Forms a colourless**	**R-OH** **<u>Accept</u>** **Alcohol/alkanol** **Carbon –carbon double / tripple bond** **Unsaturated organic cpd**

NB: Penalize fully for any contradictory functional group in (a) and b(i) above
ii)Penalize ½ mk in b(ii) above for any contradictory functional group per any function al group expected. <u>Reject</u> ; alkene / alkyne /c ≡c/c ≡ cl