CHEMISTRY PP3 QUESTIONS 1996-2016

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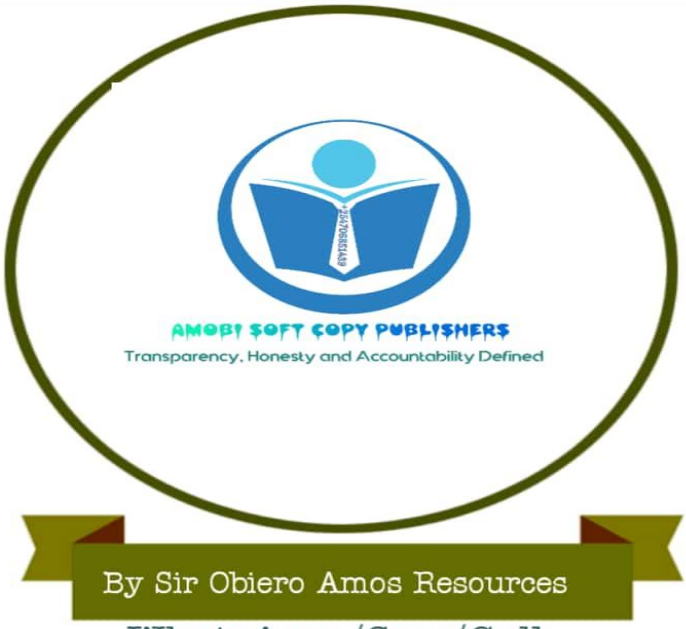

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CHEMISTRY PAPER 233/3

K.C.S.E 2005 QUESTIONS

PRACTICAL

1.

Place 150 cm^3 of tap water in a 200 ml. or 250 ml. beaker. Heat the water to near boiling. Using a test-tube holder, immerse the test-tube containing solid M into the hot water (Ensure that half of the test-tube is immersed). Continue heating the water until the solid starts to melt. Insert a thermometer into the liquid being formed in the test-tube and note the temperature when all the solid has just melted. Record the temperature in table 1. Remove the test-tube from the water and **immediately** start a stop watch/clock and record the temperature of the contents of the test-tube after every half-minute and complete the table. Dip the thermometer into the hot bath to clean it then wipe it with tissue paper.

Table 1

Time (Min)	0	$^1/_2$	I	1 ½	2	$^2/_2$	3	$^5/_2$
Temperature (°C)								

a) On the grid provided, plot a graph of time (Horizontal axis) against temperature. (3mks)

b) From the graph, determine the freezing point of solid M (1mk)

2. You are provided with:

-sodium hydroxide solution labelled solution K
-solution L, containing 60.0 g of acid L per litre of solution.

You are required to determine the relative formula mass of acid L.
Procedure

Using a burette, transfer 25.0 cm^3 of solution K into a 100 ml. beaker. Measure the temperature,

T_I of solution K and record it in table 2.
Pipette 25.0 cm^3 of solution L into another 100 ml. beaker. Measure the temperature, T_2 of solution L and record it in table 2. Add all the solution K at once to solution L. Stir carefully with the thermometer. Measure the highest temperature, T_3 of the mixture and record it in table 2. Repeat the procedure and complete table 2.

Table 2

	1	II
Initial temperature of solution K (^{0}C)		
Initial temperature of solution L T_2(^{0}C)		
Highest temperature of mixture T_3(°C)		
Average initial temperature (°C)		
Change in temperature, AT (°C)		

Calculate the

a) average A T value

(1mk)

b) (heat change for the reaction.
(*Assume density of the solution is 1 g/cm^3 and the specific heat capacity is 4.2Jg^{-1}k^{-1}*) (2 mks)

c) number of moles of acid L used given that the heat change for one mole of acid L reacting with sodium hydroxide solution is 134.4 kj (2mks)
concentration of acid L in moles per litre relative formula mass of acid L

3. a) You are provided with solid N. Carry out the tests below. Write your observations and inferences in the spaces provided.

(i) Heat about one third of solid N in a clean dry test-tube. Test the gases produced with both blue and red litmus papers.

observation	inference
2mks	1mk

ii) Using a boiling tube, dissolve the rest of solid N in about 10 cm^3 of distilled water and use the solution for the tests below.

I To about 2 cm^3 of the solution, add aqueous ammonia dropwise until in excess.

observation	inference

1mk	1mk

II To 2cm^3 of the solution, add about 5cm^3 of solution P (Aqueous sodium chloride).

observation 1mk	inference 1mk

III To 2cm^3 of the solution, add about 4 cm of aqueous barium nitrate.

observation 1mk	inference 1mk

IV To the mixture obtained in III aobe, add about 2 cm of dilute hydrochloric acid

observation 1mk	inference 1mk

(b) You are provided with solid Q. Carry out the tests below. Write your observations and inferences in the spaces provided.

(i) Place solid Q in a boiling tube. Add about 6 cm of distilled water and shake. Retain the solution for tests (ii) and (ii) below.

observation 1mk	inference 1mk

(ii) To about 2 cm^3 of the solution obtained in (b)(i) above, add a small amount of solid sodium hydrogen carbonate.

observation 1mk	inference 1mk

(iii) To the remaining solution obtained in (b)(i) above, add 3 cm of dilute hydrochloric acid. Shake and filter the mixture. Wash the residue by pouring 6 cm of distilled water to the residue while it is still on the filter paper and dry the residue between filter papers. Using a spatula, transfer the residue into a test-tube

and add 5 cm^3 of distilled water. Shake the mixture. To about 3 cm of the mixture, add a small amount of sodium hydrogen carbonate.

observation 2mks	inference 1mk

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K.C.S.E 2006 QUESTIONS

PRACTICAL

1. You are provided with

   4.5 g of solid A in a boiling tube.
   Solution B, 0.06 M acidified Potassium manganate (VTI)
   You are required to determine;
   (1) the solubility of solid A at different temperatures
   (2) flic number of moles of water of crystallisation in solid A.

Procedure

Using a burette, add 4 cm^3 of distilled water to solid A 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 A first appear. Record this temperature tn table I.

Using the burette, add 2 cm^3 of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until **all** the solid dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid A first appear.

Repeat procedure (b) two more times and record the temperatures in table 1. **Retain the contents of the boiling Cube** for use in procedure (c).

(d) (i) Complete table 1 by calculating the solubility of solid A at the different temperatures. Hie solubility of a substance is the mass of that substance dissolves In 100 cm^3 (100 g) of water at a particular temperature.

Volume of water in the boiling tube (cm^3)	Temperature at which crystals of solid A first	Solubility of solid A (g/l00g water)
4		
6		
8		

10		

Table I

(ii) On the grid provided, plot a graph of the solubility of solid A (vertical axis) against temperature. (3 mks)

(i) Using your graph, determine the temperature at which 100 g of solid A would dissolve in 100 cm^3 of water. (1 mk)

(e) (i) Transfer the contents of the boiling tube into a 250 ml volumetric flask. Rinse both the boiling tube and me thermometer with distilled water and add to the volumetric flask. Add more distilled water to make up to me mk. Label thiis solution A. Fill a burette with solution B. Using a pipette and a pipette filler, place 25 .0 cm^3 of solution A into a conical flask. Warm the mixture to about 60°C. Titrate the hot solution A with solution B until a permanent pink colour persists. Record your readings in table 2. Repeat the titration two more times and complete table 2. (Retain the remaining solution B for use In

Table 2

	I	II	III
Final burette reading			
Initial burette reading i			
Volume of solution B used (cm^3)			

ii)Calculate the

Average volume of solution B used (1mk)

H number of moles of potassium manganate (VII) used (1 mk)

IK number of moles of A in 25 cm^3 of solution A given that 2 moles of potassium manganate (VI) react completely with 5 moles of A (1 mk)

IV relative formula mass of A.

The formula of A has the form D *XH2o.* Determine the value of x in the formula

given that the relative formula mass of D is 90.0 and atomic masses of oxygen and hydrogen are 16,0 and 1.0 respectively. (2 mks)

You **are provided** with solid E.. **Carry out** the tests below. Write **your** observations and **inferences in the spaces** provided.

(a) *Place* about one third of solid E in a clean dry test-tube and heat it strongly

Observation 1mk	inferences 1mk

(b) Place the remaining solid E in a boiling tube. Add about 10 cm^3 of distilled water. Shake the mixture thoroughly *for* about one minute. Filter and divide the filtrate into **four portions.**

Observation 1mk	inferences 1mk

i)To the first portion , add 2 drops of phenolphthalein indicator

Observation 1mk	inferences 1mk

(iii) To the third portion, add 5 era^3 of aqueous sodium sulphate.

Observation 1mk	inferences 1mk

(ii) To the second portion, add 2 cm^3 of dilute hydrochloric acid.

Observation 1mk	inferences 1mk

iv) To the fourth portion ,add dilute sodium hydroxide drop wise until excess

Observation 1mk	inferences 1mk

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

a) Using a metallic spatula, take one third of solid F and ignite it using a Bunsen burner

Observation 1mk	inferences 1mk

b) Place the remaining solid F in a boiling tube. Add about 10cm^3 distilled water.

Shake the mixture until all the solid dissolves.

Observation 1mk	inferences 1mk

ii)To about 4 cm^3 of the solution, add 2 to 3 drops of bromine water. Warm the mixture

Observation 1mk	inferences 1mk

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K.C.S.E 2007 QUESTIONS

PRACTICAL

I You are provided with:

* aqueous sulphuric acid labelled solution A
* solution B containing 8,0 g per litre of sodium carbonate
* an aqueous solution of substance C labelled solution C,

You are required to determine the:

- concentration of solution A
- enthalphy of reaction between sulphuric acid and substance C.

A Procedure

Using a pipette and & *pipette filler,* place 25.0 cm of solution A into a 250 ml. volumetric flask. Add distilled water to make 250 cm of solution. Label this solution D.

Place solution D in a burette. Clean the pipette and use it to place 25.0 cm^3 of solution B into a conical flask. Add 2 drops of methyl orange indicator provided and titrate with solution D. Record your results in table 1, Repeat the Utration two more times arid complete the table.

Table 1

	I	U	III-
Final burette reading			
Initial burette reading			
Volume of solution D used *(cm*)			

Calculate the

i) Average volume of solution D used 1mk

ii)Concentration of sulphuric acid in solution B (Na=23.0; O=16.0; C=12.0 1mk

iii)Concentration of sulphuric acid in solution D 2mks

iv)Concentration of sulphuric acid in solution A 1mk

B Label six test-tubes as 1,2,3,4,5 and 6. Empty the burette and fill it with solution A From the burette, place 2 cm of solution A into test-tube number L From the same

burette, place 4 cm of solution A in test-tube number 2, Repeat the process for test-tube numbers 3,4,5 and 6 as shown in table 2.

Clean the burette and fill it with solution C. From the burette, piace 14 cm^3 of solution C into a boiitng tube. Measure the initial temperature of solution C to the nearest 0,5°C and record it the thermometer, Note and record the highest temperature reached in table

2. Repeat the process with the other volumes of solution C given in &bie 2 and complete the table.

Table 2

Test-tube number	1	2	3	4	5	6
Volume of solution A (cm)	2	4	6	8	10	12
Volume of solution C (cm^3)	14	12	10	S	6	4
Initial temperature of solution C (°C)						
Highest temperature of mixture (C)						
Change in temperature, AT (°C)						

i) On the grid provided, draw a graph of T (Vertcial axis) against volume of solution A used (3mks)

ii)From the graph, determine

i)The maximum change in temperature (1mk)

ii)The volume of solution A required to give the maximum change in temperature (1mk)

iii)Calculate the:

i)Number of moles of sulphuric acid required to give the maximum change in temperature (1mk)

II molar enthalpy of reaction between sulphuric acid and substance C (in kilojoules per mote of sulphuric acid).

Assume the specific heat capacity of the solution is 4.2Jg^1 K^1 and density of solution is 1.0 gcm^3 (2 mks)

You are provided with solid E. Carry out the tests below. Write your observations and inferences in the spaces provided.

(a) Race one half *of* solid E in a clean dry test-tube and heat it strongly. Test any gases produced with blue and red litmus **papers.**

observations 2mks	inferences 1mks

b) Place the other half of solid E in a boiling tube. Add about 10 cm^3 of distilled water and shake until **all** the solid dissolves. (Use the solution for tests (i), (ii), (iii) and (iv).)

(i) Place two or three drops of the solution in a test-tube. Add 3 cm^3 of distilled water. Add two drops of universal indicator to the mixture obtained and then determine the P^H of the mixture.

observations 2mks	inferences 1mks

ii)To about 1cm^3 of the solution in at est tube, add aqueous ammonia dorp wise until in excess

observations 2mks	inferences 1mks

iii)To 2 cm^3 of the solution in a test tube, add three or four drops of solution G aqueous potassium iodide)

observations 2mks	inferences 1mks

iv)To about 1 cm^3 of the solution in a test tube, add four or five drops of barjum nitrate solution. Shake the mixture then add about 1 cm of dilute nitric acid and allow the mixture to stand for about 2 minutes.

observations 2mks	inferences 1mks

3.You are provided with liquid F. Carry out the tests below. Record your observations and inferences in the spaces provided

a)Place three or four drops of liquid F on a watch glass. Ignite the liquid using a Bunsen burner

observations 2mks	inferences 1mks

b)To about $1cm^3$ of liquid F in a test tube, add about 1 cm3 of distilled water and shake thoroughly

observations 2mks	inferences 1mks

c)To about $1cm^3$ of liquid F in a test tube, add a small amount of solid sodium carbonate

observations 2mks	inferences 1mks

d)To about $2cm^3$ of liquid F in attest tube, add about $1cm^3$ of solution H (Acidified potassium dichromate 9VI). Warm the mixture gently and allow it to stand for about one minutes

observations 2mks	inferences 1mks

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K.C.S.E 2008 QUESTIONS

PRACTICAL

1. You are provided with:

- solid A
- 2.0M hydrochloric acid, solution B.
- 0.1M sodium hydroxide.

You are required to determine the enthalpy change AM, for the reaction between solid A and one mole of hydrochloric acid.

Procedure A

Using a burette, place 20.0cm^3 of 2.0M hydrochloric acid, solution B in a 100ml. beaker. Measure the temperature of the solution after ever)' half-minute and record the values in table 1, At exactly minutes, add **all** of solid A to the acid. Stir the mixture gently with the thermometer. Measure the temperature of the mixture after every half-minute and record the values in table 1. **(Retain the mixture for use in procedure B).**

TABLE 1

Time (1min)	0	½	1	1 ½	2	2 ½	3½	4	4½	5
Temperature (^{0}C)						X				

(5mks)

(i) Plot a graph of temperature (Y-axis) against time. (3mks)

(ii) Using the graph, determine the change in temperature. AT. 1mk

(iii) Calculate the heat change for the reaction (Assume that the specific heat capacity of the mixture is 4.2jg$^-$K$^-$1 and the density of the mixture is Ig/cm').

(2 mks)

Procedure 13

Rinse the burette thoroughly and fill it *with* sodium hydroxide. Transfer **all** the contents of the 100ml. beaker used in procedure A into a 250ml. volumetric flask. Add distilled water to make up to the mk. Label this solution C. Using a pipette and **a pipette filler,** place 25.0 cm^3 of solution C into a 250ml. conical flask. Add two or three drops of phenolpthalein indicator and titrate against sodium hydroxide. Record your results in table 2. Repeat titration to more times and complete table 2.

Table 2

	1	11	iii
final burette reading			
initial burette reading			
titre (cm^3)			

Calculate the

i) Average volume of sodium hydroxide used 1mk

ii)The number of moles of

i. Sodium hydroxide used 1mk
ii. Hydrochloric acid in 25cm^3 of solution C 1mk
iii. Hydrochloric acid in 250cm^3 of solution C 1mk
iv. Hydrochloric acid in 20.0 cm^3 of solution B 1mk
v. Hydrochloric acid t hat reacted with solid A `mk

c. Calculate the enthalpy of reaction between solid A and one mole of hydrochloric acid show the sign of ΔH)

2. You are provided with solid D. Carry out the test s below. Write your observations and inferences in the spaces provided

a) Place all of solid D in a clean dry test tube and heat it strongly until no further change occurs. Test any gases produced with both blue and red litmus papers. Allow the residue to cool and use it for test (b).

observation 2mks	inferences 1mk

b) Add about $10cm^3$ of 2M hydrochloric acid to the residue and shake for about three minutes. Keep the mixture for test (c)

observation 2mks	inferences 1mk

ci)Place about $1cm^3$ of the mixture in a test tube and add aqueous ammonia dropwise until in excess

observation 2mks	inferences 1mk

ii)To the rest of the mixture, add all of solid E provided and shake the mixt ure well.

observation 2mks	inferences 1mk

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

a)Place about one third of solid F on a metallic spatula and burn it using a Bunsen burner

observation ½ mks	inferences ½ mk

b)Place the remaining of solid F in a test tube. Add about 6cm^3 of distilled water and shake the mixture well. (Retain the mixture for use in test (c)

observation 1mks	inferences 1mk

ci)To about 2cm of the mixture, add a small amount of solid sodium hydrogen carbonate

observation 1mks	inferences 1mk

ii)To about 1cm of the mixture, ad 1 cm^3 of acidified potassium dichromate (VI) and warm

observation 1mks	inferences 1mk

iii)To about 2cm^3 of the mixture , add two drops of acidified potassium manganate (VII)

observation 1mks	inferences 1mk

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K.C.S.E 2009 QUESTIONS
PRACTICAL

1. You are provided with;

- Solid **A**, a metal carbonate M2CO3
- Solution **B**, hydrochloric acid **for use in question 1 and 2**
- Solution **C**, 0.30M sodium hydroxide
- Methyl orange indicator

You are required to

- Prepare a dilute solution of hydrochloric acid and determine its concentration
- Determine the solubility of solid **A**, in water

Procedure:

(reserve one **dry** conical flask for use in step 4)

Step 1 place all solid **A**, in a 250 ml **dry** beaker. Add 100cm3 of distilled water to solid **A** in the beaker. Using a glass rod, stir the mixture thoroughly for about two minutes. Leave the mixture to stand and proceed with step 2 and three

Step 2 Using a pipette and a **pipette filler**, place 25.0cm³ of solution B in a 250 ml volumetric flask. Add about 200 cm³ of distilled water. Shake the mixture well and add distilled water to make up to the mk. Label this as solution **D**

Step 3 Fill a bullet with solution C. Using a pipette and **a pipette filler**, place 25.0 cm³ of solution **D** into a 250 ml conical flask. Add two drops of the indicator provided and titrate solution **D** with solution **C**. record your results in table 1. Repeat the titration two more times and complete table 1. **Retain** the remaining solution **D** for use in step 5

Step 4 Filter the mixture obtained in step 1 using a **dry** filter funnel into a **dry** conical flask. Label the filtrate as solution **A.**

Step 5 Clean the burette and fill it with solution **D**. Using a pipette and **a pipette filler**, place 25.0cm³of solution **A** into a 250 ml conical flask. Add two drops of the indicator provided and titrate solution **A** with solution **D**. record your results in Table 2. Repeat the titration two more times and complete table 2.

Table 1

	i	ii	iii
Final burette reading			
Initial burette reading			
Volume of solution C used (cm^3)			

(4mks)

(a) Calculate:

(i) Average volume of solution **C** used;

(1mk)

(ii) moles of sodium hydroxide in the average volume of solution **C** used;

(1 mk)

(iii) mole of hydrochloric acid in 25.0cm^3 of solution **D**;

(1mk)

(iv) the morality of hydrochloric acid, solution **D**

(1mk)

Table 2

	i	ii	iii
Final burette reading			
Initial burette reading			
Volume of solution **D** used (cm^3)			

(4mks)

(b) Calculate:

(i) average volume of solution **D** used; (1 mk)

(ii) moles of hydrochloric acid in the average volume of solution D used;

(1 mk)

(iii) moles of the metal carbonate, solid **A** in 25.0cm^3 of solution **A**;

(2 mks)

(iv) the solubility of the metal carbonate, solid A in water. (Relative formula mass of metal carbonate=74, assume density of solution=1g/cm^3) (2mks)

2. You are provided with solid **E**. Carry out the following tests and write your observations and inferences in the spaces provided.

(a) Place about one-half of solid E in a dry test tube. Heat it strongly and test any gas produced using hydrochloric acid, solution **B** on a glass rod.

Observation	**Inferences**

(2 mks) (1 mks)

(b) Place the rest of solid **E** in a boiling tube. Add about $10cm^3$ of distilled water. Shake well and use $2cm^3$ portions for each of the tests below.

(i) to one portion, add aqueous ammonia drop wise until in excess.

observations	**Inferences**

(1 mk) (1 mk)

(ii) To a second portion, add about $1cm^3$ of hydrochloric acid, solution **B.**

observations	**inferences**

(1 mk) (2 mks)

(iii) To a third portion, add two drops of aqueous lead (II) nitrate and heat the mixture to boiling.

observations	inferences

(1 mk) (1 mk)

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

(a) place about one half of solid F in a dry test-tube. Retain the other half of solid **F** for use in (b). add all the **absolute** ethanol provided to solid **F** in the test-tube. Shake the mixture.

Observations	inferences

(1 mk) (1 mk)

Divide the mixture into two portions.

(i) Determine the **PH** of the first portion using universal indicator solution and a **PH** chart.

Observations	Inferences

(1 mk) (1 mk)

(ii) To the second portion, add one half of the solid sodium hydrogen carbonate provided.

Observation	Inferences

(1 mk) (1 mk)

(b) Place the remaining amount of solid F in a boiling tube. Add 10cm^3 of distilled

water and shake. Boil the mixture and divide it into three portions while still warm.

(i) To the first portion, add the remaining amount of solid sodium hydrogen carbonate

Observations	**inferences**

(1 mk) (1 mk)

(ii) To the second portion, add three drops of acidified potassium dichromate (VI) solution and warm.

Observations	**inferences**

(1 mk) (1 mk)

(iii) To the third portion, add five drops of bromine water.

Observations	**inferences**

(1 mk) (1 mk)

K.C.S.E 2010 QUESTIONS
PRACTICAL

1 You are provided with:

acid A labelled solution A;

2.0 M sodium hydroxide solution labelled solution B;

Solution C containing 25.0 g per litre of an alkanoic acid.

You are required to:

(a) prepare a dilute solution of sodium hydroxide, solution B.

(b) determine the:

(i) molar mass of the alkanoic acid

(ii) reaction ratio between sodium hydroxide and acid A.

Procedure 1

Using a pipette and **a pipette filler,** place 25.0 cm^3 of solution B into a 250.0 ml volumetric flask. Add about 200 cm^3 of distilled water. Shake well. Add more distilled water to make upto the mk. Label this solution **D. Retain the remaining solution B for use in procedure II.**

Fill a burette with solution C. Using a clean pipette and a **pipette filler,** place 25.0 cm^5 of solution D into a 250 ml conical flask. Add two drops of phenolpthalein indicator and titrate with solution C. Record your results in **table 1**. Repeat the titration two more times and complete the table.

Table 1	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution C (cm^3) added			

(4 mks)

Determine the:

(i) average volume of solution C used;

(ii) concentration of solution D in moles per litre;

(iii) concentration of the alkanoic acid in solution C in moles per litre (1 mole Of the acid reacts with 3 moles of the base); (1 mk)

(iv) molar mass of the alkanoic acid (1 mk)

Procedure II

Fill a **clean** burette with solution A. Place 5 cm^3 of solution A into a 100 ml beaker. Measure the initial temperature of solution A in the beaker and record it in **table II.** Using a 10 ml or a 100 ml measuring cylinder, measure 25 cm^3 of solution B. Add it to solution A in the beaker and immediately stir the mixture with the thermometer. Record the maximum temperature reached in **table II.** Repeat the experiment with other sets of volumes of solutions A and B and complete the table.

Table II

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)						
Initial temperature *(°C)*						
Change in temperature , AT						

(6 mks)

(a) On the grid provided; plot a graph of AT (Vertical axis) against the volume of solution A.

(b) From the graph, determine the volume of solution A which gave the maximum change in temperature. (1 mk)

(c) Determine the volume of solution B that reacted with the volume of solution A in above. (1 mk)

(d) Calculate the:

(i) ratio between the volumes of solutions A and B that neutralised one another; (1 mk)

(ii) concentration in moles per litre of the acid in solution A.
(Assume that the volume ratio is the same as the mole ratio).

You are provided with solids E, F and G

Carryout the tests below and write your observations and inferences in the spaces provided

a) Place all of solid E in a boiling tube. Add 20cm^3 of distilled water and shake until all he solid dissolves. Label this as solution E.

i)To about 2cm of solution E in a test tube, add 4 drops of 2M sulphuric (Vi) Acid.

observations 1mk	inferences 2mks

ii)To about 2cm of solution E in a test tube, add 2 m sodium hydroxide drop wise until in excess

observations 1mk	inferences 1mks

iii)Place one half of solid F in a test tube. Add 2 cm of distilled water and shake well. Add 4 drops of this solution to about 2 cm of solution E in a test tube.

observations 1mk	inferences 1mks

iv)To about 2 cm of solution E in a test tube, add 2 drops of aqueous potassium iodide

observations 1mk	inferences 1mks

Bi)Using a metallic spatula, ignite about one half of solid G in a Bunsen burner flame

observations 1mk	inferences 1mks

ii) Place the other half of solid G into a boiling tube

add 15cm of distilled water and shake well.

Label this solution G. Use this solution for the following tests.

1. Place 2 cm of solution G in a test tube and determine its Ph.

observations 1mk	inferences 1mks

II.To about 2 cm^3 of the solution obtained in (ii) above, add 3 drops of acidified potassium manganate (VII)

observations 1mk	inferences 1mks

II)To ABOUT 2 Cm^3 of the solution obtained in (ii) above, add 2 drops of bromine water

observations 1mk	inferences 1mks

iii)To the remaining solution G in the boiling tube, add the other half of solid F.

observations 1mk	inferences 1mks

CHEMISTRY PAPER 233/3

K.C.S.E 2011 QUESTIONS

PRACTICAL

You are provided with:

- 1.60g of solid **A,** a dibasic acid.
- Solution **B** containing 4.75g per litre of salt **B.**
- Aqueous sodium hydroxide, solution **C**.
- Phenolphthalein indicator.

You are required to prepare a solution of solid **A** and use it to determine the:-

- Concentration of sodium hydroxide, solution **C**
- React salt B with excess sodium hydroxide and then determine the relative molecular mass of salt **B**.

Procedure I

(a) Using a burette, place 25.0cm^3 of solution B in each of two 250ml conical flasks. Using a pipette and **pipette filler,** add 25 .Ocm^3 of solution C to each of the two conical flasks. (The sodium hydroxide added is in excess). **Label** the conical flasks 1 and 2.

(b) Heat the contents of the first conical flask to boiling and then let the mixture boil for 5 minutes. Allow the mixture to cool.

(c) Repeat procedure (b) with the second conical **flask.**
While the mixtures are cooling, proceed with procedure II. **Procedure II**

(a) Place **all** of solid A in a 250 ml volumetric flask. Add about 150cm^3 of distilled water, shake well to dissolve the solid and then add water to make up to the mk. Label this as solution A.

(b) Place solution A in a clean burette. Using a pipette and **pipette filler,** place 25.0cm^3 of solution C in a 250ml conical flask. Add 2 drops of phenolphthalein indicator and titrate with solution A. Record your results in Table 1. Repeat the titration two more times and complete the table.

(i) Average volume of solution A used: ($^1/_2$ mks)

(ii) Concentration in moles per litre of the dibasic acid in solution A; (2 mks)
(Relative molecular mass of **A** is 126).

(iii) Moles of the dibasic acid used; (1 mk)

(iv) moles of sodium hydroxide in 25.0cm^3 of solution C. (1 mk)

(v) Concentration of sodium hydroxide in moles per litre. (2 mks)

Calculate the:-

(i) average volume of solution A used; ($^1/_2$ mks)

(ii) moles of the dibasic acid used; (1 mk)

(iii) moles of sodium hydroxide that reacted with the dibasic acid. (1 mk)

(iv) moles of sodium hydroxide that reacted with 25.0cm^3 of salt **B** in solution **B;** (2 mks)

(v) Given that 1 mole of salt **B** reacts with 2 moles of sodium hydroxide, calculate the:

I. number of moles of salt **B** in 25.0cm^3 of solution **B;**

II. concentration in moles per litre of salt **B** in solution **B**; (1 mk)

III. Relative molecular mass of salt **B**; (2 mks)

2. (a) You are provided with solid **D.** Carry out the following tests and write your observations and inferences in the spaces provided.

(i) Place about one half of solid **D** in a test-tube and heat it strongly. Test any gases produced with both red and blue litmus papers.

CHEMISTRY PAPER 233/3

K.C.S.E 2012 QUESTIONS

PRACTICAL

1. You are provided with:

   - solution **A** containing an oxidising agent **A;**
   - solution **B,** 0.05 M aqueous sodium thiosulphate;
   - solution **C** containing a reducing agent **C;**
   - aqueous potassium iodide;
   - solution **D,** starch solution.

   You are required to determine the: concentration of solution **A:**
   rate of reaction between the oxidising agent **A** and the reducing agent **C.**

Procedure 1

1. Using a pipette and **pipette filler,** place 25.0 cm^3 of solution **A** into a 250 ml conical flask.

2. Measure 10 cm^3 of aqueous potassium iodide and add it to solution **A** in the conical flask.
   Shake the mixture. Add 10 cm^3 of 2 M sulphuric (VI) acid to the mixture and shake.

3. Fill a burette with solution **B** and use it to titrate the mixture in the conical flask until it just turns **orange-yellow.** Add 2 cm^3 of solution **D** to the mixture in the conical flask. Shake thoroughly. Continue titrating until the mixture **just turns colourless.**
   Record your results in **table 1** below.

4. Repeat the procedure and complete table 1. **Retain the remainder of** solution **A** and solution **D** for use in procedure II.

Table 1	**I**	**II**	**III**
Final burette reading			
Initial burette reading			
Volume of solution **B** used (cm^3)			

(4 mks)

(a) Calculate the:

(i) average volume of solution **B** used; (1 mk)

(ii) number of moles of sodium thiosulphate. (1 mk)

b) Given that one mole of A reacts with six moles of sodium thiosulphate, calculate the;

i) number of moles of A that were used; (1mk)

ii) concentration of solution A in moles per litre. (2mks)

Procedure II

1. Label six test - tubes as 1,2,3,4.5 and 6 and place them in a test - tube rack.
2. Using a clean burette, measure the volumes of distilled water shown in **table** 2 into the labelled test - tubes.
3. Using a burette, measure the volumes of solution **A** shown in **table** 2 into each of the test - tubes.
4. Clean the burette and rinse it with about 5 cm^3 of solution **C.**
5. Using the burette, measure 5 cm^1 of solution **C** and place it into a 100 ml beaker.
6. Using a 10 ml measuring cylinder, measure 5 cm^1 of solution **D** and add it to the beaker containing solution **C.** Shake the mixture.
7. Pour the contents of test - tube number 1 to the mixture in the beaker and immediately start a stop watch. Swirl the contents of the beaker. Record the time taken for a **blue** colour to appear in **table** 2.
8. Repeat steps 5 to 7 using the contents of test - tube numbers 2, 3,4, 5 and 6.
9. Complete **table** 2 by computing Rate = $\frac{1}{\text{time}}(s^{-1})$

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 (seconds)						
Rate = $\frac{1}{\text{time}}(s^{-1})$						

(6 mks)

a) Plot a graph of rate (y-axis) against volume of solution A. (3mks)

b) What time would be taken for the blue colour to appear if the experiment was repeated using 4cm^3 of distilled water and 6cm^3 of solution A? (2mks)

2. You are provided with solid E. Carry out the experiments below. Write your observations and inferences in the spaces provided.

(a) Place all of solid E in a boiling tube. Add about 20 cm^1 of distilled water and shake until all the solid dissolves, label the solution as solution E. Use solution E for experiments (i) and (ii).

(i) To 2 cm^3 of solution E, in a test - tube in each of experiments I, II, III and IV, add:

I. two drops of aqueous sodium sulphate;

Observations	**Inferences**
(1 mk)	(1 mk)

II. five drops of aqueous sodium chloride;

Observations	**Inferences**
(1 mk)	(1 mk)

III. two drops of barium nitrate:

Observations	**Inferences**
(1 mk)	(1 mk)

IV. two drops of lead (II) nitrate:.

Observations	**Inferences**

(1 mk)	(1 mk)

(ii) To 2 cm^3 of solution E, in a test - tube, add 5 drops of aqueous sodium hydroxide. Add the piece of aluminium foil provided to the mixture and shake. Warm the mixture and test any gas produced with both blue and red litmus papers.

Observations	**Inferences**
(2 mks)	(1 mk)

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

(a) Place all of solid **F** in a boiling tube. Add about 20 cm^3 of distilled water and shake until all the solid dissolves. Label the solution as solution **F.**
Add about half of the solid sodium hydrogen carbonate provided to 2 cm^3 of solution **F.**

Observations	**Inferences**
(1 mk)	(1 mk)

Add about 10 cm^3 of dilute hydrochloric acid to the rest of solution **F** in the boiling tube. Filter the mixture. Wash the residue with about 2 cm^3 of distilled water. Dry the residue between filter papers. Place about one third of the dry residue on a **metallic** spatula and burn it in a Bunsen burner flame.

Observations	**Inferences**
(1 mk)	(1 mk)

(ii) Place all the remaining residue into a boiling tube. Add about 10 cm^3 of distilled water and shake thoroughly. **Retain the mixture for the tests in** (C).

Observations	**Inferences**
($^1/_2$mk)	**(**$^1/_2$mk)

Divide the mixture into two portions:

(i) to the first portion, add the rest of the solid sodium hydrogen carbonate.

Observations	**Inferences**
(1 mk)	(1 mk)

ii) to the second portion, add two drops of bromine water.

Observations	**Inferences**
(1 mk)	(1 mk)

CHEMISTRY PAPER 233/3

K.C.S.E 2013 QUESTIONS

PRACTICAL

1. You are provided with:

- solution **A**, aqueous copper(II)sulphate;
- solid **B**,iron powder;
- 0.02 M acidified potassium manganate (VII), solution **C**.

You are required to determine the molar heat of displacement of copper by iron.

Procedure I

Using a burette, place 50.0cm^3 of solution **A** in a 100ml beaker. Measure the temperature of the solution and record it in table **1** below. Add **all** of solid **B** provided at once and start a stop watch. Stir the mixture **thoroughly** with the thermometer and record the temperature of the mixture after every one minute in the table .**Retain** the mixture for use in procedure **II** below.

Table 1

Time (min)	0	1	2	3	4	5	6	7
Temperature(^{0}C)								

(3 mks)

a) i) Plot a graph of temperature (vertical axis) against time in the grid provided. (3 mks)

ii) From the graph, determine the;

I) Highest change in temperature ΔT (1 mk)

II) Time taken for reaction to be completed. ($^1/_2$ mk)

iii) Calculate the heat change for the reaction.(specific heat capacity of solutions is 4.2Jg^{-1} K^{-1},Density of the solution is 1gcm^{-3}). (2mks)

Procedure II

Carefully decant the mixture obtained in procedure **I** into a 250ml volumetric flask. Add about 10cm^3 of distilled water to the residue in the 100ml beaker. Shake well, allow the mixture to settle and carefully decant into the volumetric flask. **Immediately**, add about 50cm^3 of 2M sulphuric (VI) acid to the mixture in the volumetric flask. Add more distilled water to make 250.0cm^3 of solution. Label this as solution **D**.

Fill a burette with solution **C**. Using a pipette and **pipette filler**, place 25.0cm^3 of solution **D** into a 250ml conical flask. Titrate solution **D** against solution **C** until the **first permanent pink** colour is obtained. Record your results in table 2 below. Repeat the titration two more times and complete the table. Retain the remaining solution **C** for use in question 3.

Table 2

	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution C used(cm^3)			

(4mks)

a) Determine the average volume of solution **C** used. ($^1/_2$ mk)

b) Calculate the number of moles of:

i) aqueous potassium manganate (VII)used; (1 mk)

ii) iron (II) ions in 25.0cm^3 of solution **D. (**1 mole of MnO_4^- reacts with 5moles of $Fe2^+$) (1 mk)

iii) iron (II) ions in 250cm^3 of solution **D**. (2 mks)

c) Calculate the molar heat of displacement of copper by iron.

2. You are provided with solid **E**.Carry out the following tests and write your observations and inferences in the spaces provided.

a) Place **all** of solid **E** in a boiling tube. Add about 10cm^3 of distilled water and shake thoroughly. Filter the mixture into another boiling tube. **Retain** the filtrate for use in test 2(b) below. Dry the residue using pieces of filter papers.

i) Transfer about half of the dry residue into a dry test-tube. Heat the residue strongly and test any gas produced using a burning splint.

Observations	**Inferences**
(1 mk)	(1 mk)

ii) Place the rest of the residue in a dry test-tube.add 4cm^3 of 2M hydrochloric acid. **Retain** the mixture for test (iii) below.

Observations	**Inferences**
(1 mk)	(1 mk)

iii) To $2cm^3$ of the solution obtained in (ii) above, add $6cm^3$ of aqueous ammonia drop wise.

Observations	Inferences
(1 mk)	(1 mk)

b) i) To $2cm^3$ of the filtrate obtained in (a) above, add about $3cm^3$ of aqueous ammonia (excess).

Observations	Inferences
(1 mk)	(1 mk)

ii) To $2cm^3$ of the filtrate, add about $2cm^3$ of 2M hydrochloric acid.

Observations	Inferences
(1 mk)	(1 mk)

iii) To $2cm^3$ of the filtrate, add one or two drops of barium nitrate solution.

Observations	Inferences
(1 mk)	(1 mk)

3. You are provided with solid **G**. Carry out the tests in (a) and (b) and write your observations and differences in the spaces provided. Describe the method used in part(c).

a) Place about one third of solid **G** on a **metallic** spatula and burn it in a Bunsen burner flame.

Observations	Inferences
(1 mk)	(1 mk)

b) Dissolve all of remaining solid **G** in about $10cm^3$ of distilled water in a boiling tube. Use the solution for tests (b) (i), (ii) and (c).

i) Place $2cm^3$ of the solution in tests –tube and add 2 drops of acidified potassium manganate (VII); solution **C**.

Observations	**Inferences**
(1 mk)	(1 mk)

ii) To $2cm^3$ of the solution, add all of solid sodium hydrogen carbonate provided.

Observations	**Inferences**
(1 mk)	(1 mk)

c) Determine the pH of the solution obtained in (b) above.

Method used	**Inferences**
	(1 mk)

CHEMISTRY PAPER 233/3

K.C.S.E 2014 QUESTIONS

PRACTICAL

1. You are provided with:
   - Solution **J** containing copper (II) ions
   - Solution **K**, 0.1M sodium thiosulphate
   - Aqueous potassium iodide, solution **L**
   - Solution **N**, sodium hydroxide
   - Starch indicator, solution **M**

You are required to determine the:

- Concentration of copper (II) ions in solution **J**;
- Enthalpy change of reaction between copper (II) and hydroxide ions

PROCEDURE

(a) Using a pipette and **pipette filler**, place 25.0 cm^3 of solution **J** in a 250ml volumetric flask. Add distilled water to make upto the mk. Label this as solution J_2. Retain solution **J** for use in

procedure II.

(b) Place solution **K** in a burette. Using a clean **pipette filler**, place 25.0 cm^3 of solution J_2 in a 250ml conical flask. Add 10cm^3 of potassium iodide, solution **L**. shake well, then add 2cm^3 of starch indicator, solution **M**. titrate until a blue black colour appears and continue titrating until a blue black colour disappears.

Record your readings in **Table 1** below.

(c) Repeat step (b) two more times and complete Table 1.

	I	**II**	**III**
Final burette reading			
Initial burette reading			
Volume of solution K(cm^3) used			

Table 1

Calculate the;

(i) Average volume of solution K used; (1mk)

(ii) Moles of sodium thiosulphate used (1mk)

(iii) 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)

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

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.**

Table 2

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

(3 ½ mks)

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

ii) Using the graph, determine the

i) Volume of sodium hydroxide, solution N that reacted completely 20cm^3 of solution J; (2mks)

ii) Temperature change, ΔT, for the reaction (1mk)

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

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)

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

Observation	**Inferences**
(1mk)	(1mk)

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**
(1mk)	(1mk)

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**
(1mk)	(2mks)

iii) Add five drops of dilute nitric (V) acid to the mixture

Observation	**Inferences**
(1mk)	(1mk)

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

Observation	**Inferences**
(1mk)	(1mk)

e) Give the formula of the cation and anion present in substance P.
cation: (½ mk)
anion: (½ mk)

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**
(1mk)	(1mk)

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**
(1mk)	(1mk)

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

Observation	**Inferences**
(1mk)	(1mk)

KCSE 2015
CHEMISTRY PAPER 3
PRACTICAL
OCT/NOV 2015

You are provided with:

- 2.0g of substance A, labelled solid A.
- Solution B, 0.05 M hydrochloric acid.
- Methyl orange indicator. .

You are required to determine the:

- solubility of substance A in water.
- relative formula mass of substance A.

PROCEDURE!

(i) Place 200 cm^3 of tap water in a 250 ml beaker and keep it for use in step (vi).

(ii) Place **all** of substance A in a dry boiling tube.

(iii) Using a burette, measure 10.0 cm^3 of distilled water and add it to the substance A in the boiling tube,

(iv) While stirring the mixture in the boiling tube with a thermometer, warm the mixture using a Bunsen burner, until the temperature rises to 65°C. Stop warming the mixture,

(v) Allow it to cool while stirring with the thermometer,

(vi) When the temperature drops to 60°C, start the stop watch/clock, place the boiling tube in the beaker with tap water prepared in step (i) above

(vii) Continue stirring and record the temperature of the mixture after two minutes, then thereafter record the temperature of the mixture after every one minute interval and complete **table 1. Retain the mixture with the thermometer inside for use in procedure II below.**

Table 1

Time (minutes)	0	2	3	4	5	6	7	8	9	10
Temperature (°C)	60									

(4 mks)

On the grid provided, plot a graph of temperature (vertical -axis) against time. (3 mks)

a)Using the graph, determine the temperature (Ts) when 20 g of substance A dissolves completely in 10.0cm^3 of distilled water. 1 mk

b)Calculate the solubility of substance A in grams per 100 g water at temperature, Ts. 2mks

PROCEDURE II

Using a funnel, transfer all the mixture obtained from Procedure I into a 250 ml volumetric flask. Rinse the boiling tube and the thermometer with about 20 cm^3 of distilled water and add the rinses into the volumetric flask. Repeat the rinsing two more times. Add about 100 cm^3 of distilled water to the volumetric flask. Shake until all the solid dissolves. Add more distilled water to the mk. Label this as solution A. Fill the burette with solution A. Using a pipette and **pipette filler,** place 25.0 cm^3 of solution B, into a 250 ml conical flask. Add three (3) drops of the indicator provided and titrate using solution A. Record your readings in **table** 2 below. Repeat the titration two more times and complete the table

Table 2

	I	II	III
Final Burette Reading			
Initial burette Reading			
Volume of solution A (cm^3) used.			

a)Calculate the 3mks

i)Average volume of solution A used 1mk

ii)Number of moles of hydrochloric acid, solution B used. 1mk

b) Given that two moles of acid react with one mole of substance A, calculate:

i)Number of moles substance A used. 1mk

ii)Concentration of solution A in moles per litre 1mk

iii)Concentration of solution A in g per litre: 1mk

iv)Relative formula mass of substance A 1mk

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

Place **all** the solid C in a boiling tube. Add about 15 cm^3 of distilled water and shake until all the solid dissolves. Use 2 cm^3 portions of the solution in a test-tube, for **each** of the tests in (a), (b), (c), (d), (e) and (f).

(a) Add aqueous sodium hydroxide dropwise until in excess.

observations	**inferences**
1 mk	1 mk

b)Add aqueous ammonia dropwise until in excess

observations	**inferences**
1 mk	1 mk

c) Add 2 to 3 drops of solution D, aqueous sodium carbonate. (Retain the remaining solution D for use in question 3)

observations	**inferences**
1 mk	1 mk

D)Add 2 to 3 drops of dilute hydrochloric acid.

observations	**inferences**
1 mk	1 mk

e)Add 2 or 3 drops of aqueous barioum chloride

observations	**inferences**
1 mk	1 mk

f)Add 2 or 3 drops of solution E, aqueous lead (II) nitrate

observations	**inferences**
1 mk	1 mk

You are provided with sub stance L. Carryout he following tests and record your observations and inferences in the spaces provided. USE ABOUT 2cm3 portions of substance L in a test tube for each of the tests, (a), (b), (c) and (d)

a) Add 2 or 3 drops of bromine water

observations	**inferences**
1 mk	1 mk

b)Add about 1cm3 of acidified potassium dichromate (VI). Warm the mixture

observations	**inferences**
1 mk	1 mk

c)Add about $1cm^3$ of solution D, aqueous sodium carbonate provided.

observations	**inferences**
1 mk	1 mk

d)Add piece of magnesium ribbon provided

observations	**inferences**
1 mk	1 mk

CHEMISTRY PAPER 233/3

K.C.S.E 2016 QUESTIONS

PRACTICAL

I. You are provided with the following:

- Aqueous potassium iodide, solution A
- Aqueous sodium thiosulphate, solution A_2
- Acidic solution, solution A_3 .
- Starch" solution, solution A_4
- Dilute hydrogen peroxide, solution B
- Distilled water

You are required to determine the rate of reaction between acidified potassium iodide and - hydrogen peroxide,

Procedure

Step 1

Using a 10ml measuring cylinder, place $2cm^3$ of solution A into a 100ml beaker. Add 2cm of solution A_2 followed by 2 cm^5 of solution A_r Add 5 drops of solution A_4. Finally, add $12cm^{:i}$ of distilled water and shake the mixture.

Step 2

Using a burette, place $6cm^3$ of solution B into a test tube. Pour the measured $6cm^{-1}$ of solution H into the beaker in Step 1 above and immediately start a stopwatch/clock. Swirl the mixture and place on a white paper. Observe the mixture and immediately stop the stopwatch/clock when u blue colour appears.

Record the time taken in table 2, Measure the temperature of the mixture and record in table 2. These are the results of experiment 1.

Step 3

Repeat steps 1 and 2 using the volumes of solutions given in table 1 for experiments 2, 3, 4/5 and 6 and record in table 2.

Table 1

Experiment	Volume of solutions (cm^3)				Distilled
	A,	A_2	A_3	A4	
I	2	2	2	5 drops	12
2	4	2	2	5 drops	10
3	6	2	2	5 drops	8
4	8	2	2	5 drops	6
5	10	2	2	5 drops	4
6	12	2	2	5 drops	2

a) Calculate the rate of reaction $\frac{1^{S^{-1}}}{time}$ for each experiment and fill in table 2.

Table 2

experiment number	volume of solution A1 acidified potassium iodide (cm^3)	temperature (^0C)	Time (sec) t	rate $\frac{1^{S^{-1}}}{t}$
1.	2			
2.	4			
3.	6			
4.	8			
5.	10			
6.	12			

(8 mks)

b) Plot a graph of rate of reaction $^1/_{Time}$ vertical axis against volume of potassium iodide (3 mks)

(c) Explain why it is necessary to record the temperature for each experiment.

(1 mk)

(d) If the experiment was repeated using 7 cm^3 of acidified potassium iodide, solution A_p determine:

(i) the volume of distilled water that would be used. (1 mk)

(ii) the time taken for the blue colour to appear. (2 mks)

(e) Explain how the rate of the reaction is affected by the volume of acidified potassium Iodide. (1 mk)

2. You are provided with Solution G. Carry out the following tests and record your observations and inferences in the spaces provided.

(a) Measure the pH of the solution using 2cm^3 of Solution G and universal indicator paper

Observations	Inferences

1 mk 1 mk

b) To about 2 cm^3 of G in a test tube, add drop wise dilute nitric (V) acid until no further change. Retain the mixture for use in tests (c)(i) and (c) (iii)

Observations	Inferences

1 mk 1 mk

c) Divide the mixture obtained in (b) above into two portions

i)To the first portion , add 3 drops of aqueous lead (II) nitrate

observations	Inferences

1 mk 2 mks

ii)To the second portion, add 3 drops of aqueous barium nitrate

observations	Inferences

1 mk 1 mk

d) Describe a test that you would carry out to find out if Zn^{2+} ions are present in solution G.

Test	Inferences

1 mk 1 mk

e) Carry out the test described in (d) above

observations	Inferences

1 mk 1 mk

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

a) Place all of Solid H in a boiling tube. Add about $10cm^3$ of distilled water and shake the mixture thoroughly.

observations	Inferences

1 mk 1 mk

b)To about $2cm^3$ of the mixture in a test tube, add about half of the solid sodium hydrogen carbonate

observations	Inferences

1 mk 1 mk

c) To the remaining amount of the mixture of H in the boiling tube add about 10cm^3 of dilute hydrochloric acid. Shake thoroughly then filter the mixture .wash the residue with distilled water. Dry the residue using filter papers. Use the residue for tests (i), (ii) and (iii) below.

i)Place about one third of the residue in a test tube. Add about 10cm^3 of distilled water and warm the mixture. To the warm mixture, add the remaining amount of solid sodium hydrogen carbonate

observations	Inferences

1 mk 1 mk

ii)To about one third of the residue in a test tube, add about 5 cm^3 of the distilled water, shake the mixture and then add 3 drops of bromine water

observations	Inferences

1 mk 1 mk

iii)To the remaining amount of the residue in the boiling tube, add about 10cm^3 of distilled water, about 5cm^3 of the dilute sulphuric (VI) acid and then about 5 cm^3 of ethanol warm the mixture.

observations	Inferences

1 mk 1 mk