Name ……. Index Number ……..

233/1
CHEMISTRY
PAPER 1 (THEORY)
JULY / AUGUST 2011
2 HOURS

NZAUI / MUKAA FORM 4 CLUSTER EXAMINATION
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 1 (THEORY)
2 HOURS

INSTRUCTIONS TO CANDIDATES

- Write your name and index number in the spaces provided above.
- Answer all the questions in the spaces provided .
- Mathematical tables and calculators may be used.
- All working must be clearly shown where necessary

FOR EXAMINER'S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 25	80	

This paper consists of 11 printed pages

Turn Over

1. The table below shows the pH values of solutions W, X, Y and Z.

Solution	pH value
W	2.0
X	13.5
Y	9.8
Z	7.0

(i) Which two solutions would react together to give a neutral solution? Explain. (2 marks)

_____

_____

_____

_____

(ii) Which solution is likely to be sodium chloride ? (1 mark)

_____

2. The diagram below shows how a mixture of benzene (boiling point 80^0C) and toluene (boiling point 110^0C) is separated.

Mixture of benzene and touene

(a) Name the apparatus labelled

X _____

Y _____ (2 marks)

(b) (i) Name the method of separation shown. (1 mark)

_____

(ii) Explain how the two liquids are separated. (1 mark)

_____

_____

_____

_____

3. The set-up below was used to prepare and collect a gas (T) in the laboratory.
Boiling tube Sodium peroxide Gas T Water

(i) What name is given to the method of gas collection shown. (1 mark)

_____

(ii) Identify gas T. (1 mark)

_____

(iii) What property does gas T have that make it possible for the gas to be collected using the method shown above? (1 mark)

_____

_____

(iv) Write an equation for the reaction that leads to the formation of gas T. (1 mark)

_____

_____

_____

4. A certain substance has a boiling point of 1680^0C. It does not conduct electricity when in solid form but conducts when molten. What is the most likely structure of the substance? Explain. (2 marks)

_____

_____

_____

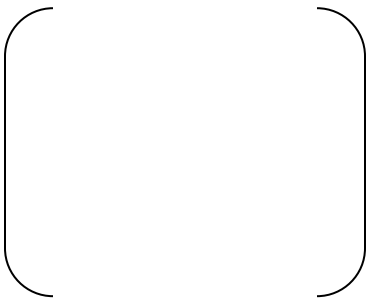
_____

5. Butane burns in air according to the equation shown below.

$$2C_4H_{10(g)} + 13O_{2(g)} \longrightarrow 8CO_{2(g)} + 10H_2O_{(l)}$$

What volume of butane must be burnt in oxygen to give 11g of CO_2 at r.t.p? (3 marks)
(Molar gas volume at r.t.p = 24.0L; C = 120; O = 16.0; H = 1.0)

6. Below is an ionic electronic structure of element X.



Write down its

(i) Valency _____ (1 mark)

(ii) Group _____ (1 mark)

(iii) Period _____ (1 mark)

(iv) Formular of its chloride. (1 mark)

_____

_____

_____

7. A sample of sodium chloride is contaminated with sulphur powder. Briefly explain how a pure sample of the sodium chloride can be obtained from the mixture. (3 marks)

_____

_____

_____

_____

_____

8. Lead II Oxide reacts with acids and alkalis.
(a) Write the equation for the reaction between lead II Oxide and
(i) Dilute nitric acid. (1 mark)

_____

_____

(ii) Sodium hydroxide. (1 mark)

_____

_____

(b) What property of lead II Oxide is being demonstrated by the above reactions? (1 mark)

_____

_____

9. Explain why potassium chloride conducts electricity in both the molten state and in aqueous solution whereas hydrogen chloride conducts electricity only in aqueous solution and not in gaseous state. (3 marks)

_____

_____

_____

_____

_____

10. A gas of known mass occupies $200cm^3$ at 25^0C and 101325 Pa pressure. What volume would it occupy at -23^0C and 1000 Pa pressure? (3 marks)

11. Name the following organic compounds. (3 marks)

(a) $CH_3\ CBr_2\ CH_2\ CH_3$

_____

(b) $CH_3\ C \equiv CCH_2\ CH_2I$ _____

(c) $CH_3\ CHCH_2\ CHCOOH$

CH_3 CH_3 _____

12. Consider the reversible reaction below which is at equilibrium.

$CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$ ΔH = Positive

State and explain what would happen to the equilibrium if

(i) A few pellets of sodium hydroxide were added to the above system. (1 ½ marks)

_____

_____

_____

_____

(ii) The system was warmed. (1 ½ marks)

_____

_____

_____

_____

13. By use of oxidation numbers show that the reaction below is a redox reaction. (3 marks)

$2MnO_4^-{}_{(aq)} + 5SO_3^{2-}{}_{(aq)} + 6H^+{}_{(aq)} \longrightarrow 2Mn^{2+}{}_{(aq)} + 5SO_4^{2-}(aq) + 3H_2O_{(l)}$

_____

_____

_____

_____

14. Excess carbon II Oxide was passed over heated sample of an oxide of iron. The following results were obtained. Determine the empirical formular of the iron oxide. (3 marks)

Mass of empty dish	= 10.98g
Mass of empty dish + oxide of iron	= 13.30g
Mass of dish + residue	= 12.66g

(Fe = 56; C = 12; O = 16)

15. The electronic configuration of element X, Y and Z are given below.

X	Y	Z
2.8	2.8.7	2.8.18.7

(a) Which is the most reactive element? Explain. (2 marks)

_____

_____

_____

_____

(b) State one use of element Y. (1 mark)

_____

_____

16. Study the standard reduction potentials given below and answer the questions that follow
(The letters do not represent the actual symbols of the element)

	E^{θ} (Volts)
$P^{2+}_{(aq)} + 2e^- \longrightarrow P_{(s)}$	-0.44
$Q^{2+}_{(aq)} + 2e^- \longrightarrow Q_{(s)}$	+0.34
$R^{+}_{(aq)} + e^- \longrightarrow R_{(s)}$	+0.80
$S^{2+}_{(aq)} + 2e^- \longrightarrow S_{(s)}$	-0.76

(i) Identify the strongest;

I Oxidising agent _____ (1 mark)

II Reducing agent _____ (1 mark)

(ii) Write an ionic equation for the reaction that take place when cell $Q_{(s)} / Q^{2+}_{(aq)}$ is coupled with cell $R_{(s)} / R^{+}_{(aq)}$ (1 mark)

_____

_____

(iii) State and explain how the mass of metal R would be affected if metal R is placed in a solution containing R^+ ions. (1 mark)

_____

_____

_____

_____

17. Using dot(.) and cross (x) diagrams to represent electrons, draw a diagram to show bonding in CO_2. (C = 6; O = 8) (2 marks)

18. The equation below represents a major reaction in the industrial processes.

$$3H_{2(g)} + N_{2(g)} \rightleftharpoons 2NH_{3(g)}$$

(a) Name the industrial process _____ (1 mark)

(b) Name the catalyst used in the above process _____ (1 mark)

(c) Explain the following observations when ammonia gas mixed with oxygen is sparked out the catalyst in (b) above, brown fumes are evolved. (2 marks)

_____

_____

_____

_____

19. When sulphur is heated in a test tube, the yellow crystals melt to form a golden yellow liquid which changes at 180^0C into dark brown very viscous liquid. On more heating to 400^0C, a brown less viscous liquid is formed.

(i) What is the molecular mass of sulphur in the yellow crystals ? (S = 32) (1 mark)

_____

_____

_____

_____

(ii) If the brown liquid at 400^0C is cooled rapidly at room temperature, which form of sulphur is produced? (1 mark)

_____

_____

_____

_____

(iii) Explain why the molten sulphur becomes viscous. (2 marks)

_____

_____

_____

_____

20. The table below shows the solubility of two salts x and y at different temperatures

Temp (^{0}C)		10	20	30	40	50
Solubility in g/100g of water	X	4.6	7.0	9.8	13.0	16.9
	Y	10.2	14.6	20.1	27.4	35.9

(a) Name the method used to separate the two salts. (1 marks)

_____

(b) A solution containing 15g of each of X and Y in 100g of water at 50^0C. Calculate the total mass of crystals obtained on cooling this solution to 10^0C. (2 marks)

21. The grid below represents a section of the periodic table. Study it and answer the questions that follow.

L	Q			M	P		J	K
S			T		V	R		

(a) Give the formular of the compound formed between element J and Q. (1 mark)

_____

_____

(b) Which element forms a stable ion with a charge of +3? (1 mark)

_____

_____

(c) Which is the least reactive element? (1 mark)

_____

_____

22. Describe how a solid sample of copper II carbonate can be prepared starting with copper (II) Oxide. (3 marks)

_____

_____

_____

_____

_____

_____

23. In an experiment $30cm^3$ of 0.1M sulphuric acid were reacted with $30cm^3$ of 0.1M sodium hydroxide solution.

(a) Write an equation for the reaction that took place. (1 mark)

_____

_____

(b) State the observation that were made when both blue and red litmus papers were dipped into the mixture. (1 mark)

_____

_____

(c) Give a reason for your answer in (b) above. (1 mark)

_____

_____

_____

_____

24. The diagram below shows a jiko when in use. Study it and answer the questions that follow.

ASH

(a) State the observation made at region C. (1 mark)

(b) Write well balanced chemical equation for the reaction taking place in the regions (3 marks)

A

B

C

25. Explain why hard water flowing in lead pipes may be safer for drinking than soft water flowing in the same pipes. (3 marks)

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MARKING SCHEME

	ANSWERS	MARKS	COMMENTS
1.	W and X √1 (i) W is a strong acid √ ½ and would neutralize X a strong base √ ½ (ii) Z √1	1 1 1	
		3	
2.	(a) X – Fractionating column √1 Y – Condenser √1 (b) (i) Fractional distillation (ii) Benzene with a lower boiling point distill out first √ ½ , then toluene distill out last √ ½	1 1 1	
		3	
3.	(i) Over water √1 (ii) Oxygen gas √1 (iii) Slightly soluble in water √1 (iv) $2Na_2O_{2(s)} + 2H_2O_{(l)} \longrightarrow 4NaOH_{(aq)} + O_{2(g)}$ √1	1 1 1 1	NB: Penalize fully if not balanced. ½ missing state symbol
		4	
4.	Glant ionic lattice √ 1 in solid form the ions are held at fixed position √ ½ ; in molten state the ions become mobile to conduct electricity √ ½	2	
		2	
5.	2 moles of $C_4H_{10} \longrightarrow$ 8 moles of CO_2 √ ½ M.M $CO_2 \longrightarrow$ 44g √ ½		

This paper consists of 5 printed pages

Turn Over

	ANSWERS	MARKS	COMMENTS
	$\therefore$ 2 x 24L of C_4H_{10} $\longrightarrow$ 44 x 8g of CO_2 √ ½ ? $\longleftarrow$ 11g = $\frac{2 \times 24}{44 \times 8}$ √ ½ x 11 √ ½ = 1.54 √ ½	3	
		3	
6.	(i) 2 √1 (ii) 2√1 (iii) 3 √1 (iv) XCl_2 √1	4	
		4	
7.	Add water √ ½ to the mixture to dissolve sodium chloride √ ½ . Filter √ ½ the mixture to obtain sulphur √ ½ . Evaporate √ ½ the filtrate to dryness to obtain sodium chloride √ ½ .	3	NB: Penalize fully if the candidate starts with dissolve
		3	
8. (a)	(i) $PbO_{(s)} + 2HNO_{3(aq)} \longrightarrow Pb(NO_3)_{2(aq)} + H_2O_{(l)}$ √1 (ii) $2NaOH_{(aq)} + PbO_{(s)} \longrightarrow Na_2PbO_{2(aq)} + H_2O_{(l)}$ √1 (b) Amphoteric √1	3	
		3	
9.	KCl contains mobile ions √1 in both state while HCl does not contain mobile ions in its gaseous state √1 but dissociate in aqueous state to form mobile ions √1	3	
		3	
10.	$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} = \frac{101325 \times 200}{298}$ √ ½ $= \frac{1000 \times V_2}{250}$ √ ½ $V_2 = \frac{101325 \times 200 \times 250}{298 \times 1000}$ √ ½ = 17.000839 $\simeq 17.0008cm^3$ √ ½	3	
		3	
11.	(a) 2, 2 – dibromo butane √1 (b) 5 – iodopent – 2 – yne √1 (c) 2, 4 – dimethylpentanoic acid √1	3	
		3	
12.	(i) Equilibrium shifts to the right √ ½ for more $CaCO_3$ to decompose to replace the CO_2 absorbed by the NaOH √1 (ii)Equilibrium shift to the right √ ½ as the forward reaction is endothermic hence favoured by high temperature √1	3	
		3	

	ANSWERS	MARKS	COMMENTS
13.	The oxidation state of Mn in MnO_4^- is +7 √ ½ is reduced to +2 √ ½ in Mn^{2+}, while oxidation state of sulphur is +4 √ ½ in SO_3^{2-} is oxidized √ ½ to +6 √ ½ in SO_4^{2-} .	3	
		3	
14.	Mass of iron = (mass of dish + residue) - mass of empty dish = 12.66g – 10.98g = 1.68g √ ½ Mass of oxygen = mass of empty dish + Oxide iron – mass of dish + mass of residue = 13.30 – 12.66 = 0.64g √ ½	3	
	Fe: 1.68 / 56 = 0.03; 0.03 / 0.03 = 3 x 1 = 3 O: 0.64 / 16 = 0.04; 0.04 / 0.03 = 1.33 x 3 √ ½; 3.999 = 4 √ ½ 3 : 4 E.f Fe_3O_4 √ ½		
		3	
15.	(a) Y, Y has the highest tendency of gaining electron / most √1 electronegative as it has the smallest atomic √1 size than Z. X does not loose or gain electron / has filled / stable	2	
	(b) - Manufacture of AgBr used in making photographic films - To produce ethylene dibromide an additive to lead gasoline √ ½	1	
		3	
16.	(i) S √ R^+ √1		
	(ii) $Q_{(s)} + 2R^+_{(aq)} \longrightarrow Q^{2+}_{(aq)} + 2R_{(s)}$ √1	4	
	(iii) R undergoes oxidation as it dissolve in the solution √		
		4	
17.	√ √ √ O C O	2	NB: Atom must be labeled otherwise penalize fully.
		2	

	ANSWERS	MARKS	COMMENTS
18.	(a) Haber process √1 (b) Platinized platinum √1 (c) NH_3 is oxidized √1 to the brown NO_2 √1	4	
		4	
19.	(i) 256 (32 x 8) √1 (ii) Plastic sulphur √1 (iii) The rigs are broken to form long chains √1 which entangles with one another making liquid viscous	4	
		4	
20.	Fractional crystallization √1 Mass of X = 15g – 4.6g = 10.4g √ ½ Mass of Y = 15g – 10.2g = 4.8g √ ½ Total mass = 10.4g + 4.8g √ ½ = 15.2g √ ½	3	
		3	
21.	(a) QJ_2 √1 (b) T √1 (c) K √1	3	
		3	
22.	Add copper (II) Oxide into a given volume of HCl √ ½ or HNO_3 until it is excess √ ½ Filter √ ½ of the excess oxide Add the filtrate to a soluble carbonate of Na_2CO_3 solution √ ½ Filter √ ½ off to recover the copper (II) carbonate	3	
		3	
23.	(a) $2NaOH_{(aq)} + H_2SO_{4(aq)} \longrightarrow Na_2SO_4 + H_2O_{(l)}$ √1 (b) Red litmus paper does not change √ ½ the blue litmus paper turn red √ ½ (c) The acid is in excess √ 0.003 moles of NaOH require ½ x 0.003 moles of H_2SO_4 √ ½ = 0.0015 moles √ ½	3	
		3	

	ANSWERS	MARKS	COMMENTS
24.	A blue flame √1 A: $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ √1 B: $CO_{2(g)} + C_{(s)} \longrightarrow 2CO_{(g)}$ √1 C : $2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_{2(g)}$ √1	4	
		4	
25.	Hard water deposit √ ½ the Insoluble Mg^{2+} and Ca^{2+} Carbonate √ ½ On the pipes preventing lead from dissolving √ ½ into the water. Lead dissolve √ ½ in the soft water leading to lead poisoning √1	3	
		3	

Name ……. Index Number ……..

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CHEMISTRY
PAPER 2 (THEORY)
JULY / AUGUST 2011
2 HOURS

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Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 2 (THEORY)
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INSTRUCTIONS TO CANDIDATES

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Question	Maximum Score	Candidates Score
1	13	
2	11	
3	13	
4	12	
5	11	
6	10	
7	10	
TOTAL	80	

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Turn Over

1. The grid below shows part of the periodic table. Study it and answer the questions that follow. The letters do not represent the true symbols of the elements.

						A			
I	B			C		D		E	
F	G								
								H	

(a) Which element forms ion with charge of -2? Explain your answer. (2 marks)

(b) What is the nature of the oxide formed by C. (1 mark)

(c) How does the reactivity of H compare with that of E. Explain. (2 marks)

(d) Write the chemical equation for the reaction between B and chlorine. (1 mark)

(e) Explain how the atomic radii of the following compare. (2 marks)
(i) F and G

(ii) B and G

(f) The oxides of B and D are separately dissolved in water. State the effects of each on litmus paper. (2 marks)

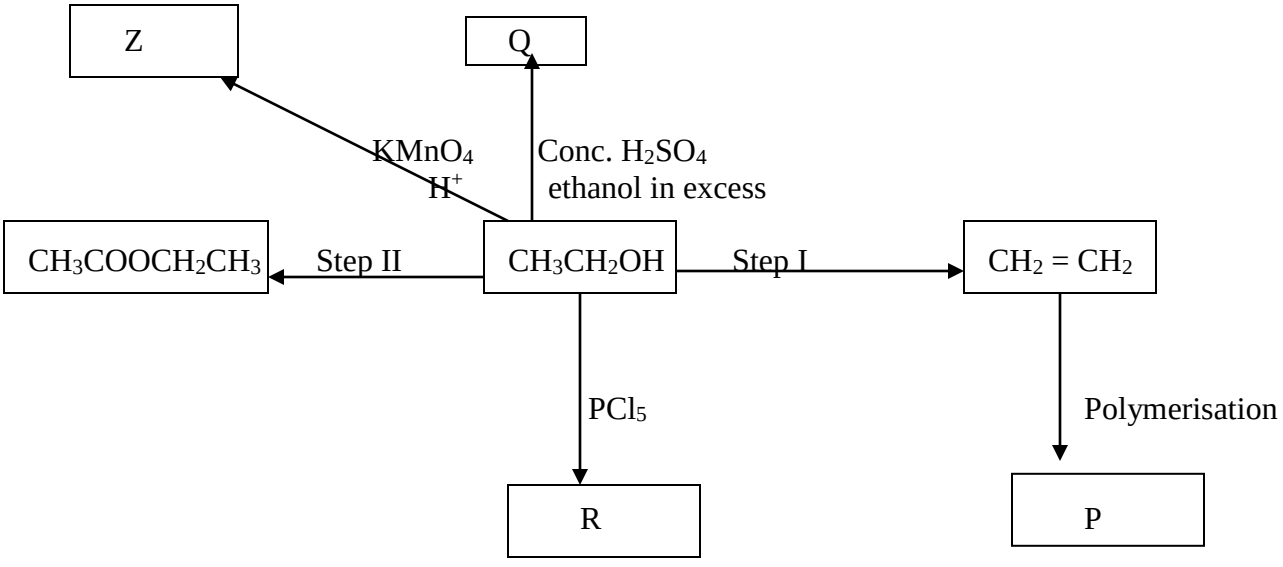
_____

_____

_____

(g) $20cm^3$ of a solution of a hydroxide of I completely neutralizes $17.5cm^3$ of 0.5M sulphuric acid. Calculate the concentration in moles / litre of solution of the hydroxide of I. (3 marks)

2. Below is a scheme of some reaction of ethanol. Study it and answer the questions that follow.



(a) (i) What other product is formed in step I? _____ (½ mark)

(ii) What chemical name is given to the process represented by step I? (½ mark)

_____

_____

(iii) Name the following

(a) Reagent used in step I _____ (1 mark)

(b) Condition for step I . _____ (1 mark)

(b) (i) Name the polymer P _____ (1 mark)

(ii) Name one disadvantage of the continued use of the polymer name in b(i) above. (1 mark)

_____

_____

_____

(c) Name the substance (2 marks)

Q _____

R _____

(d) (i) What name is given to step II _____ (1 mark)

(ii) Name one characteristic of the product produced in step II. (1 mark)

_____

_____

_____

(e) (i) Write the structural formula of substance Z. (1 mark)

_____

_____

_____

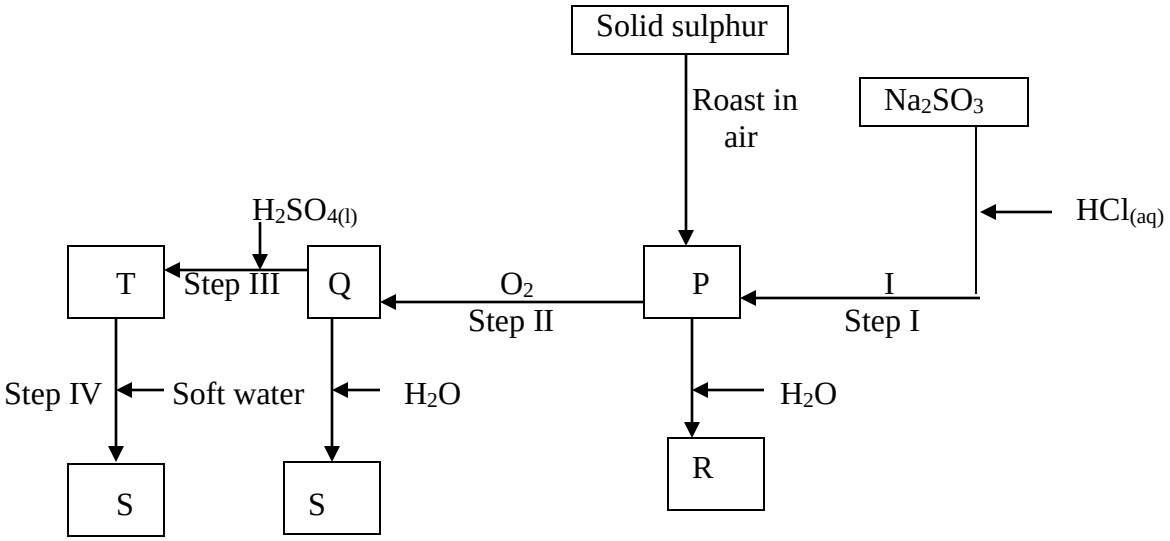
(ii) Give the systematic name of the substance Z. (1 mark)

_____

_____

_____

3. Study the flow chart below and answer the questions that follow.



(a) (i) Name substance P _____ (1 mark)

(ii) Write the chemical equation that takes place in step I. (1 mark)

_____

_____

_____

(b) (i) Name substance R _____ (1 mark)

(ii) I Three drops of potassium dichromate are added to substance R. What observation is made? (1 mark)

_____

_____

_____

II What property of substance P is shown by the observation in (ii) a, above. What condition is necessary for P to exhibit the property. (2 marks)

_____

_____

_____

(c) Name the following

(i) Catalyst for step II _____ (1 mark)

(ii) Effect of increase in pressure on step II, give a reason for your answer. (2 marks)

_____

_____

_____

(d) (i) Identify S _____ (1 mark)

(ii) Write the chemical equation for the conversion of substance T to substance S. (1 mark)

_____

_____

_____

(e) Why is it not advisable to use hard water in step IV. (2 marks)

_____

_____

_____

_____

4. In an experiment to determine the heat of displacement, the following set up was used by a student.
Copper II Sulphate Zinc powder Thermometer Plastic beaker Glass beaker Cotton wool

One gram of zinc powder was added to the copper (II) sulphate solution of volume $50cm^3$ in a plastic beaker after taking the initial temperature reading. Immediately the zinc powder was added the temperature change was recorded after a time interval and the values recorded in below. Use the table and the data given to answer the questions below.

Time in (min)	0	1 ½	1	1 ½	2	2 ½	3	3 ½	4	4 ½	5	5 ½	6	6 ½
Temperature (^0C)	22	25	29	31	34	35.5	36.5	36.5	36	35.5	35	34	34	33

(a) Plot a graph of temperature against time. (3 marks)

(b) From the graph, determine the highest temperature and also the temperature change. (2 marks)

(c) Explain why the plastic cup was used in the experiment. (1 mark)

_____

_____

_____

(d) Write the ionic equation for the reaction. (1 mark)

_____

_____

_____

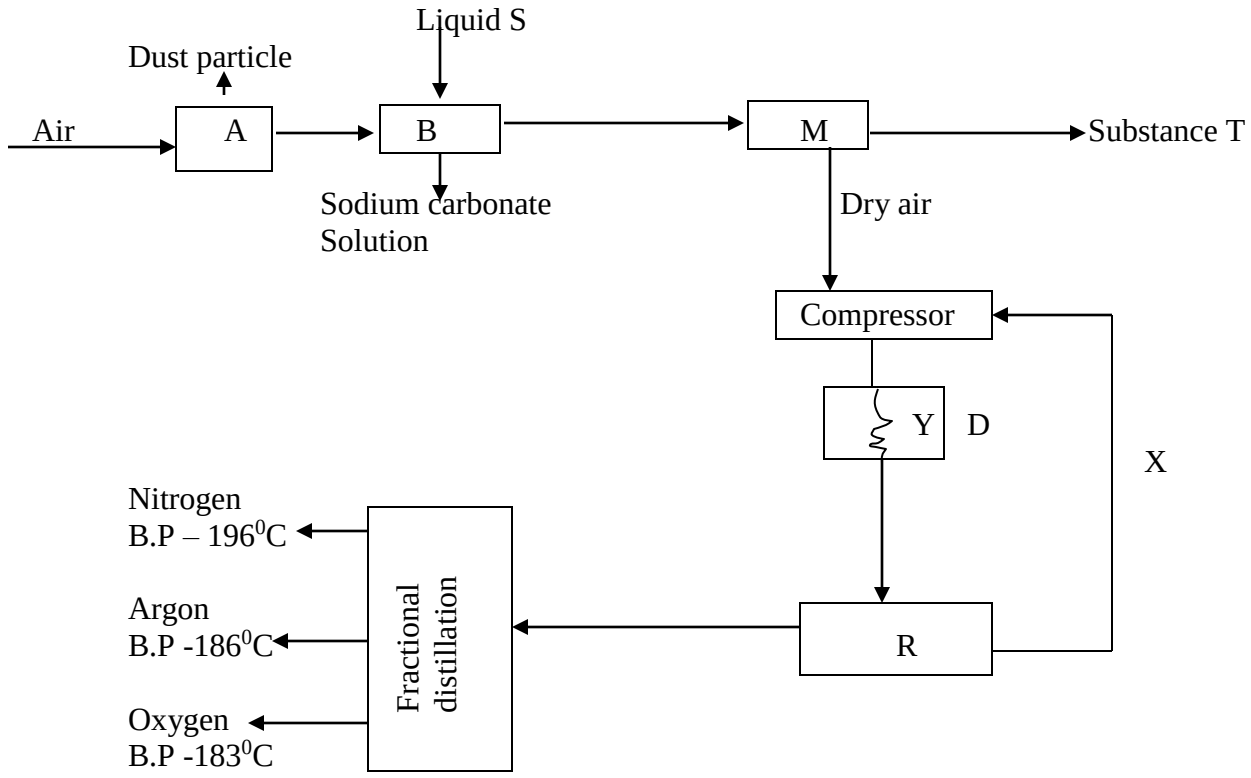
(e) Calculate the amount of heat given out during the reaction.
(Heat capacity of solution is 4.2kJ $kg^{-}k^{-}$ and density is 1g/cm^3. (2 marks)

(f) If the molar heat for the displacement reaction above is 209kJ/mole calculate

(i) The moles of copper (II) sulphate reacted. (1 ½ marks)

(ii) The concentration of the copper (II) sulphate solution. (1 ½ marks)

5. Fractional distillation of air is used in industry to produce oxygen. The diagram below shows the process.



(a) What processes are taking place in chamber

A _____

B _____

M _____

D _____ (2 marks)

(b) Name (2 marks)

(i) Liquid S _____

(ii) Substance T _____

(c) Explain why part Y in chamber D is curved. (1 mark)

_____

_____

_____

(d) Give two large scale uses of oxygen. (1 mark)

_____

_____

_____

(e) (i) In the laboratory oxygen is often prepared using manganese (IV) oxide and hydrogen peroxide. Write an equation for the formation of oxygen. (1 mark)

_____

_____

_____

(ii) An investigation was carried out using the set-up shown below. Study it and answer the questions that follow.

R Air Water Nail S Air Nail Anhydrous calcium chloride T Air Oil Boiled water Nail

(I) State and explain what will happen in the three test tubes after seven days. (3 marks)

R

_____

_____

_____

S

_____

_____

_____

T

_____

_____

_____

(II) Give one reason why some metals are electroplated. (1 mark)

_____

_____

_____

6. The following table gives the standard reduction potentials for a number of half reactions.

Half reaction			E^{θ} in volts
$Mg^{2+}_{(aq)} + 2e^-$	$\longrightarrow$	$Mg_{(s)}$	-2.37
$Mn^{2+}_{(aq)} + 2e^-$	$\longrightarrow$	$Mn_{(s)}$	-1.18
$Cd^{2+}_{(aq)} + 2e^-$	$\longrightarrow$	$Cd_{(s)}$	-0.402
$2H^{+}_{(aq)} + 2e^-$	$\longrightarrow$	$H_{2(g)}$	0.00
$Ag^{+}_{(aq)} + e^-$	$\longrightarrow$	$Ag_{(s)}$	0.799
$Ce^{4+}_{(aq)} + e^-$	$\longrightarrow$	$Ce^{3-}_{(aq)}$	1.61

(a) Identify the following

(i) Strongest oxidizing agent. _____ (1 mark)

(ii) Strongest reducing agent _____ (1 mark)

(b) Select the substance that can oxidize silver atoms into silver ions. (1 mark)

_____

_____

_____

(c) Given the two half reactions

$Mg^{2+}_{(aq)} + 2e^- \longrightarrow Mg_{(s)}$

$Cd^{2+}_{(aq)} + 2e^- \longrightarrow Cd_{(s)}$

(i) Write the cell representation made up of these two half cells. (1 mark)

_____

_____

_____

(ii) Write the overall cell reaction for the cell formed by these two half cells. (1 mark)

_____

_____

_____

(iii) Calculate the electromotive force of the cell. (2 marks)

_____

_____

_____

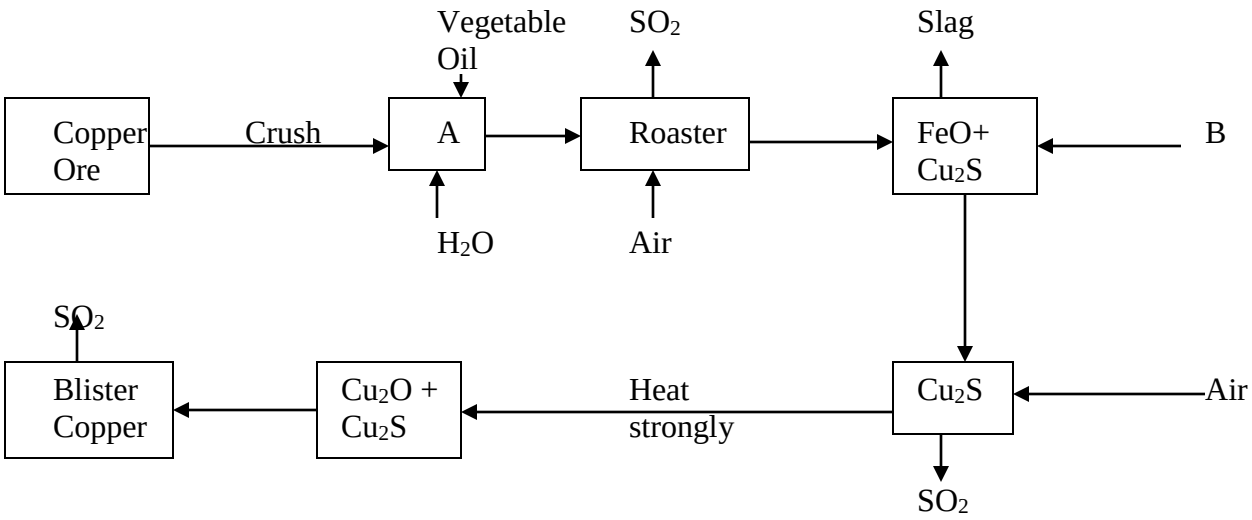
_____

_____

_____

(iv) Draw the cell made up of the metals and indicate the direction of the flow of electrons. (3 marks)

7. Study the flow chart below on extraction of copper and answer the questions that follow.



(a) Name the chief copper ore used for the extraction of copper. (1 mark)

_____

_____

_____

(b) The amount of copper in the copper ore is usually very small. State the method used to separate the impurities from the ore in chamber A. (1 mark)

_____

_____

_____

(c) (i) What substance is fed into the roaster from chamber A. (1 mark)

_____

_____

_____

(ii) Write an equation for the reaction that takes place in the roaster. (1 mark)

_____

_____

_____

(d) The copper obtained (blister copper) is not pure. Draw a labelled diagram to show the set up you would use to refine the copper by electrolysis. (2 marks)

(e) Give two side effects that this process would have on the environment. (2 marks)

_____

_____

_____

(f) Bronze is an alloy of copper and another metal

(i) Name the other metal. (1 mark)

_____

_____

_____

(ii) Give one use of bronze. (1 mark)

_____

_____

_____

233/2
CHEMISTRY
PAPER 2 (THEORY)
JULY / AUGUST 2011

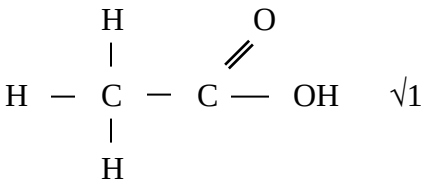
NZAUI/MUKAA FORM 4 CLUSTER EXAMS
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 2 (THEORY)

MARKING SCHEME

	ANSWERS	MARKS	COMMENTS
1.	(a) A √1 Reason: Element in group VI √ ½ , has 6 electrons in outermost energy level, reacts by gaining 2 electrons	2	
	(b) Amphoteric oxide √1	1	
	(c) Element E is more reactive than element H √1 Reason: Element E and H are in a non-metallic group i.e group VII and reactivity decreases down the group. √ ½	2	
	(d) $B_{(s)} + Cl_{2(g)} \longrightarrow BCl_{(s)}$ √1 0 mark wrong symbol ½ mark if state symbol missing or wrong	1	
	(e) (i) The atomic radius of element F is greater than that of element G √1. (ii) The atomic radius of element B is greater than that of element G √1.	2	
	(f) Solution of oxide of B change red litmus paper blue √ ½ and has no effect on blue litmus paper √ ½ Solution of oxide of D change blue litmus paper red √ ½ and has no effect on red litmus paper √ ½	2	
	(g) $2IOH_{(aq)} + H_2SO_{4(aq)} \longrightarrow I_2SO_{4(aq)} + H_2O_{(l)}$ 2 : 1 ⟶ 1 : 1 √1 Moles of H_2SO_4 ⟶ $\frac{17.5 \times 0.5}{1000}$ = 0.00875 moles √ ½ Moles of IOH ⟶ 0.00875 ÷ 2 = 0.004375 moles √ ½ Molarity = $\frac{0.004375 \times 1000}{20}$ √ ½ = 0.21875 moles / litre √ ½	3	
		13	

This paper consists of 6 printed pages

Turn Over

	ANSWERS			MARKS	COMMENTS
2.	(a)	(i)	Water (H_2O) √ ½		
		(ii)	Dehydration √ ½		
		(iii)	Concentrated sulphuric acid √1		
		(iv)	Temperature of 170^0C √1	4	
	(b)	(i)	Polyethene √1		
		(ii)	It is nonbiodegradable hence accumulate in the environment causing pollution √1	2	
	(c)		Q – Diethyl ether √1 R – Chloro ethane √1	2	
	(d)	(i)	Esterification √1		
		(ii)	Product has a sweet smell √1	2	
	(e)	(i)	 √1		
		(ii)	Ethanoic acid √1	2	
				12	
3.	(a)		(i) Sulphur (IV) oxide (SO_2) √1 (ii) $Na_2SO_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + H_2O_{(l)} + SO_{2(g)}$ √1	2	
	(b)		(i) Sulphuric (IV) acid √1		
		(ii) I)	The colour of potassium dichromate change from orange to green √1		
		II)	Sulphur (IV) oxide is a reducing agent √1 Presence of water / moisture √1	4	
	(c)		(i) Vanadium (V) oxide (V_2O_5) √1 or platinized asbestos (ii) Increases the rate √1 of production of Q. Molecules are brought closer, more collision of gases particles √1	3	
	(d)		(i) Sulphuric (VI) acid (H_2SO_4) √1 (ii) $H_2S_2O_{7(l)} + H_2O_{(l)} \longrightarrow 2H_2SO_{4(l)}$ √1	2	
	(e)		- The calcium ions in hard water would precipitate √1 the insoluble calcium sulphate - The hard water would introduce other ions in the sulphuric (VI) acid being manufactured making it impure √1	2	
				13	

4. (a)

40 35 30 25 20 15 10 5 0

P1

C1

S1

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

		ANSWERS	MARKS	COMMENTS
4.	(b)	Highest temp = 37^0C √1 Temp change = 37 – 22 = 15^0C √1	2	
	(c)	To minimize heat loss to the surrounding √1	1	
	(d)	$Cu^{2+}_{(a)} + Zn_{(s)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$ √1	1	
	(e)	Heat = M x C x ΔT = $\frac{50}{1000}$ x 4.2 x 15 √1 = 0.05 x 4.2 x 15 = 3.15 kj √1	2	
	(f) (i)	No of moles used 209kj ⟶ 1 mole 1 ⟶ $^1/_{209}$ 3.15 ⟶ $^1/_{209}$ x 3.15 √1 = 0.01507177 moles √ ½	1 ½	
	(ii)	Molarity = $\frac{0.01507177 \times 100}{50} \times \frac{20}{1}$ √1 = 0.3014 moles √ ½	1 ½	
5.	(a)	A Filtration B Absorption M Isolation of water D Cooling	√ ½ √ ½ √ ½ √ ½ 2	
	(b)	Liquid S – NaOH / KOH(aq) Substance T – Ice / water	√1 √1 2	
	(c)	To increase surface area for cooling	√1	
	(d)	- Used in steel making and extraction - Rocket fuel when mixed with other gases - Used in welding when mixed with oxygen - Used in respiratory aid	Any two 1	
	(e) I	(ii) $2H_2O_{2(l)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$ √1 (ii) R – Rusting √ ½ occurred because of air and water √ ½ S – No rusting √ ½ . Air is absent √ ½ T – No rusting √ ½ . Air is absent √ ½	1 3	
	II)	(i) To prevent rusting √ (ii) To increase aesthetic value of the metal √ } Any	1	

	ANSWERS		MARKS	COMMENTS
6.	(a)	(i) $Ce^{4+}_{(aq)}$ √1 (ii) $Mg^{2+}_{(aq)}$ √1	2	
	(b)	Ce^{4+} √1	1	
	(c)	(i) $Mg_{(s)} / Mg^{2+}_{(aq)} // Cd^{2+}_{(aq)} / Cd_{(s)}$ √1	1	
		(ii) $Mg_{(s)} + Cd^{2+}_{(aq)} \longrightarrow Mg^{2+}_{(aq)} + Cd_{(s)}$ √1	1	
		(iii) E.m.f of cell = E^{θ} reduced species – E^{θ} oxidized species $= E^{\theta}_{Cd} - E^{\theta}_{Mg}$ √1 $= -0.402 - {}^{-}2.37$ $= -0.402 + 2.37$ $= 1.968$ Volts √1	2	
		(iv) Mg rod √ ½ √ ½ √ ½ Cd rod √ ½ Solution of Mg^{2+} √ ½ Salt bridge Solution of Cd^{2+} √ ½	3	
			10	
7.	(a)	Copper pyrite ($CuFeS_2$) √1	1	
	(b)	Froth – floatation √ 1	1	
	(c)	(i) $CuFeS_2$ √1	1	
		(ii) $2CuFeS_{2(s)} + 7O_{2(g)} \longrightarrow Cu_2S_{(s)} + 2FeO_{(s)} + 3SO_{4(l)}$ √	1	

ANSWERS	MARKS	COMMENTS
(d) Battery Anode (blister copper) Cathode √ ½ (pure copper) √½		
(e) - Produces SO_2 that causes acid rain - Mining copper from the ground may led to gapping holes being left in ground	2	
(f) (i) Zinc √	1	
(ii) Used in making - Domestic utensils - Condenser tube √ - Sheets and catridge	1	
	10	

Name ……. Index Number ……..

233/3
CHEMISTRY
PAPER 3
PRACTICAL
JULY / AUGUST 2011
2 HOURS

NZAUI/MUKAA FORM 4 CLUSTER EXAMINATION
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3
PRACTICAL
2 ½ HOURS

INSTRUCTIONS TO CANDIDATES

- Answer ALL questions in the spaces provided
- Use the first 15 minutes of the time allowed to read the questions paper and make sure you have all chemical and apparatus.
- Mathematical tables and electronic calculators may be used.
- All working must be must be shown in the spaces provided.

FOR EXAMINER'S USE ONLY

Question	Maximum Score	Candidates Score
1	25	
2	15	
TOTAL	40	

This paper consists of 8 printed pages

Turn Over

1. (A) You are provided with
- 2g of solid A, $H_2(COO)_2.nH_2O$
- Solution B, 0.1M NaOH

You are required to determine the value of n in the formula of the acid.

Procedure I

Add about $5cm^3$ of distilled water to solid A. Transfer all the contents of the test-tube into a $250cm^3$ volumetric flask. Rinse the test tube with distilled water and add to the volumetric flask. Add more water to the mark. Label this solution A. Fill the burette with solution A. Using a pipette and pipette filler place $25cm^3$ of solution B into a conical flask. Add 2 drops of phenolpthalein indicator and titrate with solution A. Repeat the titration and complete table I.

TABLE I (4 marks)

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

I) The average volume of solution A used. (1 mark)

II) Calculate:-

(i) The number of moles of 0.1M sodium hydroxide solution B in $25cm^3$. (1 mark)

(ii) The number of moles of $H_2(COO)_2.nH_2$ acid in solution A used in the experiment. (2 marks)

(iii) The number of moles of $H_2(COO)_2.nH_2O$ in $250cm^3$ of solution A. (1 mark)

(iv) The molarity of the acid solution A prepared. (1 mark)

III) Determine the formula mass of the acid (2 marks)
(i)

ii) Calculate the value of n in the formula $H_2(COO)_2.nH_2O$.
(C = 12.0, O = 16.0, H = 1.0) (2 marks)

B) You are provided with:-

- Sodium thiosulphate $Na_2S_2O_3$, solution C
- 2M hydrochloric acid

You are required to determine the rate of reaction between the two solutions at different temperatures.

Procedure II

Measure $50cm^3$ portion of solution C and transfer into a $100cm^3$ glass beaker. Record the temperature of the solution in the beaker and record in the table below. Measure $5.0cm^3$ of 2M hydrochloric acid and add to the beaker with solution C stir using a thermometer and start a stopwatch at the same time. Swirl the mixture and place over a cross (x) marked on a white paper. Record the time taken for the cross to become invisible.

Clean the beaker thoroughly and repeat the experiment at temperatures 30, 40, 50 and 60 using $50cm^3$ of solution C. To attain the temperatures, warm the solutions in the beaker to the desired temperature and record your results in the table II below.

TABLE II (5 marks)

Temperature of solution C (^0C)	Room temp.	30^0c	40^0c	50^0c	60^0c
Temperature T (K)					
Time taken for cross x to become invisible t(s)					
$^I/_t$ (S^{-1})					

I) On the grid provided plot a graph of $^I/_t$ against temperature(K) (3 marks)

II) From the graph, determine the time taken for the cross to become invisible at 45^0C. (1 mark)

III) What is the effect of temperature on rate of reaction? Explain. (2 marks)

_____

_____

_____

_____

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

I) Dissolve solid D in about $10cm^3$ of distilled water in a boiling tube. Divide the mixture into four portions.

Observations	Inferences
(½ mark)	(½ mark)

(i) To the first portion dip a clean end of a glass rod. Remove it and heat over a non-luminous flame. Note the colour of the flame.

Observations	Inferences
(½ mark)	(½ mark)

(ii) To the second portion add about $2cm^3$ of sodium hydroxide solution until in excess.

Observations	Inferences
(1 mark)	(1 mark)

(iii) To the third portion add 2-$3cm^3$ of lead (II) nitrate solution.

Observations	Inferences
(1 mark)	(1 mark)

(iv) To the fourth portion add 3cm^3 of Barium nitrate followed by 2cm^3 of dilute hydrochloric acid and shake

Observations	Inferences
(2 marks)	(1 mark)

(B) You are provided with solid E. Carry out the following tests and record your observations and inferences in the spaces provided.

I) To half of solid E put in a dry test tube and add 5.0cm^3 of absolute ethanol and shake thoroughly. Divide the mixture into two equal parts.

Observations	Inferences
(½ mark)	(½ mark)

(i) To the first portion dip the universal indicator paper and determine it's pH.

Observations	Inferences
(½ mark)	(½ mark)

(ii) To the second portion add the sodium carbonate provided.

Observations	Inferences
(½ mark)	(½ mark)

II) Place the remaining solid E into a boiling tube and add $5cm^3$ of distilled water and shake well. Divide into two equal portions.

(i) To the first portion add 4-5 drops of acidified potassium manganate (VII) solution shake then warm.

Observations	Inferences
(1 mark)	(1 mark)

(ii) To the second portion add 2-3 drops of acidified potassium dichromate (VI) solution then warm

Observations	Inferences
(½ mark)	(½ mark)

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CHEMISTRY
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Kenya Certificate of Secondary Education
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PRACTICAL

MARKING SCHEME

TABLE I

Titration	I	II	III
Final burette reading (cm^3)	18.00	35.90	17.80
Initial burette reading (cm^3)	0.00	18.00	0.00
Volume of solution A used (cm^3)	18.00	17.90	17.80

- Complete table √1
- Decimals √1
- Accuracy √1
- Consistency √1

(4 marks)

I) Average volume of A used

$$\frac{18.00 + 17.90 + 17.80}{3} \quad \surd ½$$

$= 17.90cm^2$ √ ½

II) Calculate the number of moles of

(i) 0.1M sodium hydroxide in $25cm^3$

0.1 moles ⟶ $1000cm^3$

? ⟵ $25cm^3$ √ ½

$$\frac{0.1 \text{ moles} \times 25\cancel{cm^3}}{1000\cancel{cm^3}}$$

= 0.0025moles √ ½

(ii) Moles of $H_2(COO)_2n.H_2O$ of acid in experiment

$H_2(COO)_2 + 2NaOH \longrightarrow Na_2(COO)_2 + H_2O$ √1

Mole ratio 1 : 2

$= \frac{0.0025 \text{ moles}}{2}$ √ ½

= 0.00125 moles √ ½

(iii) 0.00125 ⟶ $17.90cm^3$

? ⟵ $250cm^3$ √ ½

This paper consists of 4 printed pages

Turn Over

$$\frac{0.00125 \text{ moles} \times 250\text{cm}^3}{17.90\text{cm}^3}$$

$$= 0.017458 \text{ moles } \surd \tfrac{1}{2}$$

(iv) $0.017458 \longrightarrow 250\text{cm}^3$

$? \longleftarrow 1000\text{cm}^3$

$$\frac{= 0.017458 \times 1000\text{cm}^3}{250\text{cm}^3} \quad \surd \tfrac{1}{2}$$

$$= 0.069832 \text{ moles}$$

Molarity = 0.069832M $\surd \tfrac{1}{2}$

III) (i) Formular mass = $\frac{2\text{g}}{0.017458}$ $\surd 1$

$$= 114.56 \surd 1$$

(ii) Calculate the value of n in the formula

$H_2(COO)_2n.H_2O$

(C = 12.0, O = 16.0, H = 1.0)

$2 + (12 + 32)2 + 18n = 114.56 \surd 1$

$2 + 88 + 18n = 114.56$

$90 + 18n = 114.56$

$18n = 114.56 – 90$

$\frac{18n}{18} = \frac{24.56}{18}$

$n = 1.3644 \surd 1 \simeq 2$

TABLE II

1B (i) Complete table with 5 reading ….. 1mk

Use of decimals	1 mark
Accuracy	1 mark
Trend	1 mark
$^{I}/_{t}$	1 mark

Temp of solution S(^{0}C)	Room temp	30^{0}C	40^{0}C	50^{0}C	60^{0}C
Temperature (K)	291	303	313	323	333
Time	36.0	13.7	9.2	6.2	4.9
t^{-1}	0.0278	0.0730	0.087	0.1613	0.2042

I) Scale ½ mark

Labelling of the axes ½ mark

Plotting 1 mark

Line 1 mark

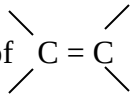
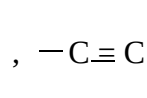
II) Showing on the graph ……. ½ mark

Stating correct reading from graph …….. ½ mark

III) The higher the temp the faster the rate of the reaction (1 mark)

The kinetic energy of the particles of the reactants increasing chance of effective collisions. (1 mark)

$X10^{-3}$ 220 200 180 160 140 120 100 80 60 40 20 0 200 230 260 290 310 330 370 Temperature (K2) $I/_t$

2A	Observation	Inferences
	(I) - No white precipitate √ ½ - Solid dissolves completely	A soluble salt √ ½
(i)	Yellow flame produced √ ½	Na^+ present √ ½
(ii)	No white precipitate √1	Na+ √1 - Amphotetic ions absence Ca^{2+}, Zn^{2+}, Pb^{2+}, Mg^{2+} absent
(iii)	- White precipitate forms √ ½ - Insoluble √ ½	Presence of $C0_3^{2-}$ or Cl^- √1 - If only 1 ion award (½ mark)
(iv)	- White precipitate forms √ ½ - Effervescence / bubbles / fizzing √1 - White precipitate dissolves √ ½	Confirm CO_3^{2-}
B)		
I)	Partially dissolves to form colourless solution √ ½	Presence of non-polar compound / substance √ ½
(i)	pH 7 √ ½	Presence of neutral compound √ ½
(ii)	No effervescence √ ½	Absence of H_3O^+ / H^+ √ ½
II) (i)	Decolorises on warming / turns to colourless solution from purple √ ½	Presence of  ,  √ ½ ROH √ ½ Treat presence of oxalic acid as contradictory
(ii)	Orange – colour of acidified potassium dichromate (VI) √ ½ Persist / remains	Absence of ROH √ ½

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CHEMISTRY
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FORM 4 CLUSTER EXAMINATION
Kenya Certificate of Secondary Education
CHEMISTRY
PAPER 3
PRACTICAL

CONFIDENTIAL

- $50cm^3$ burette
- Pipette and pipette filler
- $25cm^3$ pipette
- $250cm^3$ volumetric flask
- A label
- Exactly 2g of solid A supplied in a stoppered testtube
- $120cm^3$ solution B
- Phenolpthalein indicator
- 2 conical flask
- Stand and clamp
- $300cm^3$ of solution C. 0.5M sodium thiosulphate
- $50cm^3$ of 2M hydrochloric acid
- Thermometer
- $100cm^3$ glass beaker
- 10ml measuring cylinder
- Stop watch
- White piece of paper
- Source of heat
- Tripod stand and wire gauze
- Solid D about 1g

This paper consists of 2 printed pages

Turn Over

- Distilled water ($500cm^3$)
- 6 test tubes
- 2 boiling tube
- A glass rod
- 2M NaOH(aq)
- 0.1M $Pb(NO_3)_{2(aq)}$ Bench solutions
- 0.1M $Ba(NO_3)_{2(aq)}$
- 1M $HCl_{(aq)}$
- About 1g solid Na_2CO_3
- Solid E about 1g
- $10cm^3$ of absolute ethanol
- Universal indicator paper and it's pH chart (Range 1 – 14)
- Acidified $KMnO_{4(aq)}$
- Acidified $K_2Cr_2O_{7(aq)}$

NB:

- Solid A is oxalic acid
- Solid D is sodium carbonate
- Solid E is glucose powder
- Solution B is prepared by dissolving 4g of NaOH in $600cm^3$ of distilled water then top-up to 1 litre