Name ……..……ADM……..Class……

School…….....…….. Date…….....……

233/2
CHEMISTRY
Paper 2
THEORY
June 2023
2 hours

KASSU EXAMINATIONS

Kenya Certificate of Secondary Education
CHEMISTRY
Paper 2
THEORY
2 hours

Instructions

- *Write your name, Index number and class in the spaces provided above.*
- *Answer **ALL** the questions in the spaces provided.*
- *Mathematical tables and silent electronic calculators may be used.*
- *All working **MUST** be clearly shown where necessary.*

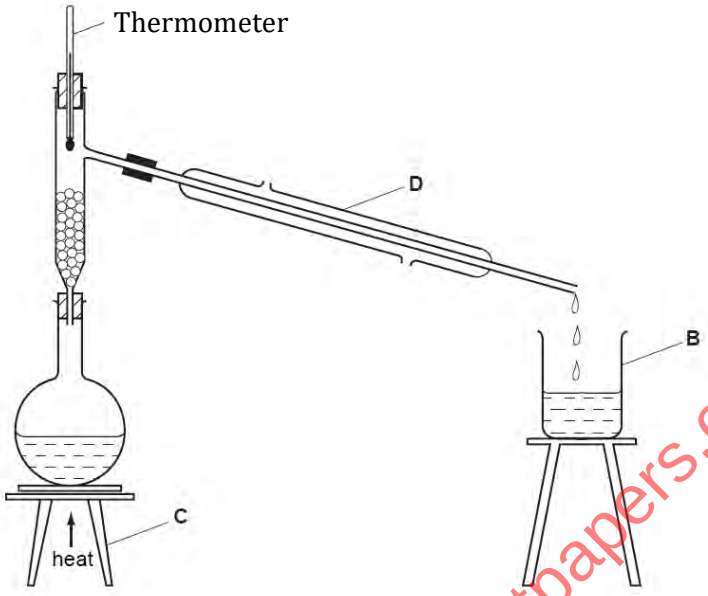
For Examiner's use only

Question	Maximum Score	Candidate's Score
1	**10**	
2	**12**	
3	**14**	
4	**13**	
5	**10**	
6	**10**	
7	**11**	
Total	**80**	

*This question paper has **13** printed pages.*
Confirm that all the pages are printed as indicated and

No questions are missing.

1. The diagram below was used to separate a mixture of liquid W (b.p = 110 ^{0}C) and liquid Z (b.p = 88 ^{0}C).



(a) Name the apparatus labelled B and C ***(2 marks)***

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(b) Using an arrow, indicate on the diagram where the water leaves apparatus D ***(1 mark)***

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(c) Which liquid was collected in apparatus B first? Give a reason for your answer. ***(2 marks)***

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(d) State the role of fractionating column in this experiment ***(1 mark)***

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(e) You are provided with a boiling tube, test tube, beaker, delivery tube, cork, ice cold water, stand & clamp, copper (II) sulphate crystals and source of heat. Draw a setup of apparatus that can be used by a student to study the effect of heat on hydrated Copper (II) sulphate ***(3 marks)***

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(f) When steam is passed over heated iron in a combustion tube, a black solid is formed. Write an equation of the reaction that leads to the formation of the black solid ***(1 mark)***

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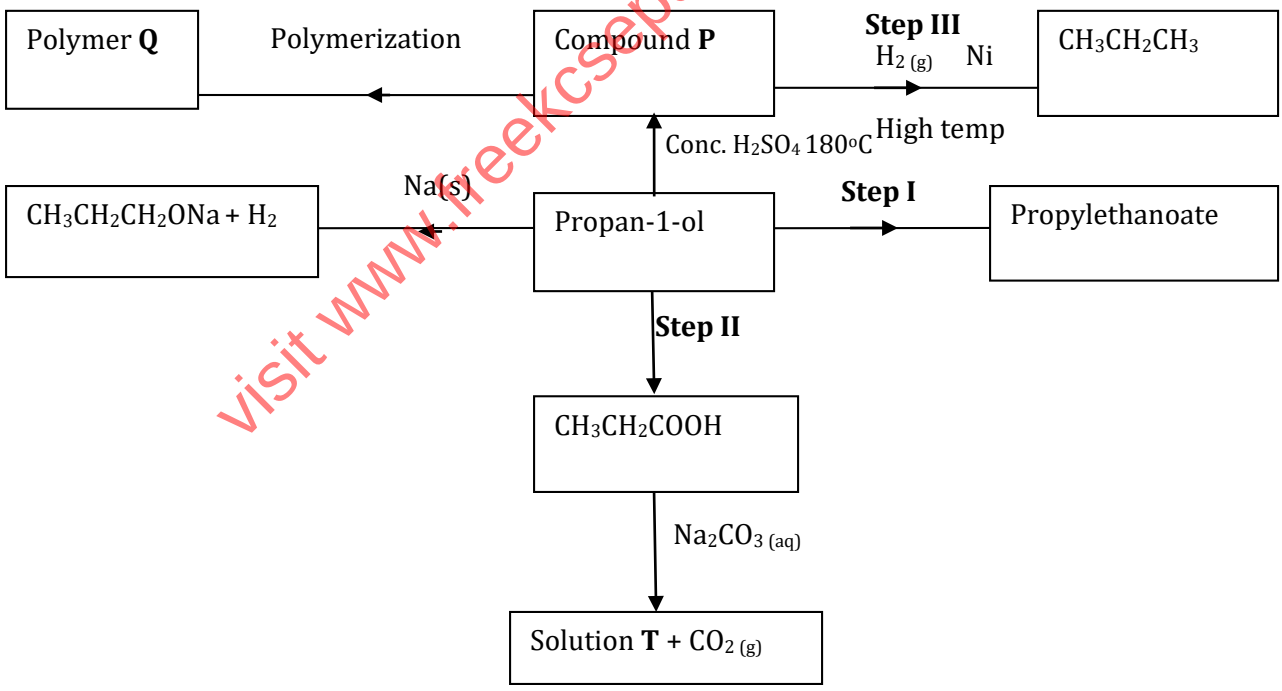
2. Study the scheme given below and answer the questions that follow:-



(a) (i) Name compound P and solution T ***(2 marks)***

Compound P……

Solution T……

(ii) Write an equation for the reaction between CH_3CH_2COOH and Na_2CO_3 ***(1 mark)***

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(b) State one use of polymer Q ***(1 mark)***

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(c) Name one oxidizing agent that can be used in step II ***(1 mark)***

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(d) A sample of polymer Q is found to have a molecular mass of 4200. Determine the number of monomers in the polymer (H = 1, C = 12) ***(2 marks)***

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(e) Name the type of reaction in step I ***(1 mark)***

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(f) State one industrial application of step III ***(1 mark)***

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(g) State how burning can be used to distinguish between propane and propyne. Explain your answer ***(2 marks)***

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(h) 1000cm^3 of ethene (C_2H_4) burnt in oxygen to produce Carbon (II) Oxide and water vapour. Calculate the minimum volume of air needed for the complete combustion of ethene (Air contains 20% by volume of oxygen) ***(2 marks)***

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3. I. (a) Sulphur exhibits allotropy. What is transition temperature? ***(1 mark)***

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(b) Briefly describe how an allotrope of Sulphur stable below 96^{0}C can be prepared. ***(2 marks)***

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(c) Sulphur is used during vulcanization of rubber. State the role of Sulphur in vulcanization of rubber. ***(1 mark)***

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(d) Explain why old newspapers turn brown after sometime. ***(1 mark)***

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(e) State the observation made when Sulphur (IV oxide gas is bubbled into a solution of acidified potassium dichromate (VI) in a boiling tube. ***(1 mark)***

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II. A rock was found in one of the valleys at Kilongolo. The rock was suspected to contain high percentage of zinc metal.

(a) Explain how you could confirm that the rock contains zinc metal. ***(3 marks)***

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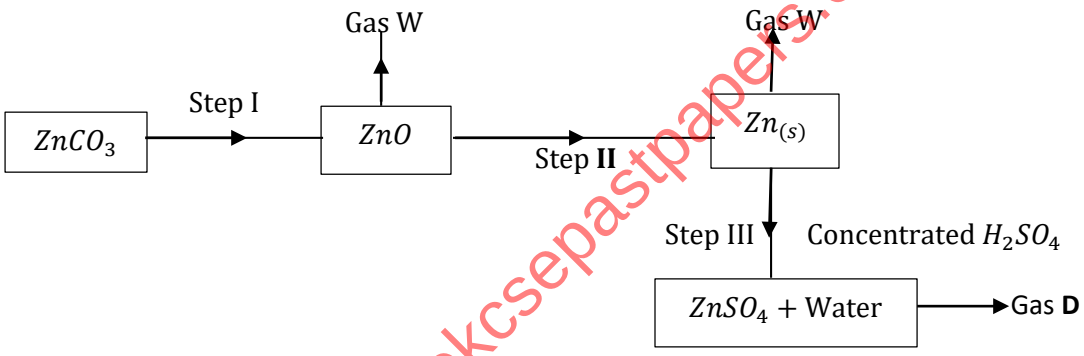
(b) Study the flow chart below and answer the following questions.



(i) State the condition necessary for the reaction in step I to occur. ***(1 mark)***

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(ii) Name (a) Gas W - ***(1 mark)***

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(b) Gas D - ***(1 mark)***

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(iii) When a current of 0.82A was passed for 5 hours through a solution of metal **Z**, 2.65 g of metal **Z** were deposited. Determine the charge on the ion of metal **Z**.
(1F = 96500C, RAM of Z = 52) ***(3 marks)***

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4. (a) Determine the electronic configuration of:

(i) Oxygen in H_2O_2 ***(1 mark)***

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(ii) Sulphur in SO_4^{2-} ***(1 mark)***

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(b) A piece of Magnesium ribbon was placed in a solution of copper (II) chloride in a beaker.

(i) State any one observation that was made. ***(1 mark)***

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(ii) Write the ionic equation for the reaction that took place. ***(1 mark)***

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(c) The following are standard reduction potentials for some metals. The letters do not represent the actual elements.

	E^{θ} (volts)
$A^{2+}_{(aq)} + 2e^{-} \longrightarrow A_{(s)}$	-2.93
$B^{2+}_{(aq)} + 2e^{-} \longrightarrow B_{(s)}$	-2.38
$C^{2+}_{(aq)} + 2e^{-} \longrightarrow C_{(s)}$	$+0.34$
$D^{+}_{(aq)} + 2e^{-} \longrightarrow D_{(s)}$	$+2.87$
$E^{2+}_{(aq)} + 2e^{-} \longrightarrow E_{(s)}$	$+1.44$

(i) Which is the most reactive metal? Give a reason. ***(2 marks)***

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(ii) Draw electrochemical cell when A and D combine ,indicate the flow of electron ***(3 marks)***

(iii) Calculate the e.m.f of the cell in (ii) above. ***(2 marks)***

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(iv) Explain if it is advisable to store a solution containing C^{2+} ions in a container made of D. ***(2 marks)***

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5. Define the following terms as used in radio activity ***(2 marks)***

i) nuclear fission

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ii) Nuclear fusion.

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(II)Study the information below and use it to answer the question that follows.

Time (days)	Mass of Radio Isotope
0	800
4.1	400
8.2	200
16.4	100
24.3	50
32.4	25

(a) Plot a graph of mass of Isotope (y-axis) against time (days) ***(3 marks)***

(b) Use your graph to-

(i) Determine the half-life of the Radio Isotope ***(1 mark)***

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(ii) The fraction of the original amount remains after 16.4 days ***(1 mark)***

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(c) If the sample continues to decay, predict how long it will take to decay to Zero. ***(1 mark)***

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(d) State one application of radioactivity in ; ***-+(2 marks)***

i) History

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ii) Medicine

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6. Study the ionization energies in Kilojoules per mole and answer the questions below.

Element	**Ionization energies in kJ/mol**					
	1st	2nd	3rd	4th	5th	6th
A	1590	2780	4700	6500	8100	12500
B	1010	1900	4900	5000	6300	7300
C	940	4800	6300	9180	12000	1600
D	1680	2010	3400	10900	12400	16500

(a) (i) What is meant by the term Ionization energy ***(1 mark)***

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(ii) Identify the group to which each element belongs to A, B, C, D ***(1 mark)***

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(iii) Write the formula of the oxide of D. ***(1 mark)***

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(iv) What type of bond will be formed when C reacts with fluorine? Explain ***(2 marks)***

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(b) The table below gives some physical properties of elements in the third period of the period table and their chlorides. The letters used are not actual symbols of the elements. Study the information and use it to answer the questions that follows.

Element	Melting Point	Boiling Point	Chloride Formula	Chloride M.P (^{0} C)
H	98	883	HCl	801
I	649	1107	ICl_2	714
J	660	2467	JCl_3	190
K	1410	2355	KCl_4	-70
L	44	280	LCl_3	-161
M	119	443	MCl_2	-78
N	-101	-38	-	-
O	-189	-186	No compound	-

(a) (i) Element K has a very high melting point. Explain why? ***(1 mark)***

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(iv) Explain why element O has a very low boiling point. ***(1 mark)***

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(v) Explain why O does not form a chloride. ***(1 mark)***

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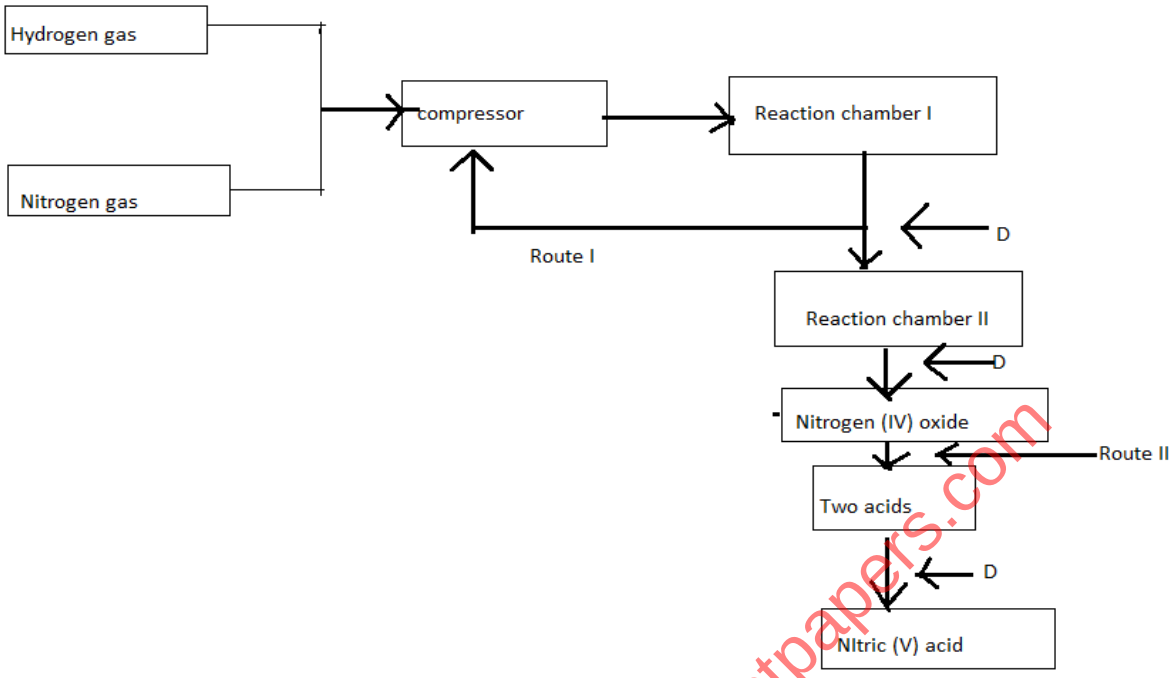
(b) Name the types of bonding and structure in the following chlorides ***(2 marks)***

Chloride	Bonding type	Type of structure
ICl_2	……	……
MCl_2	……	……

7. Study the flow chart below and answer the questions that follows



a) State one source of nitrogen ***(1 mark)***

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b) Name substances that goes through ***(2 marks)***

i) Route I

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ii) Route II

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c) Name gas D ***(1 mark)***

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d) Name the catalyst used in the reaction chamber ; ***(2 marks)***

Chamber I

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Chamber II

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e) Write equation for the reactions taking place in reaction chamber II ***(1 mark)***

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f) Identify the two acids formed above ***(2 marks)***

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g) Write an equation for the reaction between one of the two acids above with reagent D ***(1 mark)***

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h) State one use of nitric (V) acid ***(1 mark)***

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