MARANDA HIGH SCHOOL

Kenya Certificate Of Secondary Education

2025 POST-MOCK II EXAMINATION

233/2 CHEMISTRY PAPER 2

SEPT, 2025 TIME: 2 Hrs

Name: …… Admission No: ……

Stream: …….. Signature: ……..... **233/2 - CHEMISTRY**

Date……

Instructions

*(a) Write your **name, admission number, date, stream and signature** in the spaces provided above.*

(b) This paper consists of 12 printed pages with 7 questions. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing

*(c) Answer **ALL** the questions in the spaces provided and calculations **MUST** be clearly shown.*

*(d) Candidate should answer the questions in **English***

FOR EXAMINERS USE ONLY

Questions	Maximum Score	Candidate's Score
1	12	
2	13	
3	12	
4	12	
5	13	
6	10	
7	08	
TOTAL	80	

1. (a) Study the ionization energies of calcium given below and answer questions that follow.

$Ca\ (g) \longrightarrow Ca^{+}(g) + e^{-}$ (1^{st} ionization energy = $590 kJmol^{-1}$)

$Ca^{+}(g) \longrightarrow Ca^{2+}(g) + e^{-}$ (2^{nd} ionization energy = $1150 kJmol^{-1}$)

(i) Define the term ionization energy (1 mark)

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(ii) Explain why the second ionization energy in calcium is almost double the first. (2 marks)

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(b) Study the table below and use it to answer the questions.

	Na	**Al**	**Cl**	**NaCl**	**$AlCl_3$**
M.P in ^oC	98	660	-101	801	-
B.P in ^oC	880	2460	-35	1413	-
Electrical conductivity	Good	Good	Does not	Good in solution or molten	Does not
Valency	1	3	1	-	-

(i) Explain why the melting point of NaCl is higher than that of aluminium chloride yet both are period 3 chlorides (2 marks)

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(ii) Other than the properties given in the table above, give two reasons why aluminium is used in making cooking pots. (2 marks)

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(iii) State and explain the observation made when a blue litmus paper is dipped into a solution of aluminium chloride. (2 marks)

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(iv) Using dots (.) and crosses (x) to represent electrons, show the bonding in sodium chloride. (1 mark)

(v) Sodium and chlorine have the same valency. Compare with a reason their ionic radii. (2 marks)

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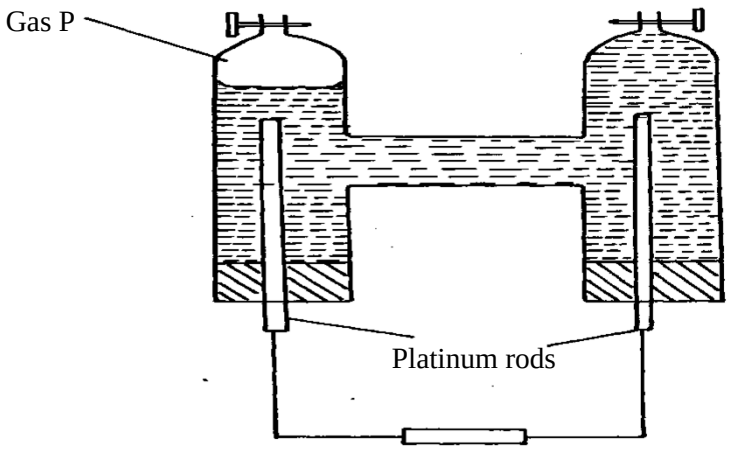
2. (a) The set-up below was used in the electrolysis of copper (II) chloride solution:



(i) What is electrolysis? (1 mark)

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(ii) Label the anode and cathode on the diagram. (1 mark)

(iii) Explain how you would confirm gas **P.** (1 mark)

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(iv) State **two** changes that occur on the electrolyte after the experiment. (2 marks)

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(b) Use the standard electrode potentials given below to answer the questions that follows.

Reaction	**E^{o}(V)**
$MnO^{-}_{4\,(aq)} + 8H^{+}_{(aq)} + 5e^{-} \longrightarrow Mn^{2+}_{(aq)} + 4H_2O_{(l)}$	+1.44
$M^{3+}_{(aq)} + e^{-} \longrightarrow M^{2+}_{(aq)}$	+077
$A^{2+}_{(aq)} + 2e^{-} \longrightarrow A_{(s)}$	+0.34
$P^{2+}_{(aq)} + 2e^{-} \longrightarrow P_{(s)}$	-0.23
$T_{2(g)} + 2e^{-} \longrightarrow 2T^{-}_{(aq)}$	+2.86

(i) State whether acidified $MnO^{-}_{4\,(aq)}$ can oxidise M^{2+}. Give a reason for your answer. (1 mark)

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(ii) Write the **E^{o}(V)** of the half-cell of A if P was used as a reference electrode. Show working. (1 mark)

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(iii) Select two half cells which would produce the highest e.m.f when combined. (1 mark)

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(iv) Is it possible to store a solution of A in a container made of P. Show your working (2 marks)

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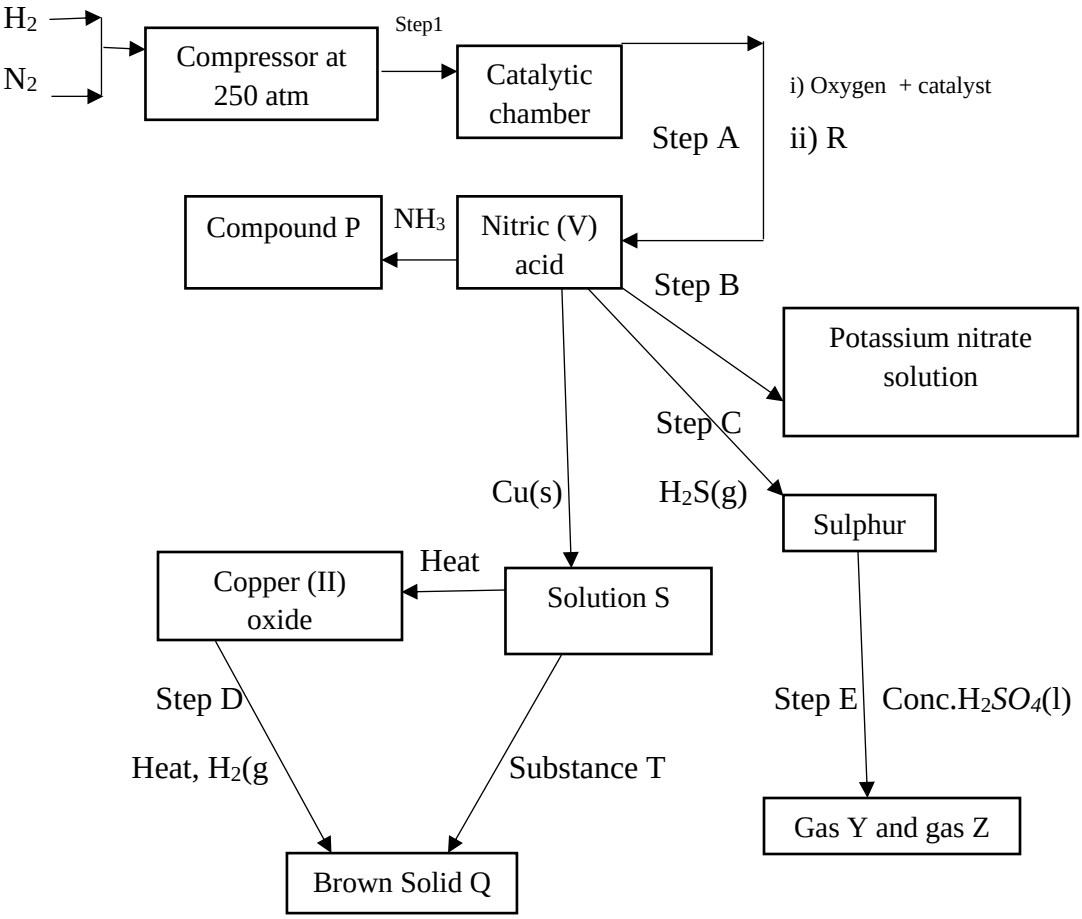
(v) Draw a well labelled diagram of the electrochemical cell formed when the half cells named in (iii) above are combined. (3 marks)

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



(a) State the optimum condition of temperature required in step 1 (1 mark)

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(b) Name the catalyst used in

I. The catalytic chamber ……... (1 mark)

II. Step A …… (1 mark)

(c) Identify R …… (1 mark)

(d) Write two balanced chemical equations taking place in step A (2 marks)

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(e) Identify the process taking place in

i) Step B (1 mark)

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ii) Step E (1 mark)

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(f) Explain how the reaction in step C occurs (1 mark)

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(g) Give the possible identity of substance T (1 mark)

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(h) Write the formula of compound P and give one of its uses (2 marks)

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4. a) Chemical reaction occur as a result of collision of particles. Give a reason why not all collisions are effective (1 mark)

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b) State and explain how the following factors affect the rate of a chemical reaction. (3 marks)

(i) Increase in temperature.

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(ii) Decrease in concentration.

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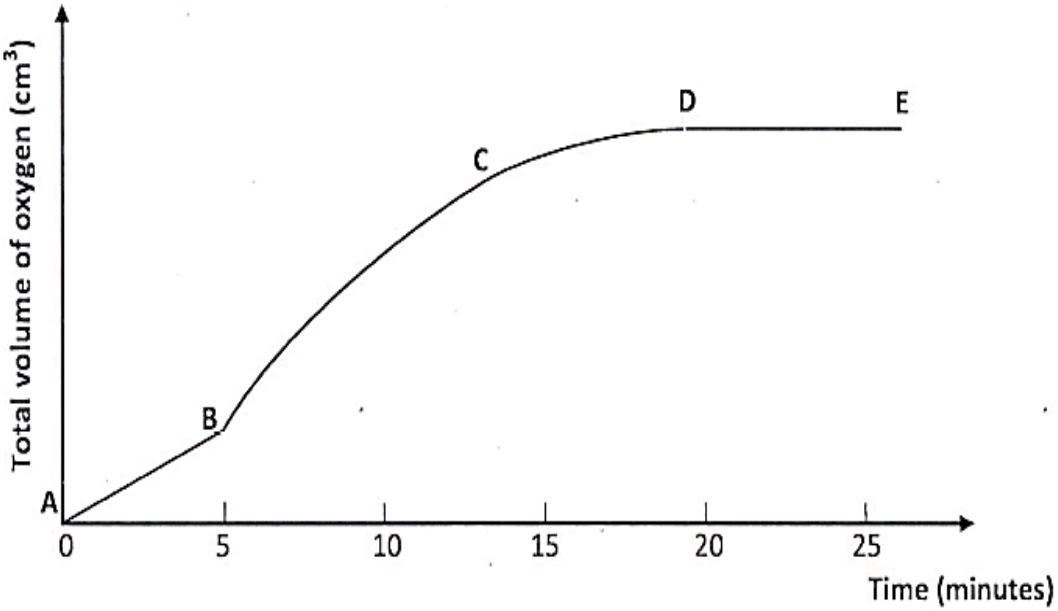
(c) A solution of hydrogen peroxide was allowed to decompose and the oxygen gas given off collected. After 5 minutes, substance G was added to the solution of hydrogen peroxide. The total volume of oxygen evolved was plotted against time as shown in the graph below



(i) Describe the procedure of determining the rate of the reaction at minute 12. (3 marks)

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(ii) How does the production of oxygen in region **AB** compare with that in region **BC**? Explain (2 marks)

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(d) i) State Lechatelier's principle. (1 mark)

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(ii) Bismuth chloride reacts with water according to the equation below.

$$BiCl_{3\,(aq)} + H_2O_{(l)} \rightleftharpoons BiOCl_{(s)} + 2HCl_{(aq)}$$

(White)

State and explain the observation made when a few drops potassium hydroxide are added to the system at equilibrium. (2 marks)

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5. (a) Write equations for the following reactions;

(i) Sodium metal reacts with pure ethanol. (1 mark)

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(ii) Ethanol and ethanoic acid reacts when equal volumes of the two substances are mixed together and warmed with a few drops of concentrated Sulphuric (VI) acid. (1 mark)

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(b) Explain the meaning of each of the following terms used in the soapy detergent manufacture.

(i) Saponification (1 mark)

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(ii) Salting out (1 mark)

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(c) (i) Write the general chemical formula of a soapless detergent. (1 mark)

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(ii) Explain briefly how soapless detergent removes grease particles during washing process (2 marks)

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(iii) State one advantage and one disadvantage of soapless detergent.

Advantage (1 mark)

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Disadvantage (1 mark)

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(d) The polymerization of tetrafloureoethene (C_2F_4) is similar to that of ethene (C_2H_4)

(i) What is meant by the term polymerization? (1 mark)

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(ii) Draw the structural formula of a portion of the polymer obtained from the monomer C_2F_4. (1 mark)

(e) State any two advantages that synthetic polymers have over natural polymers. (2 marks)

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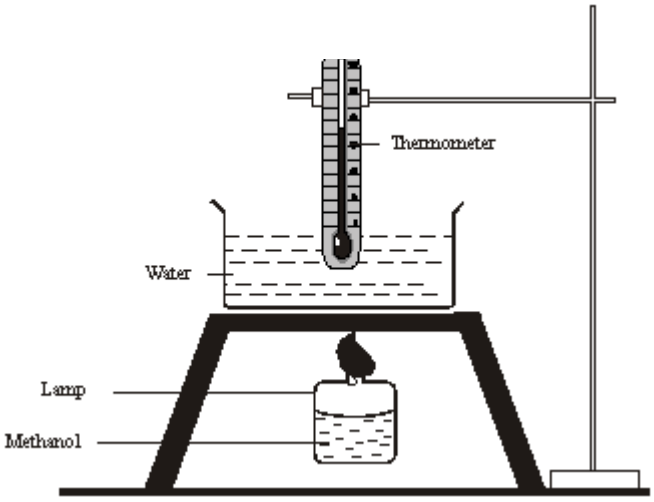
6. The diagram below represents a set-up to determine the molar heat of combustion of methanol.



(a) What do you understand by the term 'molar heat of combustion'? (1 mark)

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(b) During the experiment, the data given below was recorded.

Volume of water	$500cm^3$
Initial temperature of water	20^0C
Final temperature of water	27.0^0C
Initial mass of lamp + methanol	22.98g
Final mass of lamp + propanol	22.11g
Density of water	$1.0g/cm^3$
Specific heat capacity of water	4.2kJ/kg/K

C =12, H = 1, O = 16

(i) Calculate the temperature change. (1 mark)

(ii) Calculate the mass of methanol burnt? (1 mark)

(iii) Calculate the molar heat of combustion of methanol. (2 marks)

(c) Write down a thermochemical equation for the complete combustion of methanol. (1 mark)

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(d) Draw an energy level diagram for the reaction in this experiment. (2 marks)

(e) What is a heating value of a fuel? (1 mark)

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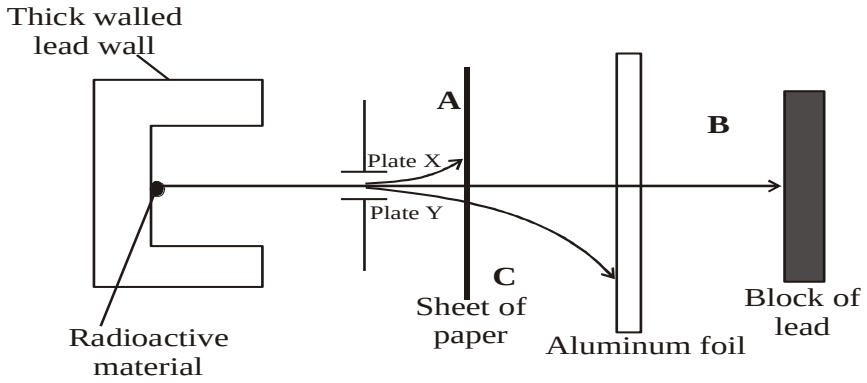
(f) Determine the heating value of methanol in this experiment. (1 mark)

7. (I)The diagram below shows some properties of the common radiation from radio isotopes. Study it and answer the questions that follow.



(a) Identify the charge on plate X. (1 mark)

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(b) Name the radiation represented by letter C. (1 mark)

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(c) State one application of the radiation represented by letter B. (1 mark)

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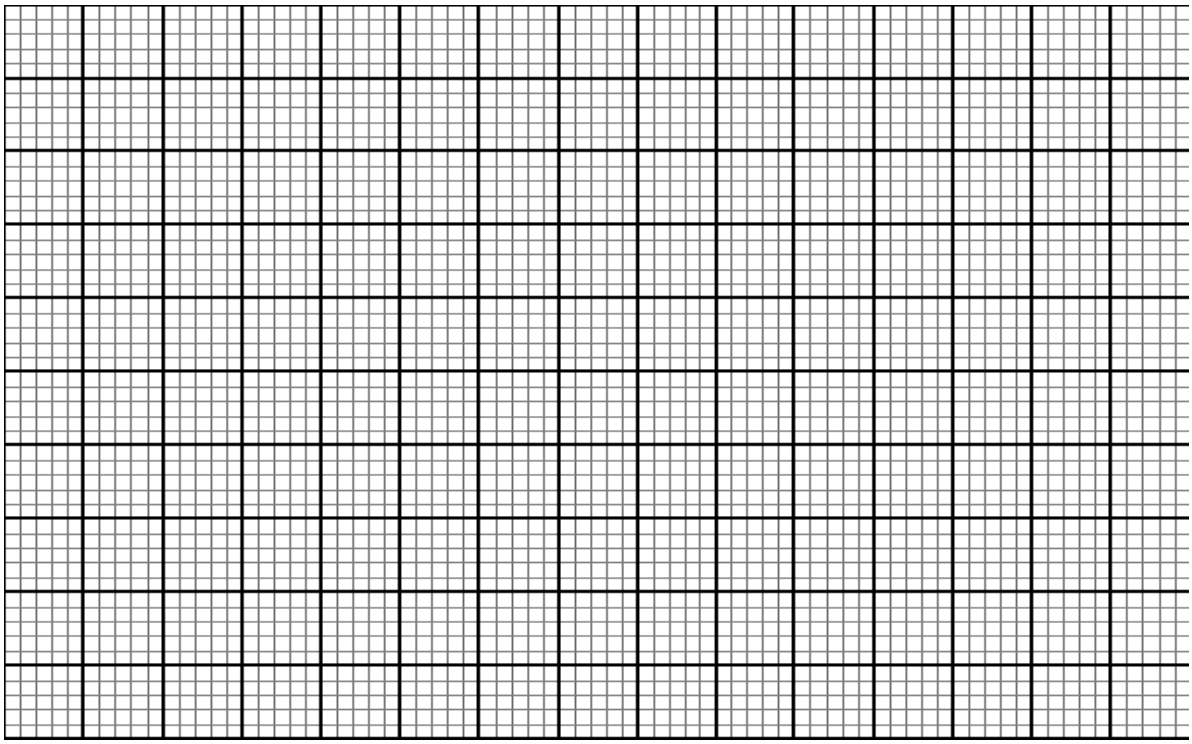
(II) The rate of radioactive decay (in counts per minute) of an isotope was measured at intervals over a number of days, the results were as shown in the table below.

Time (days)	0	1	2	3	4	5	6	7
Decay rate	1000	820	660	520	420	340	260	170

(a) On the grid provided below, draw a graph of decay rate against time. (3 marks)



(b) From the graph determine the half-life of the radioactive isotope. (1 marks)

(c) What would happen to the rate of decay of the isotope if temperature is increased? Explain your answer. (1 mark)

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