

KCSE 2023 PREDICTION CYCLES



CHEMISTRY PAPER 2



KCSE 2023 TOP PREREDICTION CYCLE 1-10

CLASS OF KCSE 2023 NOVEMBER

The set Comprises of 10 Prediction Cycles prepared by a panel of Top Writers from KNEC Nairobi HQ

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KENYA EDUCATORS CONSULTANCY

233/2

CHEMISTRY

PAPER 2

Time: 2 hours

**KCSE 2023 TOP PREDICTION MASTER
CYCLE 1**

Name

Index No.....

School

Candidate's Signature

Date

INSTRUCTIONS

- Write your name and the Index Number in the spaces provided above.
- Answer **ALL** the questions in the spaces provided after each question.
- Use of Mathematical sets and silent calculators may be used.
- All** working should be clearly shown.

FOR OFFICIAL USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATES SCORE
1	13	
2	11	
3	12	
4	12	
5	10	
6	12	
7	10	
TOTAL	80	

This paper consists of 12 printed pages.

Candidates should check to ensure that all pages are printed as indicated and no questions are missing.

1. a) The grid below represents part of a periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of elements.

S			R	E		X		
								V
Q	Z					M		
							T	

- i) Identify the most reactive non-metal (1mark)

.....

- ii) Which of the metal is the most reactive? Explain. (1mark)

.....

- iii) What name is given to the family of elements to which X and T belong? (1mark)

.....

- iv) Give reasons for the following
 Ionic radius of Q is smaller than that of M (1mark)

.....

- Atomic radius of Q is greater than that of S (1mark)

.....

- v) Give an element that does not form compounds under ideal conditions. Explain. (2marks)

.....
.....
vi) Give formula of compound formed between E and Z (1mark)

.....
b) Study the table below and answer the questions that follow.

Substance	A	B	C	D	E	F
Melting point (°C)	801	113 119	-39	5	-101	1356
Boiling point(°C)	1410	445	457	54	-36	2860
Electrical Conductivity (Solid)	Poor	Poor	Good	Poor	Poor	poor
Electrical Conductivity (Liquid)	Good	Poor	Good	Poor	Poor	Poor

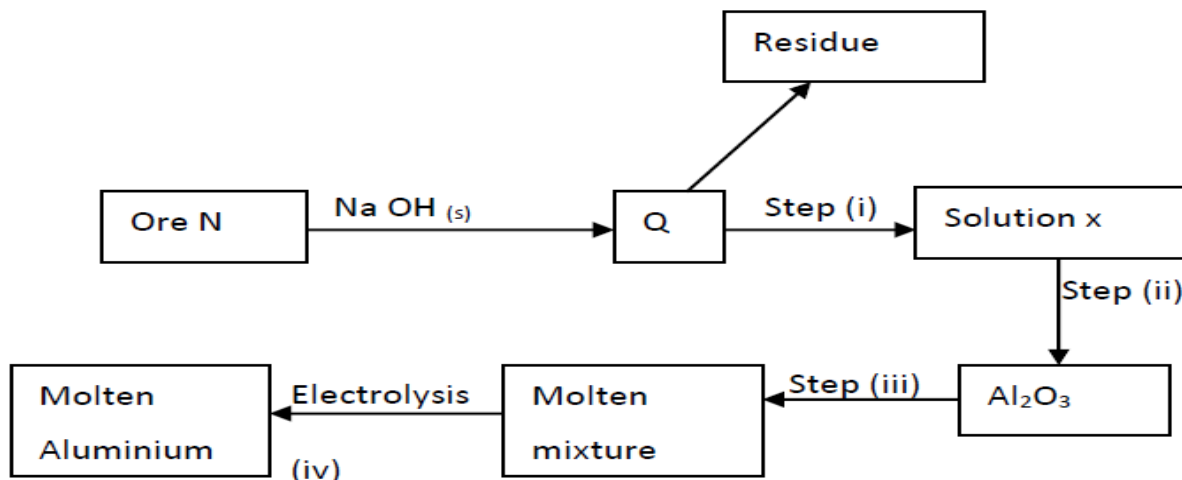
i) Identify a substance with:
a) Giant metallic structure (1mark)

.....
b) Has a molecular structure and exists in gaseous state at room temperature?
and pressure (1mark)

.....
ii) Suggest a reason why substance B has two melting points. (1mark)

.....
iii) Substances A and C conduct electric current in the liquid state. State how the two substances differ as conductors of electric current. (2marks)

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



a) Name ore N (1mark)

.....

b) Explain why the ore is first dissolved in excess sodium hydroxide solution. (1mark)

.....

c) Name the major compound present in the residue. (1mark)

.....

d) Give the formula of the aluminium compound present in solution (1mark)

.....

e) i) Explain how to obtain aluminium hydroxide from solution X (1mark)

.....

ii) Write equation for reaction that takes place in (e) above (1mark)

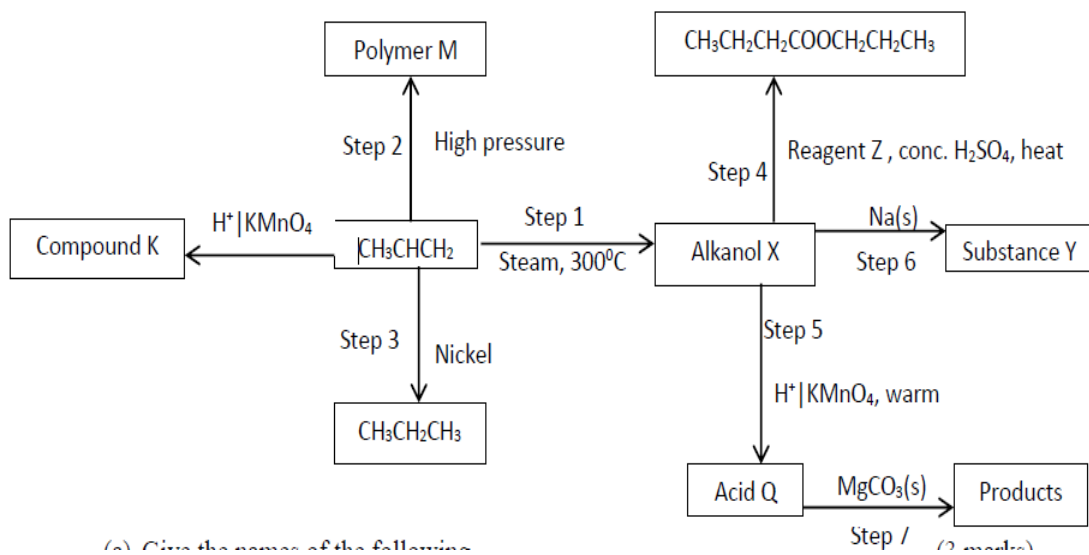
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iii) What is the role of cryolite in the extraction of aluminium. (1mark)

f) Aluminium is a good conductor of electricity. State two uses of aluminium based on this property. (2marks)

g) If sodium carbonate is added to aluminium nitrate solution, effervescence occurs. Explain. (2marks)

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



(a) Give the names of the following

a) Give the names of the following

i) Compound K

(1mark)

ii) Substance Y

(1mark)

iii) Product obtained in step 4

(1mark)

(b) Identify the **type of reaction** that takes place in step 1 and give one other condition necessary for the reaction other than the temperature indicated.

Type of reaction..... (1mark)

Condition..... (1mark)

c) Draw the structural formula of the following

i) Polymer M (1mark)

ii) Acid Q (1mark)

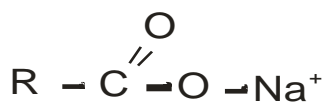
d) Give the **industrial application** for the reaction in step 3 (1mark)

e) Write chemical equations for the reactions in step 6 and step 7 . (2marks)

Step 6

Step 7

f) The following are structures of two cleansing agents.



In the table below, give one advantage and one disadvantage of each of them. (2marks)

Cleansing Agent	Advantage	Disadvantage
R-COO-Na⁺		
R-OSO₃-Na⁺		

4. The standard reduction potentials for five half cells are shown in the table **below**. Study it and answer the questions that follow. (The letters do not represent the actual symbol of elements).

Elements	E^0 (Volts)
(i) $A_{2(aq)} + 2e^- \rightarrow 2A_{(aq)}^-$	+1.09
(ii) $Q_{(aq)}^{2+} + 2e^- \rightarrow Q_{(s)}$	-0.13
(iii) $R_{(aq)}^{2+} + 2e^- \rightarrow R_{(s)}$	-2.37
(iv) $Y_{(aq)}^{2+} + 2e^- \rightarrow Y_{(s)}$	+0.34
(v) $2S_{(aq)}^+ + 2e^- \rightarrow S_{2(s)}$	0.00

I (a) With a reason, identify the strongest reducing agent. (1mark)

.....

(b) Which half-cell is likely to be hydrogen? (1mark)

.....

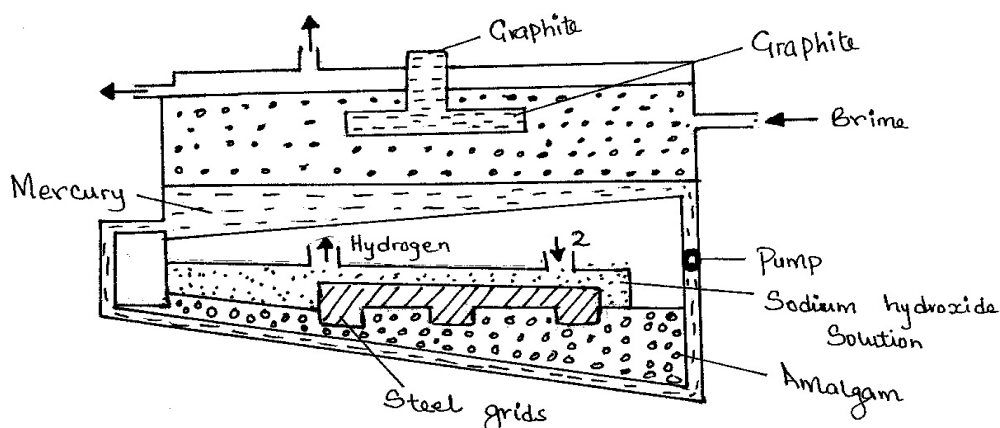
(c) Write an equation for the reaction between two half cells in (ii) and (IV). (1mark)

.....

(d) Calculate the e.m.f of the cell in (c) above. (2mark)

.....

II The diagram **below** represents a mercury cell that can be used in the industrial manufacture of sodium hydroxide. Study it and answer the questions that follow:-



(a) Name:
 (i) Raw material introduced at 2. (½ mark)

.....
 ii) Another substance that can be used in the cell instead of graphite. (½ mark)

.....
 (b) Identify the by-product that comes out at I. (1 mark)

.....
 (c) Write an equation for the reaction: -

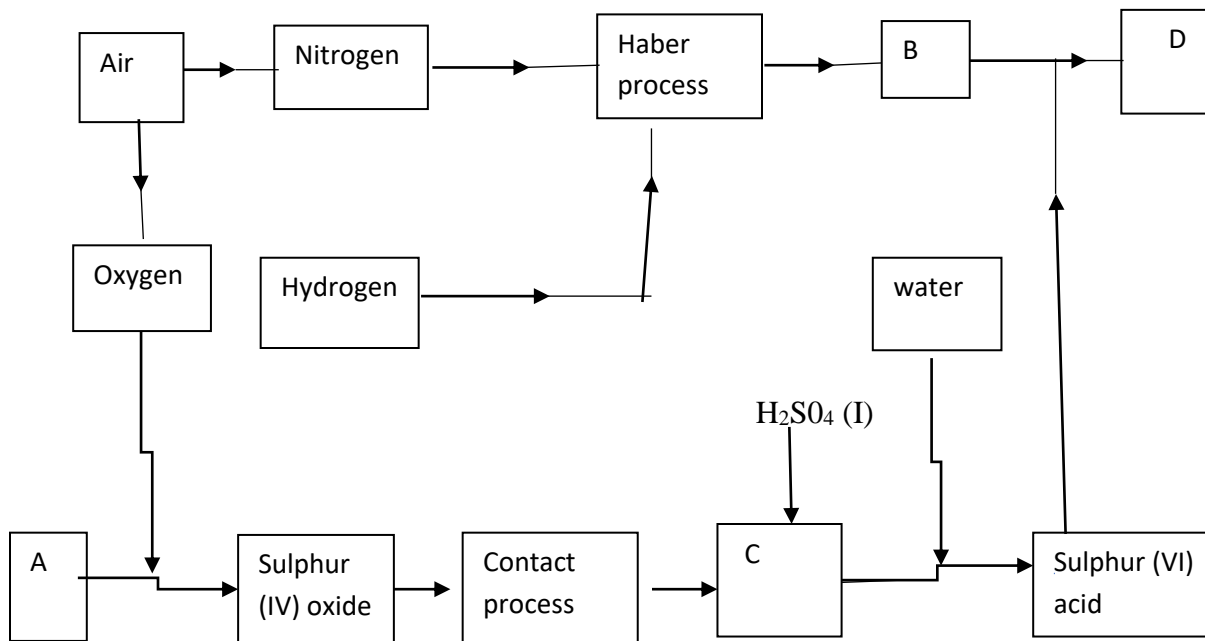
(i) That occurred at the anode. (1 mark)

.....
 (ii) In which sodium hydroxide was produced. (1 mark)

.....
 (d) Give **two** reasons why mercury is recycled. (2 marks)

.....
 (e) State one use of sodium hydroxide (1 mark)

5. The flow chart below illustrates two industrial processes. Harber process and the contact process.



(a). Name the process of obtaining nitrogen from atmospheric air. (1mark)

.....

(b). List TWO sources of obtaining large volumes of hydrogen for industrial use.

(i) (1mark)

(ii) (1mark)

(c) Write equation for Haber process. (1mark)

.....

(d) Name the catalysts for: (1mark)

(i) Haber process

.....

(ii) Contact process

.....

(e) Identify substances: (1mark)

(i) D.....

(ii) C

(f) Give ONE major use of compound D (1mark)

.....

(g) Write an equation for dilution of C with water. (1mark)

.....

h) A farmer has three plots each measuring 0.25 acres. He applied nitrogenous fertilizers as follows.

-plot A 250 kg of ammonium phosphate

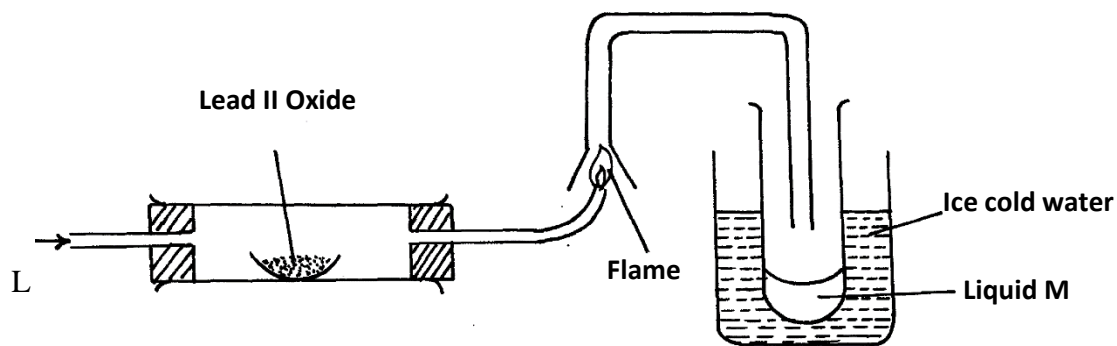
-plot B 250 kg of urea $\text{CO}(\text{NH}_2)_2$

- Plot C 250kg of ammonium nitrate

Which plot received the highest nitrogen content? (3marks)

H = 1, N = 14, O = 16. P = 31, C = 12.

6. Study the diagram below and answer the questions which follow.



(i) State **two** observations made when hydrogen gas pass over hot Lead (II) oxide. (2marks)

.....

(ii) Write the equation for the reaction which occurs in the combustion tube. (1mark)

.....

(iii) What property of hydrogen is shown in the experiment above. (1mark)

.....

(iv) Identify liquid M and describe the test for its purity (2marks)

.....

(v) What would be observed if MgO was used instead of Lead II Oxide: Explain (2marks)

.....

(vi) What is the colour of the flame (1mark)

.....

(vii) Write a chemical equation of the reaction producing the flame. (1mark)

.....

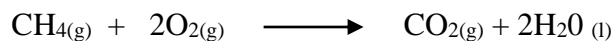
(vii) Apart from hydrogen peroxide, state **two** other reagents that can be used to prepare oxygen gas. (1mark)

.....

(viii) Write an equation to show how hydrogen gas is formed from the reagents chosen in (vii) above. (1mark)

.....

7.I. Use the data below to calculate the enthalpy change for the reaction below



(3marks)

<u>Bond</u>	<u>Energy (KJ)</u>
C – H	314
O = O	296
C = O	149
H – O	283

II. Given the following Standard Molar enthalpies of combustion. Calculate the standard heat of formation of butane (C₄H₈). (3marks)

$$\Delta H_c^\theta \text{ Carbon (Graphite)} = -393.5 \text{ KJ/mol}$$

$$\Delta H_c^\theta \text{ Hydrogen} = 285.8 \text{ KJ/mol}$$

$$\Delta H_c^\theta \text{ butene} = -2877 \text{ KJ/mol}$$

III. Use the following information to answer the questions that follow

$$\Delta H_{\text{lattice}} \text{ MgCl}_2 = -2489 \text{ kJ/ mol}^{-1}$$

$$\Delta H_{\text{hydration}} \text{ Mg}^{2+} = -1891 \text{ kJ/ mol}$$

$$\Delta H_{\text{hydration}} \text{ Cl}^- = -384 \text{ kJ/ mol}$$

b) Using energy level diagram calculate the molar heat of solution of magnesium chloride. (4marks)

Name..... Adm No.....

Signature..... Date.....

233/2-

CHEMISTRY

PAPER 2

FORM FOUR

2 HOURS

KCSE TOP PREDICTION MASTER CYCLE 2

Instructions to candidates.

- Write your name and adm number in the spaces provided above.
- Sign and write the date of examination in the spaces provided above.
- Answer **All** the questions in the spaces provided.
- KNEC mathematical tables and silent non-programmable electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.
- All answers should be written in the spaces provided.
- This paper consists of 12 printed pages.**
- Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
- Candidates should answer all the questions in English.

For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1	13	
2	12	
3	15	
4	12	
5	8	
6	10	
7	10	
Total Score	80	

1. (a) The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

				Q			
O						R	S
T							U
V							Z

i. Which element will require the least amount of energy to remove one of the outermost electrons? (1mk)

.....

ii. Select the most reactive non-metal. (1mk)

.....

iii. Which of the elements has the greatest tendency of forming covalent compounds? Explain (2mks)

.....

What name is given to the family of elements to which elements **O**, **T** and **B** belong?(1mk)

.....

iv. An element **W** has atomic number 15.m indicate the position of **W** on the grid. (1mk)

.....

v. Explain why the atomic radius of **S** is smaller than that of **R**. (2mks)

.....

vi. Explain why the atomic radius of **Z** is smaller than its ionic radius. (1mk)

.....

(b) Study the information given in the table below and answer question that follow.

Formula of compound	NaCl	MgCl ₂	AlCl ₃	SiCl ₄	PCl ₅	SCl ₂
Boiling point °C	1470	1420	Sublimes at 180°C	60	75	60
Melting point °C	800	710		-70	-90	-80

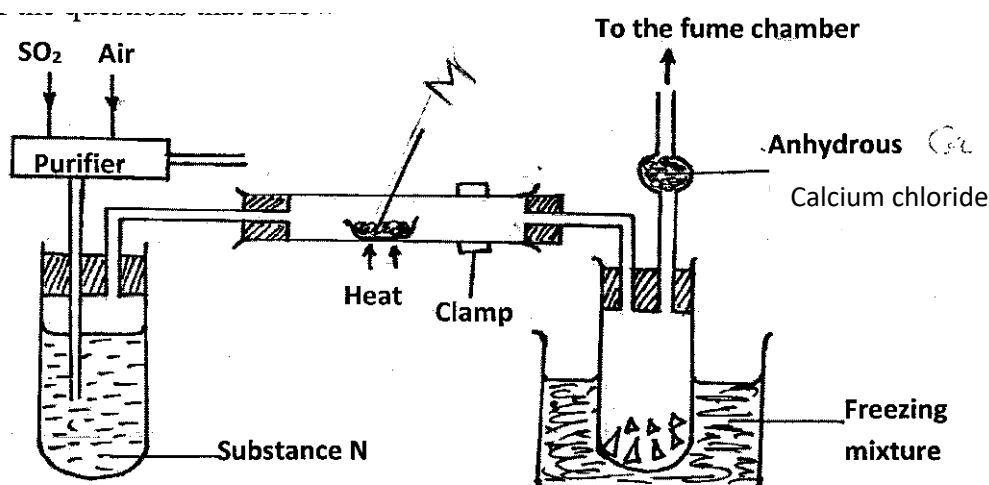
i. Give **two** chlorides that are liquids at room temperature. Give a reason for your answer. (2mks)

.....
.....
.....

ii. Give a possible reason why AlCl₃ has much lower boiling point MgCl₂ although both Aluminium and Magnesium are metals. (2mks)

.....
.....
.....

2. The figure below represents a set up that can be used to prepare sulphur (VI) oxide. Study it and answer the questions that follow.



a. Name substance **M** and **N** (1mk)
M.....

N.....

b. State the function of substance **N**. (1mk)

.....

c. Given that the equation for the reaction that occurs is
 $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{SO}_{3(g)} \Delta H = -197\text{kJ}$
What information about the reaction is provided by $\Delta H = -197\text{kJ}$? (1mk)

d. Give the name of the method of gas collection shown above. (1mk)

.....

e. What is the advantage of using calcium oxide instead of anhydrous calcium chloride in the experiment above? (1mk)

.....

II. Concentrated sulphuric (VI) acid is manufactured in large scale through contact process
i. Identify **two** substances that are recycled during contact process. (1mk)

.....
.....

ii. Why is recycling necessary? Give **two** reasons (1mk)

.....
.....

(b)(i) Sulphur (IV) oxide gas is removed by scrubbing in the contact process. What is meant by scrubbing? (1mk)

.....

(ii) Write an equation showing how sulphur (IV) oxide is scrubbed. (1mk)

- (c) Explain why sulphur (VI) oxide is dissolved in concentrated sulphuric (VI) acid and not in water during contact process. (1mk)

.....

- III. Given that a concentrated solution of sulphuric (VI) acid is 18.2M, determine the volume of the concentrated sulphuric (VI) acid that can be mixed with distilled water to make one litre of 2M sulphuric (VI) acid solution. (2mks)

3. Use the standard electrode potential for the elements A, B, C and D given below to answer the questions that follow. The letters do not represent the actual symbols of the elements.

	E^θ (volts)
$A^{+2}_{(aq)} + 2e^- \longrightarrow A_{(s)}$	-0.76
$B^{+2}_{(aq)} + 2e^- \longrightarrow B_{(s)}$	-0.44
$C_{2(g)} + 2e^- \longrightarrow 2C^-_{(aq)}$	+0.54
$D^{+4}_{(aq)} + e^- \longrightarrow D^{+3}_{(aq)}$	+1.61

- a. Which element is the:
- i. Strongest oxidizing agent. (1mk)

 - ii. Strongest reducing agent (1mk)

- b. (i) Draw a labeled diagram of the electro chemical cell that would be obtained when half cell of element A and B are combined.

(ii) Calculate the E^θ value of the electrochemical cell constructed in 3b (i) above (1mk)

(iii) Which **two** elements if used together in a cell would produce the largest e.m.f. (1mk)

.....

.....

c. Calculate the number of faradays required to completely reduce 0.1 mole of Fe^{+3} to Fe (2mks)

d. One of the major application of electrolysis is electroplating. In chromium plating the steel article is usually plated first with nickel or copper then chromium in a plating both which contain chromium compounds in sulphuric (VI) acid water. Chromium deposits on the article.

i. Give a reason why steel parts are chromium plated. (1mk)

.....

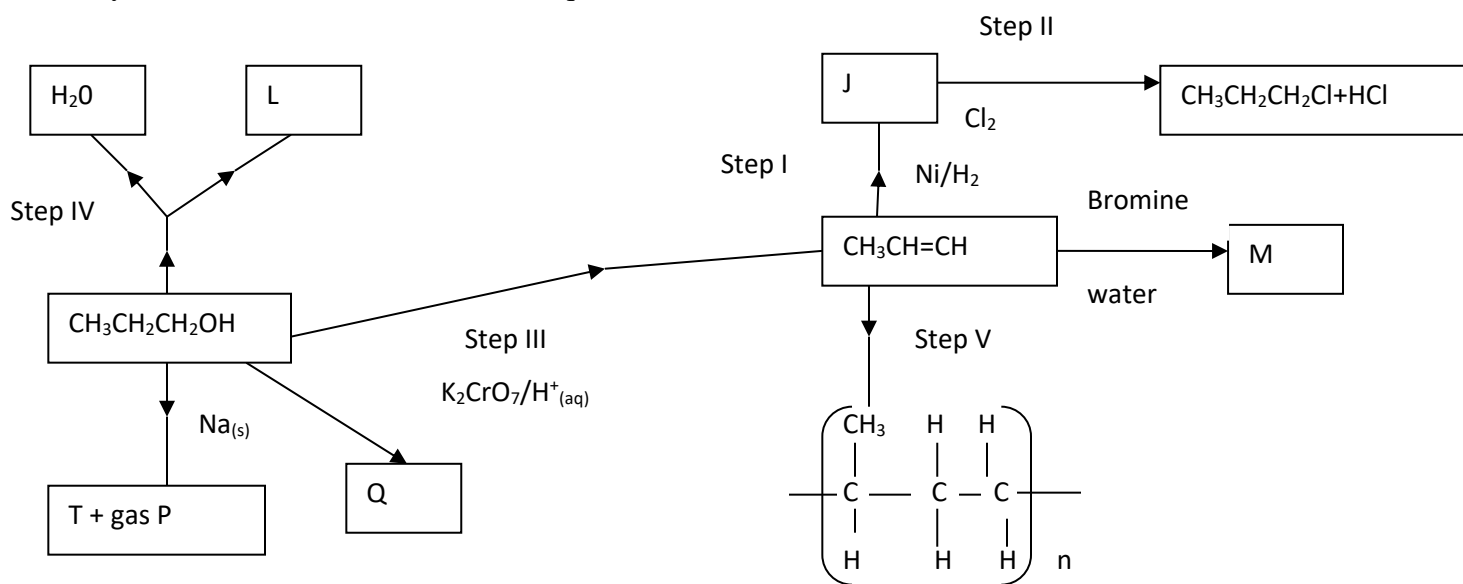
ii. Why is it necessary for the steel to be mated first with nickel or copper before chromium is applied. (1mk)

.....

iii. Give an ionic equation for the process responsible for chromium plating. (1mk)

- iv. If an electrical current of 4.5 amperes is passed through the chromium plating for 20 hours, what would be the mass of steel article? (Cr=52.0, 1 faraday = 96,500 coulombs) (3mks)
(Oxidation state of chromium = +2)

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



- a. Name substance J and draw its structural formula. (2mks)

Name

Structural formula.....

b. What reagent and conditions are necessary for: (2mks)

- (I) Step
III.....
Reagent.....
Condition.....
- (II) Step II.....
Condition.....

c. Name the following

- i. L(1mk)
- ii. Gas P..... (1mk)
- iii. Q(1mk)
- iv. M(1mk)

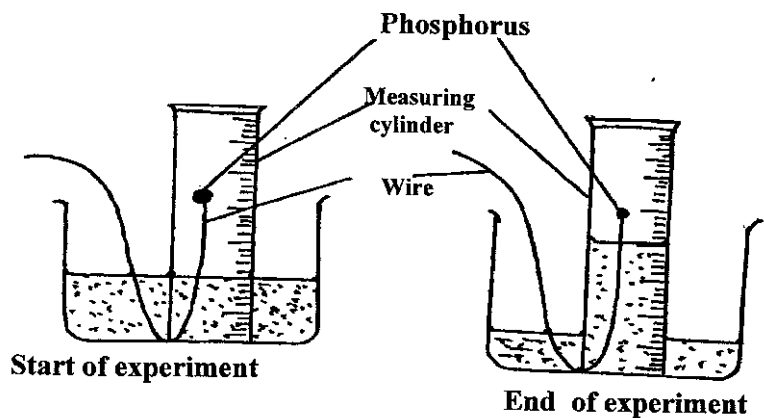
d. Write the equation of the reaction that occur in step P (1mk)

e. Give the name of process in step V (1mk)

.....
.....

f. If the relative molecular mass of R is 21,000. Determine the value of n (C=12.0, H =1.0) (2mks)

5. A student set up the apparatus shown below in order to determine the percentage by volume of oxygen in the air. Study it and answer the questions that follow.



a. (i) State one observation made in the measuring cylinder at the start of the experiment. Explain (2mks)

.....

.....

(ii) The pH of the contents of the beaker at the end of the experiment was found to be 4. Explain the observation (2mks)

.....

.....

(iii) The volume of air in the measuring cylinder at the end of the experiment was measured study the data given below and answer the questions that follow.

Volume of air at start of the experiment = 36.65cm^3

Volume of air at the end of the experiment = 24.28cm^3

Determine the percentage volume of oxygen in the air (1mk)

b. State and explain the observation made when a mixture of magnesium powder and copper (II) oxide is heated in a crucible. (2mks)

.....
.....

c. State **two** air pollutants produced by motor vehicles. (1mk)

.....
.....

6. (a) The results below were obtained in an experiment conducted by form 3 students from Ratansi secondary school using magnesium.

Mass of the crucible + Lid =19.52g

Mass of the crucible + Lid + Magnesium ribbon =20.36g

Mass of the crucible + Lid + magnesium oxide = 20.92g

(i) Use the results to find the percentage mass of magnesium and oxygen in magnesium oxide. (2mks)

(ii) Determine the empirical formula of magnesium oxide. (Mg=24, O= 16.0)

(b) Sodium hydroxide pellet were accidentally mixed with sodium chloride, 8.8g of the mixture were dissolved in water to make one litre of solution. 50cm³ of the solution was neutralized by 20.0cm³ and 0.25M sulphuric (VI) acid

i. Write an equation for the reaction that took place. (1mk)

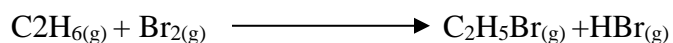
ii. Calculate the:

I. Number of moles of the substance that reacted with sulphuric (VI) acid. (2mks)

II. Number of moles of the substance that would react with sulphuric (VI) acid in the one litre solution. (1mk)

iii. The percentage of sodium chloride in the mixture. (2mks)

7. (a) Use the bond energies given in the table below to calculate the enthalpy change for the reaction. (2mks)



Bond	C – H	C - Br	Br – Br	H- Br
Bond energy KJ/mol	413	280	193	635

(b) On the space provided below, sketch the cooling curve that would be obtained when a boiling tube containing water at 80°C is immersed in a freezing mixture maintained at 10°C. (2mks)

- (c) Butane C_4H_{10} cannot be prepared directly from its elements but its standard heat of formation (ΔH_f^θ) can be obtained indirectly.

The following heats of combustion are given.

$$\Delta H_c^\theta (\text{Carbon}) = -393\text{kJ/mol}$$

$$\Delta H_c^\theta (\text{Hydrogen}) = -286\text{kJ/mol}$$

$$\Delta H_c^\theta (\text{Butane}) = -2877\text{kJ/mol}$$

- (i) Draw an energy cycle diagram linking the heat of formation of butane with its heat of combustion and the heat of combustion of its constituents elements. *(2mks)*

- (ii) Calculate the heat of formation of butane ΔH_f^θ (C_4H_{10}) *(2mks)*

- (d) Given that the lattice enthalpy of potassium chloride is $+690\text{kJ/mol}$ and hydration enthalpies of K^+ and Cl^- are -322kJ and -364kJ respectively. Calculate the enthalpy of solution of potassium chloride. *(2mks)*

NAME.....ADM NO.....

SCHOOL.....CANDIDATES SIGN

DATE.....

CLASS.....

233/2

CHEMISTRY PAPER 2

TIME: 2 HOURS

KCSE TOP PREDICTION MASTER CYCLE 3

INSTRUCTIONS TO CANDIDATES

1. Write your name, admission number in the space provided.
2. Answer all the questions in the spaces provided.
3. Mathematical tables and scientific calculators may be used.
4. All working must be clearly shown where necessary.
5. Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.

FOR EXAMINERS USE ONLY

QUESTION	MARKS	CANDIDATES SCORE
1	13	
2	11	
3	12	
4	10	
5	11	
6	12	
7	11	
TOTAL	80 MARKS	

1. The table below shows some elements in the periodic table. Use it to answer the questions that follow. The letters are not the actual symbols of the elements.

								F
A	G			E		B		D
C								

a) i) Show the electron arrangement of ions of elements:

A (1/2mk)

.....

B (1/2mk)

.....

ii) Using dots (.) and crosses (x) to represent electrons draw a diagram to show how elements C and oxygen combine to form a compound. (O = 8) (1mk)

b) Show on the grid above an element Y whose ion Y^{2-} has an electron configuration of 2.8.8. (1mk)

c) Compare the following with explanation.

i) The reactivity of A and C. (2mks)

.....

.....

.....

.....

ii) Atomic radii of elements A and B. (2mks)

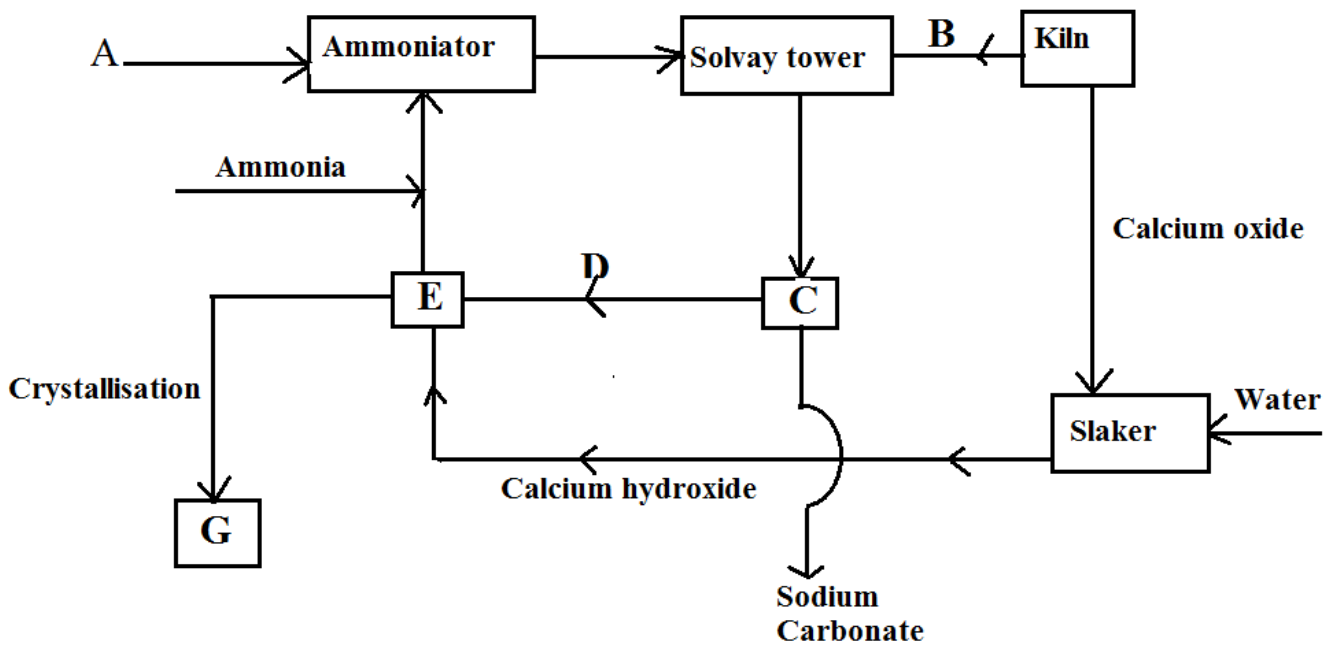
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.....
.....
.....
iii) The melting point of the oxide of element G and the oxide of D. (2mks)

.....
.....
.....
d) Name the type of bond formed when E and D react. Explain your answer. (2mks)

.....
.....
.....
e) The ionic radius of element E is bigger than its atomic radius. Explain. (2mks)

.....
.....
2. The following diagram below shows a series of steps followed in the manufacture of sodium carbonate.



a) Name substances A and B (2mks)

A.....

B.....

b) Write equations for the reactions taking place in:

i) The solvay tower. (2mks)

.....
.....

ii) Chamber E. (1mk)

.....
.....

c) i) Identify substance G. (1mk)

.....
.....

ii) State one laboratory use and one industrial use of substance G.

I. Laboratory use (1mk)

.....
.....

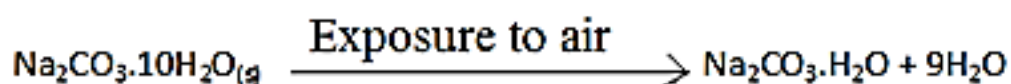
II. Industrial use (1mk)

.....
.....

d) Name one most important industry where sodium carbonate is used as a raw material. (1mk)

.....
.....

e) The reaction equation below represents a chemical change that occurs when hydrated sodium carbonate is exposed to the air for 24 hrs.



i) Give the name of the chemical change represented by the above equation. (1mk)

.....
ii) What observable change is accompanied by the above reaction? (1mk)

.....
.....

3. a) Draw the structures of the following compounds. (2mks)

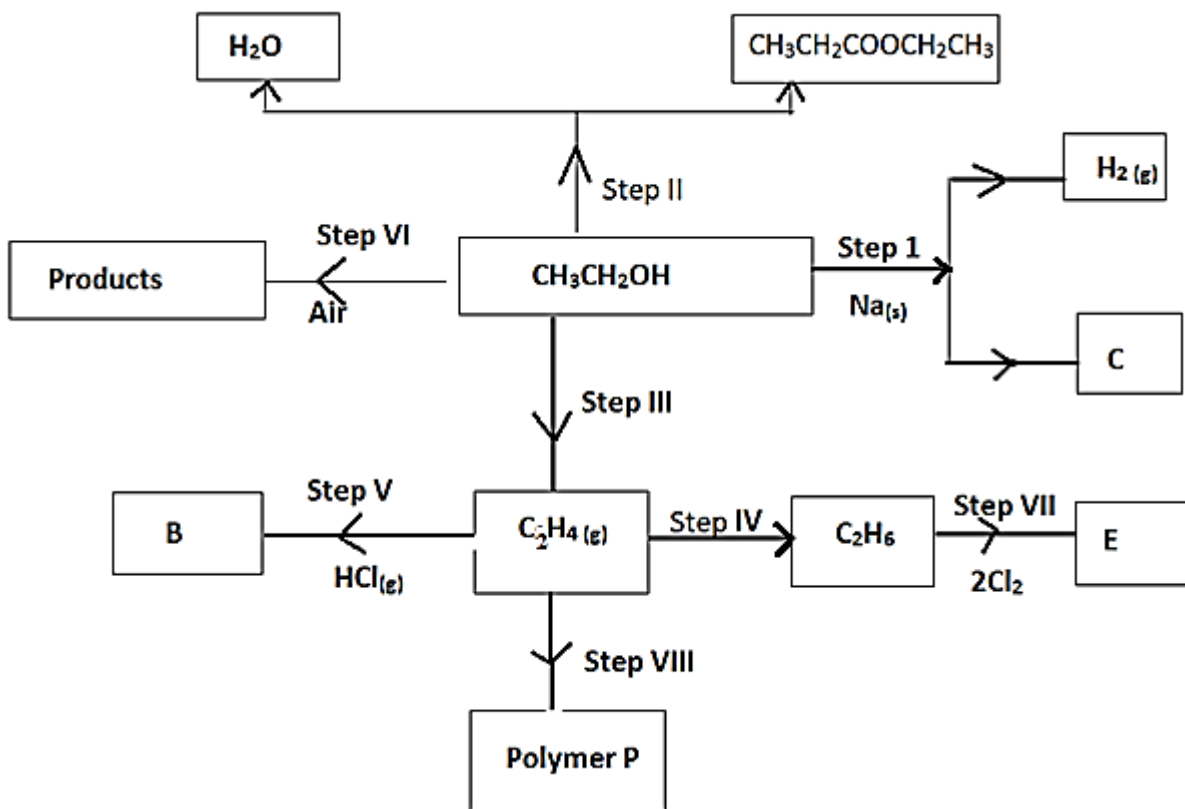
i) 2 – methylbut-2-ene

ii) heptanoic acid

b) Describe a physical test that can be used to distinguish between methanol and hexanol. (2mks)

.....
.....
.....

c) Use the flow chart below to answer the questions that follow.



i) Name:

I. The type of reaction that occurs in step VII.

(1mk)

II. Substance B

ii) What conditions and reagents are necessary to convert $\text{CH}_3\text{CH}_2\text{OH}$ to $\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3$ in step II

Conditions

(1mk)

Reagent

(1mk)

iii) Give the formula and name of substance C.

(1mk)

iv) Give the reagent and conditions necessary for the reaction in step IV.

(2mks)

.....
.....
.....
.....
v) i) Draw and name the structure of polymer P.

(1mk)

ii) Name one use of the polymer P.

(1mk)

.....
4. a) Two reagents that can be used to prepare chlorine gas are manganese (IV)oxide and concentrated hydrochloric acid.

i) Write an equation for the reaction.

(1mk)

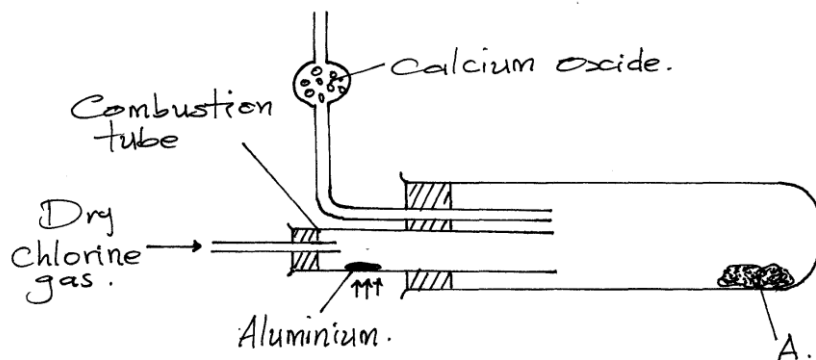
.....
.....
ii) Give the formula of another reagent that can be reacted with concentrated hydrochloric acid to produce chlorine gas.

(1mk)

.....
.....
iii) Describe how the chlorine gas could be dried in the laboratory.

(1mk)

.....
.....
b) In an experiment dry chlorine gas was reacted with aluminum as shown in the diagram below.



i) Name substance A. (1mk)

.....

ii) Write an equation for the reaction that took place in the combustion tube. (1mk)

.....

.....

iii) 0.84g of aluminium reacted completely with chlorine gas. Calculate the volume of chlorine gas used. (3mks)

(Molar gas volume is $24\text{dm}^3 \text{ Al} = 27$).

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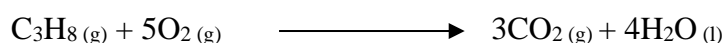
iv) Give two reasons why calcium oxide is used in the set-up. (2mks)

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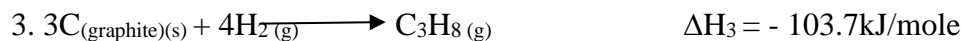
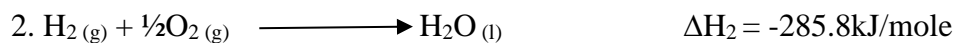
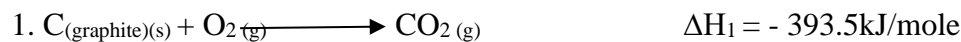
5. The combustion of propane can be represented by the following equation:



a) i) Define the term 'molar enthalpy of combustion' of a compound. (1mk)

.....

.....
.....
ii) Use the thermo chemical equations below to answer the questions that follow.



I. Name the type of enthalpy change represented by ΔH_3 . (1mk)

.....
.....

II. Draw an energy level diagram for the reaction represented by equation 1. (3mks)

iii) Using energy cycle diagram, calculate the molar enthalpy of combustion of propane. (3mks)

.....
.....
.....
.....

b) The enthalpy of formation of ethanol (CH_3CH_2OH) is -3239Kj/mole . Use the bond energies given below to calculate the bond energy of formation of O-H. (3mks)

C-C = -346kJ/mole

C-H = -414kJ/mole

C-O = -360kJ/mole

.....

.....

 6. Equal volumes of dilute sulphuric (vi) acid of various concentrations were placed in five test tubes. 0.26g of zinc granules was used in each experiment and time taken for each experiment to be completed noted. The table below shows the results obtained.

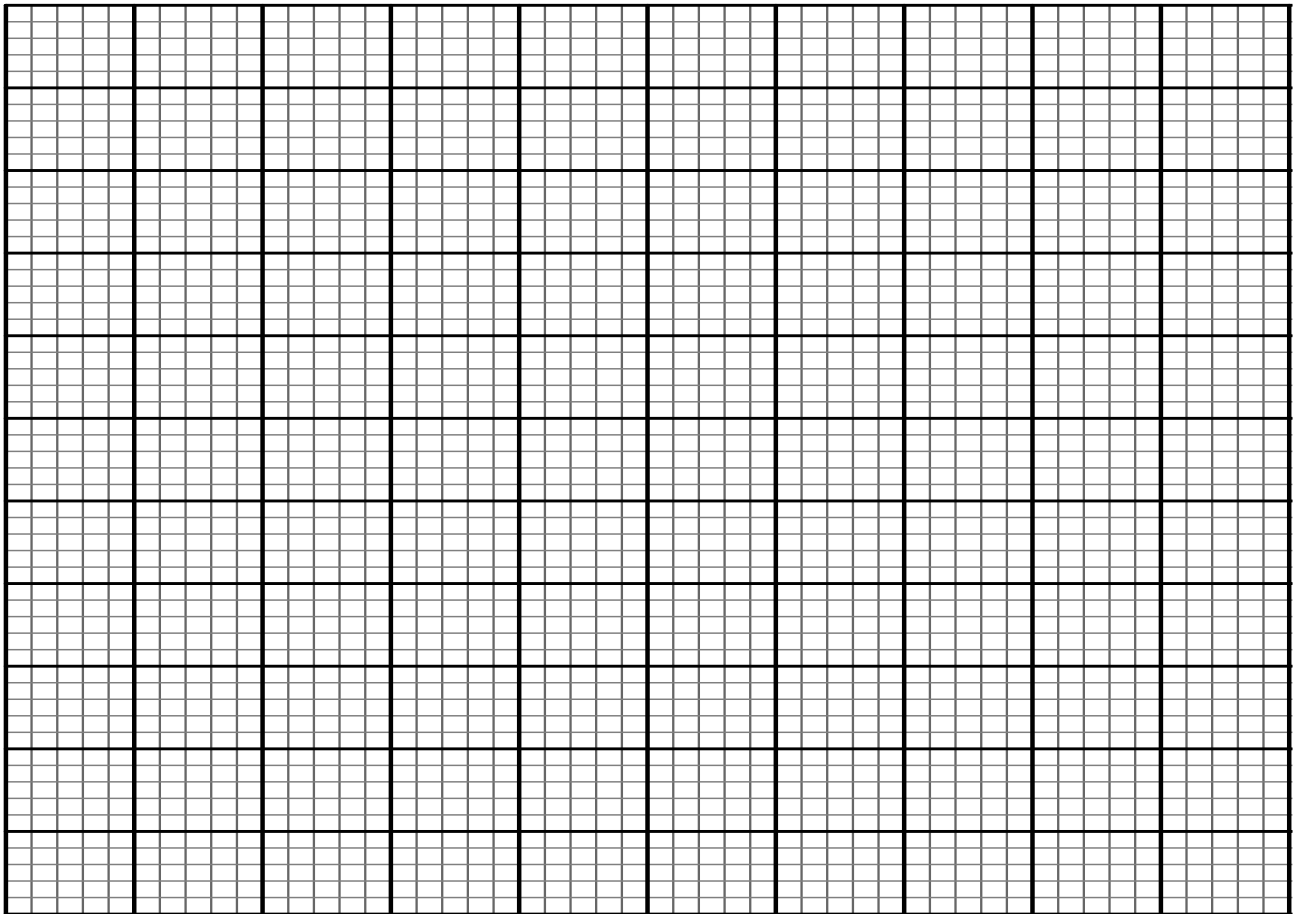
Acid concentration	0.25M	1.5M	1.6M	2.6M	3.5M
Time in sec	500	250	67.5	40	30
$\frac{1}{\text{time}(s^{-1})}$					

a) i) Complete the table above by calculating $\frac{1}{\text{time}}$

(2mks)

ii) Using the grid provided plot a graph of $\frac{1}{\text{time}(s^{-1})}$ against concentration of the acid.

(3mks)



iii) Using the graph determine the rate of reaction when the concentration is 1.5M. *(1mk)*

iv) Briefly explain the relationship between the rate of reaction and concentration. *(2mks)*

.....

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.....

v) Identify any other condition if carried would increase the rate of reaction between Zinc and Dilute sulphuric (vi) acid. *(1mk)*

.....

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.....

b) What volume of hydrogen gas is evolved when all the zinc is reacted with excess dilute sulphuric (vi) acid. (Zn = 65.4, molar gas volume = 22.4 litres) (3mks)

.....

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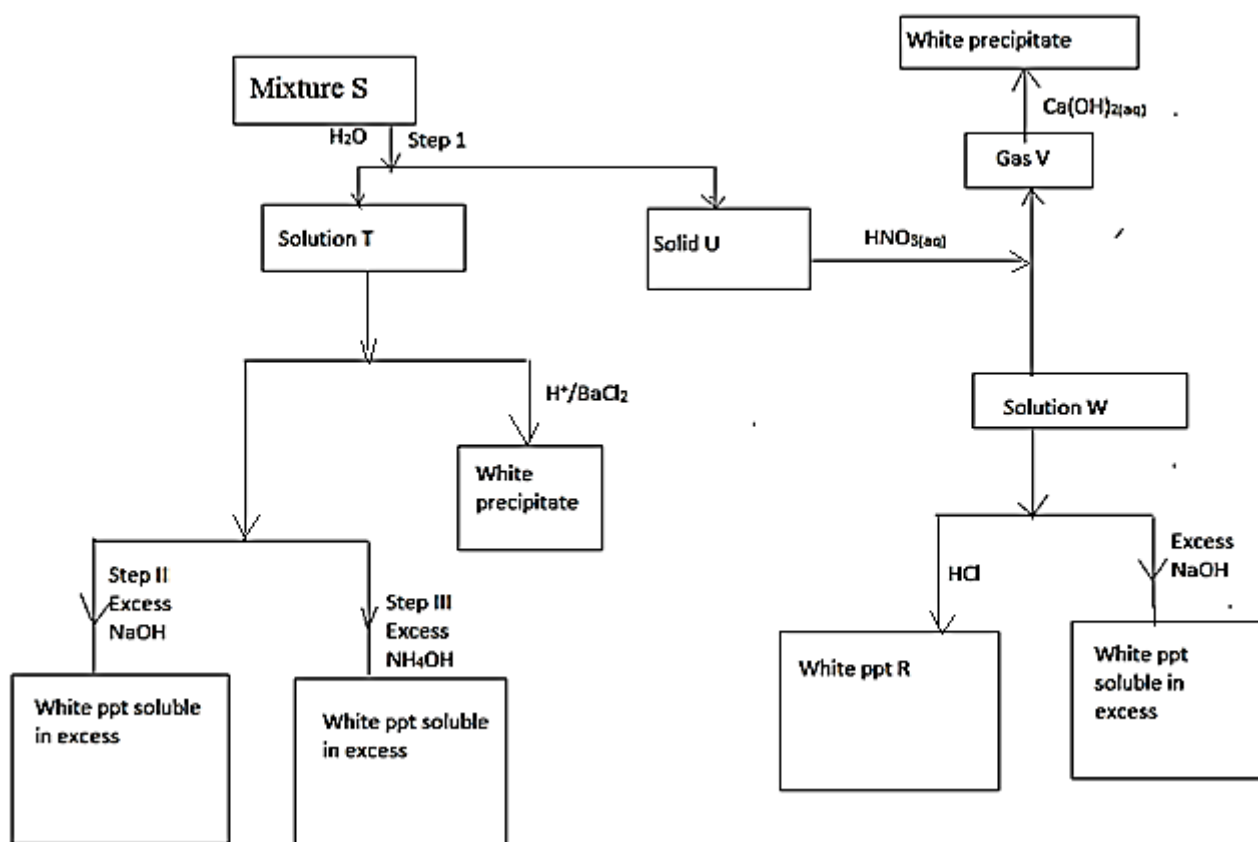
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7. Study the scheme below and answer the questions that follow.



p

a) What property of mixture S is shown in step 1. (1mk)

.....

.....

b) Name the following. (1mk)

i) Solid U

.....

.....

ii) Solid V

.....

c) Write the formula of precipitate R. (1mk)

.....

.....

d) Identify the ions present in solution T. (1mk)

.....

.....

e) Write an ionic equation for the reaction between solution T and Barium chloride solution. (1mk)

.....

.....

.....

f) Identify mixture S. (1mk)

.....

g) i) Write a chemical equation for the reaction in which the white precipitate dissolves in excess reagent in Step II. (1mk)

.....

.....

iii) Name the complex ion formed in Step III. (1mk)

.....

.....

h) Starting with lead (II) oxide, describe how a pure sample of lead (II) sulphate can be prepared in the laboratory. (3mks)

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Name.....Adm No.....

Class..... Date.....

CHEMISTRY

233/2

Paper 2

KCSE TOP PREDICTION MASTER CYCLE 4

INSTRUCTIONS TO CANDIDATES:

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

For Examiners Use Only

Question	Maximum score	Candidate's score
1	13	
2	13	
3	12	
4	09	
5	13	
6	10	
7	10	
Total	80	

This paper consists of 10 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

1. (a) The grid below show part of the periodic table.(The letter do not represent the actual Symbols. Use it to answer the questions that follow.

T								Q
				S		R	K	
A	J		Y		U		L	
W							M	B
	C						N	
P								

- (i)Select the most reactive non-metal. (1mk)

.....

- (ii)Select an elements that forms a divalent cation. (1mk)

.....

- (iii)Element **Z** has atomic number 14.Show its position in the grid. (1mk)

.....

- (iv)How do the atomic radii of **U** and **J** compare? (2mks)

.....

- (v)How do electrical conductivity of **A** and **Y** compare? (2mks)

.....

- (vi)How does the boiling point of elements **K**, **L** and **M** vary? Explain (2mks)

.....

- (b) The table below gives information on four elements by letters V, X, E and G. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	Electron arrangement	Atomic radius	Ionic radius

V	2:8:2	0.136	0.065
X	2:8:7	0.099	0.181
E	2:8:8:1	0.203	0.133
G	2:8:8:2	0.174	0.099

(a) Which two elements have similar properties? Explain. (2mks)

.....

(b) Which element is a non-metal? Explain. (1mk)

.....

(c) Which one of the elements is the strongest reducing agent. (1mk)

.....

2. (a) Petrol is a mixture of several alkane molecules ranging from pentane (C₅H₁₂) to decane (C₁₀H₂₂). Name the process by which petrol is obtained from crude oil. (1mk)

.....

(b) A decane molecule derived from petrol is cracked into hydrocarbon with equal number of carbon atoms in each molecule.

(i) What is cracking? (1mk)

.....

(ii) State **two** conditions necessary for the above process. (2mks)

.....

(iii) Write an equation for the cracking of decane molecule. (1mk)

.....

(iv) Draw and name **two** isomers of molecule with lower molecular mass obtained from cracking of decane as shown in b(iii) above. (2mks)

.....
 (v) How would you distinguish the products formed by cracking as shown in b(iii) in the laboratory. (2mks)

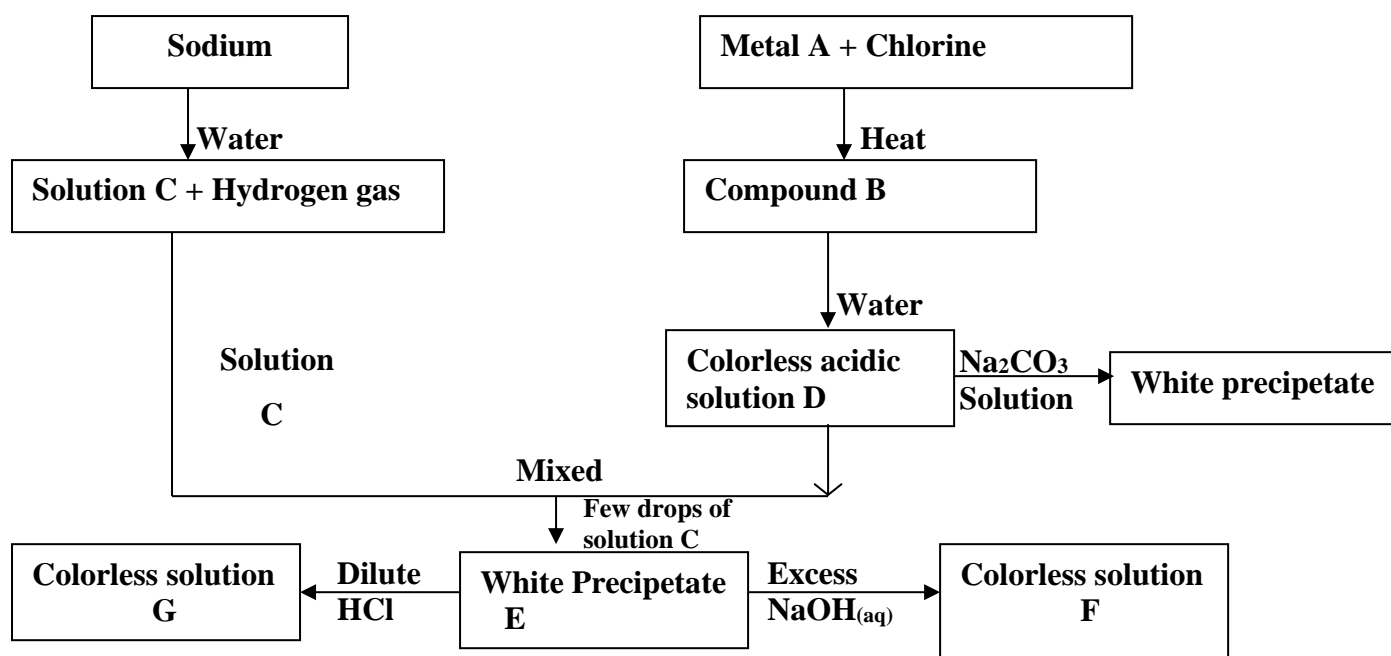
(c) Name the class to which the following cleansing agents belong.

(i) $R-COONa^+$ (1mk)

(ii) $R-\langle \text{O} \rangle-O-SO_3Na$ (1mk)

(d) Which cleaning agent above is not environmental friendly? Explain. (2mks)

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



(a) Give the name and formula of the following.

(i) White precipitate E

Name..... ($\frac{1}{2}$ mk)

Formula..... ($\frac{1}{2}$ mk)

(ii) Colourless solution F

Name (1mk)

Formula..... (1mk)

(b) What property is exhibited by white precipitate E when it reacts with Sodium hydroxide and HCl acid. (1mk)

.....
.....

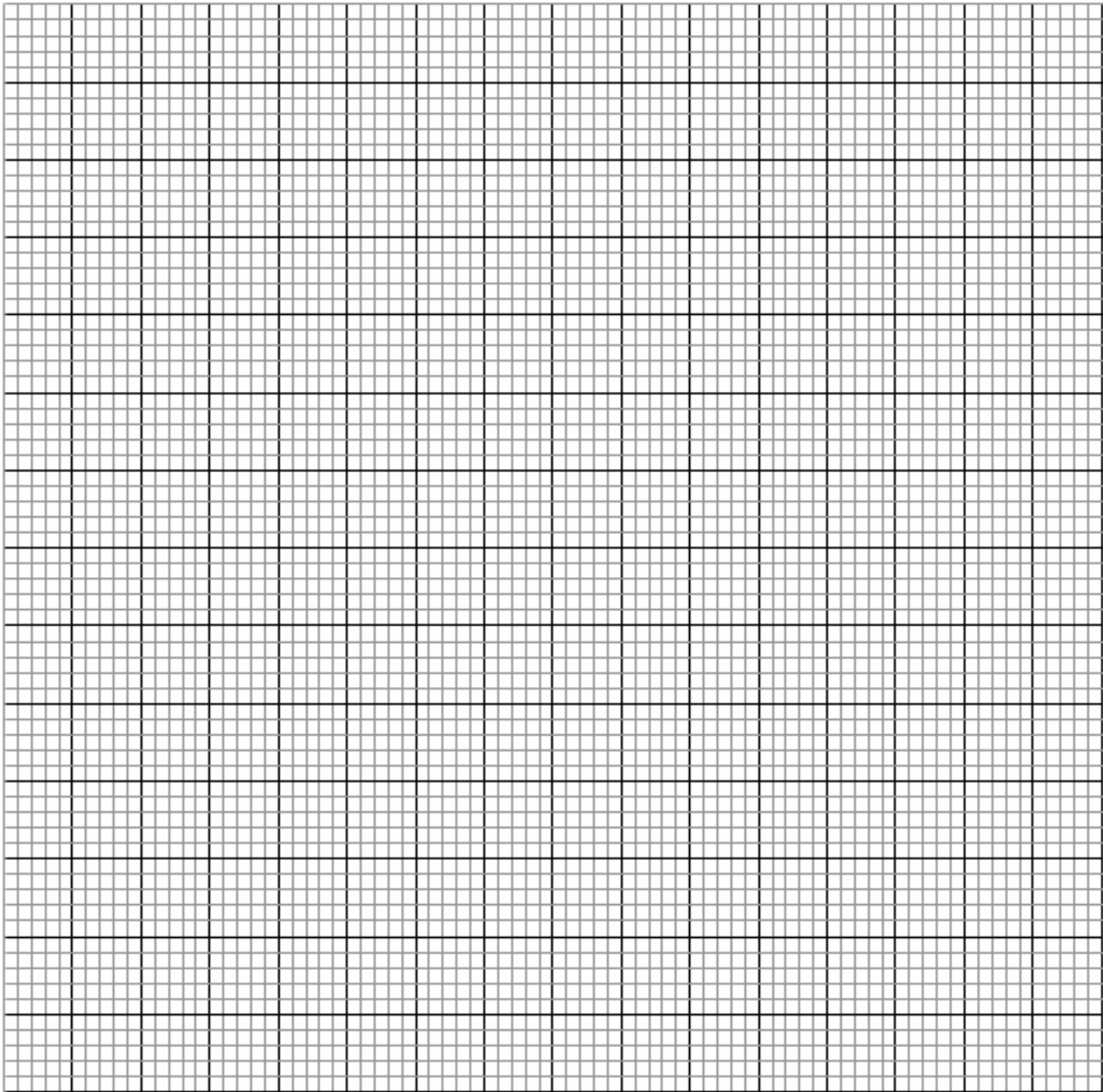
(c) Write an ionic equation for the reaction between white precipitate E and excess sodium hydroxide solution. (1mk)

.....
.....

(d) The information below gives the solubilities (In g/100g of water) of substances X and Y at various temperatures

Temperature		0	20	40	60	80	100
Solubility g/100g of water	X	10	15	26	40	63	100
	Y	30	34	37	40	44	48

(i) Plot a graph of solubility against temperature for the two salts X and y on the same axis. (4mks)



(i) From the graph state:
I The solubility of X at 50°C

(1mk)

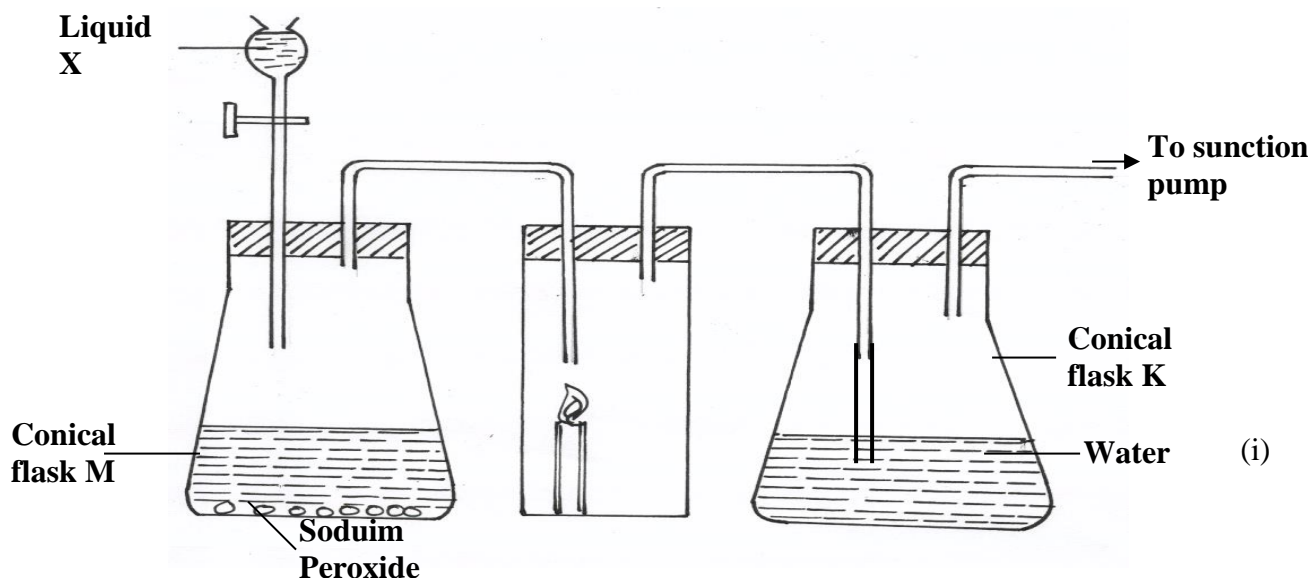
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II The temperature at which solubility of Y is 36g/100g of water. (1mk)

.....
.....

III Calculate the mass of crystals of substance X which will deposit when a solution containing 50g of X in 100g of water initially at 80°C is cooled to a temperature of 30°C (1mk)

4. The diagram below shows a set – up that was used to prepare oxygen gas and passing it over a burning candle. The experiment was allowed to run for some time.



(i) Name liquid X (1mk)

.....
.....

(ii) Suggest the PH of the solution in conical flask K. (1mk)

.....
.....

(iii) Write an equation for the reaction taking place in the conical flask M. (1mk)

.....
.....

(b) During the extraction of sodium metal from sodium chloride in the Down's cell, calcium chloride is added

(i) Explain why it is necessary to add Calcium chloride (1mk)

.....
.....

(ii) Explain why sodium metal is not used in making the overhead electric cables yet it is a conductor of electricity (1mk)

.....

.....

.....

(c) (i) Describe a simple chemical test that can be used to distinguish carbon (IV) oxide and Carbon(II) oxide gases. (1mk)

.....

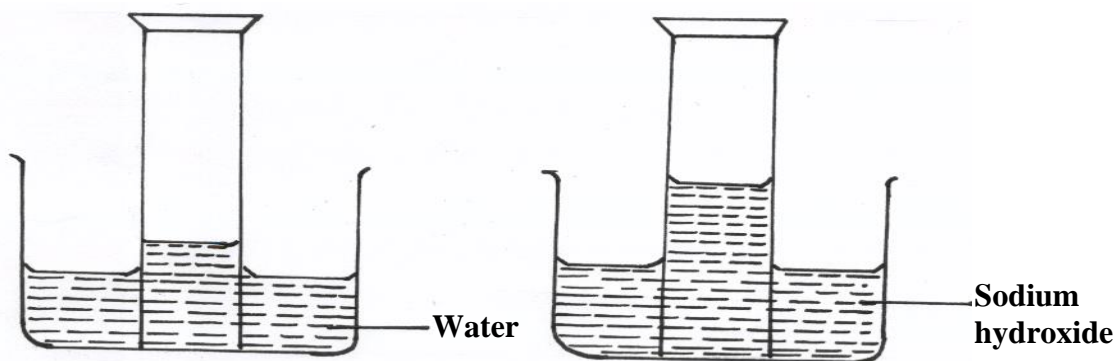
.....

(ii) Give **one** use of carbon (II) Oxide (1mk)

.....

.....

(d) A form two student inverted a gas jar full of carbon (IV) oxide over water and sodium hydroxide solution separately as shown below

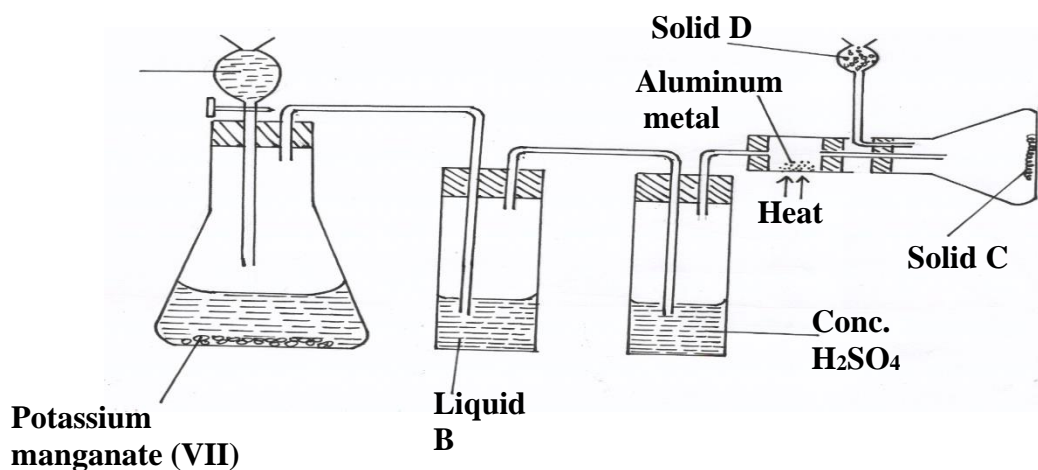


Explain the observations made. (2mks)

.....

.....

5. (a) Study the diagram below and use it to answer the questions that follow.



(i) Name liquids **A** and **B**

A..... (1mk)

B..... (1mk)

(ii) Suggest a suitable reagent that can be used as solid **D** (1mk)

(iii) State the role of Solid **D** (1mk)

(iv) Write a balanced chemical equation for the reaction in the conical flask (1mk)

(v) Explain why solid C collects further away from the heated aluminium metals. (1mk)

(vi) In the combustion tube above, 0.675g of aluminium metal reacted completely with 1800cm³ of chlorine gas at room temperature. Determine the molecular formula of Solid C, given that its relative formula mass is 267 (Al= 27.0, Cl= 35.5 molar gas volume at r.t.p = 24.0 litres) (3mks)

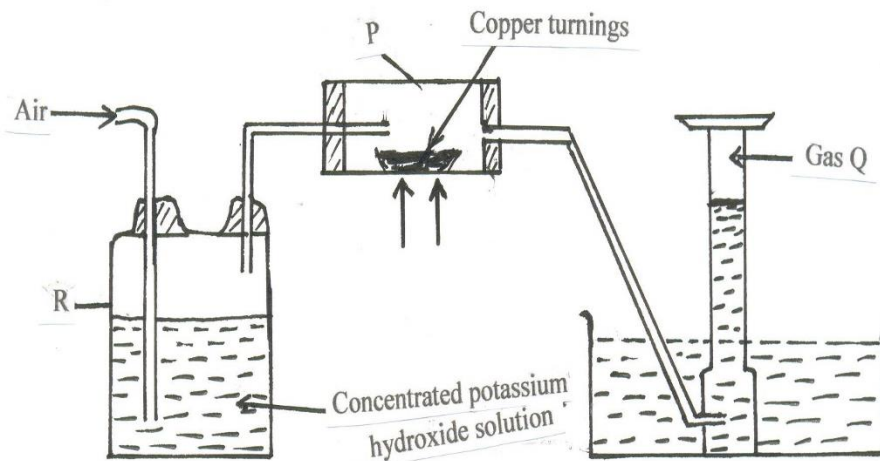
(b) The reaction between hot concentrated sodium hydroxide and chlorine gas produces Sodium Chlorate (V) as one of the products

(i) Write the equation for the reaction. (1mk)

(ii) Give **one** use of sodium chlorate.(V) (1mk)

(c) Explain the difference between bleaching by chlorine and bleaching by sulphuric (IV)oxide gases. (2mks)

6. A. Study the diagram below that is used to prepare a gas Q.



(i) (a) What component of air is eliminated in wash bottle labelled R? (1 mark)

(b) Write the reaction equation for the reaction that eliminates the component of air in a(i) above. (1 mark)

.....

(ii) What component of air is removed in hard glass tube labelled P? (1 mark)

.....

(iii) Identify gas Q. (1 mark)

B. In an experiment 1.54g of nitrogen reacted with 3.53g of oxygen to form a compound.
 N = 14, O = 16

(i) Calculate the moles of nitrogen and oxygen that reacted. (2 marks)

.....

(ii) Determine the simplest formula of the compound formed between nitrogen and oxygen. (2 marks)

.....
.....
.....
.....

(iii) Comment on the melting and boiling points of the compound in B(ii) above, explain. (2 marks)

.....
.....

7. In the preparation of Copper carbonate, copper was burnt in air and the product collected. Dilute sulphuric acid was added and the mixture filtered and cooled. Sodium carbonate was added to the filtrate and the content filtered. The residue was washed and dried to give a white powder.

a) Give the chemical name of the product formed when magnesium burns in air (1mk)

.....
.....

b) Write a chemical equation for the formation of product. (1mk)

.....
.....

c) (i) Name filtrate collected after sodium carbonate was added (1mk)

.....
.....

(ii) Name the white powder. (1mk)

.....
.....

d) Write chemical equation for the reaction between product in (a) and acid. (1mk)

.....
.....

e) Write an ionic equation to show the formation of the white powder (1mk)

.....
.....

f) Write an equation to show what happened when white powder is strongly heated. (1mk)

.....
.....
g) Using a diagram, describe how a salt can be obtained from the filtrate in c(i) above (3mks)

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NameIndex No.....

Candidates signature Date.....

233/2

CHEMISTRY

Paper 2

Theory

2 hours

KCSE TOP PREDICTION MASTER CYCLE 5

Instructions.

- Write your named and index number in the spaces provided above.
- Answer all questions in the spaces provided in the question paper.
- Mathematical tables (KNEC) and silent electronic calculators may be used.
- All workings must be clearly shown where necessary.
- Candidates should answer the questions in English.

For examiners use only.

Question	Maximum score	Candidate's score
1	12	
2	10	
3	12	
4	12	
5	12	
6	12	
7	10	

1. The grid below shows part of the periodic table. Use it to answer question the follow. The letters do not represent actual symbols.

					S	U	V
P	R				T		W
Q							

(a). Which of the elements has the highest atomic radius? Explain. (2 marks)

.....

.....

.....

.....

(b). Identify the most reactive non-metal. Explain. (2 marks)

.....

.....

.....

.....

(c). Give the electron configuration of:

(i). Element S. (1/2 mark)

.....

.....

(ii). Element Q. (1/2 mark)

.....

.....

(d). Compare the atomic radius of P and R. Explain. (2 marks)

.....

.....

.....

.....

(e). Given that the atomic mass of W is 40. Write down the composition of its nucleus. (1 mark)

.....
.....
.....

(f). Write the formula of compounds formed between

(i). Element P and S. *(1 mark)*

.....
.....

(ii). Element R and T. *(1 mark)*

.....
.....

(g). Give the formula of one stable Ion with an electron arrangement of 2.8 which is

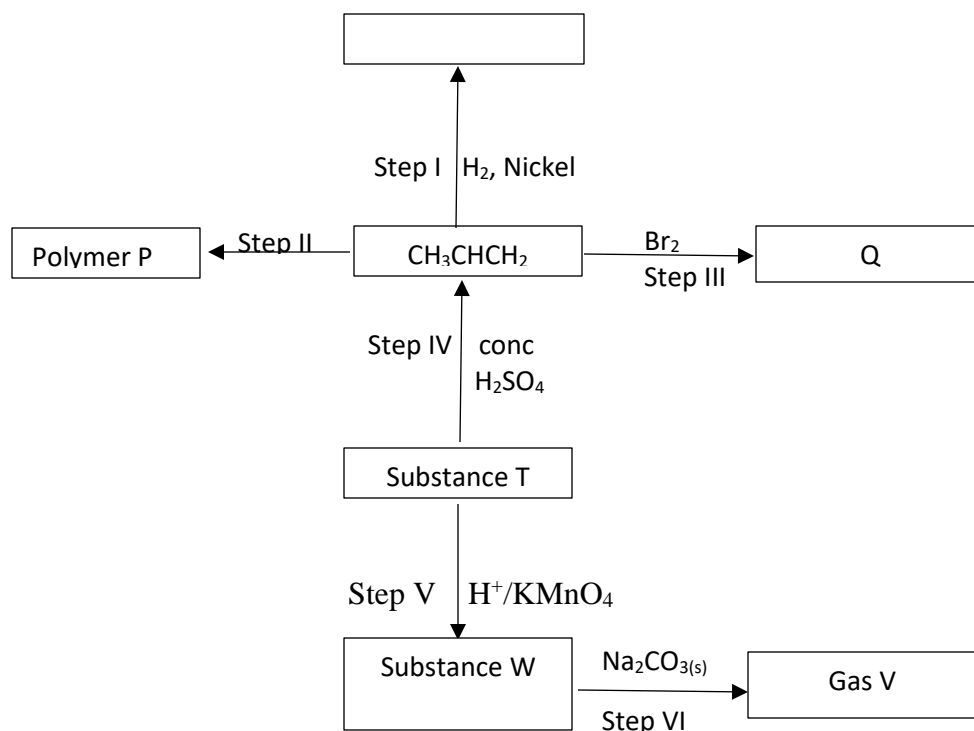
(i). Negatively charged. *(1 mark)*

.....
.....

(ii). Positively charged. *(1 mark)*

.....
.....

2. Study the flow chart below and answer the question that follows.



a. Identify the following

i. Substance W (1 mark)

ii. Gas V (1 mark)

b. Name the processes involved in the following steps

i. Step I (1 mark)

ii. Step II (1 mark)

c. i. What type of reaction is taking place in step V. (1 mark)

.....

(iii). Draw the structure and give their IUPAC name for the following compounds. (4 marks)

Compound	Structure	Name
Q	<i>(1 mark)</i>	<i>(1 mark)</i>
P	<i>(1 mark)</i>	<i>(1 mark)</i>

d. Write the equation that took place in step III. *(1 mark)*

.....

3. Study the standard electrode potentials for the half cells given below and answer the questions that follow.

	E° (volts)
$A^+_{(aq)} + e^- \longrightarrow A_{(s)}$	-2.92
$B^+_{(aq)} + e^- \longrightarrow B_{(s)}$	+ 0.52
$C^+_{(aq)} + e^- \longrightarrow \frac{1}{2}C_{2(g)}$	0.00
$D^{2+} + 2e^- \longrightarrow D_{(s)}$	-0.44
$\frac{1}{2}E_{2(aq)} + e^- \longrightarrow E_{(aq)}$	+1.36

a. Identify the strongest oxidising agent. Explain. *(2 marks)*

.....

b. (i). Which two half cells would produce the highest potential difference combined. *(1 mark)*

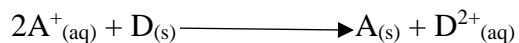
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(ii). Give the cell diagram for b (i) above *(1mark)*

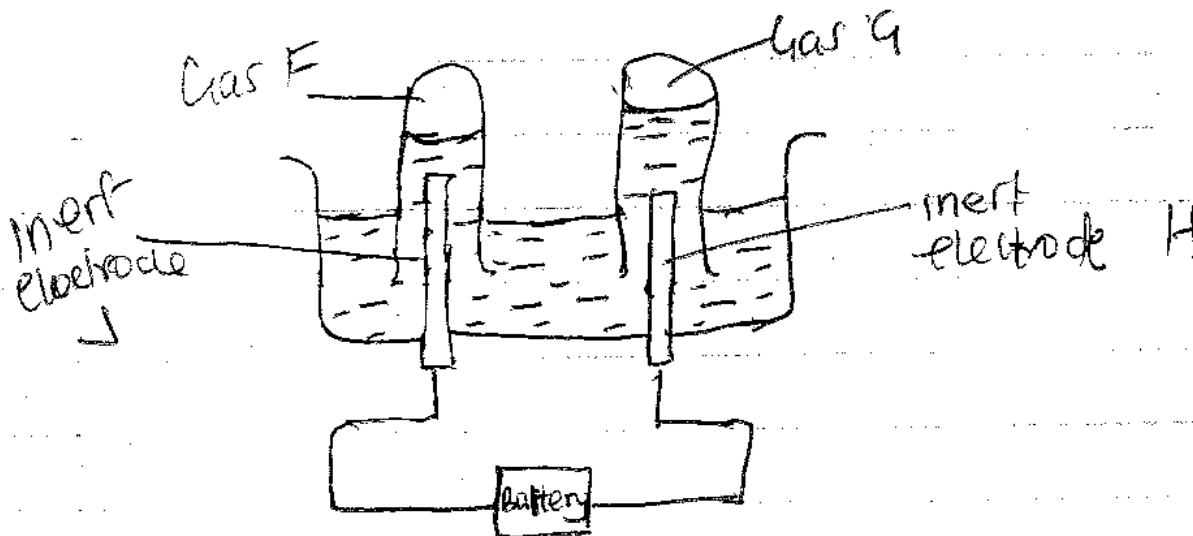
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c. (I). Explain whether the reaction represented by the equation below can take place.

(2 marks)



(II). 90cm³ of acidified water was electrolysed using the set up below.



a. Identify electrodes H and J

H - (1/2 mark)

J - (1/2 mark)

b. Describe how gas F can be identified.

(2marks)

.....
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.....

c. In the above experiment 5A of electricity was passed through the acidified water for 3 minutes and 21 seconds. Calculate the volume of gas G produced at room temperature and pressure molar gas volume at r.t.p= 24000cm^3 / $F=96\ 500\text{c}$. (3 marks)

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4.(a). The following results were obtained in an experiment
Mass of crucible + Lid = 19.52g
Mass of crucible + Lid + Magnesium ribbon = 20.36g
Mass of crucible + Lid + Magnesium oxide = 20.92g

(i). Use the results to determine the percentage mass of magnesium and oxygen in magnesium oxide. (2 marks)

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.....

(ii). Determine the empirical formula of magnesium oxide.
(Mg = 24, O = 16)

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(b). Sodium hydroxide pellets were accidentally mixed with sodium chloride. 8.8g of the mixture were dissolved in water to make one litre of solution. 50cm^3 of the solution was neutralised by 20cm^3 of 0.25M Sulphuric acid.

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

.....
.....
.....

(ii). Calculate the:

(I). number of moles of the substance that reacted with sulphuric acid. (2 marks)

.....
.....
.....

(II).number of moles of the substances that would react with sulphuric acid in the one litre solution. (2 marks)

.....
.....
.....

(iii). The percentage of sodium chloride in the mixture. (2 marks)

(H = 1.0, Na = 23.0, Cl = 35.5, O = 16.0)

.....
.....
.....
.....

5. (a). In an experiment to determine the heat of combustion of ethanol the following data was collected.

Volume of water = 450cm³

Initial temperatures of water = 25°C

Final temperature of water = 46.5°C

Mass of ethanol + lamp before heating = 125.5g

Mass of ethanol + lamp after heating = 124.0g

Calculate:

(i). Heat evolved during the experiment (Density of water = 1g/cm^3 , specific heat capacity of water

= $4.2\text{kJ/kg}^{-1}\text{K}^{-1}$. *(2 marks)*

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(ii). Molar heat of combustion of ethanol. *(2 marks)*

(C = 12, O = 16, H = 1).

.....

.....

.....

.....

(b). Write the equation for the complete combustion of ethanol. *(1 mark)*

.....

.....

.....

(c) The molar heat of combustion obtained from an experiment like the one above is usually lower than the theoretical value.

Explain. *(2 marks)*

.....
.....
.....
.....

(d). The molar heat of combustion of hydrogen is given as -286K/mol^{-2}

(i). Write the thermochemical equation for the reaction. *(1 mark)*

.....
.....

(ii). Draw an energy level diagram for the reaction in b (i) above. *(2 marks)*

e(i). What is a fuel? *(1 mark)*

.....
.....

(ii). State two factors considered when choosing fuel. *(1 mark)*

.....
.....

6. The factors which affects the rate of reaction between lead (II) carbonate and dilute nitric (V) acid were investigated by carrying out three experiments.

Experiment number	Lead (II) carbonate	Concentration of nitric (V) acid
1	Lumps	4M
2	Powdered	4M
3	Lumps	2M

(a). Other than concentration, name another factor that was investigated in the experiment.

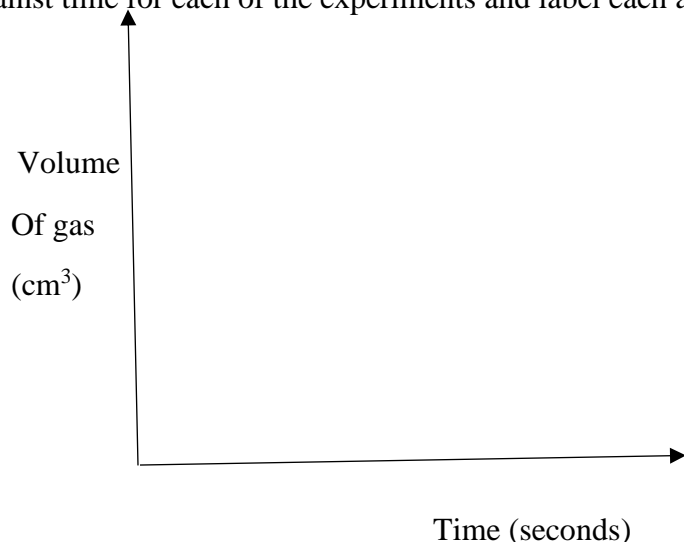
(1mark)

.....
.....

(b). For each experiment the same volume of acid (excess) and mass of lead (II) carbonate were used and the volume of gas liberated measured with time.

(i). Draw set up that can be used to investigate the rate of reaction for one of the experiments. *(3 marks)*

(ii). On the grid provided, sketch the curves obtained when the volume of gas produced was plotted against time for each of the experiments and label each as 1,2 or 3. (3 marks)



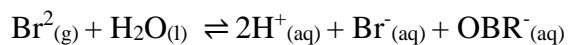
(iii). Write an equation for the reaction that took place. (1mark).

.....

(c). If the experiments were carried out using dilute hydrochloric acid instead of dilute nitric (V) acid, the reaction would start, slow down and eventually stop. Explain. (2 marks)

.....

(d). Bromine gas dissolves in water according to the following equation.



Colourless.

Yellow/orange

State and explain the observation made when hydrochloric acid is added to the mixture at equilibrium.

(2 marks)

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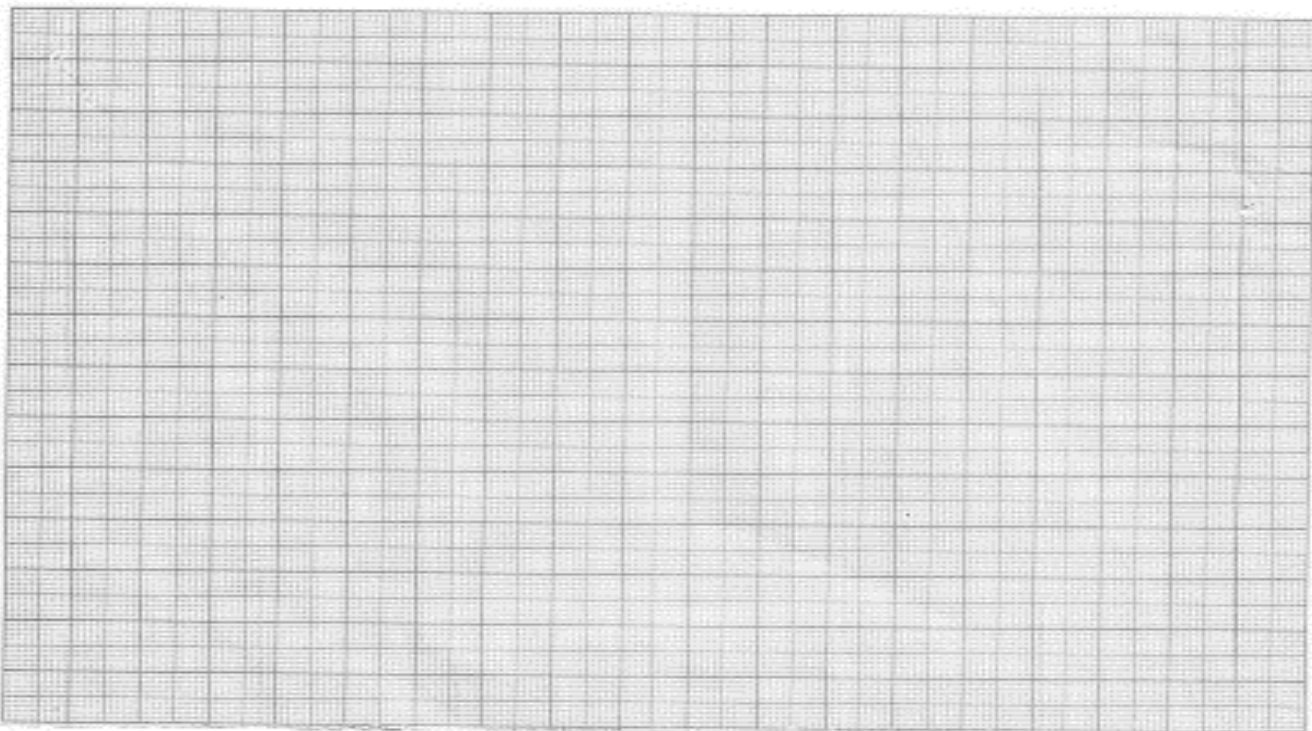
7. In an experiment to determine the solubility of potassium chlorate, the following results were obtained.

Total volume of water added (cm ³)	10.0	20.0	30.0	40.0	50.0
Mass of potassium chlorate	5.0	5.0	5.0	5.0	5.0
Temperature at which crystals appear (°c)	80.0	65.0	55.0	45.0	30.0
Solubility of potassium chlorate (g/long H ₂ O)					

(a). Complete the table to show the solubility of potassium chlorate at different temperatures. (3 marks)

(b). Plot a graph of mass of potassium chlorate per 100g water against temperature at which crystals form.

(3 marks)



(c). From the graph, determine:

(i). the solubility of potassium chlorate at 40°C. *(1 mark)*

.....
.....

(ii). The temperature at which the solubility of potassium chlorate is 35g/100g water. *(1 mark)*

.....
.....

(d). Explain the shape of the graph. *(1 mark)*

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(c). State one application of solubility and solubility curves. *(1 mark)*

.....
.....

NameIndex Number.....

Admission Number.....Class.....

CHEMISTRY PAPER 2 (233/2)

Time: 2 Hours

KCSE TOP PREDICTION MASTER CYCLE 6

Instruction to the candidates

- a)* Write your Name and Index number, Admission Number and Class in the spaces provided at the top of this page.
- b)* Answer all the questions in the spaces in the spaces provided in this paper using English.
- c)* KNEC Mathematical tables and silent electronic calculators may be used.
- d)* All working **MUST** be clearly shown where necessary

For Examiner's use only

Questions	Maximum score	Candidate's Score
1	10	
2	14	
3	14	
4	10	
5	11	
6	11	
7	10	
	80	

***This paper consists of 12 printed Pages
Candidates should check the question paper to ensure that all the
pages are printed as indicated and no questions are missing.***

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1. (a) Define nuclear fission.

(1 mark)

.....
.....

(b) State two similarities between nuclear fission and nuclear fusion?

(2 marks)

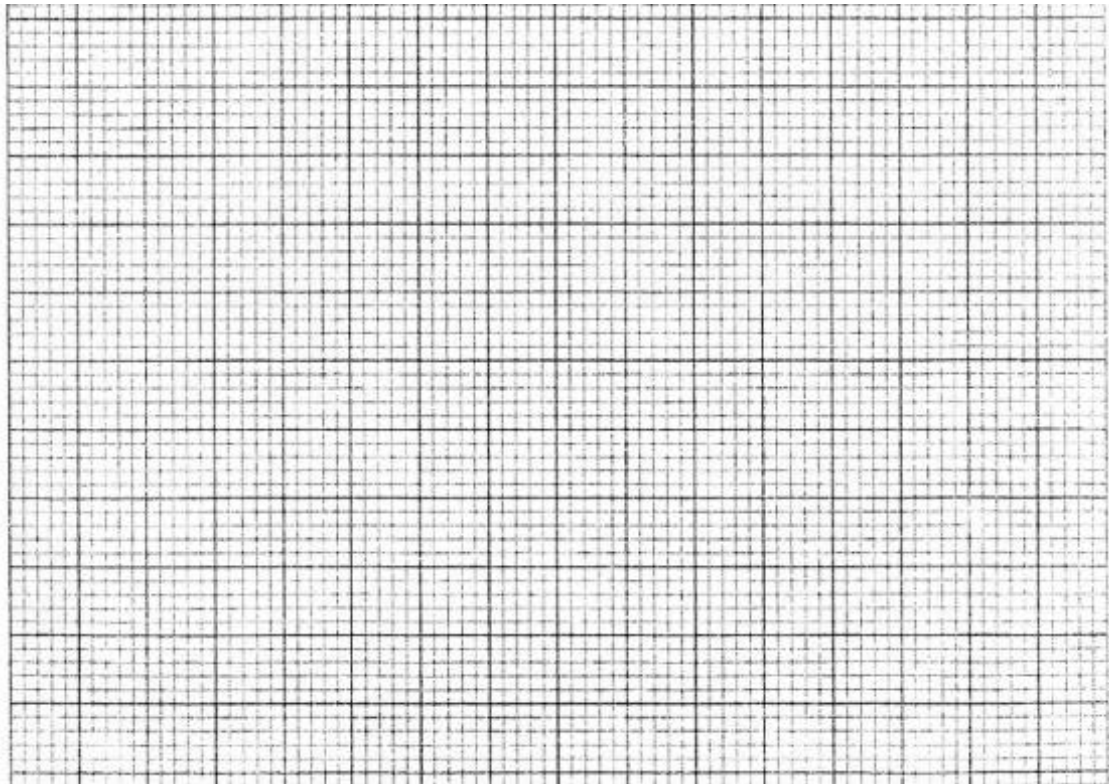
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(c) The following table shows the activity of a sample of protactinium ($^{234}_{91}\text{Pa}$), a radioactive element, measured at regular intervals.

Time (sec)	10	30	50	70	90	110	130	150	170	190
Activity(c/s)	33	29	23	17	14	12	10	9	8	6

(i) Plot a graph of activity against time.

(3 marks)



(ii) From the graph:

(I) The initial activity of the element. **(1 mark)**

.....

(II) Determine the half-life of the nuclide. **(1 mark)**

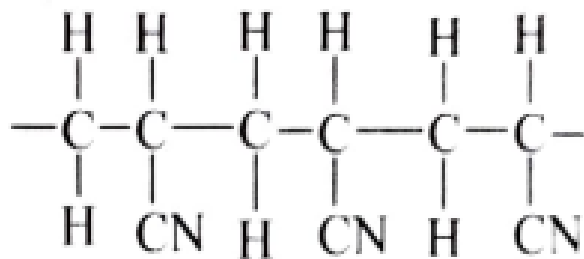
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(d) State two dangers associated with radioactivity. **(2 marks)**

.....

.....

2. (a) Acrylan and orlon are names of fibers which are made of the polymer.



(i) How many repeat units are shown in this structure? **(1 mark)**

.....

(ii) Draw a structural formula of the monomer unit from which the polymer is made.

(1 mark)

.....

.....

(iii) State two disadvantages of using the above synthetic fiber. **(2 marks)**

.....

.....

(b) Detergents contain additives that enhance their cleaning performance. Name two such additives. **(2 marks)**

.....

.....

(c) Calculate the mass of ethanol that can be made from 56g of ethene.

(2 marks)

.....

.....

(d) An organic **compound P** is found on analysis to have the empirical formula **C₆H₁₄O**. Compound P is slightly soluble in water. On oxidation compound P is converted into a **compound Q** of empirical formula **C₃H₆O** and relative molecular mass 116. Both compound P and Q react with sodium metal liberating hydrogen gas.

(i) To what class of compounds does compound P belong? **(1 mark)**

.....

(ii) Draw the displayed structural formula of P. **(1 mark)**

.....

.....

(iii) Deduce the molecular formula of Q and draw its displayed structural formula.

(2 marks)

.....

.....
.....
(iv) What other test would you carry out on Q to confirm the presence of the functional group you have indicated? **(2 marks)**
.....
.....

3. (a) During the electrolysis magnesium sulphate a current of 2 amperes was passed through the solution for 4 hours. Calculate the volume of the gas produced at the anode. (1 faraday 96,500 coulombs and volume of a gas at room temperature is 24,000cm³). **(2 marks)**
.....
.....
.....

(b) Table gives standard reduction potentials for some half cells.

Half-cell	Half-cell equation	E ⁰ /V
I	$\text{Cr}^{3+}(\text{aq}) + \text{e}^{-} \rightarrow \text{Cr}^{2+}(\text{aq})$	-0.41
II	$\text{Cd}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cd}(\text{s})$	-0.40
III	$\text{Na}^{+}(\text{aq}) + \text{e}^{-} \rightarrow \text{Na}(\text{s})$	-2.71
IV	$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cu}(\text{s})$	+0.34
V	$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Pb}(\text{s})$	-0.13
VI	$\text{Br}_2(\text{aq}) + 2\text{e}^{-} \rightarrow 2\text{Br}^{-}(\text{aq})$	+1.07
VII	$2\text{H}^{+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{H}_2(\text{g})$	0.00
VIII	$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Fe}(\text{s})$	-0.44V
IX	$\text{O}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) + 4\text{e}^{-} \rightarrow 4\text{OH}^{-}(\text{aq})$	+0.40V
X	$\text{H}_2\text{O}_2(\text{aq}) + 2\text{H}^{+}(\text{aq}) + 2\text{e}^{-} \rightarrow 2\text{H}_2\text{O}(\text{l})$	+1.23V

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(i) Identify: **(1 mark)**

I. The strongest oxidizing agent.

.....

II. The strongest reducing agent.

.....

(ii) Construct an electrochemical cell from half-cells **V** and **VI**. **(3 marks)**

(iii) Write the equation and calculate the electrode potential for the electrochemical cell constructed from half-cells **V** and **VI**. **(2 marks)**

.....

.....

.....

(iv) Explain why it is not advisable to use aqueous sodium sulphate as the salt bridge in the electrochemical cell formed between half-cells **V** and **VI**. **(1 mark)**

.....

.....

(v) Write the cell diagram for an electrochemical cell made using half-cells **V** and **VI**. **(1 mark)**

.....

(vi) Write an equation to show how rusting occurs. **(2 marks)**

.....

.....

(vii) Give two reasons why electroplating is necessary. **(2 marks)**

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.....

4. Below is a periodic table grid study it and answer the questions. (*The letters does not represent the actual symbols of the elements*)

									B
C	D		E					F	
	G							H	
I									

(a) Which element will require the least amount of energy to remove one of the outermost electrons. **(1 mark)**

.....
 (b) Select the most reactive metal. **(1 mark)**

.....
 (c) What name is given to the family of elements to which **elements D** and **G** belong? **(1 mark)**

.....
 (d) An **element A** has atomic number 9. Indicate the position of **A** on the grid. **(1 mark)**

(e) Explain why the atomic radius of **D** is smaller than that of **C**. **(1 mark)**

.....

 (f) Explain why the atomic radius of **A** is smaller than its ionic radius.

(2 marks)

.....

 (g) Element **C** combines with oxygen to form an oxide. Using dots (•) and crosses(x) to

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represent the outermost electrons, show how the two elements combine. **(1 mark)**

.....

.....

.....

(h) Explain why **chloride of E** has higher melting point than **chloride of D**.

(2 marks)

.....

.....

.....

5. (a) Describe how you can determine change in mass when magnesium is heated.

(3 marks)

.....

.....

.....

.....

(b) The table below shows the tests that were carried out on five portions of a compound and the results obtained. Study it and answer the questions that follow.

	Test	Observation
1	Addition of few drops of sodium hydroxide to the first portion until in excess.	White precipitate soluble in excess.
2	Addition of few drops of aqueous potassium iodide to the second portion	No yellow precipitate is formed.
3	Addition of few drops of acidified barium nitrate to the third portion.	White precipitate formed.
4	Addition of few drops of Lead (II) nitrate to the fourth portion.	White precipitate formed.
5	Addition of few drops of dilute nitric (V)	Effervescence of a colorless gas.

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	acid to the fifth portion.	
--	----------------------------	--

(i) Identify the ions likely present in; **(2 marks)**

I. **Step 2**

.....

II. **Step 5**

.....

(ii) Write an ionic equation for the reaction in the fifth portion. **(1 mark)**

.....

(iii) Dilute nitric (V) acid was added to a solid which is an alloy of copper. The resultant mixture was then filtered. To the filtrate, few drops of sodium hydroxide solution was added till in excess.

I. State any two observations made when dilute nitric (V) acid is added to the alloy. **(2 marks)**

.....

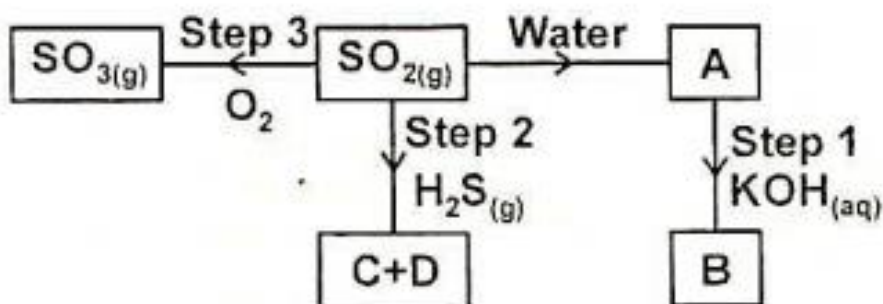
II. Name the other metal present in the alloy. **(1 mark)**

.....

III. Write an ion equation for the reaction that took place when few and excess sodium hydroxide solution is added. **(2 marks)**

.....

6. (a) Study the flow chart below and answer the questions that follow.



(i) Name a suitable method of gas collection that can be used to collect Sulphur (VI) oxide gas in the laboratory. **(1 mark)**

.....

(ii) Name substances A, B, C and D. **(2 marks)**

.....

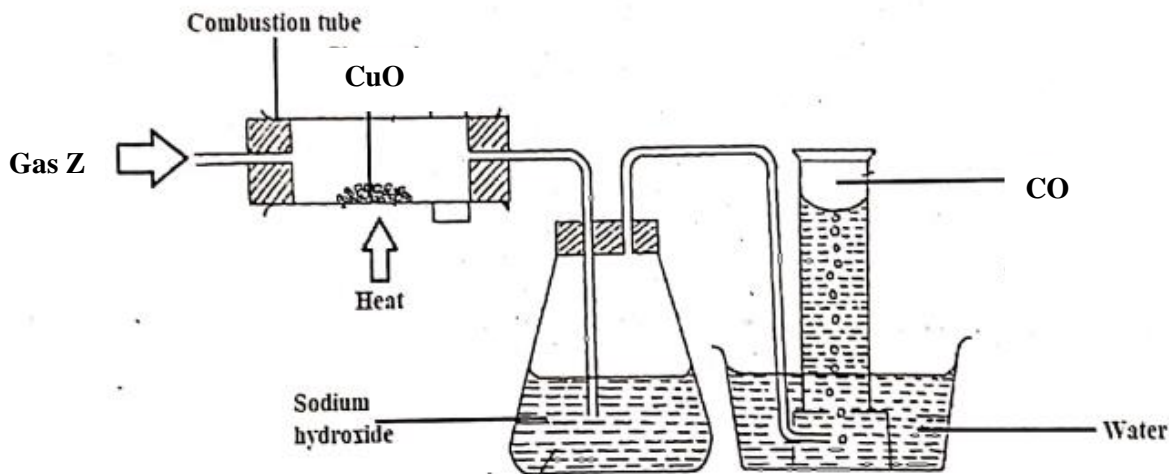
(iii) State the property of Sulphur (IV) oxide exhibited in step 2. **(1 mark)**

.....

(b) (i) Explain the observations made when burning magnesium is lowered into a gas jar containing carbon (IV) oxide. **(3 marks)**

.....

(ii) Study the diagram below and answer the questions that follows.



I. Name gas Z. (1 mark)

.....

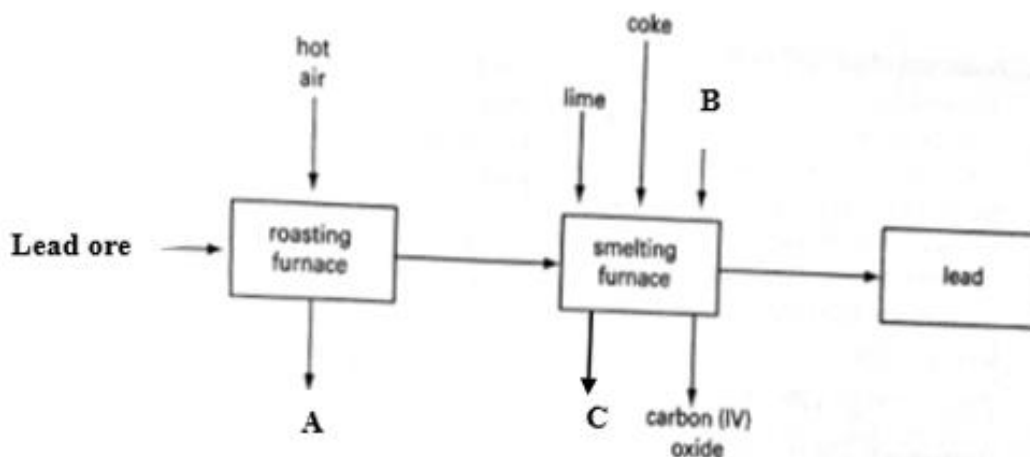
II. Write an equation for the reaction taking place in the combustion tube. (1mark)

.....

III. State and explain the observations made in the combustion tube. (1 mark)

.....

7. The flow chart in the figure below represents some stages in the extraction of lead metal. Study it and answer the questions that follow.



(a) Identify:

(i) The lead ore.

(1 mark)

.....

(ii) Substance A, B and C.

(3 marks)

.....

(b) Write an equation for the reaction that forms **substance C**.

(1 mark)

.....

(c) Name an impurity present in the ore.

(1 mark)

.....

(d) State the process by which the ore is concentrated.

(1 mark)

.....

(e) Write an equation for the reaction which occurs in the roasting chamber.

(1 mark)

.....

(f) State any one use of lead.

(1 mark)

.....

(g) Give one reason why the extraction of lead causes pollution to the environment.

(1 mark)

.....

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School: Class:

Signature: Date:

CHEMISTRY (233/2)

PAPER 2

FORM FOUR (4)

Time: 2 Hours

KCSE TOP PREDICTION MASTER CYCLE 7

Instructions to candidates

- (a) Write your name, stream, and admission number in the spaces provided above.
- (b) Answer **ALL** the questions in the spaces provided, and working **MUST** be clearly shown
- (c) This paper consists of **11 printed pages**; Candidates should check the question paper to ascertain that all the pages are printed as indicated, and that no question is missing.

FOR EXAMINERS' USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 6	80	

1.

a) The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters do not represent actual symbols of the elements

C				F	G		I
						H	K
D	E						
							J

i) Identify the most reactive non-metal. Explain (2 Marks)

.....

.....

.....

ii) What is the name given to the family of elements to which **I** and **J** belong? (1 Mark)

.....

iii) Using dots (•) and crosses (×) to represent electrons, show bonding in the compound formed between **C** and **H**. (2 Marks)

iv) How does the atomic radius of **F** compare with that of **I**? Explain. (2 Marks)

.....

.....

.....

b) Study the table below and answer the questions that follow.

Substance	M	N	O	P	Q	R
Melting Point (°C)	801	1356	-101	26	-39	113
Boiling Point (°C)	1410	2850	-36	154	457	445

Electrical conductivity in solid state	Poor	Poor	Poor	Poor	Good	Poor
Electrical conductivity in molten state	Good	Poor	Poor	Poor	Good	Poor

i) Explain why **substance M** is a good conductor of electricity in the molten state but not in the solid state. *(2 Marks)*

.....
.....
.....

ii) What is the most likely structure and bond in **substance N**? Explain. *(2 Marks)*

Structure Bond

.....
.....

iii) Identify, with a reason, a substance that exists as a liquid at room temperature. *(2 Marks)*

.....
.....
.....

a)

i) What name is given to different forms of an element which exist in the same physical state? *(1 Mark)*

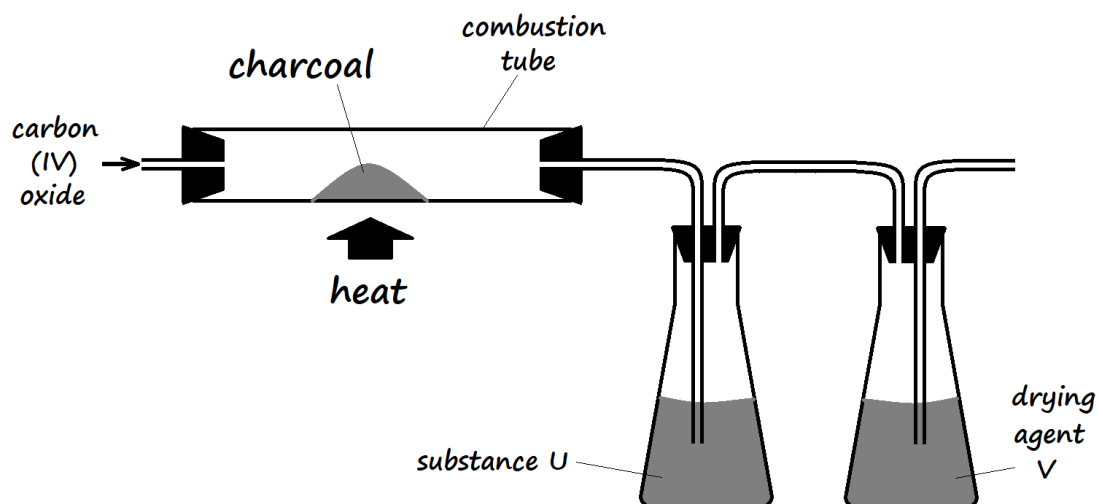
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ii) Name **two** crystalline forms of carbon *(1 Mark)*

.....

b) The figure below is part of a setup used to prepare and collect dry carbon (II) oxide from carbon (IV) oxide.

\



i) Complete the diagram to show how dry carbon (II) oxide gas is collected. (1 Mark)

ii) Identify:

- Substance U and state its use

.....

- Drying agent Y

.....

iii) Write a chemical equation for the reaction which takes place in the combustion tube (1 Mark)

.....

iv) Carbon (II) oxide is a major environmental pollutant.

- Give **one** major source of carbon (II) oxide in the atmosphere (1 Mark)

.....

- Explain how carbon (II) oxide causes poisoning (1 Mark)

.....

c) State **one** use of carbon (II) oxide (1 Mark)

.....

d) Write an equation for the formation of water gas. (1 Mark)

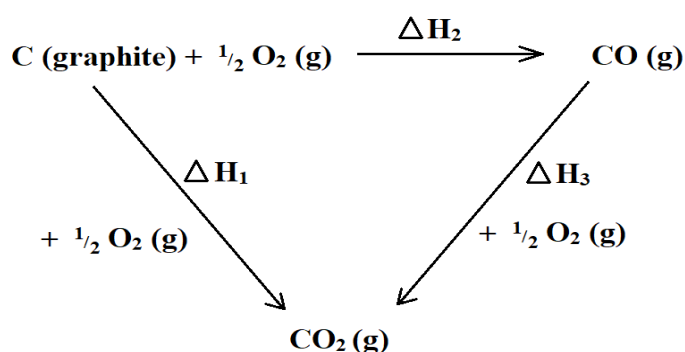
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e) Explain why sodium hydroxide solution is not used in testing for carbon (IV) oxide gas, while calcium hydroxide is preferably used. (2 Marks)

.....

2.

a) Study the following energy cycle diagram and then answer the questions that follow.



i) Name the enthalpy change represented by ΔH_2 . (1 Mark)

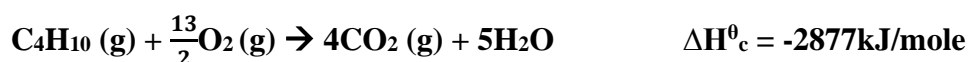
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ii) Use the following information to calculate the value of ΔH_1 for 144g of graphite. (2 Marks)

$$\Delta H_2 = -110 \text{ kJ/mole} \quad \Delta H_3 = -283 \text{ kJ/mole}$$

.....

b) The following are thermochemical equations for molar enthalpies of combustion for some substances. Study them and answer the questions that follow.



\



i) What is molar enthalpy of combustion of a substance? *(1 Mark)*

.....
.....

ii) Calculate the molar enthalpy of formation of butane (C_4H_{10}) using the information given above. *(3 Marks)*

.....
.....
.....

c) The following results were obtained in an experiment, to determine the heat of neutralization of 25cm^3 of 2M sodium hydroxide solution, using 25cm^3 of hydrochloric acid:

Initial temperature of acid	= 25.0°C
Initial temperature of alkali	= 26.0°C
Final temperature of mixture of acid + alkali	= 38.5°C
Density of solution	= 1g/cm^3
Specific heat capacity of solution	= 4.2 J/g/K

i) Define molar heat of neutralization *(1 Mark)*

.....
.....

ii) Write an **ionic equation** for the neutralization reaction involving hydrochloric acid and sodium hydroxide solution. *(1 Mark)*

.....

iii) Calculate:
• The enthalpy change during this experiment. *(2 Marks)*

\

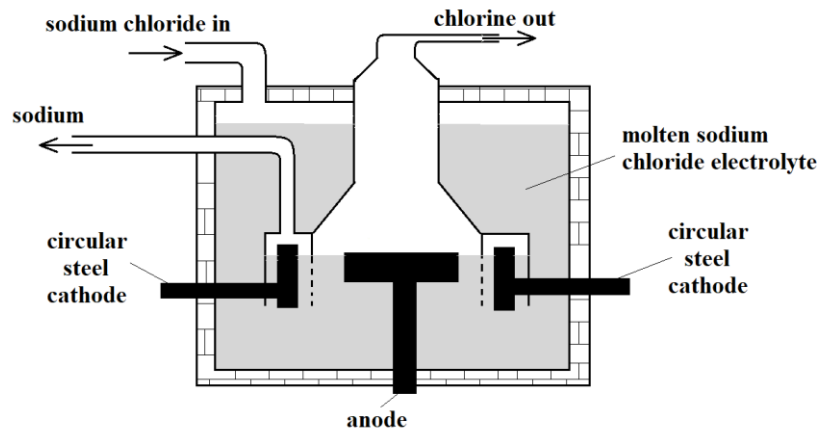
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- The molar enthalpy of neutralization for this reaction (2 Marks)

.....
.....
.....
.....

3.

- a) Below is a simplified diagram of the Down's Cell, used for the manufacture of sodium. Study it and answer the questions that follow.



- i) What material is the anode made of? Give the reason why that material is used. (2 Marks)

.....
.....

- ii) What precaution is taken to prevent chlorine and sodium from re-combining? (1 Mark)

.....
.....

iii) Write an ionic equation for the reaction in which chlorine gas is formed (1 Mark)

.....

b) In the Downs process, (used for manufacture of sodium), a certain salt is added to lower the melting point of sodium chloride from about 800°C to about 600°C.

i) Name the salt that is added. (1 Mark)

.....

ii) State why it is necessary to lower the temperature in b) above (1 Mark)

.....

.....

c) Explain why aqueous sodium chloride is not suitable as an electrolyte for the manufacture of sodium in the Down's Process. (2 Marks)

.....

.....

d) Sodium metal reacts with air to form two oxides. Give the formulae of the two oxides (1 Mark)

.....

e) State two uses of sodium (2 Marks)

.....

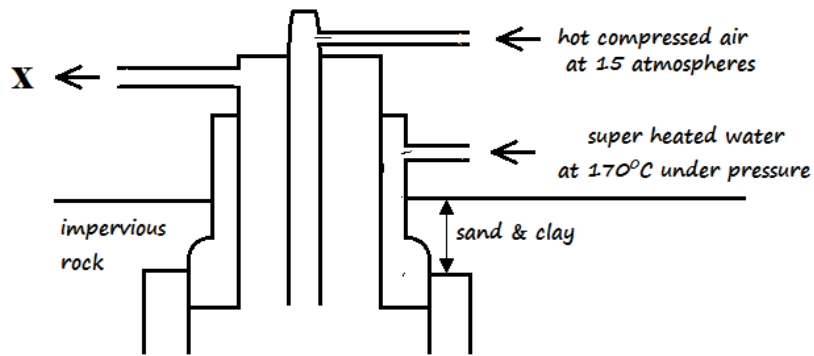
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4.

a) The diagram below shows part of the Frasch process, used for the extraction of sulphur. Use it to answer the questions that follow.

\



- i) Identify X(1 Mark)
- ii) Why is it necessary to use superheated water and hot compressed air in this process? (2 Marks)

.....

.....

.....

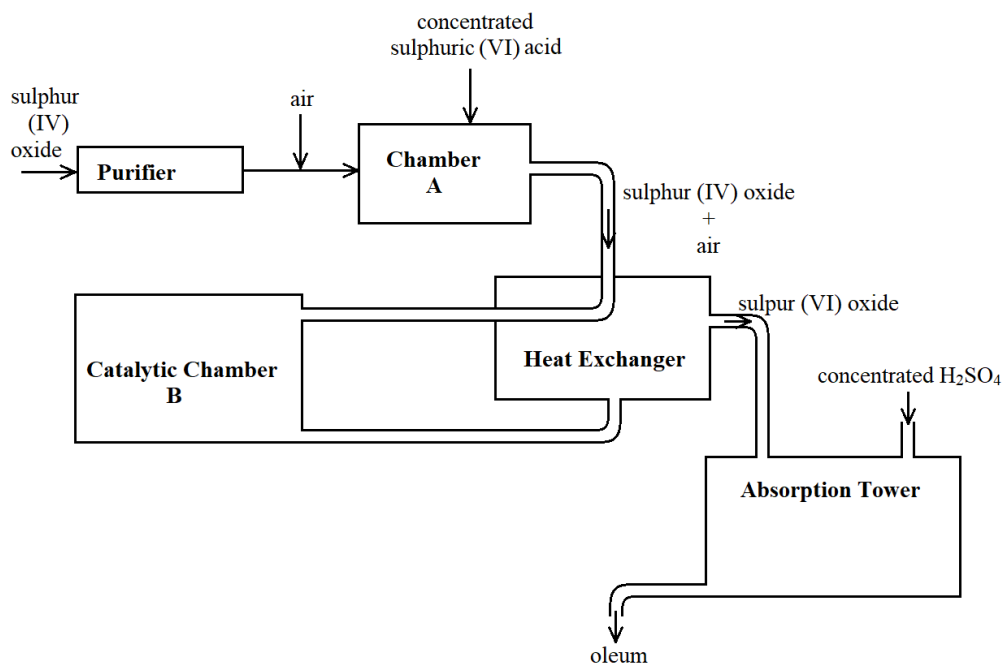
- iii) State **two** physical properties of sulphur that makes it possible for it to be extracted by this method. (2 Marks)

.....

.....

b) The diagram below shows part of the process in the manufacture of sulphuric (VI) acid. Study it and use it to answer the questions that follow.

\



i) Give **two** reasons why air is referred to as a mixture *(2 Marks)*

.....

ii) What is the role of concentrated sulphuric (VI) acid in **Chamber A**? *(1 Mark)*

.....

iii) Name **two** catalysts that can be used in the Catalytic **Chamber B**. *(2 Marks)*

.....

iv) State **two** roles of the heat exchanger *(2 Marks)*

.....

v) Describe the test for sulphite anion, SO_3^{2-} *(2 Marks)*

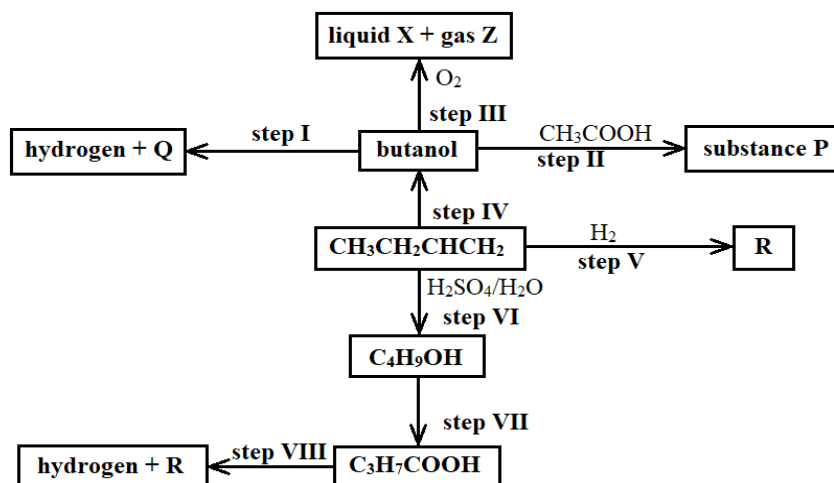
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- vi) Explain the observation made when a few drops of concentrated sulphuric (VI) acid are added to crystals of hydrated copper (II) sulphate. Explain your answer. (2 Marks)

.....

5. Study the reaction scheme below and answer the questions the follow:



- i) What is the distinguishing physical property of **Substance P**? (1 Mark)
-

- ii) Identify a suitable reagent that can be used in **Step I**. (1 Mark)
-
- iii) Describe a chemical test on how **C₃H₇COOH** can be distinguished from **C₄H₉OH**. (2 Marks)
-

- iv) Write an equation for the reaction that takes place in **Step III** (1 Mark)
-
- v) Name the types of reaction that occur in steps **II, III, V, and VII** (2 Marks)

II.....

III.....

V.....

VII.....

- vi) If 7.4g of butanol completely underwent Step III, determine the volume of gas Z produced at s.t.p. (MGV = 22.4 litres, C = 12, H = 1, O = 16) (3 Marks)

.....
.....
.....
.....

- vii) Write an equation for the reaction between **R** and one mole of fluorine gas (1 Mark)

.....

- viii) Describe a chemical test for **liquid X** (2 Marks)

.....
.....
.....

\

233/2
CHEMISTRY
PAPER 2
Time: 2 hours

KCSE 2023 TOP PREDICTION MASTER CYCLE

9

Name Index Number...../.....

Signature Date/...../.....

INSTRUCTIONS TO CANDIDATES

1. Write your name and index no in the spaces provided above.
2. Sign and write the date of exam in the spaces provided above.
3. Answer all the questions in the spaces provided after each.
4. Mathematical tables and silent electronic calculators may be used.
5. All working must be clearly shown where necessary.
6. This paper consists of 12 printed pages. Candidates should check to ensure that all pages are printed as indicated and that no questions are missing.
7. All answers should be written in English.

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

1. Study the information in the table below and answer the questions that follow.

The letters do not represent the actual symbols of the elements.

Elements	Electronic configuration	Ionization energy kJmol^{-1}
P	2:1	519
C	2:8:1	494
R	2:8:8:1	418

(i) What is the general name given to the group which elements P, C and R belong? (1mark)

.....

(ii) What is meant by ionization energy? (2marks)

.....

(iii) Explain why element P has the highest ionization energy. (2marks)

.....

(iv) (a) When a piece of element “C” is placed on water, it melts and hissing sound is produced as it moves on the surface of the water. Explain these observations. (2marks)

.....

.....

(b) Distinguish between a strong and a weak base. Give an example of each. (3marks)

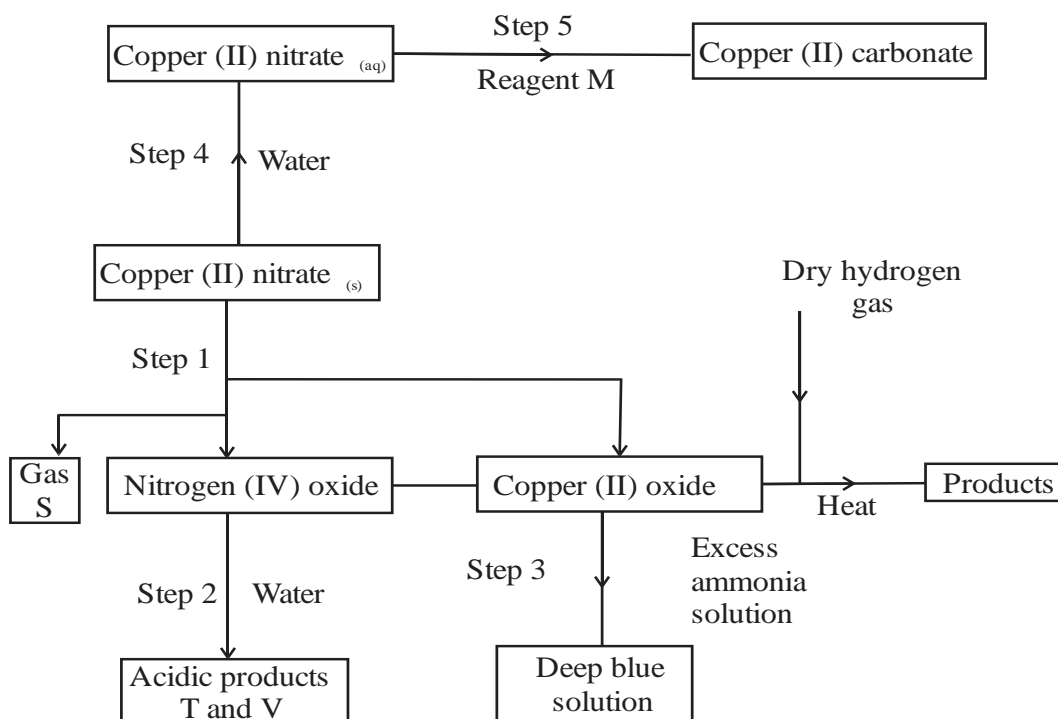
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2. The flow chart below shows some reactions starting with copper (II) nitrate. Study it and answer questions that follow.



a) State the condition necessary in step 1. (1mark)

i. Identify Reagent M (1mark)

Gas S (1mark)

Acidic products (2marks)

T.....

V.....

ii. Write the formula of the complex ion formed in step 3. (1mark)

.....

iii. Write the equations for the reaction in, (2marks)

Step 1

.....

Step 2

.....

iv. Write an ionic equation for that occurs in step 5. (1mark)

.....

v. State any **one** observation made in STEP 1, (1mark)

.....

3. a) State **two** types of polymerization. (2marks)

.....

.....

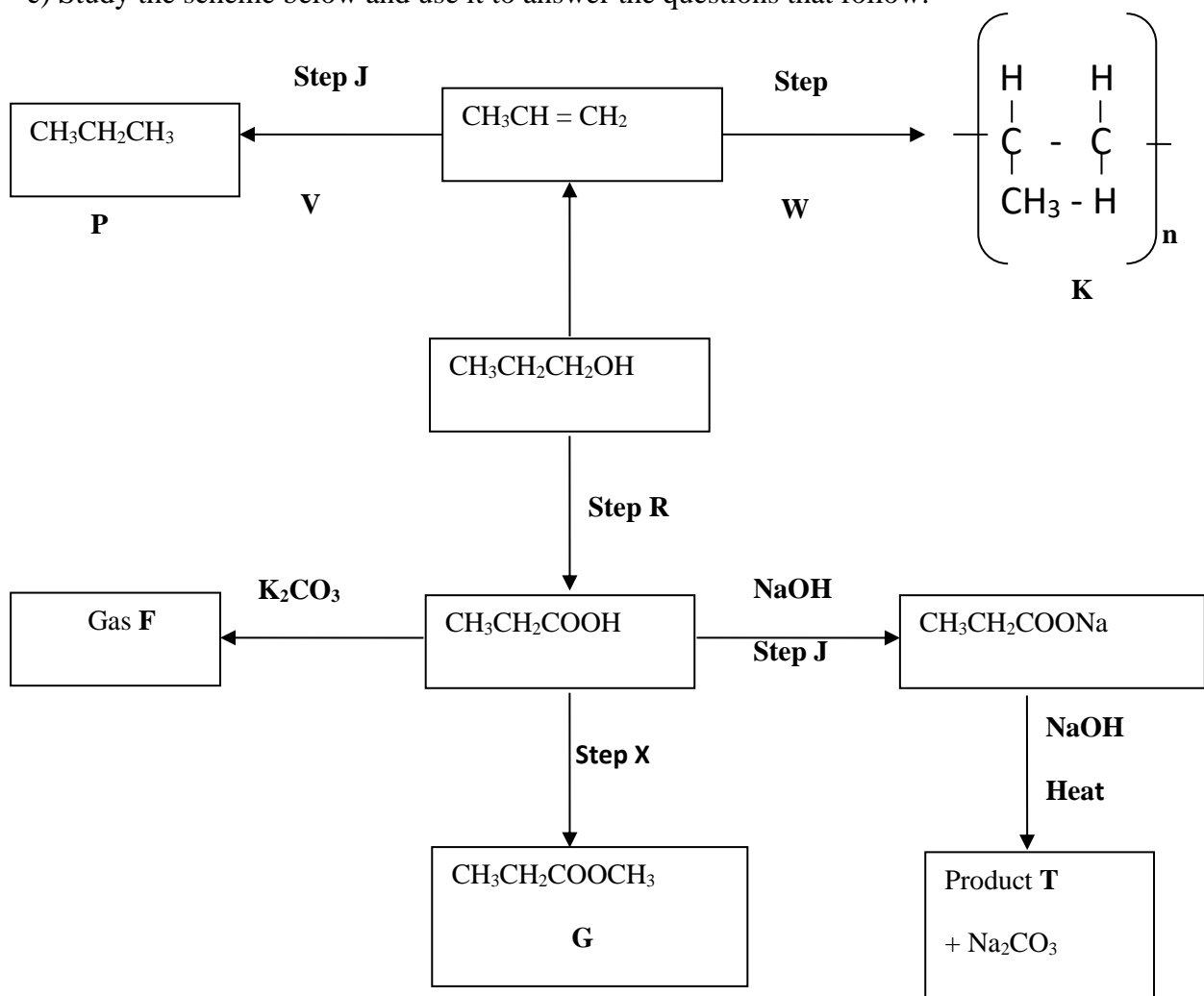
b) Name the compound with the formula below:



(1mark)

.....

c) Study the scheme below and use it to answer the questions that follow:-



- Name the following compounds:- (2marks)
 - Product T
 - K
- State **one** common physical property of substance G. (1mark)
.....
- State the type of reaction that occurred in step J. (1mark)
.....
- Give **one** use of substance K. (1mark)
.....
- Write an equation for the combustion of compound P. (1mark)
.....

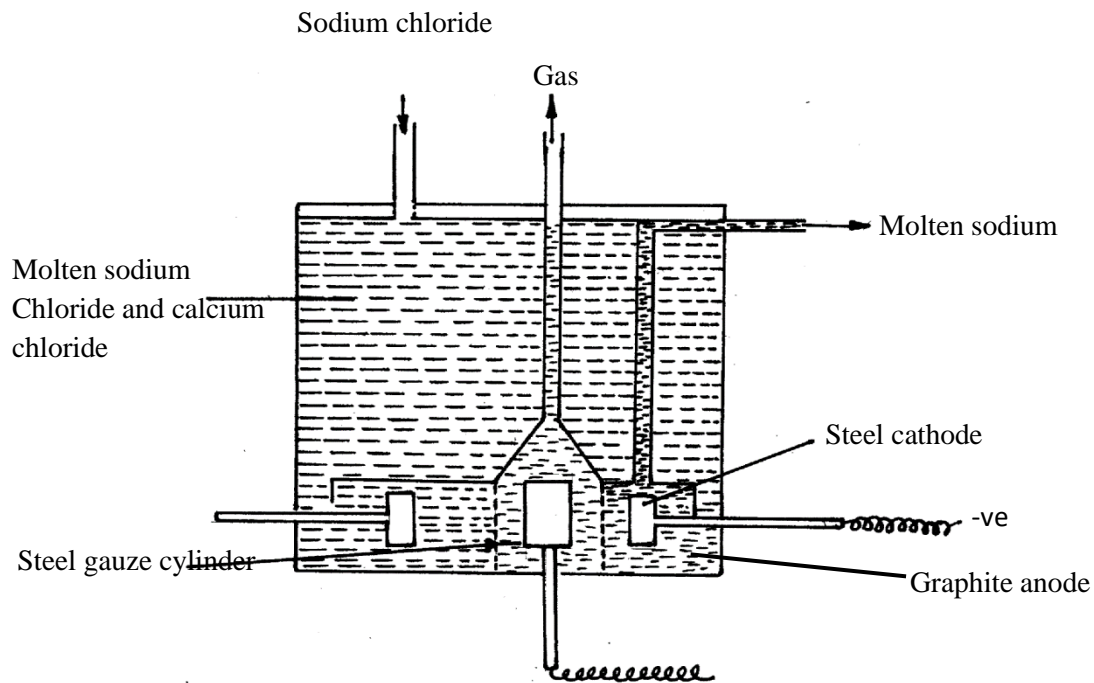
vi. Describe how compounds $\text{CH}_3\text{CH}_2\text{COOH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ can be distinguished chemically. (2marks)

.....
.....
.....

vii. If a polymer **K** has relative molecular mass of 12,600, calculate the value of **n** (H=1 C =12) (2marks)

.....
.....
.....

4. The diagram below shows the extraction of sodium metal using the downs cell. Study it answer the questions that follow.



i. Explain why in this process the sodium chloride is mixed with calcium chloride. (2marks)

.....
.....

ii. Why is the anode made of graphite and not steel? (1mark)

.....
.....

iii. State **two** properties of sodium metal that make it possible for it to be collected as shown in the diagram. (2marks)

.....
.....

iv. What is the function of the steel gauze cylinder? (1mark)

.....
.....

v. Write ionic equations for the reactions which take place at: (2mks)

Cathode.....

Anode.....

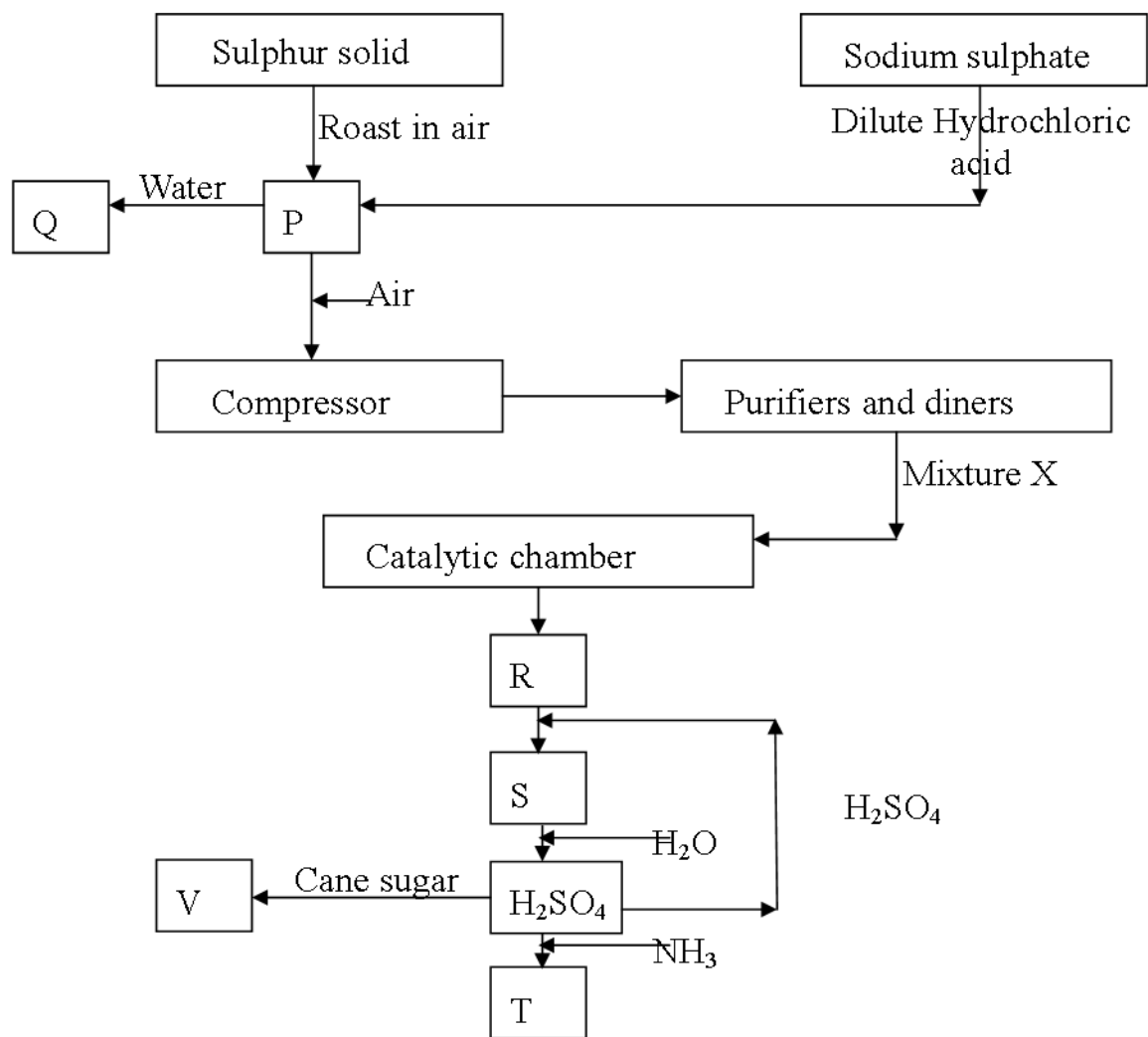
vi. Give **one** industrial use of sodium metal. (1mark)

.....
.....

b) Explain why the sodium metal is kept stored under kerosene. (1mark)

.....
.....

5. Below is a simplified diagram for the manufacture of sulphuric (VI) acid in large scale.



a) Name the substances **P, Q, R, S, T** and **V** (3marks)

P..... **S**.....

Q..... **T**.....

R..... **V**.....

b)

i. What is the use of the compressor? (1mark)

.....

ii. Name **two** impurities removed in purification chamber? (1mark)

-

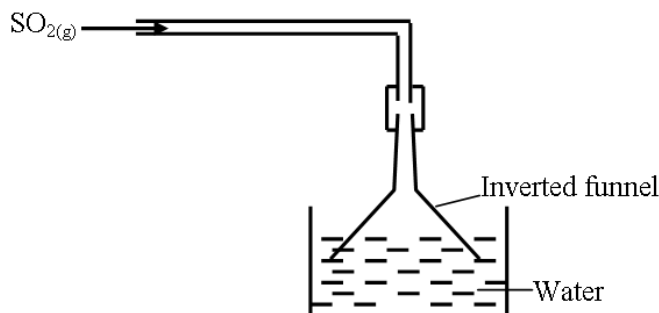
- c)
- i) State **two** conditions for the formation of **R** other than the catalyst. (1mark)
-

- ii) Write the chemical formula of the commonly used catalyst in the catalytic chamber. (1mark)
-

- iii) Write an equation for the reaction in the catalytic chamber. (1mark)
-
- d) Describe a chemical test to confirm the presence of **P**. (1mark)
-

- e) One of the uses of sulphuric (VI) acid is ‘pickling’ metals. What does the term ‘pickling’ mean? (1mark)
-

- f) The following diagram represents the method of preparing sulphur (IV) oxide solution.



- i. Why is an inverted funnel used? (1mark)
-

- Explain the observation made when moist litmus paper is dipped in a gas jar containing sulphur (IV) oxide gas. (1mark)

.....
.....
g) State and explain what would be observed if concentrated sulphuric (VI) acid is added to canesugar leading to formation of substance Q. (2marks)

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.....
.....

6.The following results were obtained in an experiment to determine the heat of neutralization of 50cm³ of 2M HCl and 50cm³ of 2M NaOH.

Mass of plastic cup	=	45.1g
Initial temperature of acid	=	27.0°C
Initial temperature of Alkali	=	23.0°C
Mass of Plastic cup + NaOH + HCl	=	145.1g
Temp. of the mixture of HCl + NaOH	=	38.5°C.

a) Define molar heat of neutralisation. (1mark)

.....
.....

b) Write an ionic equation for the neutralisation of HCl and NaOH. (1mark)

.....
.....

a) Calculate:

i. The amount of heat produced during the experiment. (*Specific heat capacity of solution = 4.2kJ/kg/K and density of solution = 1g/cm³*). (2marks)

.....
.....
.....

ii. The molar heat of neutralisation for this reaction. (2marks)

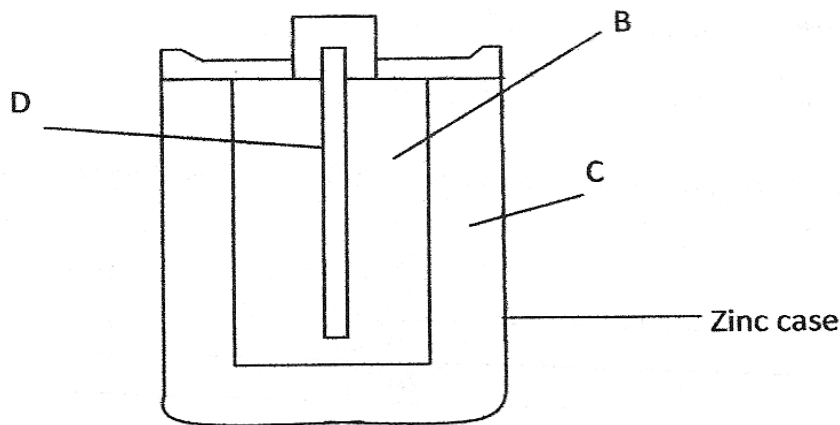
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b) Explain why the molar heat of neutralisation of sodium hydroxide and ethanoic acid of equal volume and molarity would be less than the value obtained in c (ii) above. (2 marks)

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.....

e) Draw an energy level diagram for the neutralisation reaction in (c) above. (2 marks)

7. The figure below shows parts of Le'Clanche cell (dry cell).



(a) Name:

(i) Substance D (1mark)

(ii) Mixture B (1mark)

(iii) Electrolyte C (1mark)

(b) In the cell, the electrolyte is a paste. Explain. (1mark)

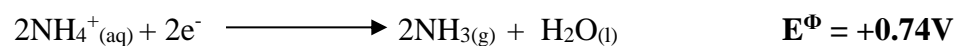
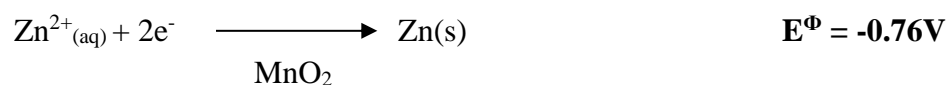
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(c) The following reaction occurs when the cell is in use.



Given that:



Calculate the e.m.f. of the cell.

(1mark)

(d) Use the standard electrode potentials given below to answer the questions that follow.

Half reactions	Electrode potential, E^\ominus (V)
$\text{D}^+_{(aq)} + e^- \longrightarrow \text{D}_{(s)}$	+ 0.80
$\text{E}^{2+}_{(aq)} + 2e^- \longrightarrow \text{E}_{(s)}$	+ 0.34
$\text{F}^{2+}_{(aq)} + 2e^- \longrightarrow \text{F}_{(s)}$	-0.13
$\text{G}^{2+}_{(aq)} + 2e^- \longrightarrow \text{G}_{(s)}$	-0.76

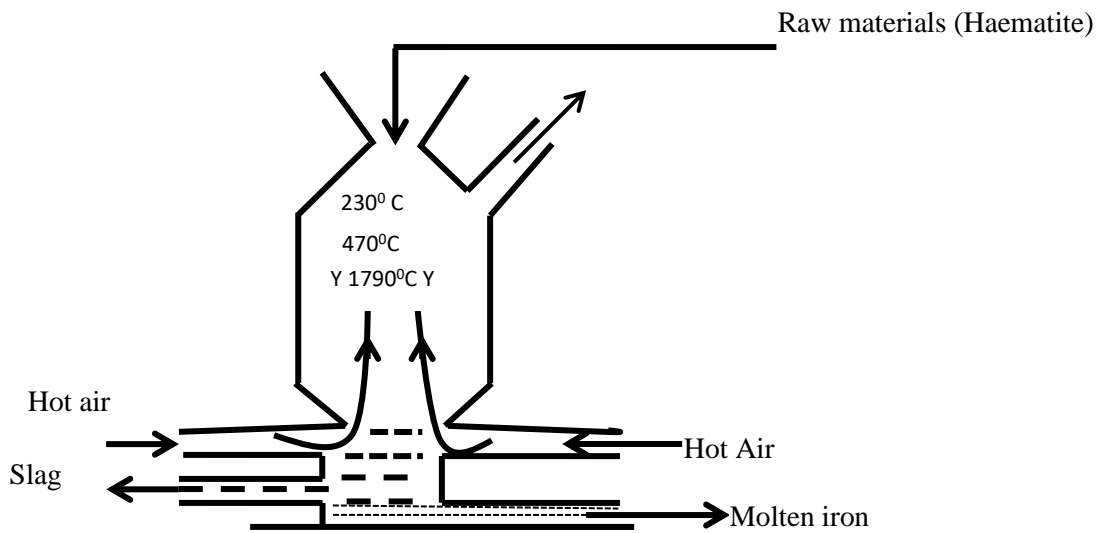
(i) Construct an electrochemical cell that will produce the lowest emf.

(3 marks)

(ii) Calculate the emf of the cell constructed in (i) above.

(1 mark)

8. a) Iron is obtained from haematite using a blast furnace shown below. Study it and answer the questions that follow.



i) Four raw materials are required for the production of iron. Three of these are haematite, hot air and coke. Give the name of the fourth raw material and its use. (1 mark)

I Name.....

II Use.....

ii) Name another Iron ore other than the one shown in the blast furnace. (1 mark)

.....
.....

iii) State one physical property of slag other than density that allows it to be separated from molten Iron as shown in the figure. (1 mark)

.....
.....
.....

iv) Iron from the blast furnace contains about 5% carbon.

I. Describe how the carbon content is reduced.

(1 mark)

.....
.....
.....

II. Why is it necessary to reduce the carbon content?

(1 mark)

.....
.....

v) Explain why temperature in the region marked Y is higher than that of the incoming hot air (1 mark)

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.....
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vi) Describe the process which led to the formation of iron in the blast furnace

(3 mark)

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vii) Give a reason why the melting point of the Iron obtained from the blast furnace is 1200°C while that of pure iron is 1535°C

(1 mark)

.....
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.....
.....

viii) One of the components of the waste gases is Nitrogen (IV) oxide. Describe the adverse effects it has on the environment.

(2 marks)

.....
.....

NAME.....ADM.....CLASS.....

233/2

CHEMISTRY

Paper

2 Hours

KCSE TOP PREDICTION MASTER CYCLE 10

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

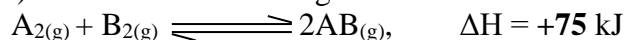
Question	Maximum Score	Candidate's Score
1	11	
2	12	
3	12	
4	12	
5	11	
6	11	
7	11	
Total	80	

*This question paper has 10 printed pages.
Confirm that all the pages are printed as indicated and
No questions are missing.*

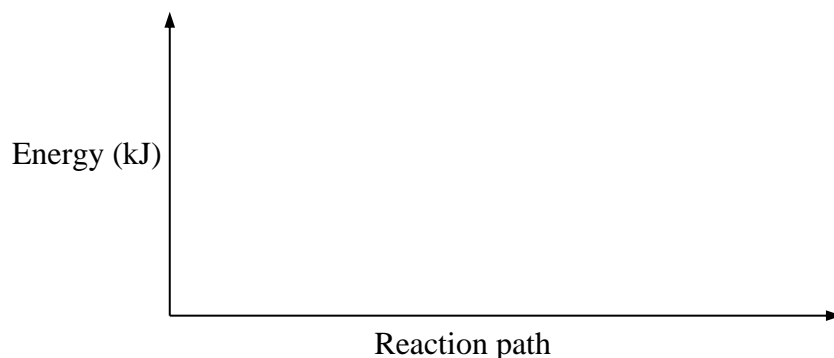
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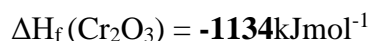
1. a) Consider the following reaction:



Sketch an energy level diagram showing the relative activation energies for the catalysed and uncatalysed reactions using the axes below. (2mks)



b) Given that; $\Delta H_f(\text{Al}_2\text{O}_3) = -1590 \text{ kJmol}^{-1}$



Calculate the heat of reaction for; $2\text{Al}_{(s)} + \text{Cr}_2\text{O}_{3(s)} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}_{(s)}$ (2mks)

c) The following data was obtained during an experiment

Mass of ethanol burnt = 0.2g

Mass of water in the calorimeter = 200g

Specific heat capacity of water = $4.2 \text{ Jg}^{-1}\text{K}^{-1}$

Initial temperature of water = $23.5 \text{ }^\circ\text{C}$

Final temperature of water = $28.0 \text{ }^\circ\text{C}$

i) **How** was the mass of ethanol that burnt determined? (1mk)

.....
.....

ii) **How** much heat was required to raise the temperature of water from 23.5 °C to 28.0°C? (2mks)

.....

.....

iii) Two assumptions were made in calculating the enthalpy of combustion for ethanol. **State them.** (1mk)

.....

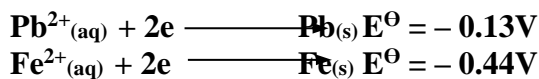
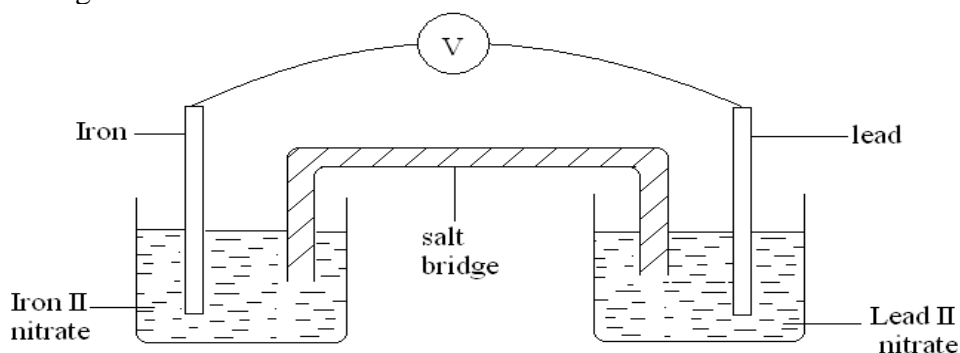
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iv) **Determine** the molar enthalpy of combustion of ethanol.(C= 12,H=1, O=16) (2mks)

v) **Write** a thermochemical equation for the combustion of ethanol given the accurate value for enthalpy of combustion is – 1368 kJmol⁻¹. (1mk)

.....

2. Two half cells were connected as shown to form a voltaic cell. The reduction potentials are given.



a) **Calculate** the e.m.f of the cell. (1mk)

- b) **Sodium chloride is used as the salt bridge. State the two functions of the salt bridge.** (2mks)

.....
.....

- c) **Show the direction of the electron flow in the external circuit.** (1mk)

- d) The e.m.f of the cell will reduce with time. Give a reason for this. (1mk)

.....
.....

- e) During electrolysis of water acidified with Sulphuric acid, two gases were produced at the electrodes:

- i) **State** which ions are preferentially discharged at the electrodes. **Explain** with aid of half ionic equations.

Anode. (2mks)

.....
.....

Cathode. (2mks)

.....
.....

- ii) **Calculate** the volume of the gases at s.t.p produced when a current of 0.025A is passed for 4 hours. (1 Faraday=96500C) (3mks)

3. a) The fermentation of glucose is catalysed by enzymes from yeast. Yeast is added to aqueous glucose, the solution starts to bubble and becomes cloudy as more yeast cells are formed.



The reaction is exothermic. Eventually the fermentation stops when the concentration of ethanol is about 12%.

- (i) On a large scale, the reaction mixture is cooled. Suggest a reason why this is necessary. (1mk)

.....
.....
(ii) Why does the fermentation stop? Suggest one reasons. (1mk)

.....
.....
(iii) What technique is used to concentrate the aqueous ethanol? (1mk)

.....
.....
b) A compound X contains carbon, hydrogen and oxygen only. X contains 54.54% of carbon by mass, 9.09% of hydrogen by mass and 36.37% of oxygen by mass. (C=12, O=16, H=1)

(i) Determine the empirical formula of compound X. (2mks)

(ii) Compound X has a relative molecular mass of 88. Draw the structural formula of compound X. (2mks)

c) The table below gives formulae of three organic compounds A, B and C

Compound	Formulae
A	$C_2H_4O_2$
B	C_2H_6O
C	C_2H_6

Giving a reason in each case, select the letter(s) which represent a compound that

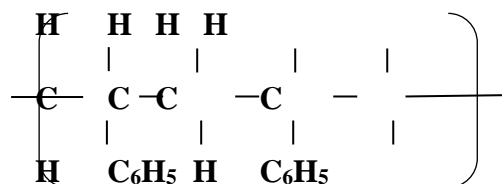
i) Decolourises acidified potassium manganate (VII). (1mk)

.....
.....
ii) Gives effervescence with sodium hydrogen carbonate. (1mk)

.....
.....
iii) Undergoes substitution reaction with chlorine gas. (1mk)

.....

 d) The following is a small reaction of polystyrene polymer. Study it and answer the questions that follow.



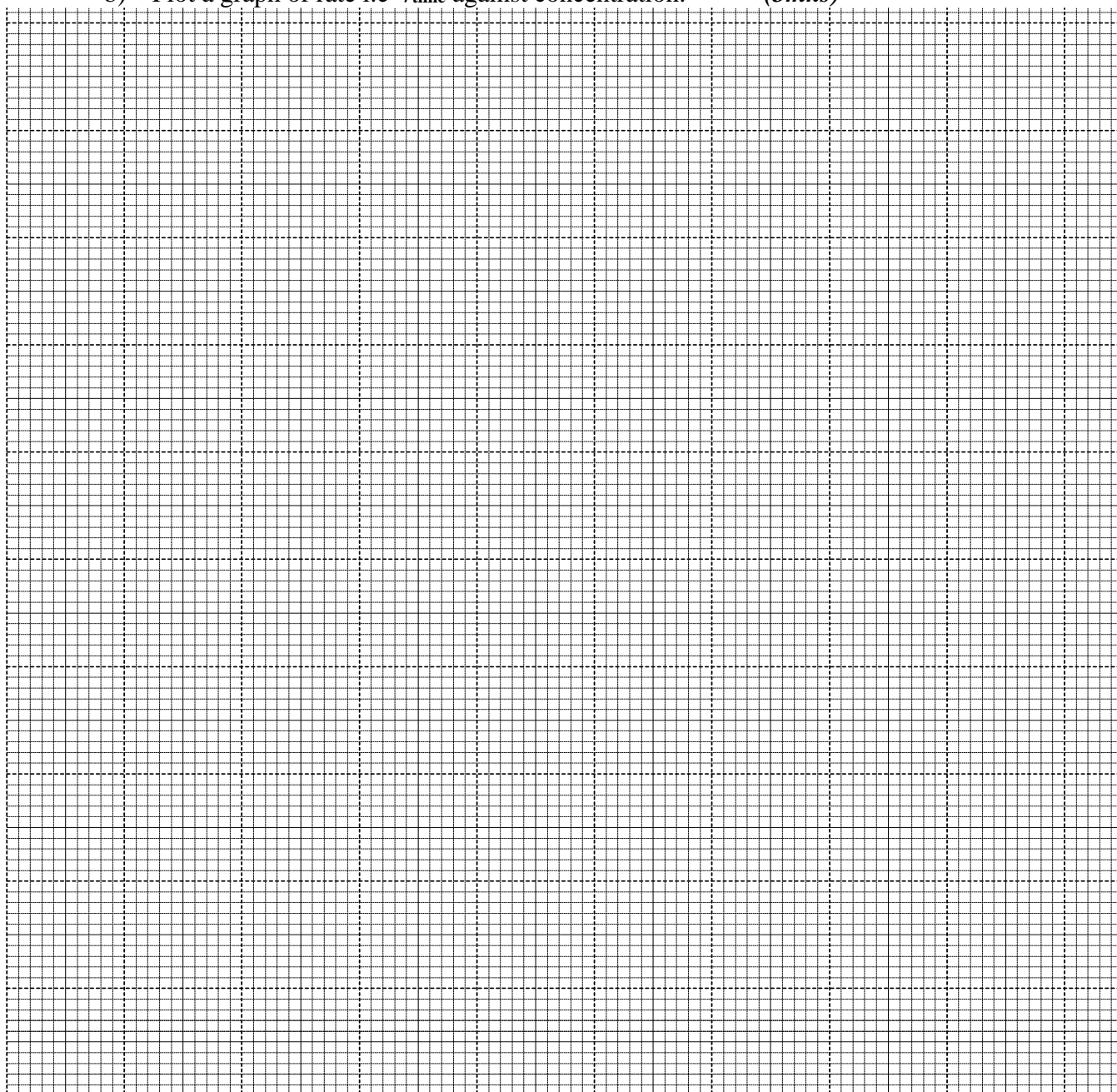
(i) Draw the structure of the monomer unit of polystyrene. (1mk)

(ii) Calculate the number of monomers used to form the polystyrene of relative molecular mass of 18096. (H = 1, C = 12) (1mk)

4. An experiment was carried out using magnesium ribbon and dilute hydrochloric acid of different concentrations. The time needed to produce 50cm³ of the gas for every experiment was recorded in a table.

Concentration of HCl (moles per litre)	2.0	1.75	1.50	1.25	1.00	0.75	0.50	0.25
Time (seconds)	8.8	10.0	11.7	14.0	17.5	18.7	35.0	70.0
$\frac{1}{\text{time}}$ (Sec ⁻¹)								

- a) Complete the table above for $1/\text{time}$. (4mks)
b) Plot a graph of rate i.e $1/\text{time}$ against concentration. (3mks)



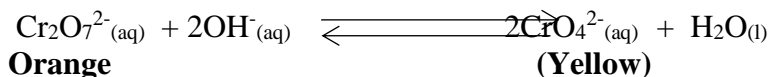
- c) From your graph determine the concentration needed to produce 50cm^3 of hydrogen gas when time is 15.0 seconds (1mks)

.....
.....

- d) From your graph state the relationship between the rate of reaction and concentration. Give a reason. (1mk)

.....

 e) A state of equilibrium between dichromate (vi) and chromate ions is established as shown below



i) What is meant by dynamic equilibrium? (1mk)

.....

ii) State and explain observation made, when a few pellets of Hydrochloric acid are added to equilibrium mixture (2mks)

.....

5. I) The table below shows properties of some elements represented by symbols W,X,Y and Z. Study the information in the table and answer the questions that follows

Element	No. Of protons	Atomic radius(nm)	Boiling point °C
W	2	0.93	-269
X	10	1.31	-246
Y	18	1.54	-186
Z	36	1.89	-152

a) Write down the electron arrangement for elements W and X (1mk)

.....

b) In which group of the periodic table are the elements in the table above? Give the name of the group (2mks)

.....

c) Explain why the atomic radius of W is smaller than that of X (1mk)

.....

d) state one use of element X (1mk)

.....

 II. The section below represents part of the periodic table. Study it and answer the questions that follow. The letters are not the actual symbol of the elements.

				Q			
X			B	H		M	T
Y		A					V
Z							S

a) **Select** the least reactive non-metal. *(1mk)*

.....

b) **Which** of the elements has the greatest tendency of forming covalent compounds in nature? **Explain** your choice. *(1mk)*

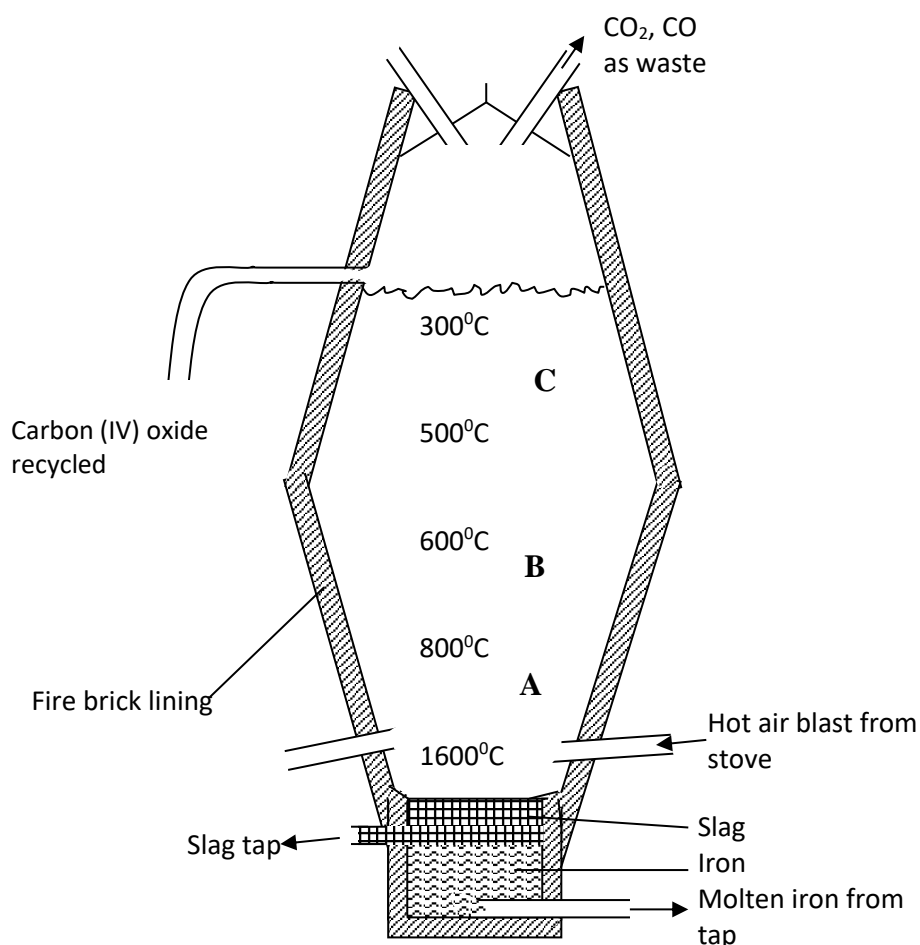
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c) **Explain** why the atomic radius of **T** is smaller than that of **M**. *(2mks)*

.....

d) Compare the electrical conductivity of element X and B. *(2mks)*

6. Extraction of iron involves two main processes, smelting and refining. Below is the blast furnace which is used to smelt iron from its ore.



- a) (a) (i) The chief ore is Haematite. Name one other ore used in extraction of iron (1 mark)

.....

.....

- (ii) Name the reducing agent in the process. (1mk)

.....

.....

- (i) What is the role of the hot air blast in the process? (2mks)

.....

.....

- (b) Write equations for the reactions that take place at the region marked A, B and C. (3mks)

A.....

B.....

C.....

(c) What is the purpose of limestone in the extraction process? (1mk)

.....

(d) Write equations to show how impurities are removed from the ore. (2mks)

.....

.....

.....

(e) State one environmental effect of the process. (1mk)

.....

.....

7. a) Read the following passage and answer the questions.

A salt K was heated with slaked lime (calcium hydroxide). A colourless gas L with a characteristic smell and turns red litmus paper blue was evolved. A large quantity of this gas was passed through an inverted filter funnel into Copper(II)sulphate solution, and a deep blue solution M was obtained.

a) Identify gas L (1mk)

.....

.....

b) What is K most likely to be? (1mk)

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.....

c) Write an equation for the reaction between K and slaked lime (1mk)

.....

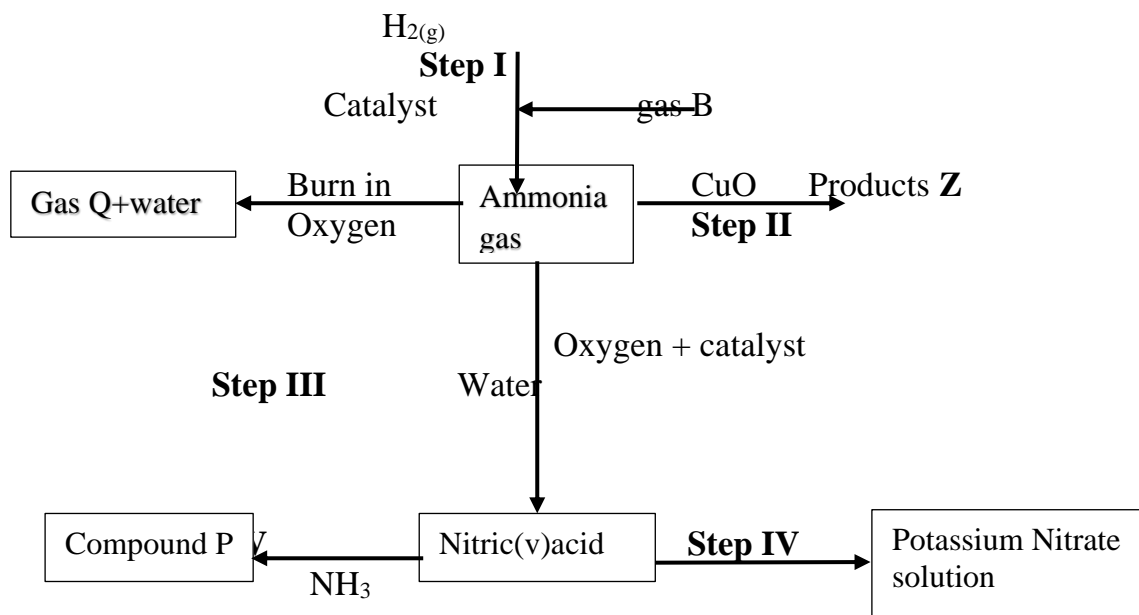
d) Write an ionic equation for the reaction with copper(II) sulphate forming the deep blue solution (1mk)

.....

.....

.....

b) Study the flow chart below and answer questions that follow:



(i) State **one** source of gas B (1mk)

.....

.....

(ii) Name the catalysts used in; (1mk)
 a) Step I

.....

b) Step III

.....

(iii) Write chemical equations for reactions in; (3mks)
 a) Step I

.....

b) Step II

.....

c) Step V

.....
(iv) Identify any other gas that can be used instead of Ammonia in step II (1mk)

.....
(v) State one use of gas Q (1mk)