KCSE 2024 FINAL PREDICTION

CHEMISTRY

(PREDICTIONS TRIALS 1-10)

Final series of Possible Questions expected to be examined in the forthcoming Final Exams. This provides a framework and means of illumination to guide our candidates in preparation for the KCSE Examinations scheduled for November 2024

The following are Questions to expect in KCSE 2024.

CONFIDENTIAL!

For Marking Schemes

Mr Isaboke 0746 222 000 / 0742 999 000

ALL THE BEST IN KCSE!

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 1

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

For Examiners Use Only

STIONS	IMUM SCORE	DENTS SCORE
1-29	80	

1. When magnesium metal is burnt in air, a white ash is formed. Write the formula of the two components of the white ash. **(2marks)**

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2. What type of bond is formed when sodium and chlorine react? Explain. **(2marks)**

(Atomic numbers: Na = 11 and Cl = 17)

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3. When solid Sodium carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no apparent reaction. On addition of water to the resulting mixture, there was vigorous effervescence. Explain these observations. **(3marks)**

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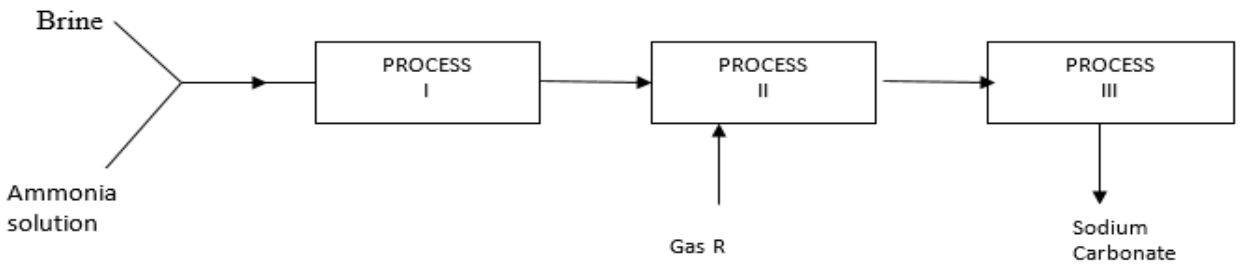
4. Below is a simplified scheme of Solvay process. Study it and answer the questions that follow:



a) Identify gas R. **(1mark)**

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b) Write an equation for the process III. **(1mark)**

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c) Give **two** use of sodium carbonate. **(1mark)**

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5. When potassium nitrate is heated, it produces potassium nitrite and gas C.

(a) Identify gas C **(1mark)**

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(b) Name the type of reaction undergone by the potassium nitrate **(1mark)**

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6. When a few drops of aqueous ammonia were added to copper (II) nitrate solution, a light blue precipitate was formed. On addition of more aqueous ammonia, a deep blue solution was formed. Identify the substance responsible for the:

a. Light blue precipitate. **(1mark)**

……

b. Deep blue solution. **(1mark)**

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7. The first step in the industrial manufacture of nitric (v) acid is the catalytic oxidation of ammonia gas.

(a) What is the name of the catalyst used? **(1 mark)**

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(b) Write the equation for the catalytic oxidation of ammonia gas. **(1mark)**

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(c) Nitric acid is used to manufacture ammonium nitrate, state two uses of ammonium nitrate. **(1mark)**

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8. a) Complete the table below to show the colour of the given indicator in. **(1mark)**

tor	r in	
	solution	solution
l orange	…….	w
lphthalein	less	……

b) How does the pH value of 0.1 M potassium hydroxide solution compare with that of 0.1M aqueous ammonia? Explain. **(2marks)**

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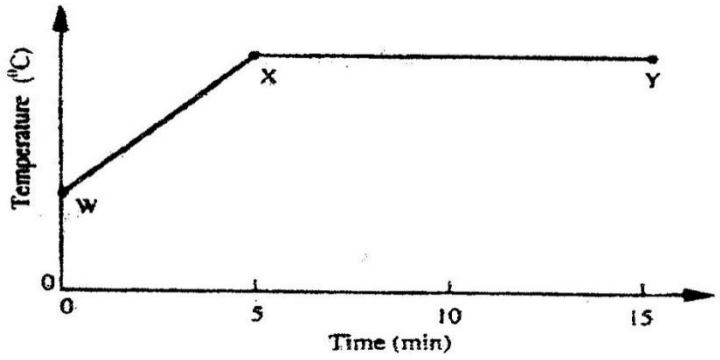
9. Sketch and label a graph to show activation energy in an endothermic reaction. **(3marks)**

10. The graph below shows a curve obtained when water at 20°C was heated for 15 minutes.



a) What happens to the water molecules between points W and x? **(1mark)**

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b) In which part of the curve does a change of state occur? **(1mark)**

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c) State one application of the effect of impurities on melting point of substances. **(1mark)**

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11. In an experiment, magnesium reacted with copper (ii) sulphate solution.

a) What type of reaction is illustrated. **(1mark)**

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b) state two observations made. **(2marks)**

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12. 15.0cm^3 of ethanoic acid (CH_3COOH) was dissolved in water to make 500cm^3 of solution. Calculate the concentration of the solution in moles per litre. (C=12.0; H=1.0; O=16.0; density of ethanoic acid is 1.05 g/cm^3). **(3marks)**

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13. In an experiment, a few drops of concentrated nitric (v) acid were added to aqueous iron (II) sulphate in a test tube. Excess sodium hydroxide solution was then added to the mixture.

a) State the observations that were made when:

i) Concentrated nitric (v) acid was added to aqueous iron (II) sulphate. **(1mark)**

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ii) Excess sodium hydroxide was added to the mixture. **(1mark)**

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b) Write the ionic equation for the reaction which occurred in (a) (ii) above. **(1mark)**

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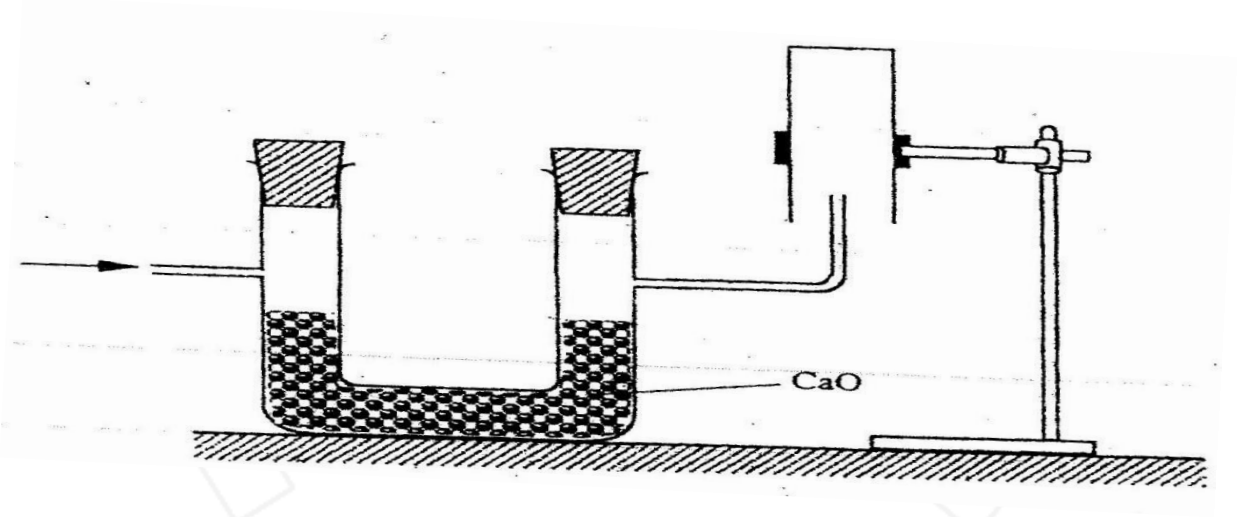
14. The set-up below was used to collect a dry sample of a gas.



a) Give two reasons why the set-up cannot be used to collect carbon (iv) oxide gas. **(2marks)**

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b) Name a gas that can be collected by the above set up**.** **(1mark)**

……

15 The basic raw material for extraction of aluminium is bauxite

a) Name the method that is used to extract aluminium from bauxite. **(1mark)**

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b) Write the chemical formula of the major component of bauxite. **(1mark)**

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c) Name two major impurities in bauxite. **(1mark)**

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16. During the electrolysis of aqueous silver nitrate, a current of 5.0A was passed through the electrolysis for 3 hours.

a) Write the equation for reaction which took place at the cathode. **(1mark)**

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b) Calculate the mass of silver deposited at the cathode. (Ag = 108; IF=96500C). **(2marks)**

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17. A compound whose general formula is $M(OH)_3$ reacts as shown by the equation below.

$M(OH)_{3(s)} + OH_{(aq)} \rightarrow M(OH)_{4(aq)}$

$M(OH)_{3(s)} + 3H^+_{(aq)} \rightarrow M^{3+}_{(aq)} + 3H_2O_{(i)}$

(a) What name is given to compounds which behave like $M(OH)_3$ in the two Reactions **(1 mark)**

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(b) Name two elements whose hydroxides behave like that of M **(2 marks)**

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18. a) State the Graham's law of diffusion. **(1mark)**

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b) The molar masses of gases W and X are 16.0 and 44.0 respectively. If the rate of diffusion of W through a porous material is $12cm^3s^{-1}$, calculate the rate of diffusion of X through the same material. **(2marks)**

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19. In a closed system, aqueous iron (III) chloride reacts with sulphide gas as shown in the equation below.

$$2FeCl_{3(aq)} + H_2S_{(g)} \rightleftharpoons 2FeCl_{2(aq)}\ 2HCl_{(aq)} + S_{(s)}$$

State and explain the effects on the position of equilibrium point when dilute hydrochloric acid is added to the system at equilibrium. **(2marks)**

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20.In an experiment to determine the percentage of magnesium hydroxide in an anti-acid, a solution containing 0.50 g of the anti-acid was neutralized by 23.0 cm^3 of 0.1M hydrochloric acid (Relative formula mass of magnesium hydroxide =58)

Determine the,

a) Mass of magnesium hydroxide in the anti-acid. **(2marks)**

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b) Percentage of magnesium hydroxide in the anti-acid . **(1mark)**

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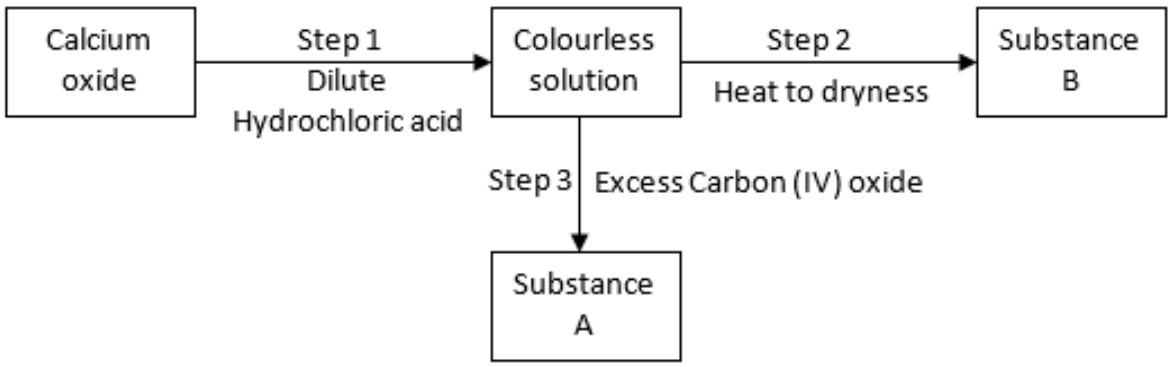
21. Study the flow chart below and answer the questions that follow.



a) Give the name of the process that takes place in step 1. **(1mark)**

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b) Give;

(i) The name of substance A. **(1mark)**

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(ii) One use of substance B. **(1mark)**

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22. Starting with 50 cm^3 of 2.8M sodium hydroxide, describe how a sample of pure sodium sulphate crystals can be prepared. **(3 marks)**

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23. Use the information below to answer the questions that follow:

Equation	Enthalpy of formation
$H_2(g) + ½ O_2(g) \rightarrow H_2O(l)$	$\triangle H = -286\ kjmol^{-1}$
$C(s) + O_2(g) \rightarrow CO_2(g)$	$\triangle H = -394 kjmol^{-1}$
$2C(s) + 3H_2(g) + ½ O_2 \rightarrow C_2H_5OH(i)$;	$\triangle H = 277 kjmol^{-1}$

a) Define the term "enthalpy of formation of a compound **(1mark)**

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b) Calculate the molar enthalpy of combustion, $\triangle H_c$ of ethanol:

$C_2H_5OH\ (l) + 3O_2(g) \rightarrow 2CO_2\ (g) + 3H_2O\ (l)$ **(2mks)**

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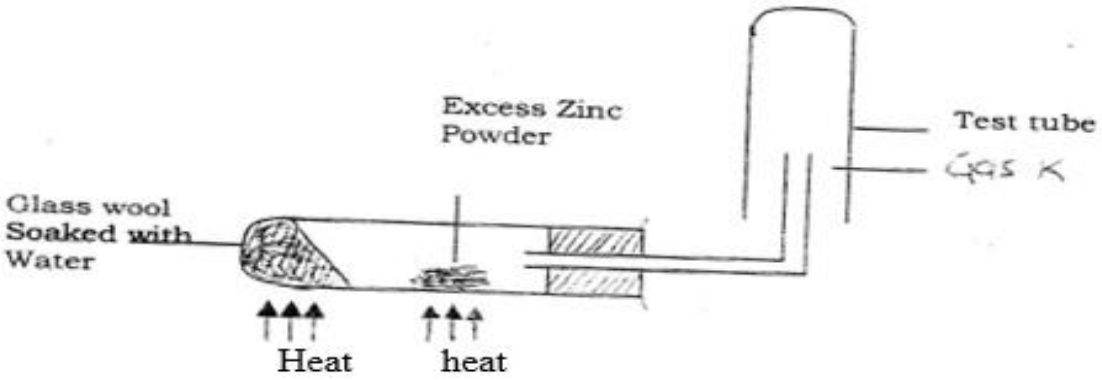
24. A student set up the experiment below to collect gas K, the glass wool was heated before heating the Zinc powder.



a) Explain why was it necessary to heat the moist glass wool before heating zinc powder. **(2marks)**

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b) Identify gas K. **(1mark)**

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25. Compound W (not its actual symbol) is a solid with a giant ionic structure. In what form would the compound conduct an electric current, explain. (**2marks)**

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26.Pentane and ethanol are miscible. Describe how water could be used to separate a mixture of pentane and ethanol. **(3marks)**

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27. But -2- ene undergoes hydrogenation according to the equation given below

$$CH_3CH = CHCH_3\ (g) + H_2\ (g) \rightarrow CH_3CH_2CH_2CH_3\ (g)$$

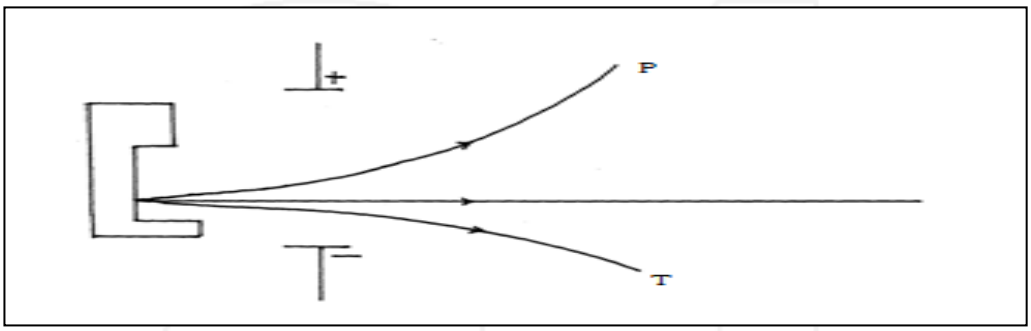
(a) Name the product formed when but -2 – ene reacts with hydrogen gas. **(1mark)**

……

(b) State one industrial use of hydrogenation. **(1mark)**

……

28. The figure below shows the behaviour of emissions by a radioactive isotope x. Use it to answer the question follow



(a) Why does isotope **X** emits radiations.

(1mark)

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(b) Name the radiation labelled **T** **(1mark)**

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c) What is half-life **(1mark)**

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29.a) State two reasons why cars are **painted** **(1mark)**

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b) Explain why electric cars are better than ordinary fuel cars. **(2marks)**

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 1

233/2

CHEMISTRY

PAPER 2

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

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

(b) *Answer **all** the questions in the spaces provided in the question paper.*

(c) *Non-programmable silent electronic calculators and KNEC mathematical tables may be used.*

(d) *All working **must** be clearly shown where necessary.*

(e) *Candidates should answer the questions in English.*

For Examiner's Use Only

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	12	
2	13	
3	11	
4	11	
5	12	
6	10	
7	11	
Total score	80	

1. (a) Detergents are substances that improves cleansing properties of what. Name two substances that are added to detergents to make them more effective in cleansings. **(1mark)**

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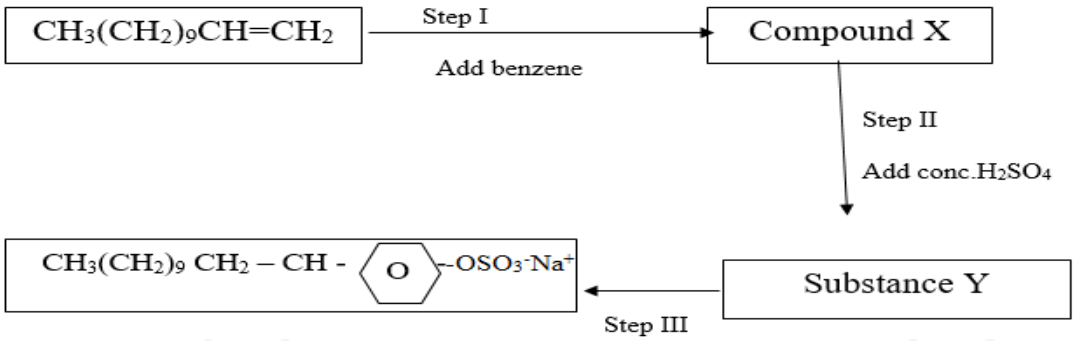
(b) The flow chart below shows steps in the manufacture of soapless detergent. Study it and answer the questions that follow.



(i) State the condition necessary for Step I. **(1mark)**

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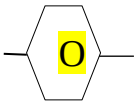
(ii) Write an equation for the reaction in step I (benzene, C_6H_6 is represented as). 

(1 mark)

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(c) (i) Name the process in step III. **(1mark)**

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(ii) Give the reagent in step III.

(1mark)

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(iii) Give the name of the product of step III.

(1mark)

.....

(d) Explain:

(i) One advantage of soapless detergents over soaps. **(1mark)**

.....

.....

(ii) One disadvantage of soapless detergents over soaps. **(1mark)**

.....

(e) Pentanoic acid reacts with butan-1-ol to form an organic compound.

(i) What is the name given to the above type of reaction? **(1mark)**

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(ii) A certain catalyst must be added to the mixture to increase the rate of reaction.

Name the catalyst**.** **(1mark)**

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Explain the role of the catalyst in the above reaction. **(1 mark)**

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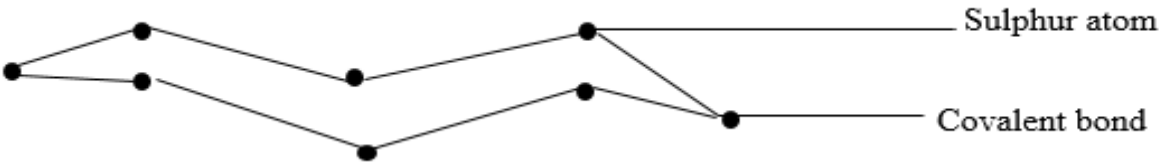
1. Study the structure below and use it to answer the questions that follows



(a) State two observations made when the molecule is heated to a temperature of 113°c**. (2 mks)**

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(b) Write an equation of the reaction between sulphur atom with hydrogen gas. **(1mark)**

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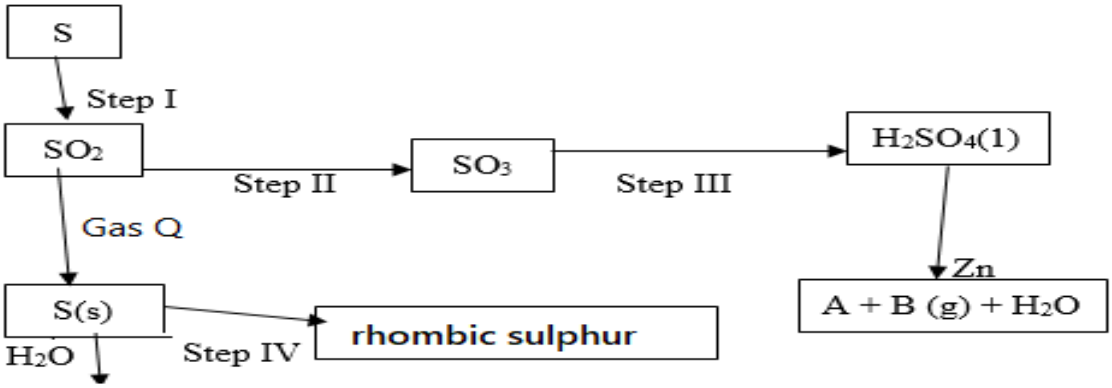
(c) Below is a flow chart. Use it to answer the questions that follow.



Name: **(2 marks)**

(i) Gas Q ……

(ii) Gas B ……

(d) (i) State the observations made in step I. **(2marks)**

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(ii) Step I and Step II occur in the Contact process. State the optimum conditions necessary for Step II to occur. **(2marks)**

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(iii) Name the reagent used in Step IV. **(1 mark)**

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(iv) Explain why water is not used in Step III. **(1 mark)**

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(e) Sulphur (iv) oxide is a major environmental pollutant and should not be emitted into the atmosphere. Name the reagent used to achieve this. **(1 mark)**

……

(f) Explain the role of Sulphur in vulcanization of rubber. **(1 mark)**

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3. Study the Standard electrode potential for the half-cell given below and use it to answer the questions that follow. The letters do not represent the actual symbols of elements.

		Eθ (volts)
) + e^-	P(s) →	2
) + e^-	Q (s) →	52
)+ e^-	½R → (g)	0
) + $2e^-$	S(s) →	4
g) + e^-	$T^-_{(aq)}$ →	36

(a) Identify the strongest oxidizing agent. Give a reason for your answer. **(2 marks)**

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(b) Which half cells would produce the highest potential difference when combined? **(1 mark)**

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(c) Predict whether the reaction represented below can take place. **(2 marks)**

$$S_{(s)} + P^+_{(aq)} \longrightarrow S^{2+}_{(aq)} + P_{(s)}$$

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(d)Write a cell representation for the cell that would be constructed by combining P and Q. **(2 mks)**

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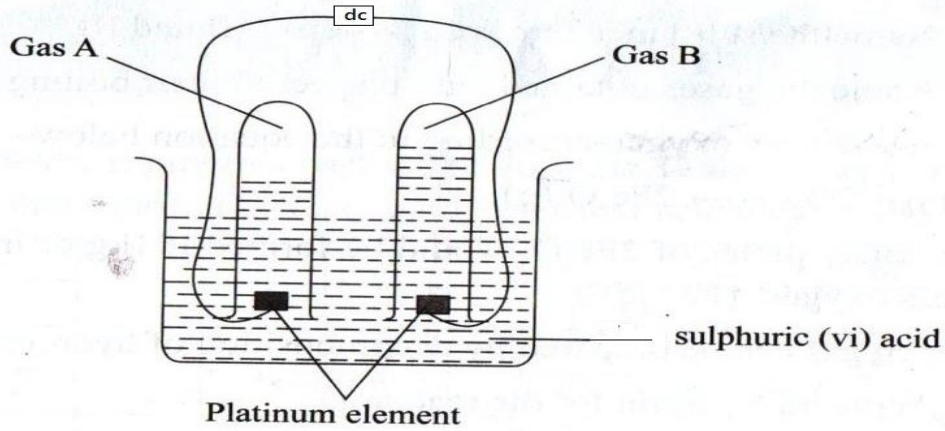
(e) 100 cm^3 of 2M sulphuric acid was electrolyzed using the set up represented by the following diagram.



(i) Write an equation for the reaction that produces gas B.

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(ii) Describe how gas A can be identified. **(1 mark)**

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(iii) Explain the differences in the volumes of gases produced at the electrodes. **(2 marks)**

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(f) An electric current is passed through a solution for 18 minutes. The volume of gas produced at the cathode is 480 cm3.Calculate the current used. (Molar gas volume at rtp = 24 dm3 IF = 96500 C) **(2 marks)**

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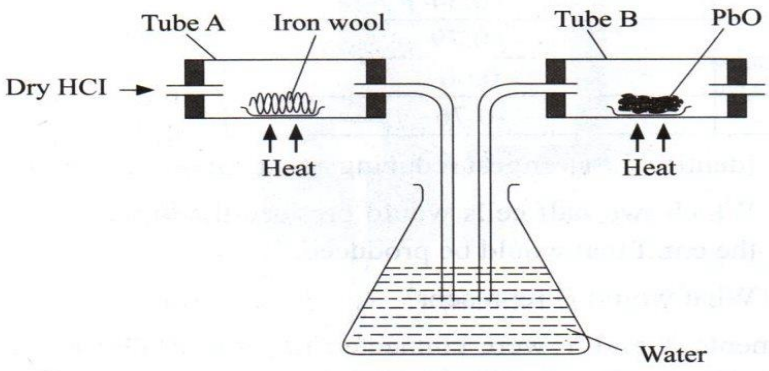
4. In an experiment, dry hydrogen chloride gas was passed through heated iron wool as shown in the diagram below. The gas produced was then passed through heated lead (II) oxide.



(a) (i) State the function of water in the flask. **(1 mark)**

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(ii) Write the equation for the reactions that took place in tubes labeled A and B. **(2 marks)**

Tube A

……

Tube B

……

(iii) Explain how the total mass of tube B and its contents would compare before and after the experiment. **(2 marks)**

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(b) Chlorine gas and hydrogen chloride gas can be prepared using the following reagents: sodium chloride, concentrated Sulphuric (VI) acid and potassium manganate (VII) and hydrochloric acid.

(i) State the role of each of the following in the reaction. **(1 mark)**

Concentrated Sulphuric (vi) acid

……

……

Potassium manganate VII. **(1 mark)**

……

……

(ii) Name the bleaching agent formed when chlorine gas is passed through cold dilute sodium hydroxide solution. **(1 mark)**

……

(iii) Apart from bleaching action, state the other use of compound formed in (ii) above. **(1 mark)**

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……

(c) 1.9 g of magnesium chloride were dissolved in water. Silver nitrate solution was then added until in excess. Calculate the mass of $AgNO_3$ that was needed for the complete reaction. **(2 marks)** **(Ag = 108, O = 16, N = 1, Mg = 24, Cl = 35.5)**

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5. Use the grid below to answer the questions that follow (the letters do not represent the actual symbols of the elements)

A								
F	J				M		O	
G			K	L		N	P	Q
H								

(a) Give the family name to which elements in the shaded area belong. **(1 mark)**

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(b) State and explain the difference in reactivity between G and J. **(2 marks)**

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(c) How does the atomic radius of K compare to that of L? Explain. **(2 marks)**

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(d) Element R forms an oxide of formula RO_2 and it belongs to period 2.

Indicate on the grid the position of R. **(1mark)**

(e) Give the formula of the compound formed between K and P. **(1mark)**

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(f) Give the type of bond formed when F reacts with O. Explain. **(2 marks)**

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(g) Give the electronic arrangements of the ions of G and M. **(1mark)**

G……

M……

h) Element A can fit in two groups. Name the two groups and explain. **(2 marks)**

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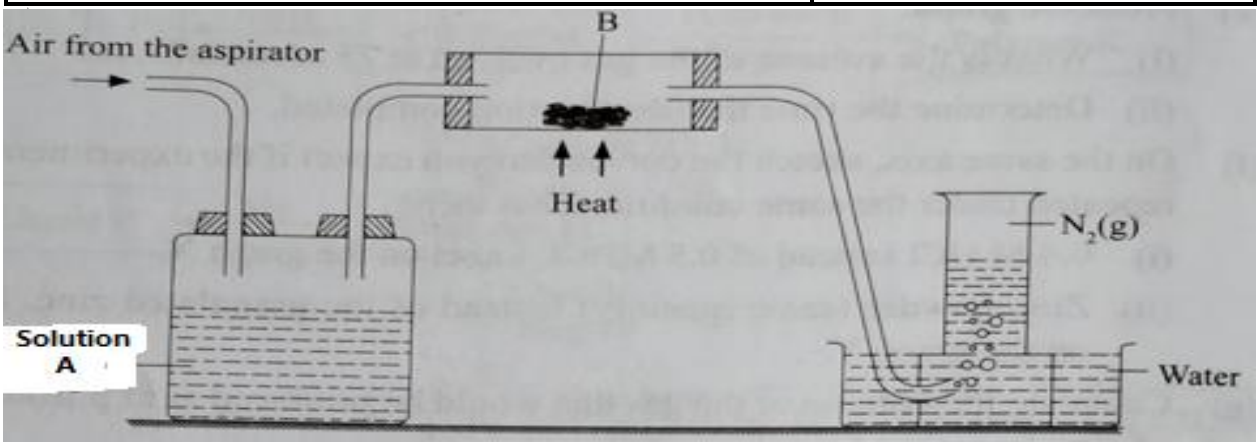
6. An experiment was carried out using the apparatus as shown below to prepare a sample of nitrogen gas from air.



(a) Identify one mistake in the setup. **(1mark)**

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……

(b) Name what is contained in: **(2marks)**

(i) Bottle A ……..

(ii) Tube B ……

(c) The nitrogen prepared by his method is denser than nitrogen prepared by fractional distillation of liquid air. Explain. **(1mark)**

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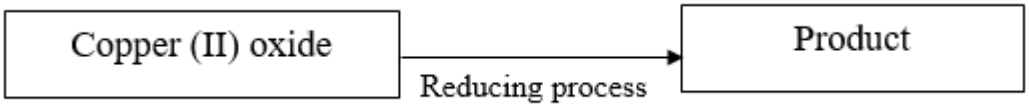
(d) Use the flow diagram to answer the questions



(i) Give the formulae of three gases which can reduce hot copper (II) oxide. **(3 marks)**

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(ii) Explain what will be observed when the above reaction takes place. **(1 mark)**

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(e) In the Haber process, the optimum yield of ammonia is obtained when a temperature of 450°c,a pressure of 200 atmospheres and an iron catalyst are used.

$$N_{2(g)} + 3H_{2\,(g)} \rightleftharpoons 2NH_{3(g)} \quad \Delta H = -92\ kJ/mol$$

How is the yield of ammonia affected if the temperature is raised to 600° C. Give a reason? **(2mks)**

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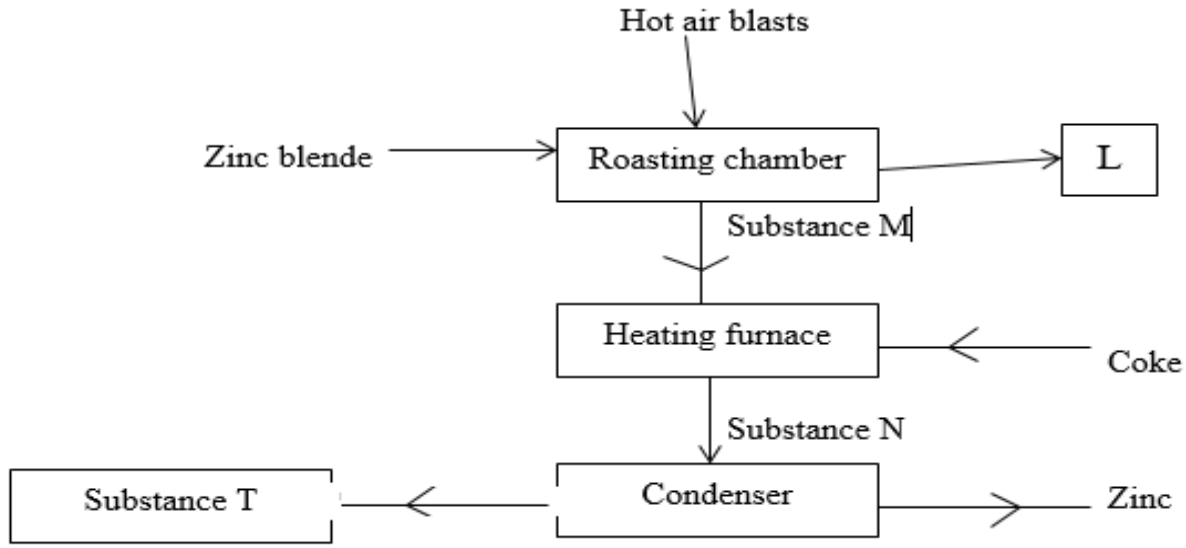
7. The flow chart below illustrates extraction of Zinc from zinc blende. Study it and answer the questions that follow



(a) Give an equation for the reaction in roasting furnace. **(1 mark)**

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(b) Name each of the substances marked L and N. **(2 marks)**

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(c) Why is it necessary to condense substance N? **(1 mark)**

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(d) Which other factory can be set up near the zinc extraction plant. Explain. **(2marks)**

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(e) Give one use of zinc metal. **(1 mark)**

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(f) **(i)** Zinc sulphide and sulphuric acid react according to the following equation.:

$$ZnS_{(s)} + H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + H_2S_{(g)}$$

2.91g of zinc sulphide reacted with 100cm^3 of 0.2M Sulphuric acid. Determine the reagent that was in excess. (Zn = 65.0, S = 32.0). **(2 marks)**

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(ii) Calculate the volume of hydrogen sulphide H_2S) gas produced in the reaction above at rtp. Molar gas volume 24 dm^3**)** **(2 marks)**

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 2

CHEMISTRY

233/1

PAPER 1

(THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

Instructions To Candidates

a) Write your name and index number in the spaces provided

b) Sign and write the date of examination in the spaces provided

c) Answer ALL questions in the spaces provided

d) Mathematical table and electronic calculators may be used.

e) ALL working MUST be shown clearly where necessary

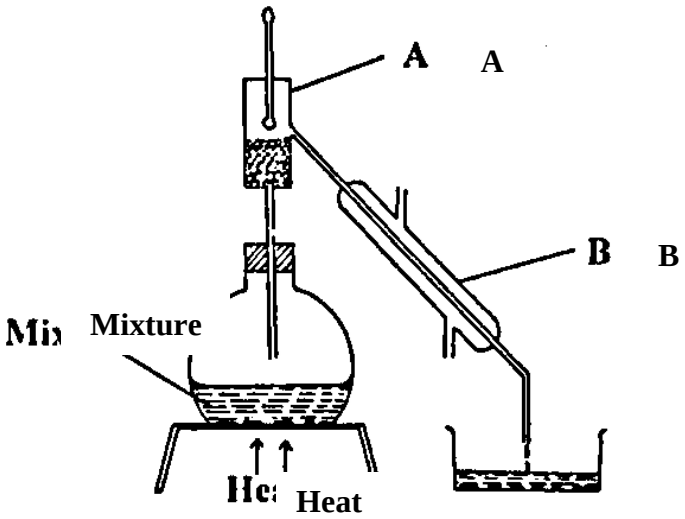
f) Candidates should check the question paper to ensure that all pages are printed as indicated and no questions are missing

For Examiner's Use Only

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORES
1 – 31	80	

QUESTIONS

1. The diagram below shows a set-up of apparatus used to separate immiscible liquids.



a) Name the parts labelled A and B. **(1 mark)**

A .....

B .....

b) State the function of the part labelled A . **(1 mark)**

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2. Element K (not actual symbol of the element) has isotopes with relative abundance as shown below.

Isotope	**abundance %**
$^{10}_{5}K$	18.69%
$^{11}_{5}K$	81.28%

Calculate the relative atomic mass of K. **(2 marks)**

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3. The table below gives the ionization energies of the alkali metals.

Element	**1st ionization energy** kJ mol
A	494
B	418
C	519

Which of the three metals is the least reactive. Give a reason. **(1mark)**

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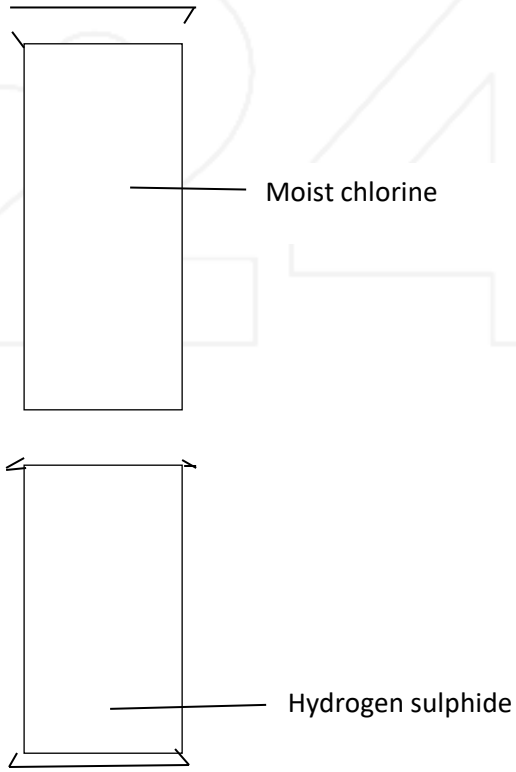
4. A jar full of moist chlorine was inverted over a jar of hydrogen sulphide as shown below.



(a) State the observation made. **(1 mark)**

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(b) Write the equation for the reaction and show using oxidation numbers that the reaction above is redox. **(2 marks)**

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5. A piece of burning Magnesium was introduced into a gas jar of nitrogen, water was then added to the products. The resultant solution was tested with litmus paper.

(i) Explain the observation. **(1mark)**

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(ii) Write an equation for the formation of the final solution. **(1mark)**

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6. State one reagent that can be used to distinguish between the pairs of ions.

(a) Pb^{2+} (aq) Al^{3+}(aq)

Reagent

Observation **(2 marks)**

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(b) $SO^{2-}4$ and $SO3^{2-}$

Reagent

Observation **(2marks)**

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7. 20cm^3 of sodium carbonate solution was reacted completely with 25cm^3 of a 0.8M hydrochloric acid according to the equations.

$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + CO_2 + H_2O$

Calculate the concentration of sodium carbonate in grams per litre. **(3 marks)**

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8. The electronic arrangement of ions of a certain element represented by letters P Q R and S.

P^{2-} 2:8:8

Q^{2+} 2:8

R^{+} 2:8

S 2:8:8

a) Explain why S is not represented as an ion. **(1mark)**

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b) Which element has the largest atomic radius? Explain **(1mark)**

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9. A label on a bottle of Hydrochloric acid has the following information;

Density 1.134gm and percentage purity 37%

Determine the molarity of the solution. **(4 marks)**

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10. The P^H values of some solutions are given below

P^H	14.0	1.0	8.0	6.5	7.0
Solution	M	L	N	P	Z

(a) **Identify** the solution with the lowest concentration of hydrogen ion. Give reason for your answer **(1mk)**

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(b) Which solution would be used as an anti-acid for treating stomach upset. Give for your answer **(1mk)**

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11. The atomic number of P and S are 6 and 17 respectively.

a) Using dots and cross draw the compound formed when P react with S. **(1mark)**

b) Name the type of bond and explain whether the compound would conduct electricity. **(2 marks)**

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12. A given volume of a gas G diffuses through a membrane in 10 seconds. Under same condition an equal volume of oxygen diffuses for 12.5sec. Determine the molecular mass of G**. (2 marks)**

13. (a) Using an equation explain the observation made when sodium hydroxide is added to aluminum oxide dropwise until in excess.

(2 mks)

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(b) Name the product of the reaction

(1mark)

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14. (a) Cynogen is a gaseous compound of carbon and Nitrogen only. 250cm^3 Cynogen. On complete combustion in oxygen. 750cm^3 of nitrogen (iv) Oxide and 1000cm^3 of the rest of product. Determine the formula of cynogen. **(3 marks)**

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b) Complete the reaction by indicating the polymer. **(1mark)**

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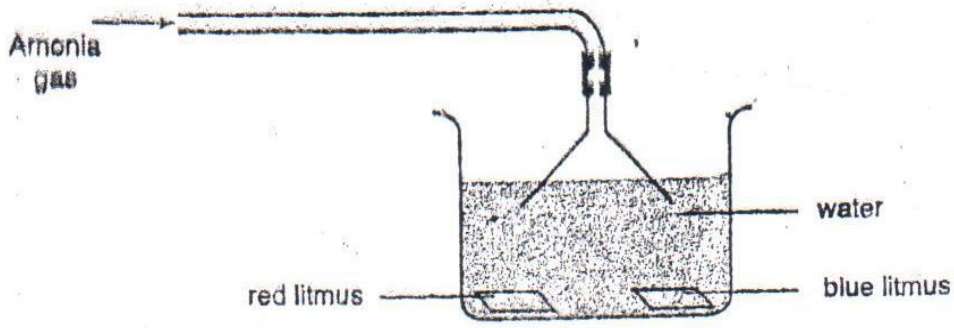
15. A stream of Ammonia was bubbled in water containing litmus papers.



a) State one physical property of the gas **(1mark)**

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b) Explain the observation made during the experiment.

(1mark)

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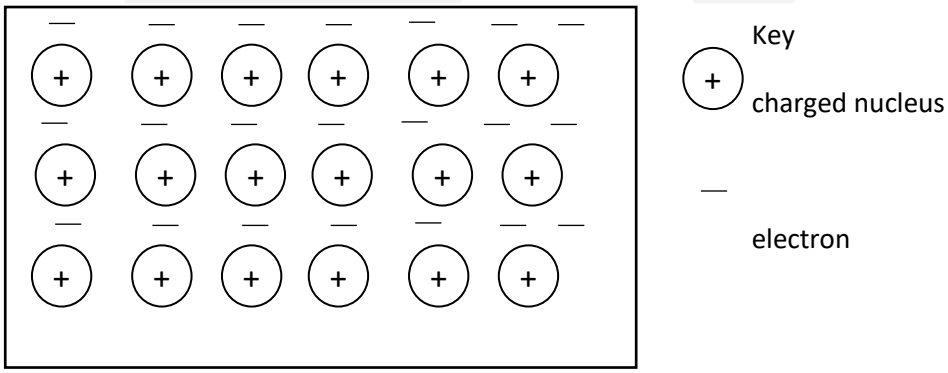
16. The diagram below is a section of a model of the structure of element K



a) State the type of bonding that exist in **K** **(1mk)**

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b) In which group of the periodic table does element K belong. Give a reason **(2mks)**

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17. Propene and propane both decolourises bromine liquid at different conditions.

a) Explain with an equation how the hydrocarbons decolourises bromine. **(4 marks)**

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b) Complete the reaction by indicating the polymer **(1mark)**

C_2H_4 ⟶

c) State type of reaction and calculate the value of n given the molecular mass of polymer is 33600.

(4 marks)

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18. Below is a chemical reaction

$2SO_2 + O_2 \rightleftharpoons 2SO_3$ H-ve $\triangle$

Using an energy level diagram represent the reaction when vanadium (V) oxide is used. **(2 marks)**

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a) State the effect of increase temperature to the equilibrium **(1mark)**

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b) Give one characteristic of a dynamic equilibrium. **(1mark)**

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19. Study the test below and answer the questions.

(i)

Test	Observation
P is heated until no further change	olourless liquid condensed on the cooler parts of the test t colourless gas which turns Aqueous potassium chromate green was given out and red-brown residue R was left.

(ii)

ɔrine gas was bubbled through an aqueous	Solution turn from green to yellow

a) Identify **P**.....

R.....**1mark)**

b) Describe how a student would test for onion in solid P. **(3 marks)**

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c) Name one reagent that can be used to confirm cation in P. **(1mark)**

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20. Name the main ores of. **(2 marks)**

a) Iron

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b) Copper

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c) Sodium

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d) Aluminium

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21. Calculate the oxidation number of P given the following P_2O_5 **(1mark)**

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22. State and explain observation made when chlorine gas bubble through a solution of potassium iodine. **(2 marks)**

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23. Sketch the bond formed between the complex of tetramine copper(II) ions. **(1mark)**

24. Explain why graphite is used as a lubricant in machines. **(3 marks)**

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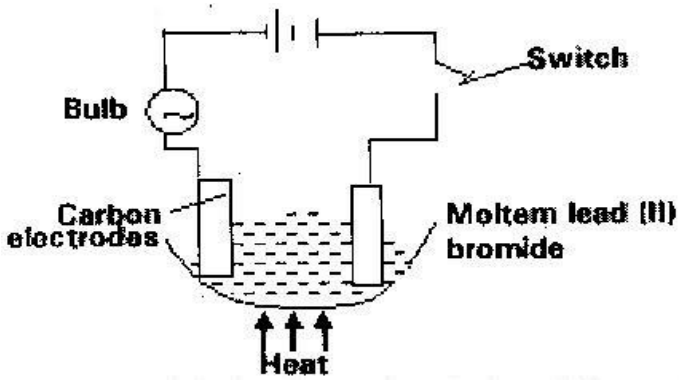
25. Study the set up below and answer the questions that flows



State all the observations that would be made when the circuit is **completed** **(3mks)**

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26. Most natural water occurs as permanent hard water or temporary hard water.

a. Name **two** compounds that cause;

i. Temporary hardness **(1mk)**

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ii. Permanent hardness **(1mk)**

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b. How is temporary hardness removed from water? **(1mk)**

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c. State **one** disadvantage of using hard water in boilers.

(1mk)

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27. Use the information below to answer the questions that follow.

$H2(g) + {}^{1}\!/_{2}O_2 \longrightarrow H_2O(l)$ $\quad \Delta H_1 = -286KJ/Mol$

$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\quad \Delta H_2 = -384KJ/Mol$

$C(s) + 4H_2(g) + {}^{1}\!/_{2}O_2(g) \longrightarrow C_3H_7OH$ $\quad \Delta H3 = -2686.6KJ/Mol$

a. Define '**enthalpy** of formation'

(1mk)

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b. Determine the molar enthalpy of formation of propanol. **(2mks)**

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KCSE 24

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 2

CHEMISTRY

233/2

PAPER 2

(THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… SIGN……

INDEX NO…… ADM NO……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) Write your name and index number in the spaces provided

b) Sign and write the date of examination in the spaces provided

c) Answer ALL questions in the spaces provided

d) Mathematical table and electronic calculators may be used.

e) ALL working MUST be shown clearly where necessary

f) Candidates should check the question paper to ensure that all pages are printed as indicated and no questions are missing

FOR EXAMINER'S USE ONLY

STION	IMUM SCORE	CANDIDATE'S SCORES
1 – 6	**80**	

Answer ALL questions in the spaces provided

1. I. 3 g of granules of carbonate of metal M of formula MCO_3 were mixed with excess 0.5M dilute hydrochloric acid. The mass of the reaction vessel ants its contents were recorded at various times. The total loss in the mass of the reaction vessel and its contents was calculated and recorded.

Time(min)	0	0.5	1	1.5	2	2.5	3	3.5
otal loss in mass(K	0	0.008	0.37	0.90	1.19	1.28	1.32	1.32

a) Why is there continuous loss of mass of the reaction mixture? **(1mark)**

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b) i) State two ways by which the reaction could be made more rapid.

(1mark)

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ii) On the same grid sketch, graphs of total loss in mass (g) against (mins) before and after the changes in b(i) above. **(1mark)**

c) i) Write an equation for the reaction that takes place. **(1mark)**

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ii) Given the experiment was carried out at room temperature , calculate the number of moles of carbon (iv) oxide gas produced .(C=12,O=16)

(1mark)

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iii) Determine the relative molecular mass of metal M. **(2marks)**

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II During the manufacture of Sulphuric (VI) acid by contact process, Sulphuric (IV) Oxide is converted to Sulphur (VI) Oxide in the presence of a catalyst according to the equation below

$$2SO_{2\,(g)} + O_2 \rightleftharpoons 2SO_{3(g)} \quad \Delta H = 19Kj/Mol$$

a) Write a formula of the catalyst used **(1mark)**

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b) What would be the effect on the production of Sulphur (VI) Oxide of the following?

i) Increasing the temperature ;Explain **(1mark)**

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ii) Reducing the pressure? Explain **(1mark)**

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c) Write equations showing how Sulphuric (VI) acid is obtained from Sulphuric (VI) Oxide

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2 a) The table below shows information about chlorides of some period 3 elements

Chloride	NaCl	$MgCl_2$	$AlCl_3$	$SiCl_4$	PCl_5
Melting Point (^{0}C	801	712	Sublimes at 183	-70	-90

i) State the nature of the solution formed when the following chlorides are dissolved in water. Explain **(2marks)**

NaCl……

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$AlCl_3$.....

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ii) Explain why $AlCl_3$ has much lower melting point than $Mg\ Cl_2$ although both Al and Mg are metals **(2marks)**

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iii) Draw (.) and cross(x) diagram to show bonding in:

$MgCl_2$ **(1mark)**

$SiCl_4$ **(1mark)**

iv) Identify the type of bonding in each case **(1mark)**

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...

b) $10cm^3$ of water was placed in a test tube and the initial temperature of the water recorded. A spatula of $Si\ Cl_4$ was added to the water and the final temperature recorded when the entire solid had dissolved.

i) Explain the observations made. **(2marks)**

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ii) Write an equation for the reaction that occurred **(1mark)**

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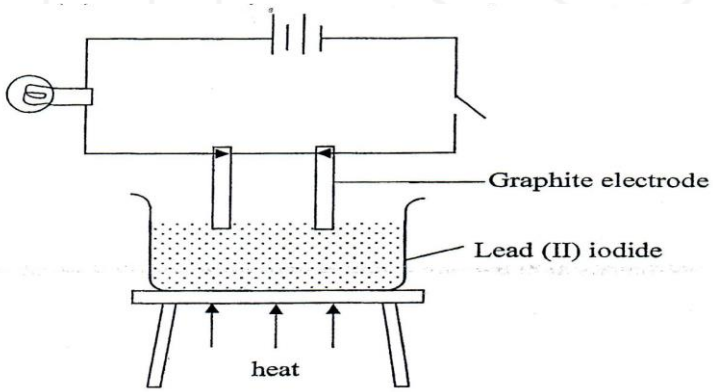
3. The diagram below shows a setup which was used to investigate the effect of electricity on solid and molten lead(II) iodide. Study it and answer the questions that follow.



a) i) The bulb only lit after the Lead (II) iodide had melted .Explain **(1mark)**

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ii) State and explain the observation at the anode when the circuit is completed. **(1mark)**

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iii) What precaution should be taken when carrying out this experiment **(1mark)**

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iv) Write the equation for the reaction taking place as the cathode **(1mark)**

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v) On the diagram; indicate the movement of ions in the electrolyte. **(1mark)**

vi) When a current was passed through 23.6g of molten Lead (II) iodide for 3 mins 5 secs 19.1g of the electrolyte remained. Calculate the amount of current passed.

(3marks)

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b) Given the following standard electrode potentials;

$Cu^{2+}_{(ag)} + 2e^-$ $Cu_{(s)}$ $\longrightarrow$ $E^0 = + 0.34V$

$Zn^{2+}_{(ag)} + 2e^-$ $Zn_{(s)}$ $\longrightarrow$ $E^0 = - 0.77V$

Explain whether it's advisable to store a solution of Zinc sulphate in a copper can. **(2marks)**

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4. a) Name the following organic Compounds **(3marks)**

i. $CH_3\ CCCH_3$

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ii. $CH_3\ CH\ CH\ CH_2\ CH_3$ (OH)

……

iii. $CH_3\ COOO\ CH_2\ CH_3$

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b) i) Define isomerism **(1mark)**

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ii) Draw and name one branching isomer of C_5H_8 **(2marks)**

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iii) To which homologous series does C_5H_8 belong? State the general formula of the members of the series

(1mark)

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c) Identify two reagents that can be used to prepare 3 - Bromobutan – 2-ol in the laboratory **(1mark)**

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d) In an experiment, ethanol was warmed with acidified potassium manganate (VI). State and explain the observation made at the end of the experiment **(2marks)**

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5. In an experiment to investigate the enthalpy of displacement of copper by iron, 25.0 cm^3 of Copper (II) sulphate solutions was placed in plastic beaker. The temperature of the solution was recorded every half minute of 1.5 minutes. At exactly two minutes excess iron powder was added and the temperature of the mixture recorded every half minute for an additional three minutes. The results were recorded in the table below

Time (min)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Temp ^0C	18.0	18.0	18.0	18.0	X	31.0	29.0	28.5	25.0	23.0	21.0

a) Plot a graph of Temperature (^0C) against time (mins) **(3marks)**

Graph paper provided

b) From the graph, determine the highest temperature, hence the temperature change. **(2marks)**

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c) Write the ionic equation for the reaction. **(1mark)**

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d) Calculate the amount of heat given out during the reaction

(c= 4.2kj/Kg/K, density of solution = 1g/cm^3) **(2marks)**

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e) Given the molar heat for the displacement in the above reaction is -151kj/Mol, calculate:

i) The moles of Copper (II) sulphate reacted **(1mark)**

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ii. The concentration of the copper (II) sulphate solution in g/litre **(2marks)**

(Cu = 63.5,S= 32,O= 16)

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6. a) A compound whose formula is $Z(OH)_2$ reacts as shown by the equations below

$Z(OH)_{2(S)} + 2OH^-_{(ag)} \quad Z^{2+}{}_{(ag)} + 2H_2O_{(1)}$

$Z(OH)_{2(S)} + H^+_{(ag)} \quad Z^{2+}{}_{(ag)})H_20_{(1)}$

i) State the property exhibited by the compound in the reactions **(1mark)**

……

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ii) Name two elements whose hydroxides exhibit the above property. **(1mark)**

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b) The table below shows tests carried out on a sample of water.

Test	Results
dditional of sodium hydroxide drop wise ti excess	hite precipitate which is insoluble in exces
2. Addition of sodium Sulphate Solution	White precipitate
. Addition of Lead (II) nitrate solution .The warming	ite precipitate , which dissolves on warmi

i) Identify the anion present in the water **(1mark)**

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…

ii) Write an ionic equation for the reaction in step 1 **(1mark)**

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iii) Given two methods that can be used to soften the water sample **(2marks)**

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c) The following tests were carried out on Solid M.

i) Solid M was added to water and the mixture stirred, a colorless solution was formed

ii) Barium nitrate was added to a portion of the colourless solution, a white precipitate was formed which dissolved in dilute Nitric (V) acid to form a colourless solution.

iii) Orange acidified potassium dichromate (VI) changed to green when added to a portion of the solution

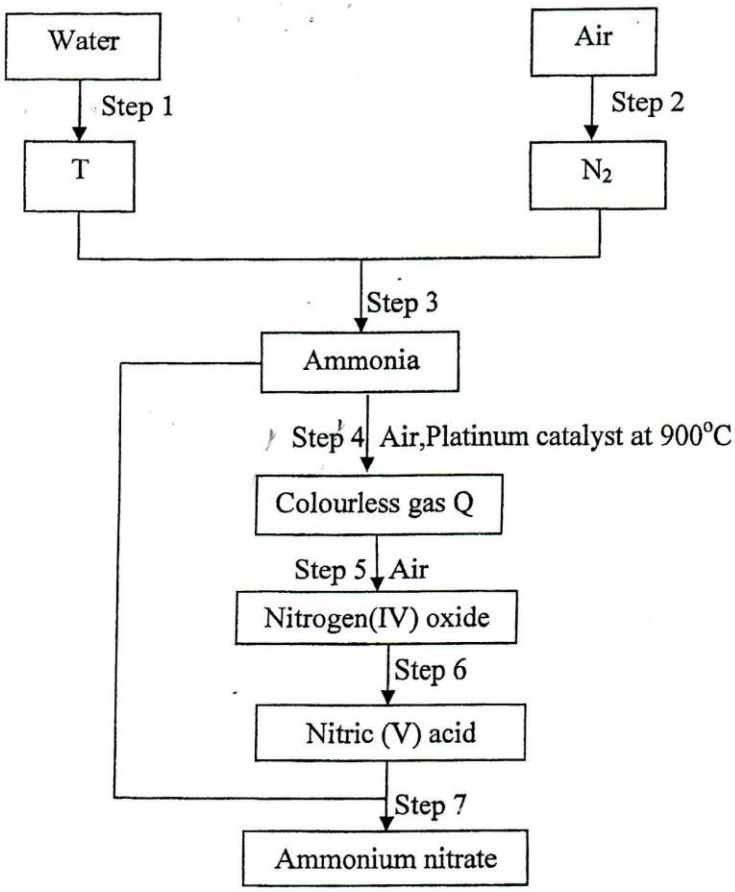
iv) When Chlorine gas was bubbled into a portion of the colourless solution followed by addition of acidified Barium nitrate solution, a white precipitate was formed.

Name and write the formula of white precipitate formed in:-9

Step II..... **(1mark)**

Step IV..... **(1mark)**

d) Study the flow chart below and answer the questions that follow.



i) Name element t **(1 ½ marks)**

.....

ii) Identify the process in **(1 ½ marks)**

Step 1.....

Step 2.....

Step 4.....

iii) Identify colourless gas

Q..... **.(1½ marks)**

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 3

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

(a) *Write your **name** and **index number** in the spaces provided above.*

(b) *Sign and write the date of the examination in the spaces provided above.*

(c) *Answer all the questions in the spaces provided in the question paper.*

(d) ***Non-programmable** silent electronic calculators and **KNEC** mathematical tables may be used.*

(e) *All working must be clearly shown where necessary.*

(f) *Candidates should answer the questions in English.*

FOR EXAMINER'S USE ONLY

ion	mum score	idate's score

1. State **two** laboratory rules that should be followed to avoid contamination and wastage of chemicals. **(2 marks)**

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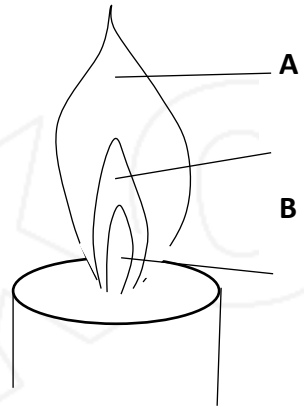
2. The figure below shows a flame obtained from a Bunsen burner.



(a) Name the type of flame. **(1 mark)**

……

(b) A matchstick head placed at region C will not ignite. Explain. **(1 mark)**

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……

(c) Name region **A**. **(1 mark)**

……

3. In the last stage of the Solvay process a mixture of sodium hydrogen carbonate and ammonium chloride is formed.

a) State the method of separation used. **(1 mark)**

……

b) Write an equation showing how lime is slaked. **(1 mark)**

……

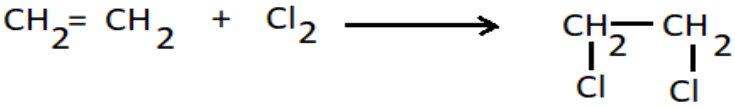
c) Name the by - products recycled in the above process. **(1 mark)**

……

4. The following is a list of bond energies.

	y kJ/mol
Cl —	
Cl —	

Calculate the enthalpy change for the following reaction. **(3 marks)**



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5. The equation below represents an equilibrium between chromate ions Cr_4O^{2-} and dichromate ions $Cr_2O_7^{2-}$

$$2Cr_4O^{2-}_{(aq)} + 2H^+_{(aq)} \rightleftharpoons Cr_2O_7^{2-}{}_{(aq)} + H_2O_{(l)}$$

Yellow Orange

State what would happen to the position of the equilibrium reaction if dilute sodium hydroxide solution is added to the mixture. Give a reason for your answer. **(2 marks)**

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6. The table below gives some physical properties of substances D, E and F. Study it and answer the questions that follow;

ance	°C)	ility in water	rical conductivity	
				d
		ble	onductor	onductor
		le	onductor	uctor
		ble	ucts	ucts

Identify the substance that has ;

(i) Giant atomic structure **(1 mark)**

……

(ii) Giant Ionic structure **(1 mark)**

……

(iii) Metallic bonding **(1 mark)**

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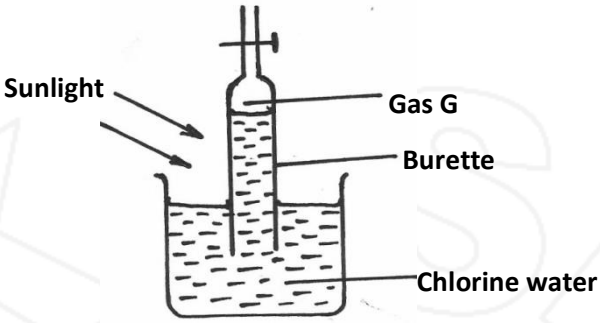
7. An experiment was set up using chlorine water as shown below;



(i) Identify gas G **(1 mark)**

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(ii) Write an equation for the production of gas G **(1 mark)**

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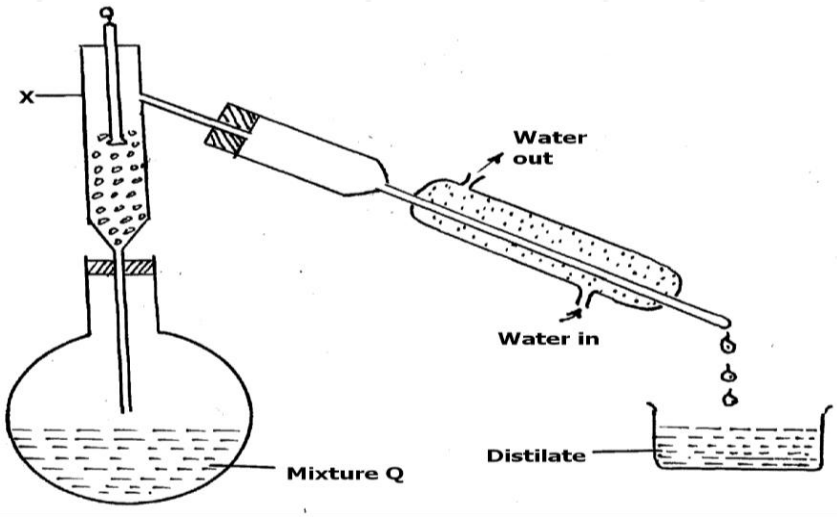
8. Study the diagram below and answer the questions that follow. The diagram shows the method of separating components of mixture Q.



(a) Name the part labelled X. **(1mark)**

……

(b) State what would happen if the water inlet and water outlet in the Liebig's condenser is interchanged. **(1mark)**

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9. Element **J** with atomic number 12 and **L** with atomic number 9.

(a) To which chemical family is; **(2 marks)**

J - ……

L - ……

(b) Write the equation for the reaction between **J** and **L**. **(1 mark)**

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10. Carbon and silicon are group IV elements. At room temperature, carbon (IV) oxide exists as a gas while silicon (IV) oxide exists as a solid. Explain this observation in terms of structure and bonding. **(2 marks)**

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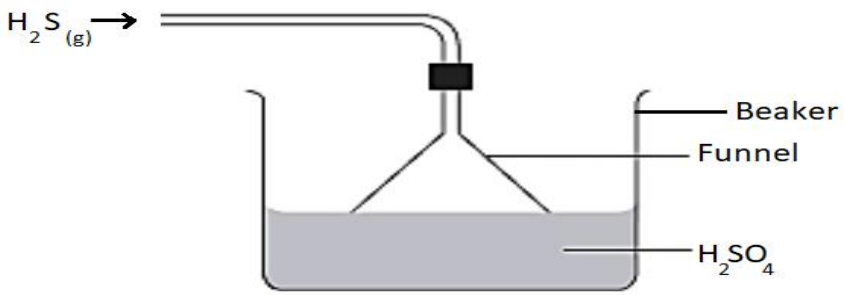
11. Study the diagram below and answer the questions that follow.



(a) Give the observation made in the beaker. **(1 mark)**

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(b) Write an equation for the reaction that took place in the beaker. **(1 mark)**

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(c) Give one reason why the gas is directed into the beaker using the inverted funnel as above? **(1 mark)**

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12. a) Define solubility**.** **(1 mark)**

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b) The following results were obtained during an experiment to determine solubility of solid M at 25^0C;

Mass of evaporating dish = 45.0g

Mass of evaporating dish + saturated solution = 59.0g

Mass of evaporating dish + dry solid B = 53.0g

Calculate the solubility of B at 25^0C. **(2 marks)**

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13. When a hydrocarbon was completely burnt in oxygen, 4.2g of carbon(IV)oxide and 1.71g of water were formed. Determine the molecular formula of the hydrocarbon given that its relative molecular mass is 42. (H = 1.0, C = 12.0, O = 16.0) **(3 marks)**

……

……

……

……

14. A mixture of magnesium powder and lead (II) oxide reacts vigorously to form a white residue when heated, but no reaction is observed when a mixture of magnesium oxide and lead powder is heated.

a) Explain this observation. **(2 marks)**

……

……

……

b) Write a chemical equation for the reaction of magnesium powder and lead (II) oxide **(1 mark)**

……

c) **In** the reaction above, identify:

The reducing **agent** **(1 mark)**

……

The oxidized **species** **(1 mark)**

……

15. During laboratory preparation of ethane gas, solid N was mixed with soda lime and heated .

a) Identify solid N. (1 mark)

……

b) Give one reason why soda lime is preferred to pure sodium hydroxide pellets in this experiment. **(1 mark)**

……

……

c) State one use of ethane gas**.** **(1 mark)**

……

……

16. (a) State Graham's law of diffusion. **(1 mark)**

……

……

(b) $20cm^3$ of hydrogen chloride gas diffuses through a porous pot in 20seconds. How long would it take $40cm^3$ of Sulphur (IV) oxide gas to diffuse through the same pot under the same conditions (H =1 Cl = 35.5 S = 32 O =16**)** **(2 marks)**

……

……

……

……

17. a) When gases are required dry, they are collected after passing them through a drying agent. Identify the suitable drying agents for the following gases; **(2 marks)**

	ABLE DRYING AGENT
onia	
gen sulphide	

b) State one use of ammonia. **(1 mark)**

……

……

18. Describe how to experimentally separate a mixture of lead(II)chloride and zinc carbonate. **(2 marks)**

……

……

……

……

19. Using dots(.) and crosses (x) show how magnesium combines with oxygen to form magnesium oxide. (Mg = 12, O = 8) **(2 marks)**

……

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……

20. Equal masses of liquid dinitrogen tetraoxide and liquid ammonia are warmed to form gases independently at room temperature and pressure. State and explain the gas which will occupy greater volume. (N = 14, H = 1, O = 16) **(2 marks)**

……

……

……

……

21. a) Define allotropy. **(1 mark)**

……

……

b) Name the allotropes of sulphur. **(1 mark)**

……

……

c) Which allotrope of carbon conducts electricity. **(1 mark)**

……

22. The structures below represent two cleansing agents: U and V

U : $R - COO^- Na^+$

V : $R - OSO_3^- Na^+$

a) Identify the class of cleansing agents to which U belongs. **(1 mark)**

……

b) Which cleansing agent is suitable for use with water which contains Ca^{2+} ions? Explain.

(1mark)

……

……

c) State one disadvantage of usage of compound V. **(1 mark)**

……

23. Study the table below showing pH of certain solutions and use it to answer the questions that follow;

SOLUTION	pH
S1	13.0
S2	3.0
S3	7.0
S4	8.5

a) In which of the solutions will phenolphthalein be colourless. **(1 mark)**

……

b) Which of the solutions can be used to relieve heart burn? Explain. **(2 marks)**

……

……

……

24. When excess magnesium powder was added to 100 cm^3 of 0.5M copper(II)sulphate solution, the temperature changed from 25^0C to 31^0C.

a) Apart from the rise in temperature, state two other observations made. **(1 mark)**

……

……

b) Calculate the molar heat of displacement for this reaction. (Density of water 1 g/cm^3, specific heat capacity of water = 4.2J/g/K**)** **(2 marks)**

……

.....

.....

25. The table below gives some properties of gas W and Y.

	ty	on H_2SO_4	on NaOH
	r than air	to form salt	ve without reacting
	er than air	ffected	ffected

(a) Describe how you would obtain a sample of dry gas Y from the mixture of gas W and Y.

(2 marks)

.....

.....

.....

(b) Suggest a possible identity of gas W. Give reasons for your answer. **(2 marks)**

.....

.....

.....

26. (a) Using an equation show how an electron can be generated from a neutron. **(1 mark)**

.....

.....

(b) The table below gives the rate of decay of a radioactive element Z.

er of days	**in g**
0	48.0
270	1.5

Calculate the half-life of the radioactive element Z. **(2 marks)**

.....

.....

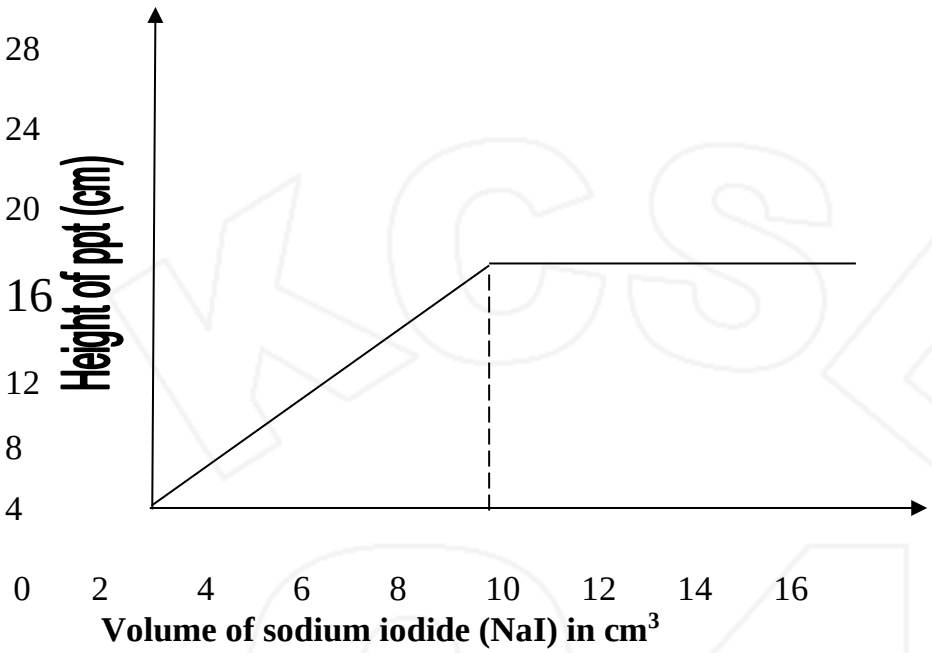
.....

c) State one application of radioactivity in food industry**.** **(1 marks)**

……

……

27. In an experiment, various volumes of 1M sodium iodide solution were added to the same volume of 1M lead (II) nitrate solution. The heights of the precipitate were measured and plotted against volume of 1M sodium iodide used. The graph below was obtained.



(a) State the observation made when sodium iodide solution is mixed with lead (II) nitrate solution. **(1 mark)**

……

……

(b) What volume of sodium iodide was required to react completely with lead (II) nitrate? Explain. **(1 mark)**

……

……

(c) Explain the shape of the curve. **(1 mark)**

……

.....

28. 0.45A of current was passed for 72 minutes during electrolysis of dilute magnesium sulphate solution. Determine the volume of gas produced at the anode**.** (1 F =96 500 coulombs, molar gas volume is 22400 cm^3) **(3 marks)**

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 3

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

1. Write your name and index number in the spaces provided above

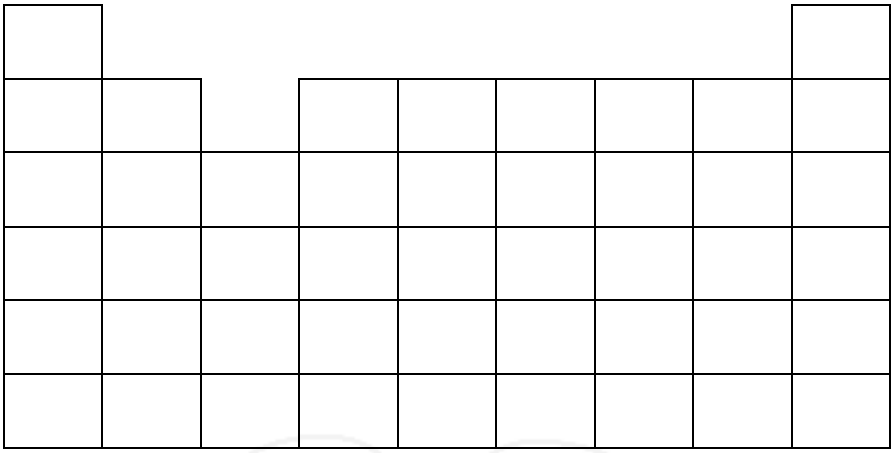
3. Answer all the questions in the spaces provided

*4. All working **must** be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1		
2		
3		
4		
5		
6		
7		
AL	80	

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



a) Which element exists naturally as a; **(2mks)**

i. Diatomic gas

ii. Monoatomic gas

b) Write down the formula for the most stable ion of K and its electronic arrangement. **(1mk)**

c) How do the atomic radii of G and L compare? Explain. **(2mks)**

……

……

……

d) How do the first ionization energies of G and L compare? Explain. **(2mks)**

……

……

……

e) Which two electrons would react most vigorously with each other? **(1mk)**

f) Give an equation for the reaction between the elements you have given in (e) above. **(2mks)**

……

……

g) Which element has the smallest atomic radius? Explain. **(2mks)**

……

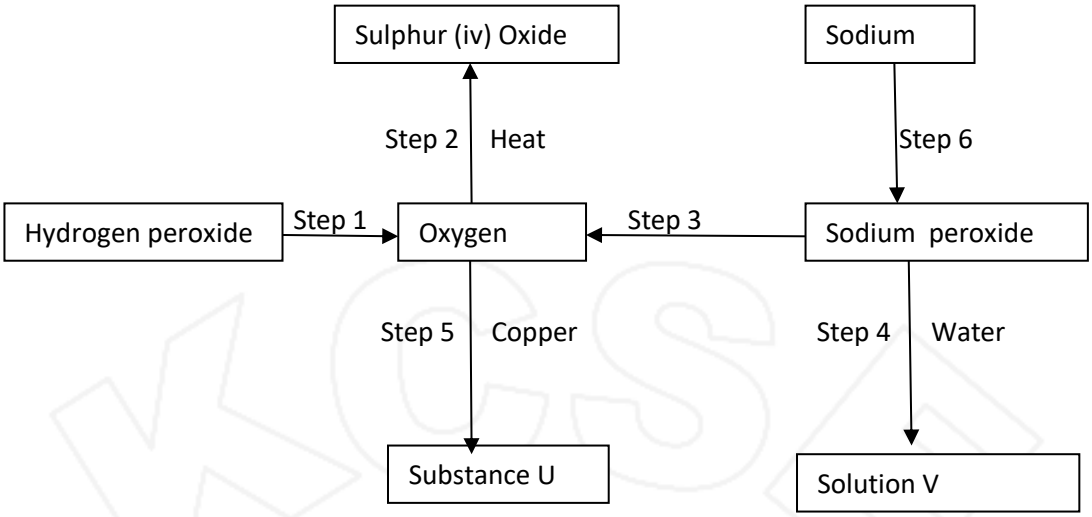
……

h) Give the number of valence electrons in; **(2mks)**

i. K

ii. T

2. Study the reaction scheme below and answer the questions that follow.



a) Identify substance U and solution V. **(2mks)**

b) Name the reagents necessary for the reactions in the following steps. **(2mks)**

i. Step 1

ii. Step 2

iii. Step 3

iv. Step 6

c) Give the condition necessary for the reaction in step 5 to take place. **(1mk)**

d) Write equations for the reactions in the following steps. **(3mks)**

i. Step 1

ii. Step 2

iii. Step 5

e) State and explain the observation made in step 5. **(2mks)**

……

……

……

3. The table shows the variation of volumes at different amounts of pressure.

ure in atmosphe					
ne (cm^3)					
rocal of pressu					

i. Complete the table by determine the reciprocal of pressure. **(2mks)**

ii. Plot a graph of volume against reciprocal of pressure. **(3mks)**

iii. Use the graph to determine the volume of gas P at a pressure of 3.2 atmosphere. **(1mk)**

iv. Calculate the pressure of gas P which has a volume of 5 litres. **(2mks)**

v. A given volume of nitrogen gas requires 68.3 seconds to diffuse through a tinny hole in a chamber. Under the same conditions another unknown gas requires 85.6 seconds for the same volume to diffuse. What is the molecular mass of this gas?(r=14) **(3mks)**

4. In an experiment to determine the molar heat of neutralization of hydrochloric acid with sodium hydroxide, students of Anestar Secondary school reacted 100cm^3 of 1M hydrochloric acid with 50cm^3 of 2M sodium hydroxide solution. They obtained the following results.

Initial temperature of acid=25.0^oC

Initial temperature of base = 25.0^oC

Highest temperature reached (acid +alkali mixture) = 34.0^oC

a) Define the term molar heat of neutralization. **(1mk)**

b) Write an ionic equation for the neutralization reaction between hydrochloric acid and sodium hydroxide. **(1mk)**

c) Calculate:

i. The change in temperature(T) $\triangle$

ii. The amount of heat produced during the reaction (specific heat capacity = $4.2KJkg^{-1}k^{-}$)

iii. The molar heat of neutralization of sodium hydroxide.

d) Write the thermochemical equation for the reaction. **(1mk)**

e) Draw an energy level diagram for the reaction. **(2mks)**

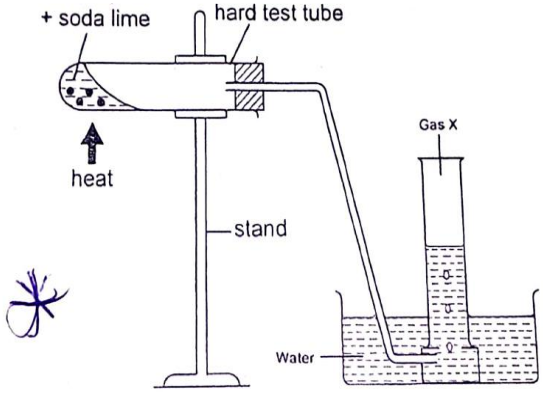
f) Explain why the enthalpy of neutralization of ethanoic acid with sodium hydroxide

……

……

……

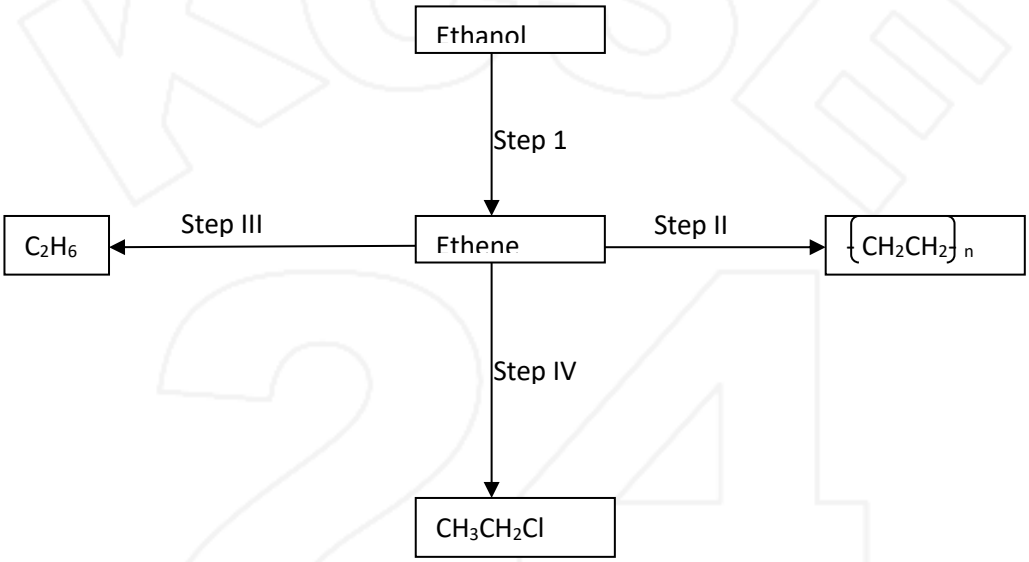
5. a) The diagram below was used to prepare a gas X in the laboratory. Study it answer the questions that follow.



i. Name gas x. **(1mk)**

ii. Write an equation to show the production of gas x. **(1mk)**

b) Study the scheme diagram below and answer the questions that follow.



i. Name the catalyst that is suitable to carry out the reaction in step 1. **(1mk)**

……

ii. Name the process that takes place in step II. **(1mk)**

……

iii. State the conditions necessary for the reaction in step III to occur. **(1mk)**

……

……

iv. Write down the equation for the reaction that takes place in step IV. **(1mk)**

……

c) Other than using burning, describe how you would distinguish between ethane and ethayne.

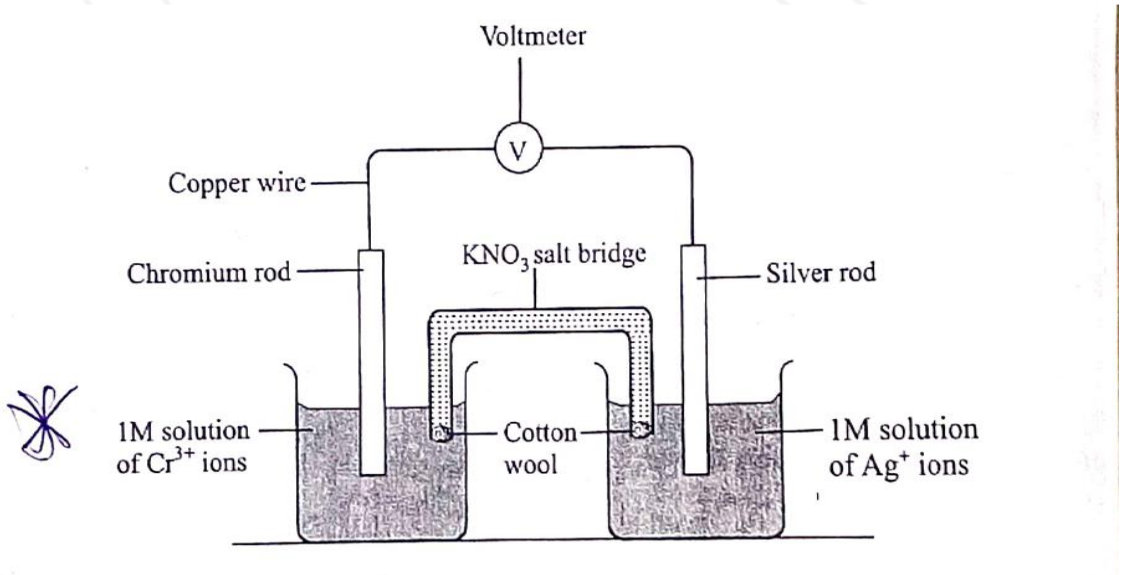
……

……

……

d) Draw and name all structures of the isomers of the compound with molecular formula C_4H_8. **(3mks)**

6. The diagram below shows a voltaic cell formed between half cells $Cr^{3+}(aq)/Cr(s)$ $E^{\ominus}=+0.80$ Study it and answer the questions that follow.



a) What is the e.m.f of the cell? **(1mk)**

……

……

……

b) State the direction of movement of electrons. **(1mk)**

……

c) Which electrode is the anode? Explain. **(1mk)**

……

……

d) State the half cell in which reduction occurs and give the equation for the reaction. **(2mks)**

……

……

e) What will happen to the electrodes during the operation of the cell? **(2mks)**

……

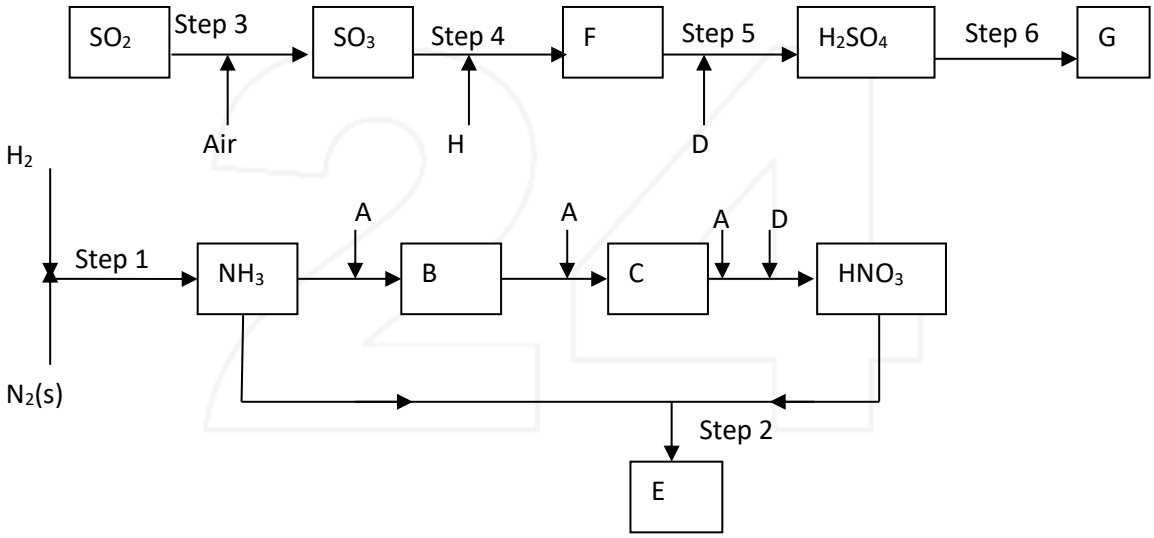
……

f) State two function of the salt bridge. **(2mks)**

……

……

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



a) Name substance A,B,D, and F. **(2mks)**

b) Substance E and ammonium sulphate have one common use. State the use. **(1mk)**

c) Name the suitable catalyst in step 3. **(1mk)**

d) Write the chemical equation in step 4. **(1mk)**

e) Identify two gaseous environmental pollutants from the above flow chart. **(1mk)**

f) State the observation when potassium hydroxide is warmed with substance G. **(1mk)**

g) Write a chemical equation where concentrated sulpheric (VI) acid is used as an oxidizing agent. **(2mks)**

h) Write type of reaction is shown in the equation: **(1mk)**

$KNO_3(aq) + H_2SO_4(l) + HNO_3(g)$

i) Carbon (IV) oxide reacts with red hot carbon to produce a colourless gas P. Name gas P and state and explain the precaution you take when preparing this colourless gas P. **(2mks)**

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 4

233/1 Chemistry (Theory) Paper 1

Time: 2 Hours

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS

1. *Write your name and school and index number in the spaces provided at the top of this page*
2. *All answers should be written in the spaces provided.*
3. ***Non-programmable** silent electronic calculators and KNEC mathematical tables may be used.*
4. *Students 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	MAXIMUM SCORE	CANDIDATES SCORE
1 – 29	80	

1. In the extraction of zinc, the zinc ore is crushed to a powder, mixed with oil and water and air blown through the mixture.

(a) What is the name given to this process? ***(1 mark)***

……

(b) Explain how this process works. ***(1 mark)***

……

……

(c) Name the chief ore from which zinc is extracted. ***(1 mark)***

……

2. (a) Using the oxidation number, identify and explain oxidizing and reducing agent ***(2 marks)***

$2\ H_2S(g) + SO_2(g) \rightarrow 3S(s) + 2H_2O(l)$

……

……

……

……

(b) Atomic number of Sulphur is 16. Write the electron configuration of S in SO_3^{2-} ***(1 mark)***

……

……

……

3. Name the process which takes place when: ***(3 marks)***

(a) Solid carbon (IV) oxide changes to gas

……

(b) Red litmus paper turns white when dropped in chlorine water

……

(c) Ethene gas molecules are converted into giant molecules

……

4. 3.1g of an organic compound containing carbon, hydrogen and oxygen only, produced 4.4g of carbon (IV) oxide and 1.8g of water on complete combustion. Determine its molecular formula if its formula mass is 60. ***(3 marks)***

5. Use the table below to answer the question that follow:

Element	Atomic number
A	11
B	13
C	14
D	17
E	19

(a) Write an equation for the reaction between **element A** and water. ***(1 mark)***

……

……

(b) Explain the trend of atomic radii between elements **A** and **D**. ***(2 marks)***

……

……

……

6. (a) Define the term allotropy ***(1 mark)***

……

……

(b) In terms of structure and bonding, explain why graphite is used as a lubricant. ***(2 marks)***

……

……

……

7. (a) State Boyles Law. ***(1 mark)***

……

……

(b) A given mass of the gas occupies $20cm^3$ at 25^0 C and 670mmHg pressure. Find the volume it will occupy at 10^0 C and 335mmHg. ***(2 marks)***

8. Concentrated sodium chloride was electrolysed using graphite electrodes. Name the product formed at the anode and give a reason for your answer. ***(2 marks)***

……

……

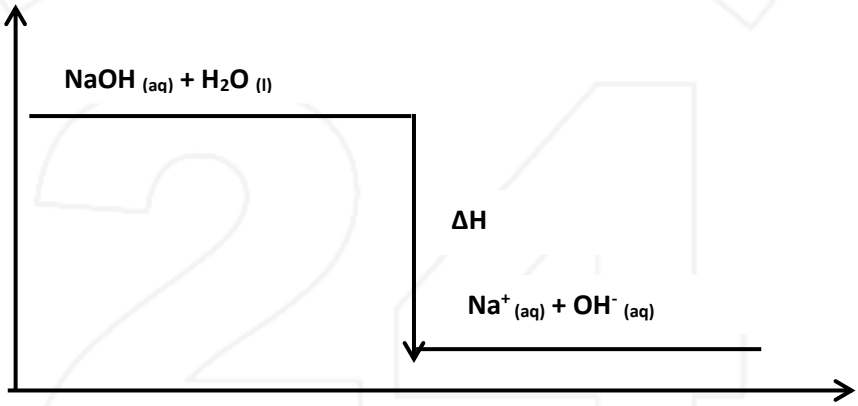
……

9. (a) What is meant by lattice energy? ***(1 mark)***

……

……

(b) Study the energy level diagram below and answer the question that follows:



What type of reaction is represented by the diagram? ***(1 mark)***

……

10. Magnesium chloride dissolves in water to form a neutral solution while aluminium (III) chloride forms an acidic solution. Explain. ***(3 marks)***

……

……

……

……

……

11. When solid **B** was heated strongly, it gave off water and a solid residue. When water was added to the solid residue, the original solid **B**, was formed.

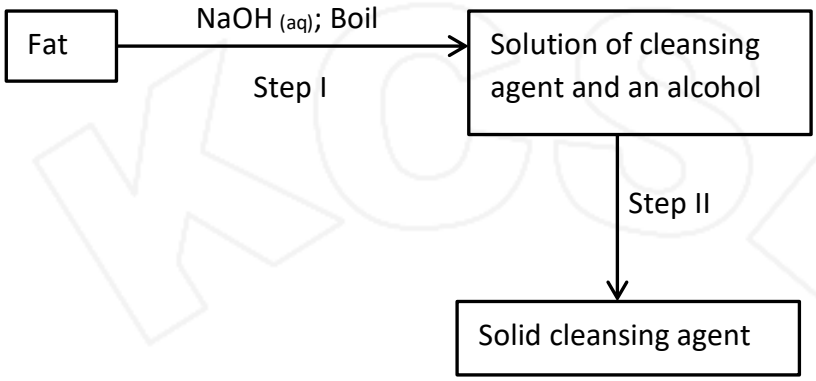
(a) What name is given to the process described? ***(1 mark)***

……

(b) Give **one** example of solid **B**. ***(1 mark)***

……

12. The scheme below was used to prepare a cleansing agent. Study it and answer the questions that follow.



(a) What name is given to the type of cleansing agent prepared by the method shown in the scheme?

(1 mark)

……

(b) Name one chemical substance added in step II. ***(1 mark)***

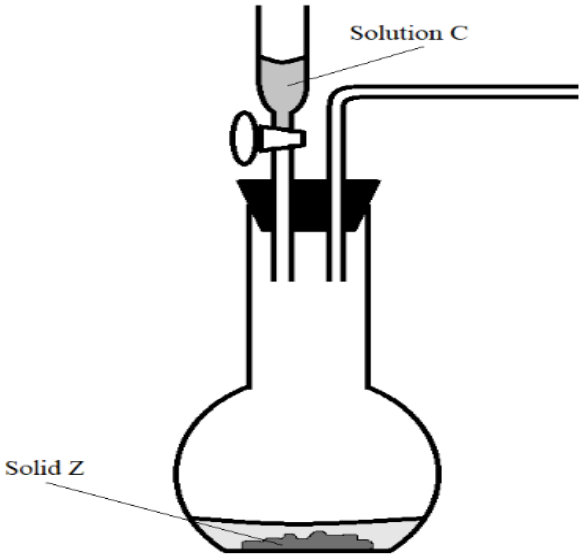
……

(c) What is the purpose of adding the chemical substance named in (ii) above? ***(1 mark)***

……

……

13. The diagram below represents part of a setup arranged for the collection of hydrogen gas in the laboratory. Study it and answer the questions that follow.



(a) Complete the diagram to show how a dry sample of hydrogen can be collected. ***(2 marks)***

(b) Give the most suitable identity of solid **Z**. ***(1 mark)***

……

14. **(a)** Define ionization energy. ***(1 mark)***

……

……

(b) Explain why the second ionization energy of magnesium is higher than its first ionization energy. ***(2 marks)***

……

……

……

15. A state of equilibrium between dichromate (VI) and Chromate ions is established as shown below.

$$Cr_2O_7^{2-}(aq) + 2OH^-(aq) \rightleftharpoons CrO_4^{2-}(aq) + H_2O(l)$$

(Orange) (Yellow)

(a) What is meant by a dynamic equilibrium? ***(1 mark)***

……

……

(b) State and explain observation made when a few pellets of potassium hydroxide are added to the equilibrium mixture. ***(2 marks)***

……

……

……

16. Describe how you would obtain solid sample of each of the following components of solid mixture containing lead (II) chloride, ammonium chloride and copper (II) oxide ***(3 marks)***

……

……

……

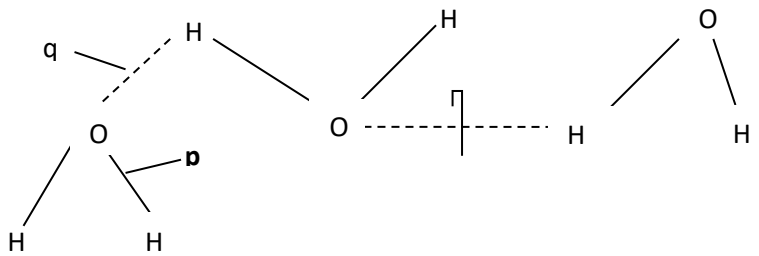
……

……

17. **(a)** Using dot and cross diagrams, show bonding in hydroxonium ion, H_3O^+. ***(2 marks)***

(b) Identify the type of bonds represented by **p** and **q** in the substances below.

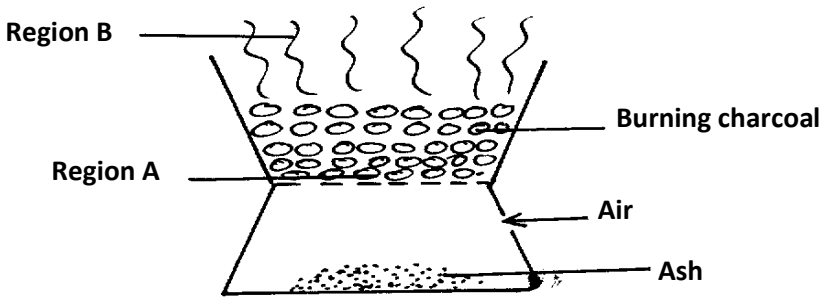
q



p ……..…….... ***(½ mark)***

q ……. ***(½ mark)***

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



(a) Identify the gas formed at region **B** ***(1 mark)***

……

(b) Using an equation, explain what happens at region **A** ***(1 mark)***

……

……

19. The following table gives the melting point of oxides of the third period elements. Study it and answer the questions that follow.

ıla of oxides						
ıg point (^{0}O)						

(a) Explain the large difference in the melting points of Na_2O and SO_2. ***(2 marks)***

……

……

……

(b) Write the equation for the reaction between Al_2O_3 with;

(i) NaOH ***(1 mark)***

……

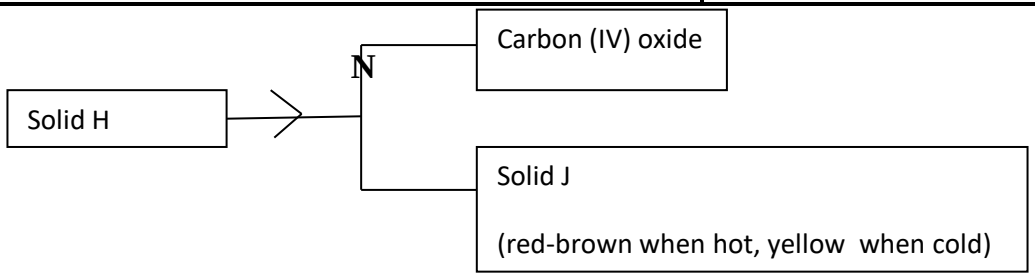
……

(ii) HCl ***(1 mark)***

……

……

20. Use the scheme below to answer the question that follow.



(a) Identify **process N**. ***(1 mark)***

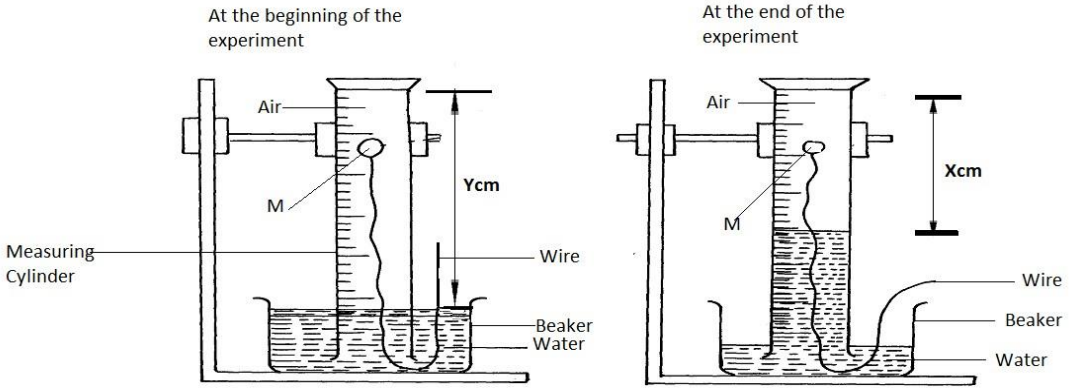
……

(b) Identify the solids ***(2 marks)***

H- ……

J- ……

21. A form one class carried out an experiment to determine the active part of air. The diagram below shows the set-up of the experiment and also the observation made.



(a) Identify substance M ***(1 mark)***

……

(b) State two reasons for the suitability of substance M for this experiment ***(1 mark)***

……

……

……

(c) Write the equation for the reaction of substance **M** and the active part of air ***(1 mark)***

……

22. The table below gives three experiments on the reaction of excess hydrochloric acid and 1.5g of zinc done under different conditions. In each the volume of gas was recorded at different time internals.

Experiment	Form of Zinc	Hydrochloric acid solution
I	Powder	1.5M
II	Granules	1.0 M
III	Powder	1.0 M

On the axis below draw and label three curves that could be obtained from such results. ***(3 marks)***



23. When solid magnesium carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no observable change. On addition of some water to the mixture, there was effervescence. Explain the observation. ***(2 marks)***

……

……

……

……

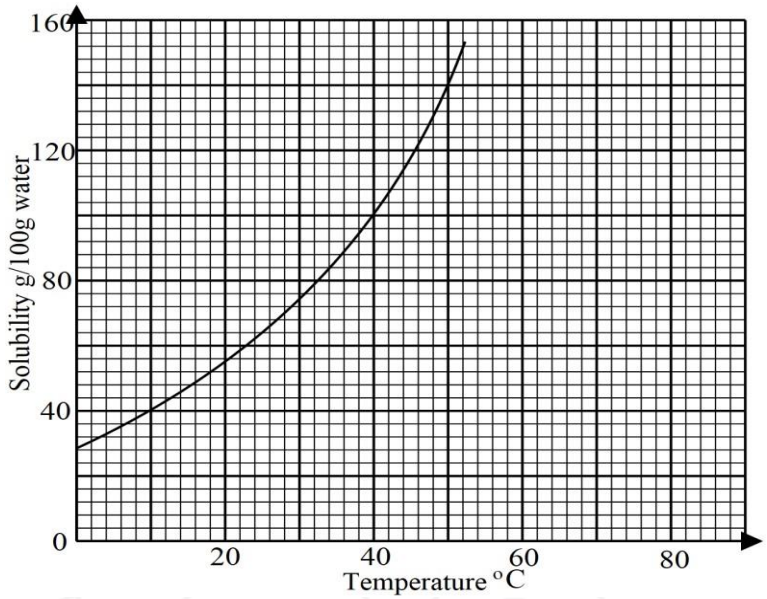
24. **(a)** Define the term solubility. ***(1 mark)***

……

……

……

(b) The solubility curve of potassium nitrate is shown in the figure below.



(i) Determine the solubility of potassium at 50°C. ***(1 mark)***

……

……

……

(ii) Determine the molar concentration of saturated potassium nitrate at 50°C. (K = 39.0, O = 16.0, N = 14.0 and density of water 1 g/cm^3). ***(2 marks)***

25. Use the bond energies given below to calculate the heat of reaction for: ***(3 marks)***

$$H_2\,(g) + Cl_2\,(g) \longrightarrow 2HCl\,(g)$$

Bond	ergy (kJ/Mo
H – H	435
Cl – Cl	243
H – Cl	431

26. The following table shows the products formed when nitrates of metals **J**, **Y**, and **W** are heated strongly.

Nitrate of	Products formed

J	oxide + Nitrogen (IV) oxide + Oxygen
Y	+ Nitrogen (IV) oxide + Oxygen
W	nitrite + Oxygen

(a) Arrange the metals in their order of decreasing reactivity. ***(1 mark)***

……

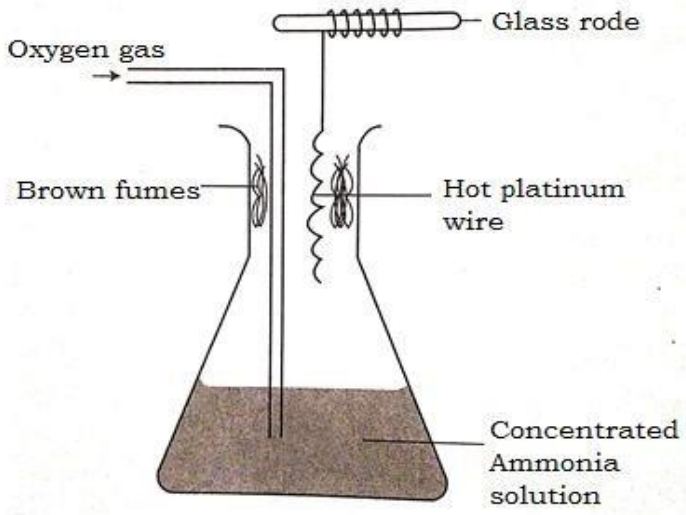
(b) Which metal forms a soluble carbonate? ***(½ mark)***

……

(c) Give an example of nitrate **Y**. ***(½ mark)***

……

27. Use the set up below to answer the questions that follow.



(a) Describe the formation of brown fumes. ***(2 marks)***

……

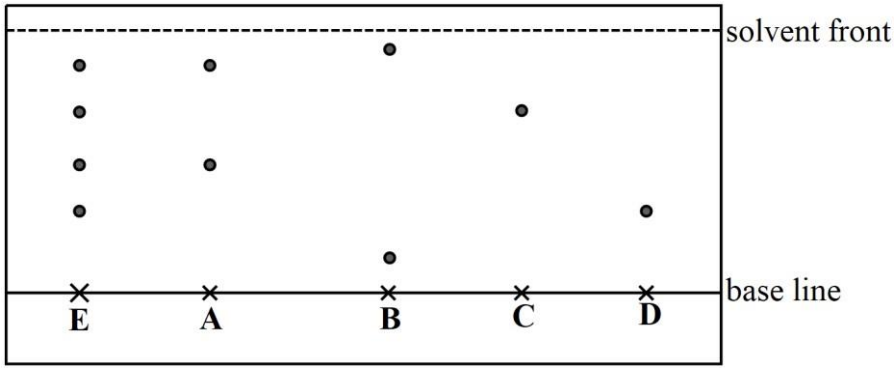
……

……

(b) Name another substance that can be used instead of platinum. ***(1 mark)***

……

28. An experiment was carried out to determine the presence of substances **A**, **B**, **C** and **D** in mixture **E**. the results obtained are shown in the figure below.



(a) Name a suitable solvent used in the method of separation illustrated in the figure. ***(1 mark)***

……

(b) Select:

(i) one substance which contains a component **not** present in **E**. ***(½ mark)***

……

(ii) a pure substance which is least soluble in the solvent used. ***(½ mark)***

……

(c) State one application of chromatography in an athletics competition. ***(1 mark)***

……

……

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 4

233/2 Chemistry (Theory) Paper 2

Time: 2 Hours

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

(f) *Write your name and admission number in the spaces provided above.*

(g) *Answer **all** the questions in the spaces provided in the question paper.*

(h) *Non-programmable silent electronic calculators and KNEC mathematical tables may be used.*

(i) *All working **must** be clearly shown where necessary.*

(j) *Candidates should answer the questions in English.*

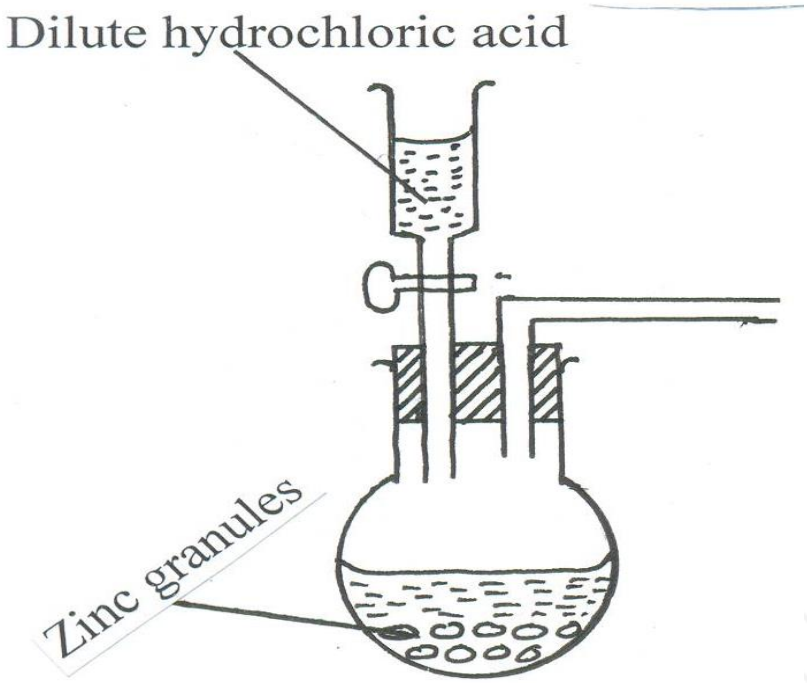
For Examiner's Use Only

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	13	
2	10	
3	11	
4	10	
5	14	
6	11	
7	11	
Total score	80	

1. The set up below shows the reagents that can form hydrogen gas in a laboratory.

(a) Complete the diagram to show how a dry sample of hydrogen gas can be collected.

(3 marks)



(b) Write the chemical equation for above reaction. **(1 mark)**

……

……

……

(c) Why is it not advisable to use calcium in this method to prepare hydrogen? **(1 mark)**

……

……

……

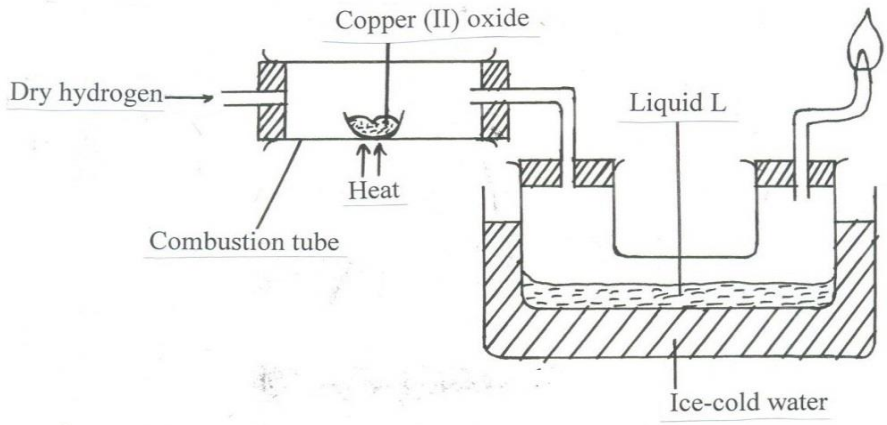
(d) Why is it advisable to discard the first jar of the gas collected? **(1 mark)**

……

……

……

(e) The set-up below was used to investigate some of the properties of hydrogen gas.



(i) State the observation made in the combustion tube. **(1 mark)**

……

(ii) Write down the equation leading to formation of liquid L. **(1 mark)**

……

(iii) What property of hydrogen is being investigated? **(1 mark)**

……

(**iv)** Why is potassium oxide not used to investigate this property of hydrogen gas? **(1 mark**

……

……

(v) Hydrogen gas is used in hydrogenation of oils. What do you understand by the term? hydrogenation? **(1 mark)**

……

……

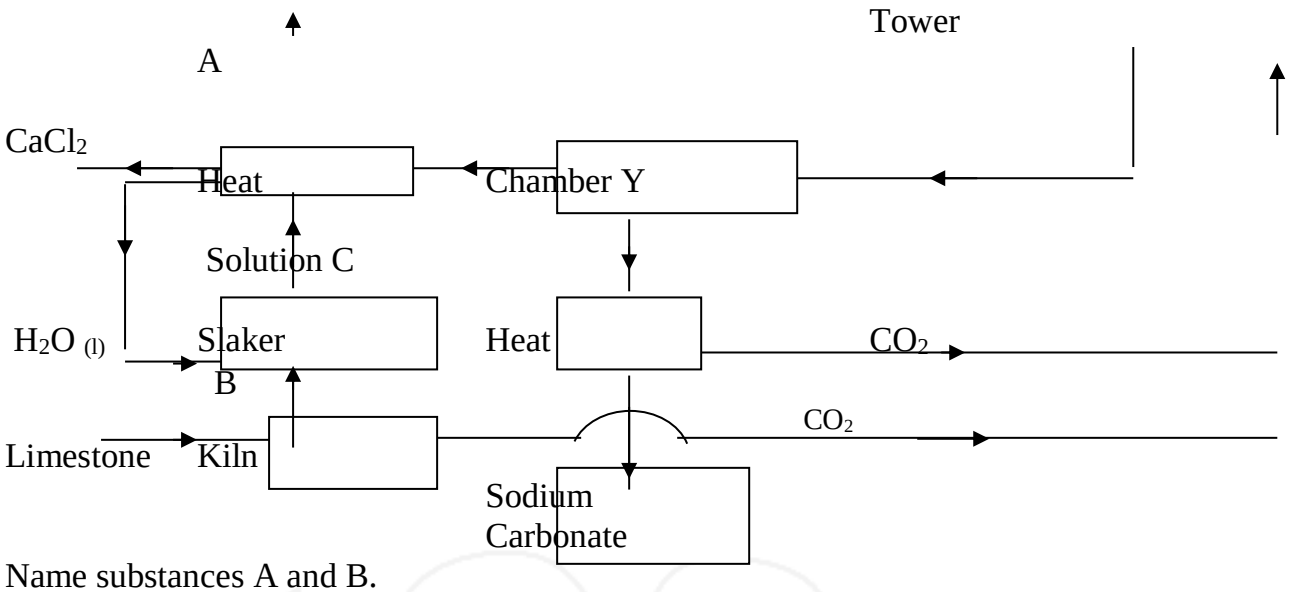
(vi) Give any two other industrial uses of hydrogen gas. **(2 marks)**

……

……

2. The chart below represents the main steps in the large-scale manufacture of sodium carbonate.





(a) Name substances A and B.

A …… **(1 mark)**

B …… **(1 mark)**

(b) Write down the chemical equation leading to formation of C. **(1 mark)**

……

……

(c) A stream of cold water is made to circulate around chamber X. What does this suggest about the reaction taking place. **(1 mark)**

……

……

(d) Name the process that takes place in chamber Y. **(1 mark)**

……

(e) State any two by-products recycled in the process. **(2 marks)**

……

……

(f) Give any two uses of sodium carbonate. **(1 mark)**

……

……

(g) In an experiment, wood charcoal was mixed with concentrated sulphuric (VI) acid in a test-tube. The mixture was then placed over a Bunsen-burner flame for some time.

(i) Write down the chemical equation of the reaction that takes place. **(1 mark)**

……

……

(ii) State the property of concentrated sulphuric (VI) acid investigated in (i) above. **(1 mark)**

……

……

3. a) Ethyne gas can be prepared in the laboratory by action of water on a certain compound M

(i) Name compound M ……. **(1 mark)**

(ii) Write an equation for the reaction taking place between compound M and water. **(1mark)**

……

(iii) Name the homologous series in which ethyne belongs. (**1mark)**

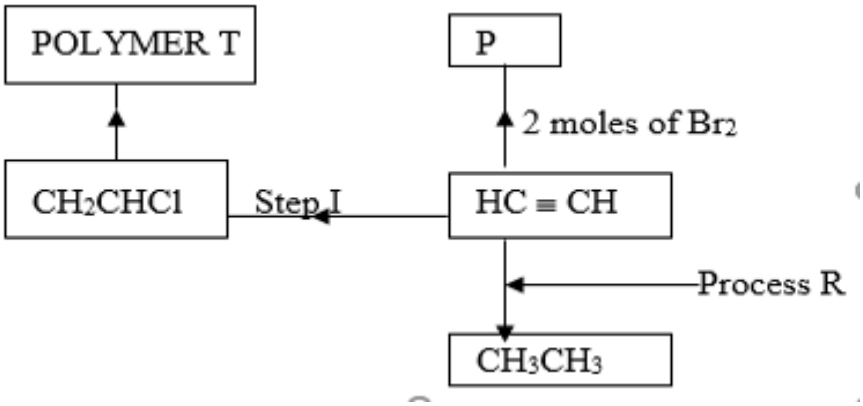
……

(iv) State one commercial use of ethyne. **(1 mark)**

……

……

(**b)** The scheme below represents some reactions of ethyne. Study it and answer the questions that follow.



(i) Name compound P and draw its structural formula. **(2 marks)**

(ii) Identify the reagents used in:

I) Process R ……**(1 mark)**

II) Step I ……**(1 mark)**

(iii) Draw the repeating unit in polymer T. **(1 mark)**

(iv) Name polymer T **……...(1 mark)**

(v) Give one use of polymer T **(1 mark)**

……

……

4. 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 solution was added to the filtrate and the content filtered. The residue was washed and dried to give a green powder.

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

……

b) Write a chemical equation that leads to the formation of the green powder. **(1mk)**

……

……

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

……

(ii) Name the green 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 green powder **(1mk)**

……

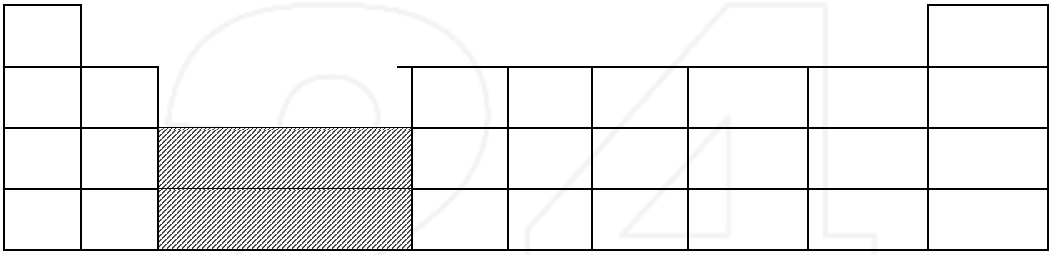
f) Write an equation to show what happened when green powder is strongly heated. **(1mk)**

……

……

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

5. The grid below shows a section of the periodic table. The letters do not represent the actual symbols of the elements.



a) Name the family to which element P belongs**. (1mark)**

……

b) Which two elements will form carbonates that do not decompose on heating. **(1 mark)**

……

c) With a reason, identify an element in period three with the largest atomic radius**. (2marks)**

……

……

d) Write the formula of the compound formed between L and M **(1 mark)**

……

e) State two uses of element **R** and for each use, state property of element **R** that makes it possible for the use

(i) Use **(1mark)**

……

Property **(½ mark)**

……

……

(ii) Use **(1 mark)**

……

Property **(½ mark)**

……

f) Using dots **(.)** and cross **(x),** show bonding in the compound formed between **R** and oxygen .

(2 marks)

g) In terms of structure and bonding, explain why the boiling point of the oxide of L is higher than that of N. **(2 marks)**

……

……

……

……

h) Calculate the volume of the gas produced when 1.95g of element W reacts with water (W= 39, Molar gas volume at S.T.P= 24,000cm^3) **(2 marks)**

……

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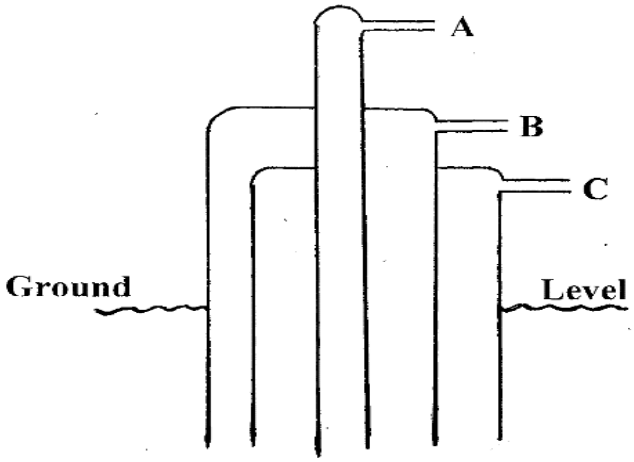
……

……

……

6. (a) The diagram below represents the extraction of Sulphur by the Frasch process.



i) Identify and state the use of the substances that pass through tubes A and C. **(2 marks)**

A……

C……

ii) Rhombic and monoclinic are allotropes of Sulphur. They are inter convertible as shown below

$$\text{Rhombic} \underset{}{\overset{96^{o}C}{\rightleftharpoons}} \text{Monoclinic}$$

I. What does the temperature 96°C represent? **(1 mark)**

……

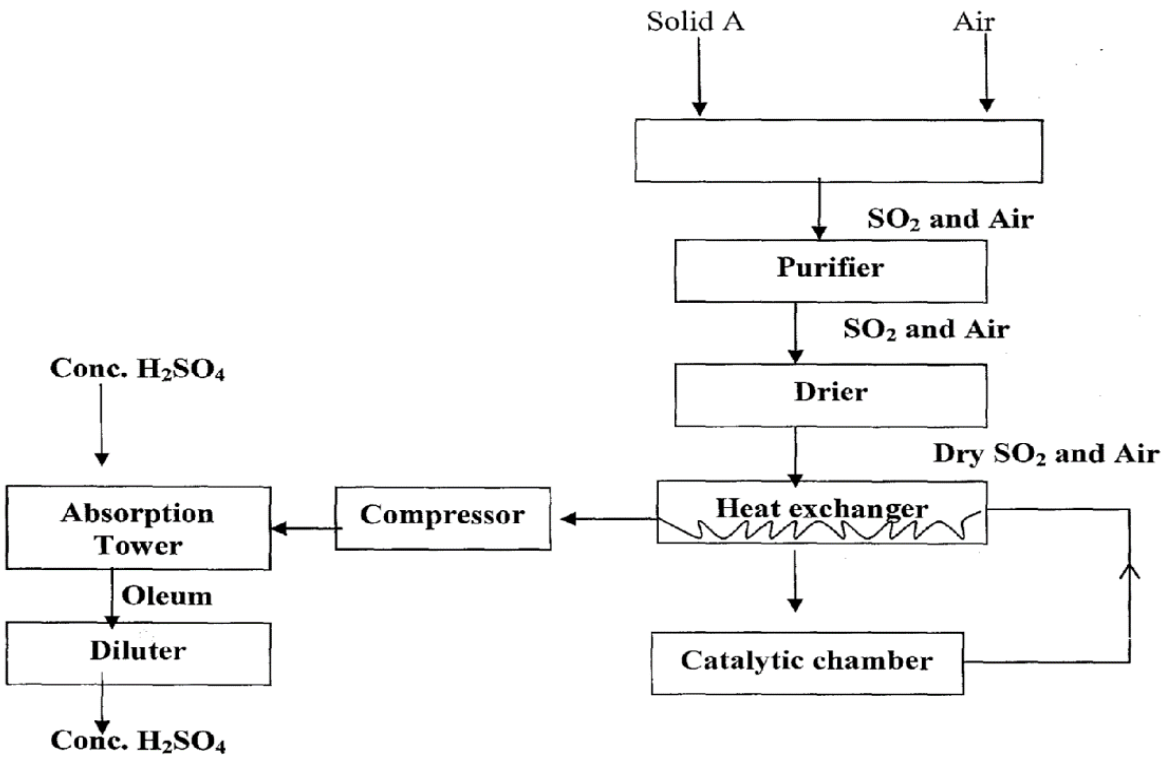
II. State the difference in crystalline appearances between rhombic and monoclinic crystals. **(l mk)**

……

……

……

(b) The following scheme represents the steps followed in the contact process, study it and answer the questions which follow.



i) Name solid **A**. **(1 mark)**

……

ii) Name **two** impurities removed by the purifier. **(1 mark)**

……

……

iii) Why is it necessary to remove impurities? **(1 mark)**

……

……

iv) Write chemical equations for the reactions which occur in the;

Catalytic **chamber** **(1 mark)**

……

Diluter **(1 mark)**

……

v) State the optimum temperature used in the catalytic chamber**.** **(1 mark)**

……

vi) Why is sulphur (VI) oxide gas not dissolved in water directly. **(1mark)**

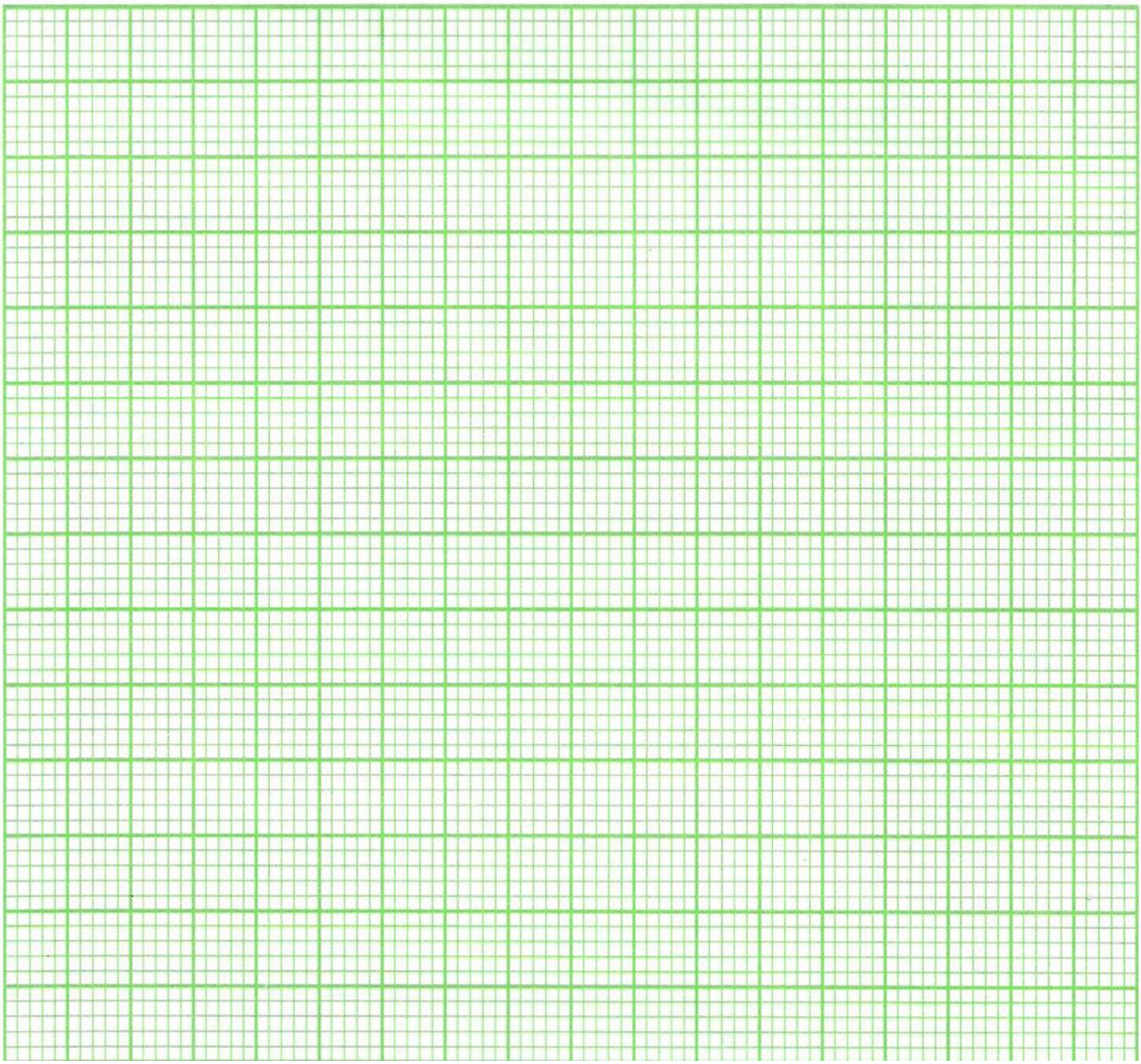
……

……

1. Equal masses (0.65g) of zinc granules and zinc powder were reacted in separate experiments with 2.0M hydrochloric acid. The volume of hydrogen liberated was measured at half-minute intervals and these volumes were measured at s.t.p. The results obtained are given in the table below.

(minutes)	**ne of Hydrogen produced using zi nules**	**ne of Hydrogen produced us c powder.**
0.5	17	88
1.0	34	144
1.5	76	207
2.0	134	222
2.5	184	224
3.0	216	224
3.5	222	224
4.0	224	224

a) Plot the graphs of the volume of hydrogen produced against time using zinc granules and zinc powder respectively on the axis. **(4 marks)**



b) Which reaction has a greater initial rate? Explain your answer. **(2 marks)**

……

……

……

……

c) At what time is the rate of the two reactions the same? Explain. **(2 marks)**

……

……

……

……

d) What mass of zinc will be left after one minute in the reaction between zinc powder and hydrochloric acid (molar volume at s.t.p = 22.4dm3, zn = 65) **(2 marks)**

……

……

……

……

e) On the same axis, draw a sketch of the graph that would be obtained if the zinc granules are reacted with 1.0M hydrochloric acid. **(1 mark)**

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 5

233/1 **Chemistry** Paper 1

Time: 2 Hours

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

- *Write your **name and ADM NO** in the spaces provided above.*
- *Answer **All** the questions in the spaces provided below each question.*
- *All working **MUST** be clearly shown where necessary.*
- *Sign and write the date of examination in the spaces provided above.*
- *Electronic calculators may be used.*

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1- 29	80	

*Answer **all** questions in the spaces provided*

1. State two laboratory rules that should be followed to avoid contamination and wastage of chemicals. **(2 marks)**

……

……

……

……

2. Describe one method used to distinguish between sodium sulphate and sodium sulphite. **(2 mk**

……

……

……

……

3. A gaseous compound consists of 86% carbon and 14% hydrogen by mass. At s.t.p 3.2 dm^3 of the compound has a mass of 6 grams. Calculate:

a) Its empirical formulae (C=12,H=1, MGV=at stp 22.4dm^3 **(2 marks)**

……

……

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……

b) its molecular formulae **(2 marks)**

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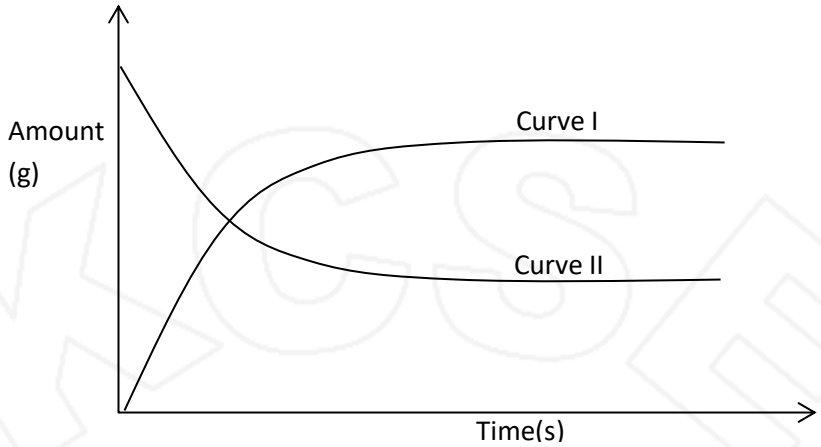
4. The graph below shows amount of calcium carbonate and calcium chloride varying with time in the reaction.

$CaCO_3 + 2\,HCl \longrightarrow CaCl_2 + H_20 + CO_2$



a) Which curve shows amount of calcium chloride varying with time **(1 mark)**

……

b) Explain why the two curves become horizontal after given period of time **(1 mark)**

……

……

……

c) Sketch on graph curve II would appear if the experiment was repeated using more dilute hydrochloric acid solution **(1 mark)**

5. The thermal chemical equation for the reaction between X and Y are shown below.

$2X_{2\,(g)} + Y_{2(g)} \longrightarrow 2X_2Y_{(g)} \quad \Delta H = -197KJ/mol$

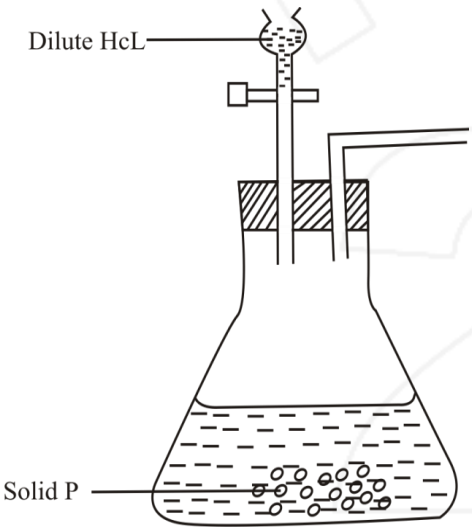
a) Other than change in temperature, suggest two ways in which yield of X_2Y can be increased **(1 mark)**

……

……

b) draw a well labeled energy level diagram for the forward reaction **(2 marks)**

6. The diagram below was used by a form two student at Kimuchul secondary school to prepare and collect dry carbon IV oxide.



a) Name suitable solid p **(1 mark)**

……

b) Complete the diagram above **(3 marks)**

7. The melting point of Nitrogen is -196^0c while that of sodium is 98^0 c. In terms of structure and bonding explain the difference in the melting point of Nitrogen and sodium **(2 marks)**

……

……

……

……

……

……

8. The following tests were carried out on three separate portion of colourless solution P.

TEST	OBSERVATION
ition of dilute hydrochloric acid to the tion of solution P	ation of effervescence
lition of aqueous potassium sulphate ution to the second portion of solution	hite precipitate
dition of acqueous sodium hydroxide t d portion to portion of solution P till im ess	precipitate formed which dissolved in excess colorless solution

a) From information in test(i),name two anions that are likely to be present in solution P **(1 mk)**

……

b) Identify cations that are likely to be present in solution P **(1 mark)**

……

c) Write an ionic equation for the reaction which takes place in test (i) **(1 mark)**

……

……

9. Describe how you would prepare crystals of potassium sulphate starting with 100cm^3 of 0.5M Potassium hydroxide **(3 marks)**

……

……

……

……

……

10. use dot(.) and cross(x) diagram to show bonding in magnesium fluoride (Mg=12 , F=9) **(1 mark)**

11. An element R has a relative atomic mass 88. When a current of 0.5A were passed through fused chloride of R for 32 minutes and 10 seconds, 0.44g of R were deposited at cathode. Determine charge of ion Q (I F– 96500C) **(3 marks)**

……

……

……

……

……

12. a) Define the term isomerism **(1 mark)**

……

……

b. Draw and name two positional isomers of butanol **(2 marks)**

13. During the extraction copper and zinc from their ores, some processes include:

a) Crushing **(1 mark)**

……

……

b) Mixing of the crushed one with oil and water and bubbling air through it.

i) Name the process (b) above **(1 mark)**

……

ii) What is the purpose of(b) above **(1 mark)**

……

……

14. Write an equation when the following compounds are heated

a) zinc nitrate **(1 mark)**

……

b) silver nitrate **(1 mark)**

……

15. The table below gives solubilities of potassium bromide and potassium sulphate at 0^0c and 40^0c.

	Solubility g/100g H_2O at	
	0^0c	40^0c
Potassium bromide	55	75
Potassium sulphate	10	12

When an aqueous mixture containing 60g of potassium bromide and 7g of potassium sulphate in 100g of water at 40^0c was cooled to 0^0c some crystals were formed.

a) identify the crystal **(1 mark)**

……

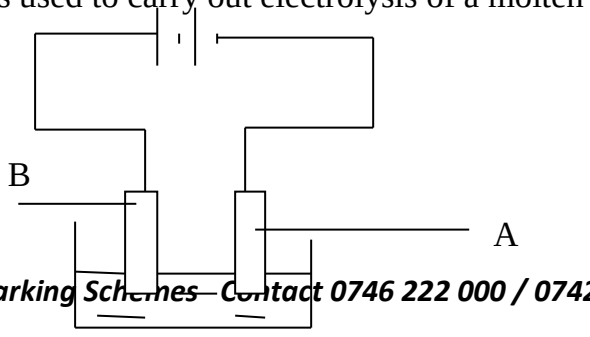
b) Determine the mass of the crystal **(1 mark)**

……

……

……

16. The set up below was used to carry out electrolysis of a molten bromide of metal X,XBr_2.



XBr_2

a) write equations for reaction taking place at:

i) Anode : …… **(1 mark)**

ii) Cathode …… **(1 mark)**

b) Give reason why experiment should be carried out in fume chamber **(1 mark)**

……

……

17. below are the standard electrode for electrodes X and Y

$X^{2+}_{(aq)} + 2e \rightleftharpoons X(s)$ **-2.92 V**

$Y^{2+}_{(aq)} + 2e \rightleftharpoons Y(s)$ **+ 0.34 V**

a) Identify the electrode which is the least reducing agent **(1 mark)**

……

b) calculate the e.m.f of the cell formed when the two electrodes are connected **(2 marks)**

……

……

……

c) write cell representation for the cell above **(1 mark)**

……

……

18. a) Give two differences between a nuclear reaction and a chemical reaction **(2 marks)**

……

……

……

……

b. complete the nuclear equation below **(1 mark)**

$^{230}_{90}Th \longrightarrow {}^{230}_{92}Pa + \ldots\ldots\ldots\ldots\ldots\ldots$

19. Explain why the boiling point of ethanol is higher than that of hexane (R.m.m of ethanol 46 while that of hexane is 86. **(2 marks)**

……

……

……

20. The atomic number of element Q is 8 and that of P is 11.

a) Write down the formulae of compound formed between Q and P **(1 mark)**

……

b) Name the type of bond formed by compound given in (a) above .Explain. **(2 marks)**

……

……

……

21. a) State charles' law **(1 mark)**

……

……

……

b. sketch a graph to represent Charles law **(1 mark)**

c. A gas occupied a volume of $250cm^3$ at -23^0c and atmosphere. Determine volume at $107\ ^0c$ when pressure kept constant. **(2 marks)**

……

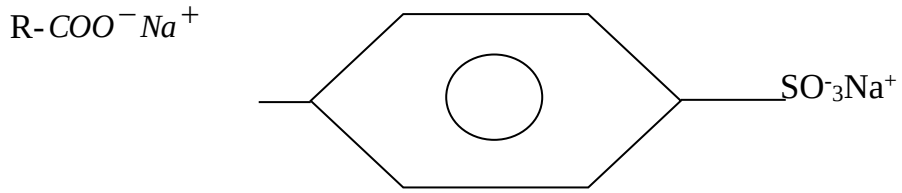
……

……

……

22. The structures shown below represent two cleansing agent A and B.

A **B**



(a) Name the type of cleansing agent **A** **(1 mark)**

……

(b) Which of the **two** cleansing agents is more suitable for washing in water containing calcium chloride? Give a reason. **(2 marks)**

……

……

……

……

23. a) Define the term enthalpy of formation of a compound. **(1 mark)**

……

……

b)Use the information below to answer the questions that follow:

	Equation	**Enthalpy of formation**
(i)	$H_{2(g)} + ½\ O_{2(g)} \longrightarrow H_2O_{(l)}$	$\Delta H_1 = -286 kJmol^{-1}$
(ii)	$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$	$\Delta H_2 = -394 kJmol^{-1}$
(iii)	$2C_{(s)} + 3H_{2(g)} + ½\ O_{2(g)} \longrightarrow C_2H_5OH_{(l)}$	$\Delta H_3 = -277 kJmol^{-}$

Calculate the molar enthalpy of combustion of ethanol. Given that:

$$C_2H_5OH_{(l)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(l)}$$ **(3mks)**

……

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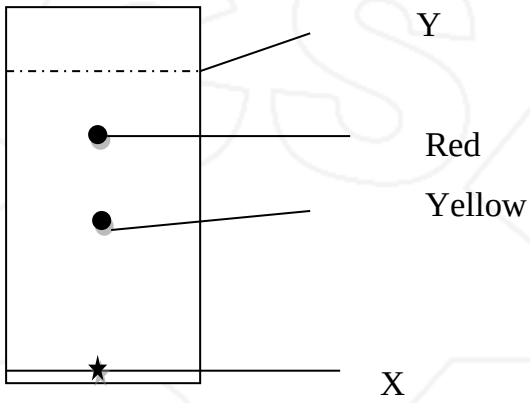
……

24. The chromatogram below shows the constituents of a flower extract. Study it and answer the questions that follow



a) Explain the different positions of red and yellow pigments. **(2 marks)**

……

……

……

b) Describe how the solid yellow pigment can be obtained in the chromatogram **(2 marks)**

……

……

……

……

25. When excess chlorine gas is bubbled through cold dilute sodium hydroxide solution, the resulting solution acts as a bleaching agent.

(a) Write an equation for the reaction between chlorine gas and sodium hydroxide solution.

(1 mark)

……

(b) Explain how the resulting solution acts as a bleaching agent. **(2 marks)**

……

……

……

26. The table below gives some properties of four substances. Study it and answer the questions that follow:

Substance	M.P ^{0}C	B.P ^{0} C	Electrical Conductivity	
			Solid	Liquid
W	1723	2230	Poor	Good
X	993	1695	Poor	Poor
Y	- 183	- 164	Poor	Poor
Z	1083	2567	Good	Good

(a) Which substance is suitable for making cooking pans? Explain. **($1\frac{1}{2}$ marks)**

……

……

……

……

……

(b) Which substance is likely to have a giant atomic structure? Explain. **($1\frac{1}{2}$ marks)**

……

……

……

……

27. 17g of Zinc carbonate was reacted with 50 cm^3 of 4M nitric acid .Calculate the mass of Zinc Carbonate that remained unreacted. (Zn = 65, C = 12, O = 16) **(3 marks)**

……

……

……

……

……

28. A certain element Z forms an ion of type Z^{3-}. If the element is in period 3.

(a) Write the electronic configuration of Z^{3-}. **(1 mark)**

……

(b) How do the sizes of Z and Z^{3-} compare. Explain your answer. **(2 marks)**

……

……

……

……

29.A sample of copper turnings was found to have contaminated with copper II oxide .

Describe how a sample of copper metal can be separated from the mixture. **(2 marks)**

……

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……

……

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KCSE 24

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 5

233/2 **Chemistry** Paper 2

Time: 2 Hours

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

1. Write your name and index number in the spaces provided above

3. Answer all the questions in the spaces provided

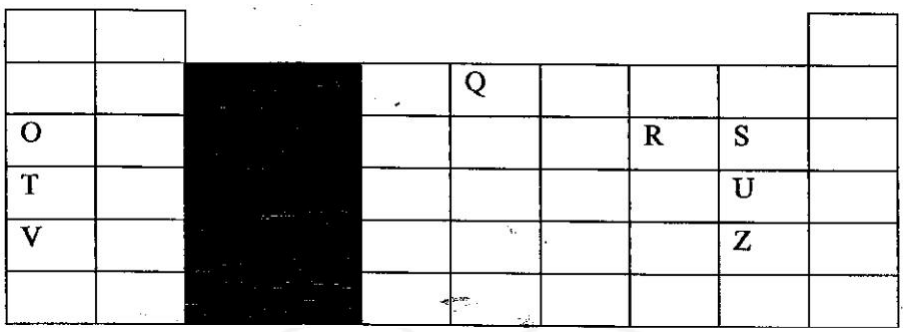
*4. All working **must** be clearly shown where necessary.*

*5. **Candidates should check to ascertain that each page s printed as indicated and that no question is/are missing.***

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1	11	
2	9	
3	12	
4	9	
5	10	
6	10	
7	10	
8	9	
AL	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.



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? Explain **(2mks)**

……

……

……

……

ıame is given to the family of elements to which elements **O**, **T** and **V** belong?**(1mk)**

……

ment **W** has atomic number 15. Indicate the position of **W** on the grid.

……

vi. ı why the atomic radius of **S** is smaller than that of **R**.

---

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	MgCl2	AlCl3	SiCl4	PCl5	SCl2
Boiling point ^{0}C	1470	1420	Sublimes at 180^{0}C	60	75	60
Melting point ^{0}C	800	710		-70	-90	-80

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

……

……

……

Give a possible reason why AlCl3 has much lower boiling point than MgCl2 although both Aluminum and Magnesium are metals. **(1mks)**

……

……

2. The table below gives standard reduction potentials for some half cells.

Half-cell	**Half-cell equation**	
I	$Cr^{3+}(aq) + e^- \rightarrow Cr^{2+}(aq)$	-0.41
II	$Cd^{2+}(aq) + 2e^- \rightarrow Cd(s)$	-0.4
III	$Na^+(aq) + e^- \rightarrow Na(s)$	-2.71
IV	$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	0.34
V	$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$	-0.13
VI	$Br2(aq) + 2e^- \rightarrow 2Br^-(aq)$	1.07
VII	$2H^+(aq) + 2e^- \rightarrow H2(g)$	0
VIII	$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$	-0.44V
IX	$O2(g) + 2H2O(l) + 4e^- \rightarrow 4OH^-(aq)$	+0.40V
X	$H2O2(aq) + 2H^+(aq) + 2e^- \rightarrow 2H2O(l)$	+1.23V

(i) Identify with reasons**: (2mks)**

I. The strongest oxidizing agent.

……

……

II. The strongest reducing agent.

……

……

ii) Draw an electrochemical cell from half-cells **V** and **IV. (3mks)**

Write the equation and calculate the electromotive force for the electrochemical cell constructed from half-cells **V** and **IV.** **(2 marks)**

……

……

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 **IV. (1mark)**

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

……

……

……

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

2 – methylbut-2-ene

heptanoic acid

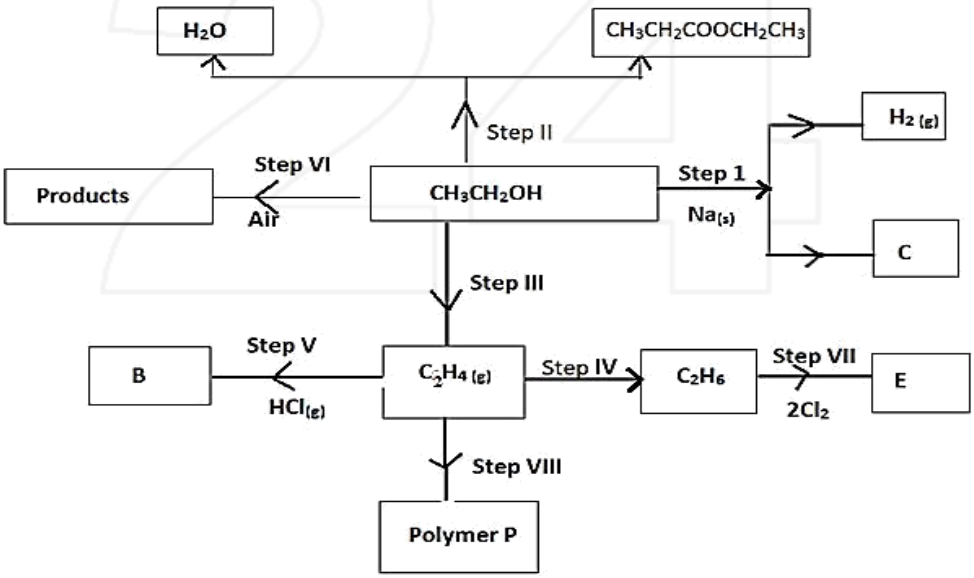
b) Describe a physical test that can be used to distinguish between ethanol and ethene**(2mks)**

……

……

……

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 (1mk)

.....

.....

What conditions and reagents are necessary to convert CH3CH2OH to CH3CH2COOCH2CH3 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)**

……

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……..

v) i)Draw and name the structure of polymer P. **(1mk)**

ii) Name one use of the polymer P. **(1mk)**

.....

.....

4. Several students prepared hydrogen gas using different reagent

Student 1: Used Zinc granules and dil. Nitric (V) acid

Student 2: Used Zinc granules and dilute sulphuric acid and a catalyst.

Student 3. Used calcium and dilute sulphuric(VI) acid.

Student 4: Used copper and dilute hydrochloric acid.

(a) State and explain the observation made in the set-ups for;

(i) Student 2. **(1mk)**

……

……

(ii) Student 3 **(2mks)**

……

……

……

……

(b) Explain why no hydrogen was collect for set ups of student;

(i) 1 **(1mk)**

……

……

(ii) 4 **(1mk)**

……

……

(c) Name the catalyst used by student 2. **(1 mk)**

……

……

(d) Write the equation for the reaction that took place in the set-up for student 2. **(1mk)**

……

……

(e) Explain why group 1 metals are not used to prepare hydrogen gas in the laboratory. **(1mk)**

……

……

(f) State two uses of hydrogen gas. (1 mk)

……

……

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

Volume of water = $450cm^3$

Initial temperatures of water = 25^oc Final temperature of water = 46.5^oc

Mass of ethanol + lamp before heating = 125.5g

Mass of ethanol + lamp after heating = 124.0

Calculate:

(i). Heat evolved during the experiment (Density of water = $1g/cm^3$, specific heat capacity of water = $4.2kJ/kg^{-1}k^{-1}$.**(2 marks)**

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……

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

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

……

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……

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

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……

The molar heat of combustion obtained from an experiment like the one above is usually lower than the theoretical value. Explain. **(2 marks)**

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.....

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

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

.....

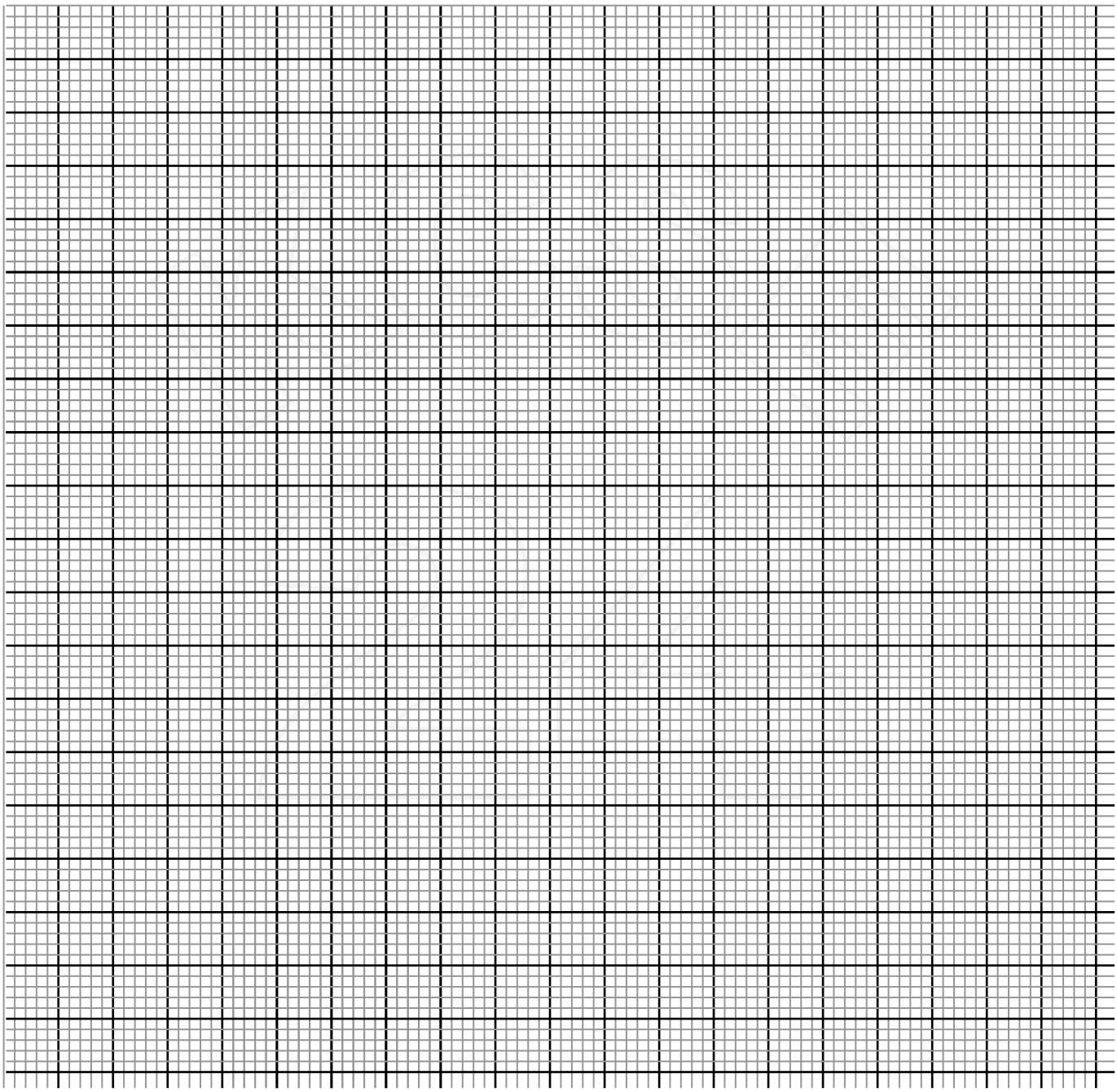
(ii). Draw an energy level diagram for the reaction in d (i) above.**(2 marks)**

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

Total volume of water added (cm^3)	10	20	30	40	50
Mass of potassium chlorate (g)	5	5	5	5	5
Temperature at which crystals appear (^oc)	80	65	55	45	30
Solubility of potassium chlorate (g/100 H2O)					

(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 from. **(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)**

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.....

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 green powder.

a) Give the chemical name of the product formed when copper 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 green 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 green powder **(1mk)**

……

……

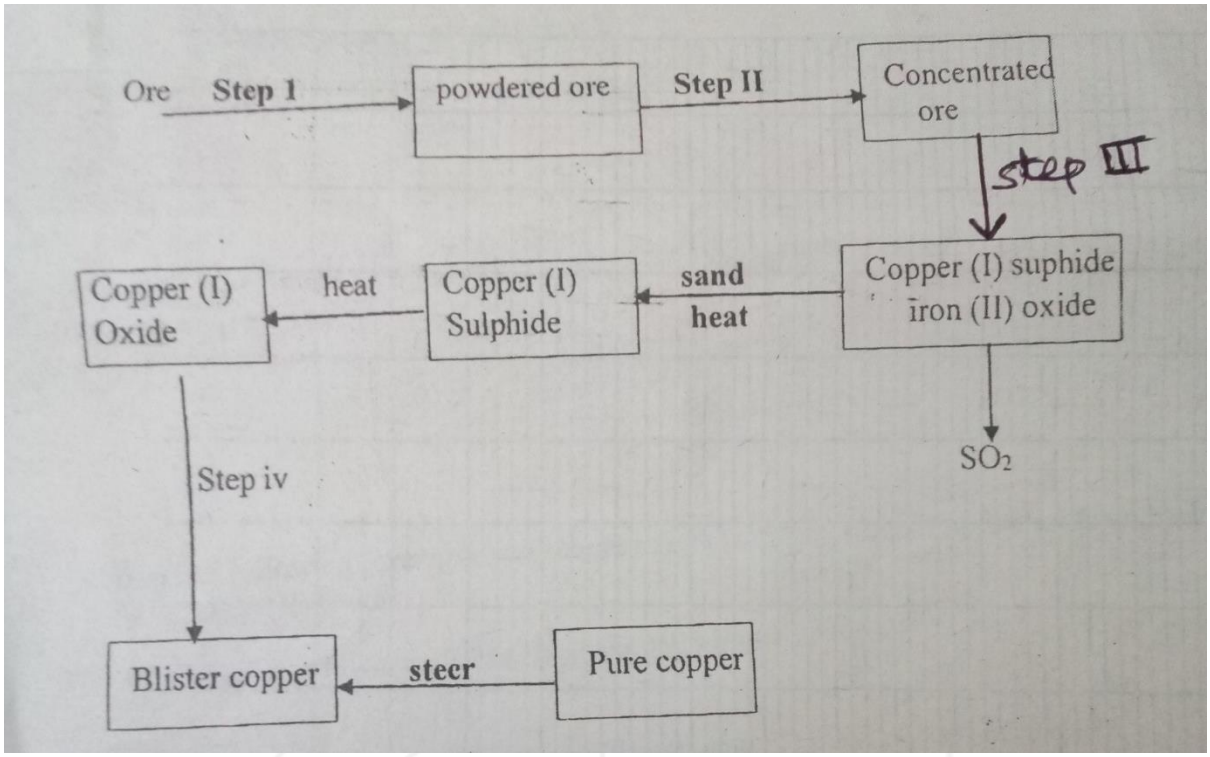
f) Write an equation to show what happened when green powder is strongly heated. **(1mk)**

……

……

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

8. The diagram below is a flow chart for the extraction of copper. Study it and answer the question that follow.



a) Give the name and formula of the major ore from which copper is extracted. (1mk)

……

……

……

b) Give the name of the process carried out in step II and III. (1mk)

……

……

……

c) Write equation for the reactions taking place in step III and IV**.** **(2mks)**

……

……

d) Iron (ii) oxide is an impurity during extraction of copper. Write the equation for the reaction to show how it is removed**.** **(1mk)**

……

……

……

e) i) Draw a well labelled diagram to show blister copper is purified to form pure copper. **(2mks)**

ii) Write the ionic equation for the anode and cathode reaction during purification of copper.

(2 mks)

……

……

……

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 6

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

FOR EXAMINERS USE ONLY

Questions	Maximum Score	Students Score
1-28	80	

For Marking Schemes Contact 0746 222 000 / 0742 999 000

1. a) Name another gas, which is used together with oxygen in welding**.** **(1 mark)**

……

(b). Explain the change in mass that occurs when the following substances are separately heated in open crucibles.

(i) Copper metal. **(1mark)**

……

……

(ii) Copper (II) nitrate. **(1mark)**

……

……

2. Aluminum metal is a good conductor and is used for overhead cables. State any other two properties that make aluminum suitable for this use. **(2marks)**

……

……

3. Give two reasons why helium is used in weather balloons**.** **(2marks)**

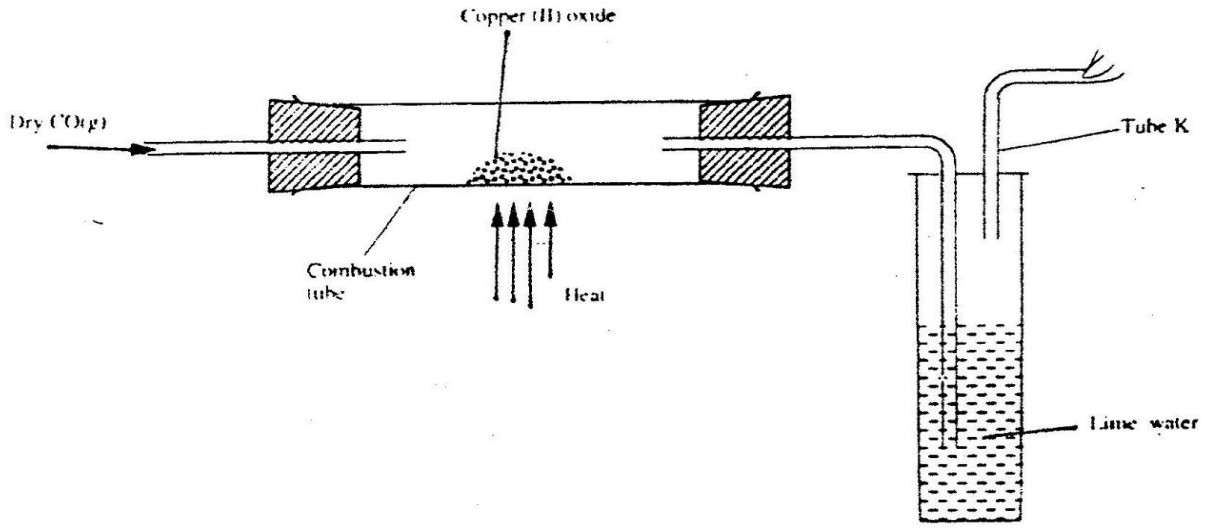
……

……

……

4. Draw two positional isomers of the third member of alkyne series. **(3marks)**

5. The apparatus shown below was used to investigate the effect of carbon (ii) oxide on copper (II) oxide.



a) State the observation that was made in the combustion tube at the end of the experiment.**(1mk)**

……

b) Write an equation for the reaction that took place in the combustion tube **(1mark)**

……

C) Why is it necessary to burn the gas coming out of tube K? **(1mark)**

……

……

6.Give a reason why

(i) Phosphorus is stored under water**.** **(1mark)**

……

……

ii) Chlorine gas is prepared in the fume chamber. **(1mark)**

……

……

iii) Concentrated sulphuric acid is not used to dry ammonia gas**.** **(1mark)**

……

……

7. A certain matchstick head contains potassium chlorate and Sulphur. On striking, the two substances react to produce Sulphur (iv) oxide and potassium chloride. State the environmental effect of using such matches in large numbers. **(2marks)**

……

……

……

8. When a sample of concentrated sulphuric acid was left in an open beaker in a room for two days, the volume was found to have increased slightly.

a) What property of concentrated sulphuric acid was being investigated. **(1mark)**

……

b) State one use of concentrated sulphuric acid that depends on the property named above.**(1mark)**

……

9. The following two tests were carried out on chlorine water contained in two test tubes

a) A piece of colored flower was dropped into the first – tube. Explain why the flower was bleached **(2marks)**

……

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……

b) The second test- tube was corked and exposed to sunlight after a few days, it was found to contain a gas that rekindled a glowing splint. Write an equation for the reaction which produced the gas. **(1mark)**

……

……

10. In the Haber process, the optimum yield of ammonia is obtained when a temperature of 450^0C, a pressure of 200 atmospheres and iron catalysts are used

N_2 (g) + $3H_2$ (g) $\rightleftharpoons$ $2NH_3$ (g); $\Delta H = -92kJ$.

a) How would the yield of ammonia be affected if the temperature was raised to 600^0C? Explain. **(2marks)**

……

……

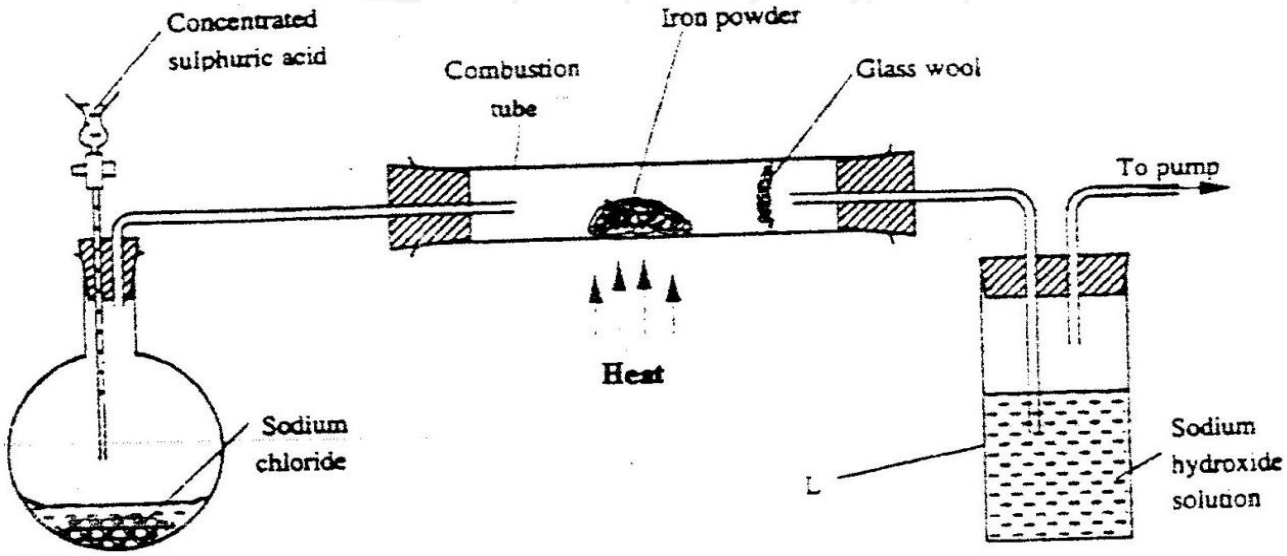
……

b) Give two use of ammonia. **(1mark)**

……

……

11. The set – up below was used to prepare hydrogen chloride gas and react it with iron powder. Study it and answer the questions that follow.



At the end of the reaction, the iron powder turned into a light green solid.

a) Identify the light green solid. **(1mark)**

……

b) At the beginning of the experiment, the pH of the solution in container L was about 14. At the end, the pH was found to be 2. Explain. **(2marks)**

……

……

……

12. Below is part of the Thorium decay series.

$$^{232}_{90}Th \xrightarrow{(i)} {}^{228}_{88}Ra \xrightarrow{(ii)} {}^{228}_{89}Ac \xrightarrow{(iii)} {}^{228}_{90}Th \xrightarrow{(iv)} {}^{224}_{88}Ra$$

(i) Write an overall nuclear equation for the conversion of Th-232 to Ra-224. **(1mark)**

……

……

(ii) Give any **two** uses of radio isotopes in medicine. **(2marks)**

……

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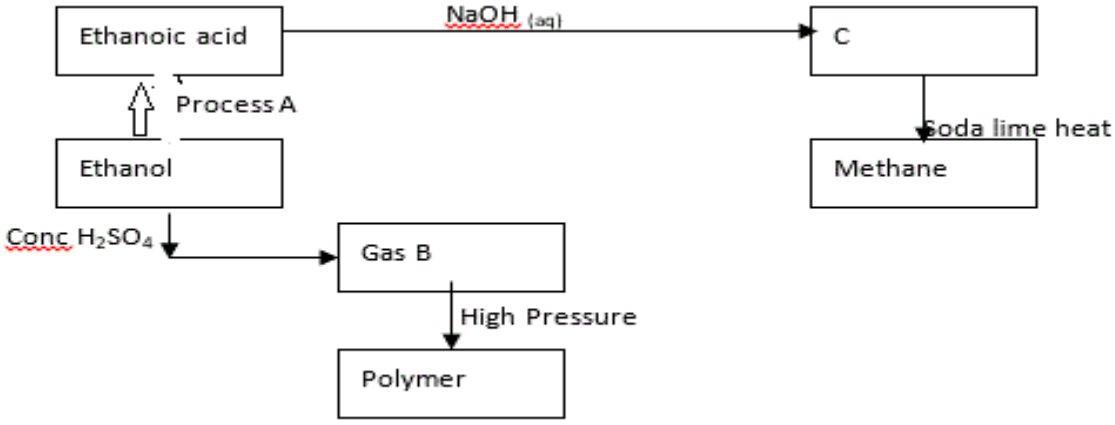
……

13. The flow chart below shows a series of reactions starting with ethanol , Study it and answer the questions that follow.



i) Name:

I. **Process A……** **(1mark)**

II. Substances B and C

B..... **(½mark)**

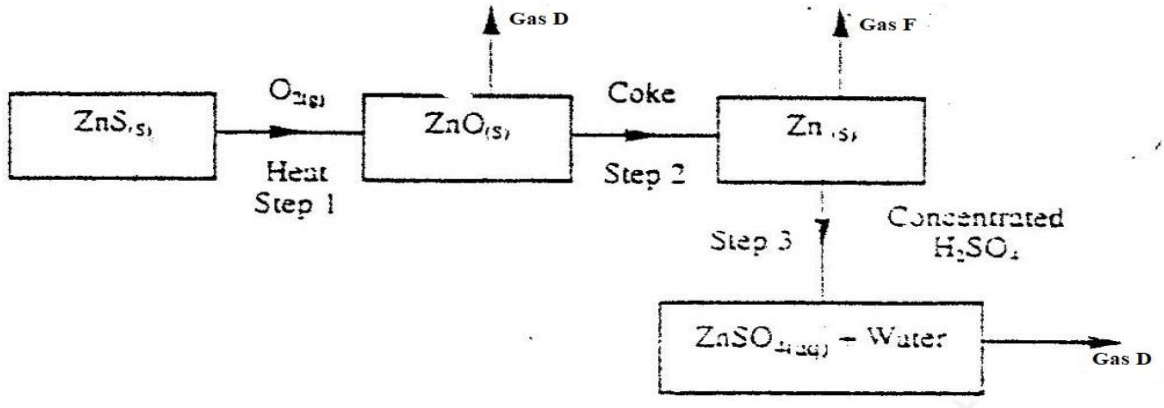
C..... **(½mark)**

ii) Write the equation for the reaction leading to formation of methane. **(1mark)**

.....

.....

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



a) State the condition necessary for the reaction in step 2 to **occur** **(1mark)**

.....

b) Name gases D and F: **(1mark)**

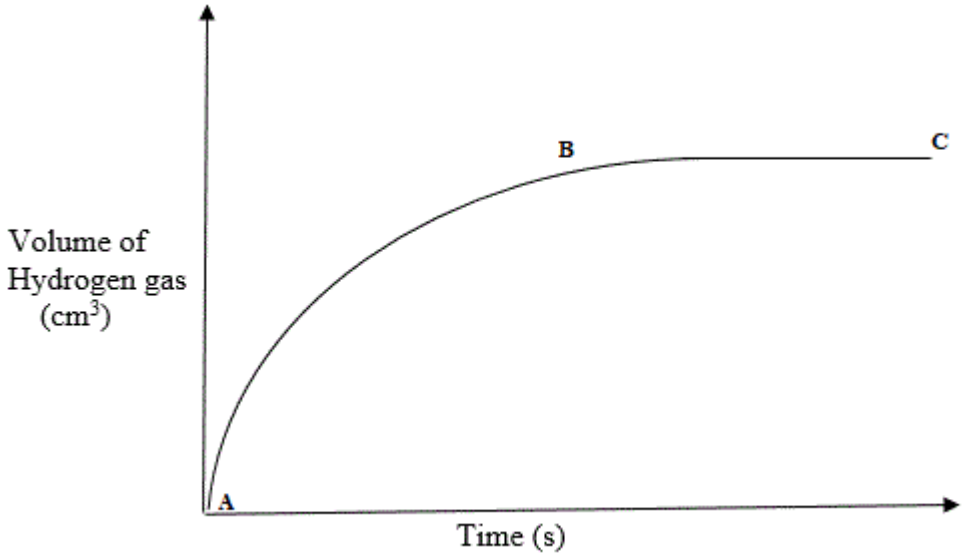
i) Gas D.....

Gas F .....

ii) State one use of zinc metal. **(1mark)**

.....

15. The reaction between a piece of magnesium ribbon with excess 2M hydrochloric acid was investigated at 25°C by measuring the volume of hydrogen gas produced as the reaction progressed. The sketch below represents the graph that was obtained.



a) Explain the shape of the curve between B and C. **(1mark)**

……

……

b) Suggest another parameter that can be used to determine the rate of the above reaction **(1mk)**

……

c) On the same diagram, sketch the curve that would be obtained if the experiment is repeated using powdered magnesium metal**.** **(1mark)**

16. Zinc oxide reacts with acids and alkalis.

a) Write the equation for the reaction between zinc oxide and:

i)Dilute sulphuric acid **(1mark)**

……

ii) Sodium hydroxide solution **(1 mark)**

……

b) What property of zinc oxide is shown by the reactions in (a) above? **(1 mark)**

……

17. **0.84 g** of aluminum reacted completely with chlorine gas. Calculate the volume of chlorine gas used (Molar gas volume is $24dm^3$, al = 27). **(3 marks)**

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18. Proper use of soaps in washing hands has proven to control the spread of corona novel virus.

a) Write the formula of the grey insoluble substance left in the washing basin when one uses soap with tap water given that the formula of the soap is $C_{17}H_{35}COONa$. **(1mark)**

……

……

b) State two advantages of Soapy detergents over soapless detergents. **(2marks)**

……

……

19. a) Use the information given below to draw a labeled diagram of an electrochemical cell that can be constructed to measure the electromotive force between G and J.

$G2+(aq) + 2e \rightarrow G(s)$; $E^{\theta} = - 0.74$ V

$J2+(aq)+ 2e \rightarrow J(s)$; $E^{\theta} = -0.14$ V **(2marks)**

b) Calculate the E^{θ} value for the cell constructed in (a) above. **(1mark)**

……

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……

20. a) Sate Le' Chetelier's principle. **(1mark)**

……

……

b) Study the following equilibrium reaction and answer the questions that follow: -

$$\underbrace{HL_{(aq)} + H_2O_{(l)}}_{\text{Red}} \rightleftharpoons \underbrace{H_3O^+(aq)\ L^-(aq)}_{\text{Blue}}$$

Given that in an acid solution, $H_3O^+_{(aq)}$ act in place of hydrogen ions, H^+, according to the equation.

$$\mathbf{H_3O^+_{(aq)} + OH^-_{(aq)} \longrightarrow 2H_2O_{(l)}}$$

Explain what would be observed when potassium hydroxide solution is added to the above equilibrium mixture. **(2marks)**

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……

……

21. The table below gives information on four elements K, L, M and N. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	Electron arrangement	Atomic radius (nm)	Ionic radius(nm)
K	2, 8, 2	0.136	0.065
L	2, 8, 7	0.099	0.181
M	2, 8, 8, 1	0.203	0.133
N	2, 8, 8, 2	0.174	0.099

a) Which two elements have similar chemical properties? Explain. **(2marks)**

……

……

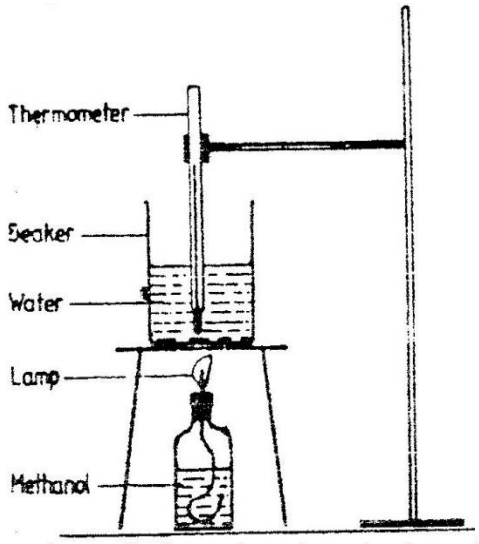
……

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

……

……

22.In an experiment to determine the heat of combustion of methanol, a student used the set-up below.



Volume of water = 500cm^3

Final temperature of water= 27.0^{0}C

Initial temperature of water = 20.0^{0}C

Final mass of lamp + methanol = 22.11g

Initial mass of lamp+ methanol= 22.98g

Density of water = 1.0g/cm^3

Specific heat capacity = 4.2kJ/g/k

Calculate:

(i) The number of moles of methanol used in this experiment given that the R.F.M is 32.

(1mark)

……

……

……

(ii) The heat of combustion per mole of methanol. **(2mark)**

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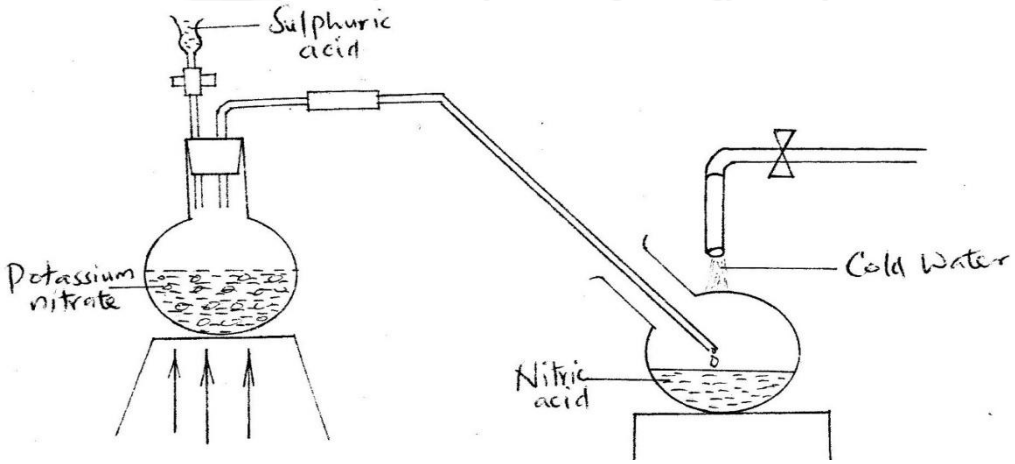
23. Using dots (.) and crosses (x) to represent outermost electrons, draw diagrams to show the bonding in, CO_2 and H_3O^+. (Atomic numbers; H = 1.0,C= 14.0, O = 8)

i) CO_2. **(1mark)**

ii) H_3O^+ **(2marks)**

24. The diagram below shows a set- up that was used to prepare and collect a sample of nitric (v) acid



HEAT

a)Give a reason why it is possible to generate nitric (v) acid from sulphuric(vi) acid in the set – up.

(1mark)

……

……

b) Name another substance that can be used instead of potassium nitrate. **(1mark)**

……

c) Give two use of nitric (v) acid. **(1mark)**

……

……

25. When a hydrocarbon was completely burnt in oxygen, 4.2g of carbon (IV) oxide and 1.71 g of water were formed. Determine the empirical formula of the hydrocarbon

(H= 1.0 ; C=12.0 ; 0 = 16.0). **(3marks)**

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……

26. Starting with 50 cm^3 of 2.8M sodium hydroxide describe how a sample of pure sodium sulphate crystals can be prepared. **(3 marks)**

……

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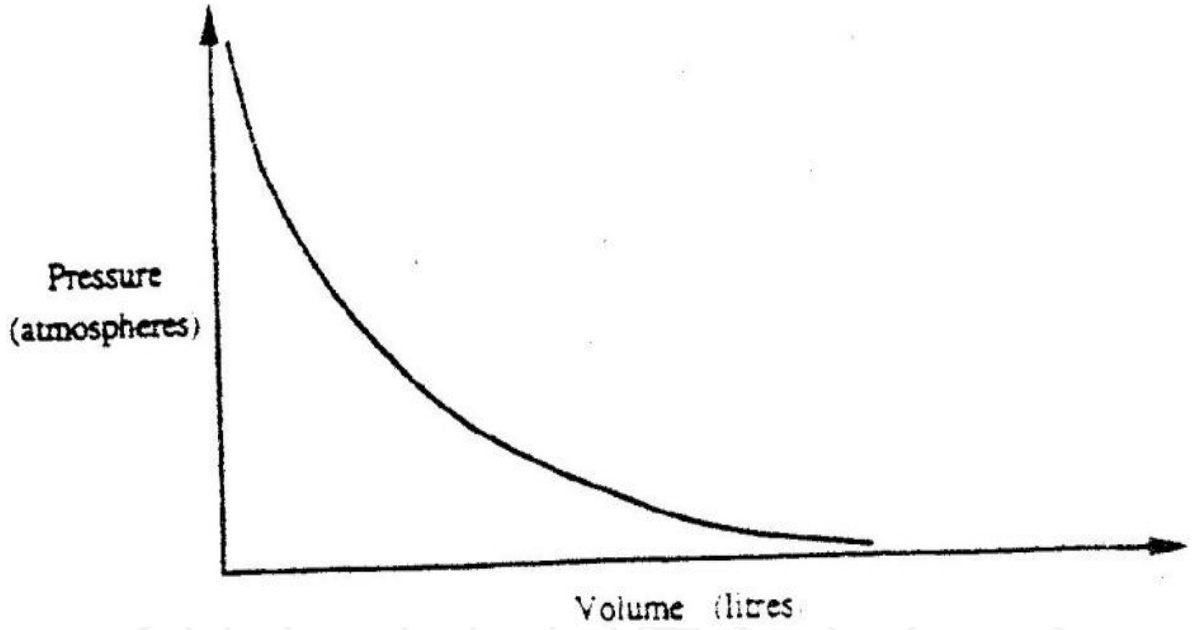
……

27. The graph below shows the behavior of a fixed mass of a gas at constant temperature.



a) What is the relationship between the volume and the pressure of the gas**?** **(1mark)**

……

……

b) Three litres of oxygen gas at one atmosphere pressure were compressed to two Atmospheres at constant temperature. Calculate the volume occupied by the oxygen gas. **(2marks)**

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……

28. Explain the following observations

i) Very little amount of hydrogen gas is collected when dilute sulphuric acid react with calcium metal. **(1mark)**

……

……

……

ii) When hydrogen chloride gas is dissolved in water, the solution turns blue litmus paper to red, while when hydrogen chloride gas is dissolved in methyl benzene; the resulting solution has no effect on the blue litmus paper. **(2marks)**

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 6

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

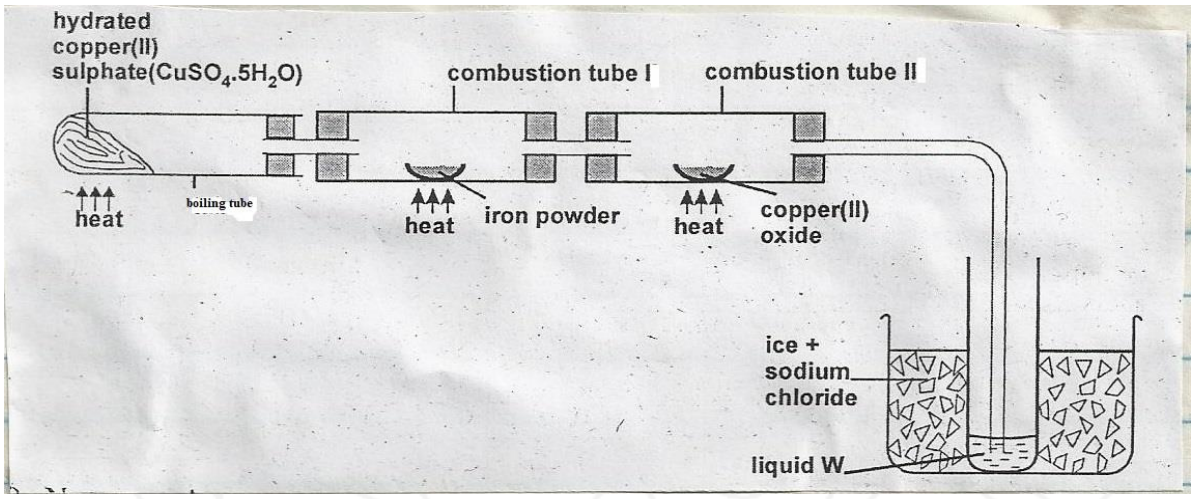
1. *Write your name and index number in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *Answer **all** the questions in the spaces provided.*
4. *Mathematical tables and silent electronic calculators may be used.*
5. *All working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

UESTION	AXIMUM SCORE	ANDIDATE'S SCORE
1	11	
2	12	
3	12	
4	11	
5	11	
6	12	
7	11	
Total score	**80**	

For Marking Schemes Contact 0746 222 000 / 0742 999 000

1. The diagram below shows the apparatus for the preparation of gas A and investigate on its properties. Study it and answer the questions that follow.



a) (i) Name gas A.

(1mark)

……

(ii) Suggest the property of gas A under investigation. **(1mark)**

……

(iii) Write chemical equations for the reactions in the;

Boiling tube **(1 mark)**

……

Combustion tube I **(1 mark)**

……

b) State and explain the observation made in

(i) Boiling tube. **(1mark)**

……

……

(ii) Combustion tube II. **(1mark)**

……

……

c) What is the use of hydrated copper (II) sulphate in the experiment?

(1mark)

……

……

d) (i) Name one other substance that comes out of tube II. **(1mark)**

……

(ii) Name liquid W. **(1mark)**

……

(iii) What is the role of sodium chloride in the ice (freezing mixture). **(1mark)**

……

……

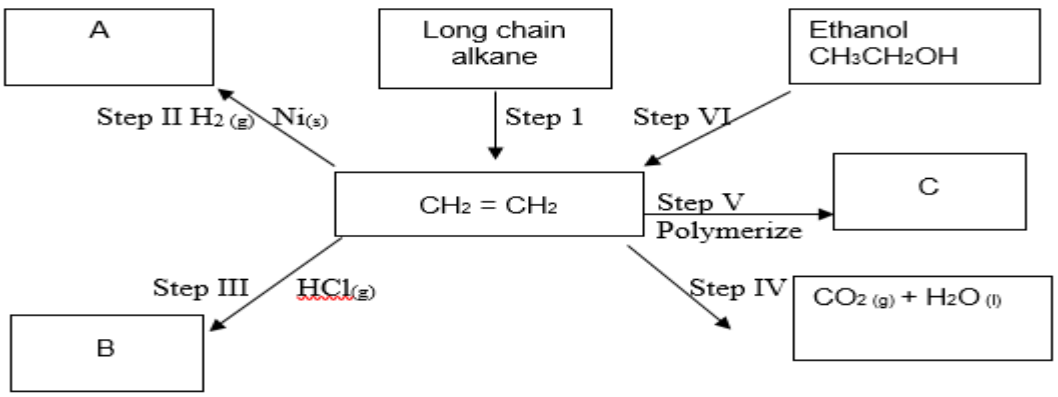
(iv) Explain why hydrogen gas has been replaced by helium in filling of aereoplane tyres.

(1mark)

……

……

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



(i) Name the process-taking place in step I.

(1mark)

……

Describe a chemical test that can be carried out determine the identity of organic compound A.

(2marks)

……

……

……

Give the name of the following: **(2marks)**

I.A……..

II. B……..

(ii) Give the structural formulae of substance C. **(1mark)**

……

……

……

(iii) Name the type of reaction that occurs in:

I. Step IV . **(2marks)**

……

II. Step VI:

……

(iv) Give the reagent and the condition necessary for step VI**.** **(2marks)**

Reagent……

Condition……

(b) Give the systematic names of the following compounds:

I. $CH_3CHCHCH_2CH_3$ **(1mark)**

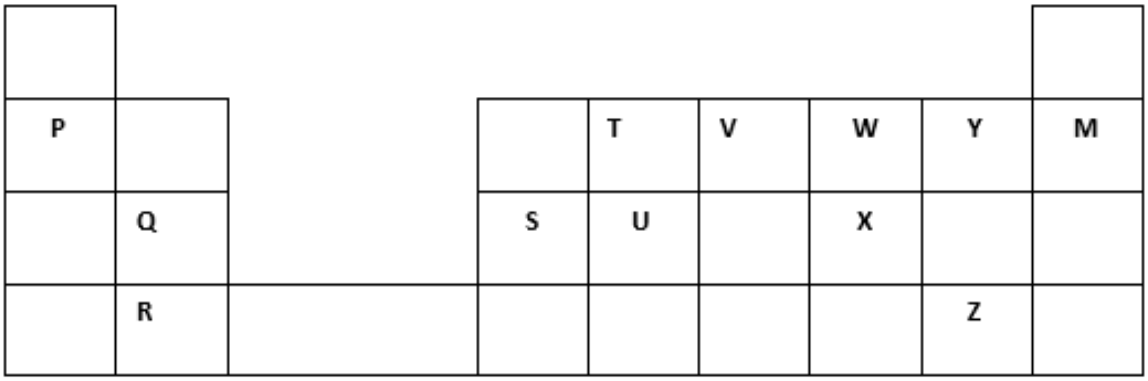
……

II. $CHCCH_3$

(1mark)

……

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



a) Write the general name given to the group where element P belong. **(1mark)**

……

b) An element N has an atomic number of 15. Write down its electronic arrangement and hence fix it in its right position on the grid above**.** **(2marks)**

Electronic arrangement

……

……

……

b) Compare the size of the atom of R and that of its ion. Explain your answer. **(2marks)**

……

……

……

c) Give the formula of the compound formed between**.** **(1mark)**

i. P and W

……

ii. T and Y

……

e) Compare the melting points of element Q and S. Explain. **(2marks)**

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……

f)State the most reactive non-metal from the grid. Give a reason for your answer. **(2marks)**

……

……

……

g) Write chemical equations for the thermal decomposition of nitrates of: **(2marks)**

i)Q

……

ii) P

……

4. a) The results below were obtained in an experiment conducted by form three students from **Isaboke 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.

(2marks)

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(ii) Determine the empirical formula of magnesium oxide. (Mg=24.0, O=16.0) **(2marks)**

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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. **(2marks)**

……

……

……

……

II. Number moles of the substance that would react with sulphuric acid in the one litre solution.

(1mark)

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……

III. The percentage of sodium chloride in the mixture. **(3marks)**

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

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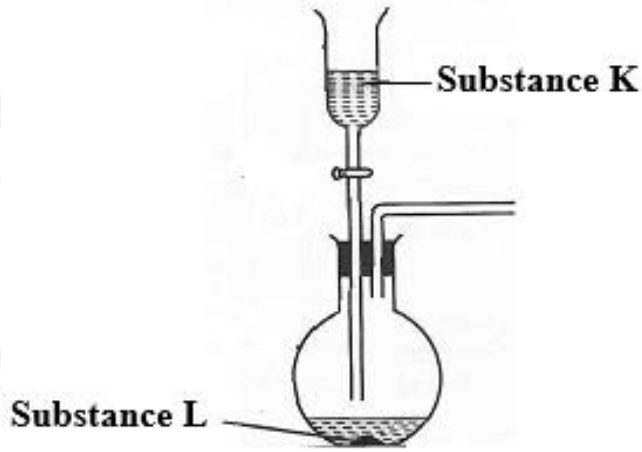
5. The set-up below can be used to generate a gas.



(a) (i) Complete the table below giving the names of substance **K** and **L** if the gases generated are carbon (IV) oxide and carbon (II) oxide. **(2marks)**

Substance	Carbon (IV) oxide	Carbon (II) oxide
K		
L		

(ii) Complete the diagram to show how a sample of carbon (II) oxide can be collected.

(2marks)

(iii) State two ways that can be used to distinguish carbon (IV) oxide from carbon (II) oxide? **(2marks)**

……

……

……

(b) (i) In an experiment, carbon (IV) oxide gas was passed over heated charcoal held in a combustion tube. Write a chemical equation for the reaction that took place in the combustion tube.

(1mark)

……

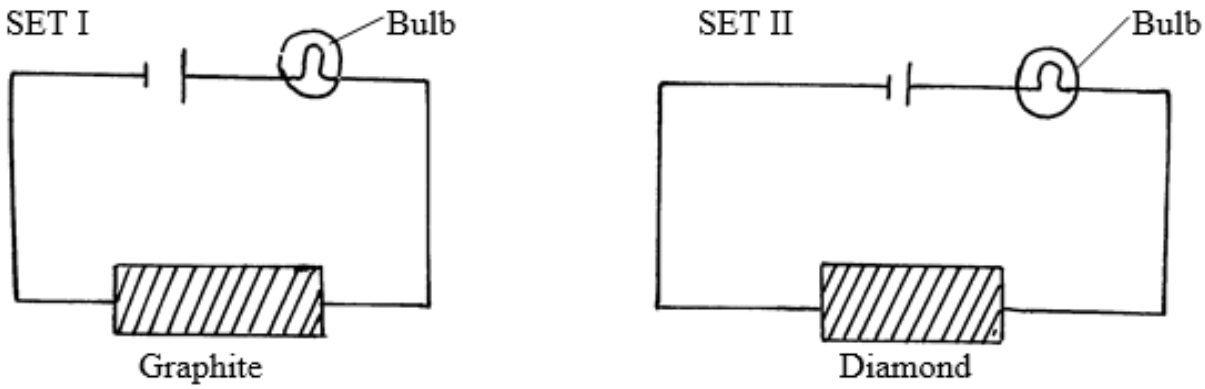
……

(ii) State one use of carbon (II) oxide. **(1mark)**

……

……

(c) The following set ups were used by Form Two students. Study and use them to answer the questions that follow.



State and explain the observations made in set up I and II above. **(3marks)**

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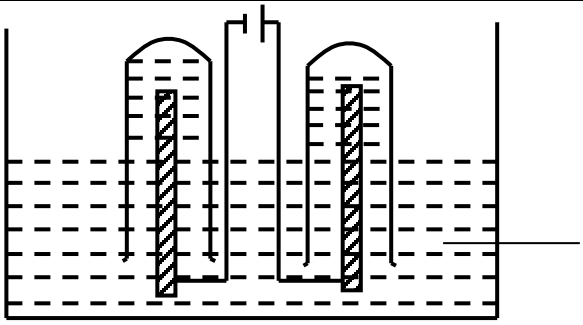
……

6. a) The set up below was used during electrolysis of aqueous copper (II) sulphate using inert electrodes.



i) Name a suitable pair of electrodes for this experiment. **(1 mark)**

……

ii) Write formula of the anions and cations in the solution. **(1 mark)**

……

……

iii) On the diagram, label the cathode. **(1mark)**

iv) Write ionic equation for the reaction that took place at the anode. **(1 mark)**

……

v) Explain the observation that occurred to the Copper (II) Sulphate solution during the experiment. **(2 marks)**

……

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……

vi) During the electrolysis, 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 coulomb. Volume of gas at room temperature = 24,000cm^3). **(3 marks)**

……

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……

b) **i)** Draw a diagram to show how an impure copper lump can be refined through electrolysis.

(2marks)

ii) State one other application of electrolysis other than the one shown in b (i) above. **(1mark)**

……

……

7. **(a)**The solubilities of potassium nitrate and potassium bromide at different temperatures were determined. The following data was obtained.

mperature ^{0}C										
lubility g/100g H_2O	NO_3							5	5	5
	Br									

(i) Draw solubility curves for both salts on the same axis. **(3marks)**

(ii) What was the solubility of each salt at 65^0C? **(1mark)**

……

……

(iii) 100g of a saturated solution of potassium nitrate at 75^0C was cooled to 25^0C. What mass of the crystals will be formed? **(3marks)**

……

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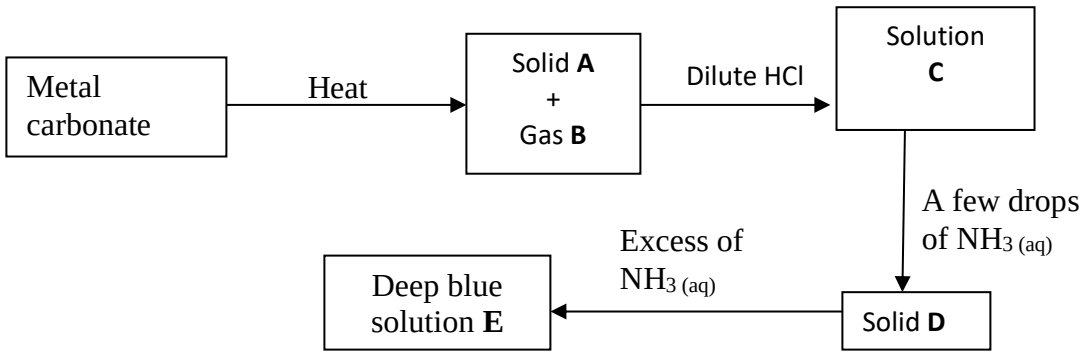
……

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



(i) Write an equation for the formation of solid **A** and gas **B**. **(1mark)**

……

……

(ii) Name;

Solution **C** …… **(1mark)**

Solid D ……..…… **(1mark)**

(c) Write the formula of the complex ion in solution **E**. **(1mark)**

……

……

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 7

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO THE CANDIDATES:-

- Write your **name** and **Admission number** in the spaces provided.
- Answer ***all*** the questions in the spaces provided.
- Mathematical tables and electronic calculators may be used
- All working **MUST** be clearly shown where necessary.

FOR EXAMINER'S USE ONLY:

Question	Maximum score	Candidate's score
1-25	80 MARKS	

1 [a]State Boyle's law **[1mk]**

……

……

[b]At 400^0C, 850cm^3 of a gas exert a pressure of 560mmHg. What volume of the same gas would exert a pressure of 640mmHg at the same temperature? **[3mks]**

……

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……

……

2. When burning magnesium is lowered into a gas jar containing nitrogen (I) oxide, it continues to burn forming a white solid

[a]Name the white solid **1mk]**

……

[b]Write a chemical equation of the reaction that **occurred** **[1mk]**

……

……

3. Carbon {IV} oxide is one of the gases used in fire extinguishers

[a] State any other possible use of carbon {IV} **oxide** **[1mk]**

……

[b]Name any two reagents that can be reacted together to generate carbon {IV} oxide **[2mks]**

……

……

……

4. Rusting is a process that causes massive destruction of iron structures

[a]State one condition that accelerates rusting **[1mk]**

……

[b]State one advantage of **rusting** **[1mk]**

……

……

5. At 60^0C, 38 grams of lead{II} nitrate saturate 56cm^3 of water. Determine the solubility of lead {II} nitrate at this temperature

[2mks]

……

……

……

6. Explain why molten sodium chloride conducts electricity, but solid sodium chloride does not

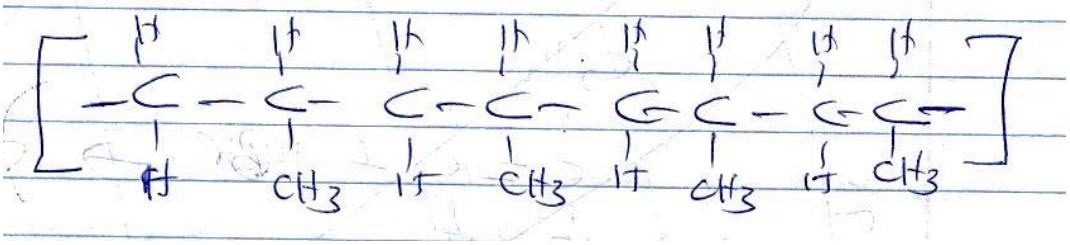
[2mks]

……

……

……

7. A polymer can be represented as



[a]Name and draw the structure of the monomer **[2mks]**

……

……

……

……

……

[b]What type of polymerization occurs in the above case? **[1mk]**

……

[c]Given that the molecular mass of the polymer is 25620, how many units of the monomer make the polymer **[2mks]**

……

……

……

8. A reaction can be represented as;

$C_2H_{4[g]} + HBr_{[g]} \longrightarrow C_2H_5Br_{[g]}$

Given the bond energies of C-H, C=C, C-C, C-Br, and H –Br as 20kJ/mol, 580Kj/mole, 446Kj/mole, 438KJ/mole and 396kJ/mole respectively. Determine the heat of formation of C_2H_5Br **[3mks]**

……

……

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9 [a]Define the term, dynamic **equilibrium** **[1mks]**

……

……

[b]A reaction at equilibrium can be represented as

$2CrO^{2-}_{4[aq]} + 2H^{+}[aq] \rightleftharpoons Cr_2O7\ ^{2}_{[aq]} + H_2O_{\{l\}}$

Yellow **orange**

State and explain the observation made when;

[i] NaOH is added to the equilibrium **mixture** **[2mks]**

……

……

……

[ii] HCl is added to the equilibrium **mixture** **[2mks]**

……

……

……

10. During the electrolysis of dilute copper {II} chloride using carbon electrodes, a current of 1.5A was passed through the solution for 2 hours and 30 minutes

[**a]** Write the ionic equation of the reaction that occurred at the **cathode** **[1mk]**

……

……

[b] Given R.A.M of copper = 64 and 1F = 96500C, calculate the change in mass of the cathode **[3mks]**

……

……

……

……

……

11. [a] Define the term half-**life** **[1mk]**

……

……

[b]Name two particles likely to be emitted when a radioactive nuclide undergoes radioactivity **[2mks]**

……

……

[c]The half-life of a radioactive nuclide is 3 hours. Given that its initial mass is 288g, determine the remaining mass after 12 hours. **[2mks]**

.....

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.....

12. The reduction potentials of elements M and N are;

$M^{2+}_{[aq]}$ +2e- $\rightleftharpoons$ $M_{[s]}, E^{\theta}$ =+0.44V

$N^{+}_{[aq]}$ e- $\rightleftharpoons$ $N_{[s]}$, E^{θ} = -1.64V

Using the above reduction potentials, predict whether a reaction would occur between $N^{+}_{[aq]}$ and $M_{[[s]}$ **[3mks]**

.....

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13. An hydrocarbon can be represented as: C_2 H_2

[a] Name the hydrocarbon **[1mk]**

.....

[b] State two reagents that can be reacted together to generate the hydrocarbon **[2mks]**

.....

[c] Identify the group of hydrocarbons into which C_2H_2 belongs to **[1mk]**

.....

14. **[a]** Define allotropy and give an element with allotropes apart from sulphur **[2mks]**

.....

.....

.....

[b]In an experiment to investigate a certain property of sulphur, Maina added few drops of conc HNO_3 to sulphur in a test tube and warmed the mixture

[i]State one observation made **[1mk]**

.....

[ii]Write a chemical equation of the reaction that occurred **[1mk]**

.....

.....

15. Chlorine is commonly used in the manufacture of $Ca(OCl)_2$

[i] State one use of the above compound of chlorine **[1mk]**

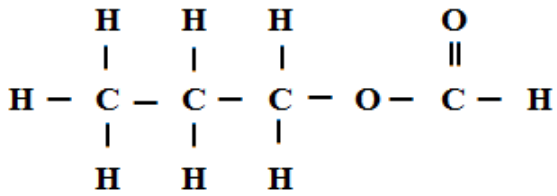
.....

[ii] Write a chemical equation leading to the production of $Ca(OCl)_2$ **[1mk]**

.....

.....

16. A compound can be represented as



[a] What name is given to the above class of **compounds** **[1mk]**

.....

[b] Name two reagents that can be reacted together to generate the above compound **[2mks]**

.....

.....

.....

[c] State two conditions necessary for the reaction leading to formation of the above compound to occur **[2mks]**

……

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……

17. Using dots and crosses, show bonding in carbon {II} oxide **[2mks]**

18. When 20g of a compound containing carbon, hydrogen and oxygen was burnt in the air, 29.3g of carbon{IV} oxide and 11.7g of water were produced. Determine its empirical formulae.
{C=12, H=1 , O=16} **[3mks]**

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……

19. Few drops of hydrochloric acid were added into a test tube containing lead {II} Nitrate solution

{a} State one observation **made** **[1mk]**

……

{b} Write an ionic equation of the reaction that occurred in the test tube **[1mk]**

……

20. In the industrial manufacture of Ammonia one of the raw materials is nitrogen gas

{a} Name one other raw material **[1mk]**

……

{b} Name two possible sources of the raw material you have named in {a} above **[2mks]**

……

……

{c} Name two substances that can be used as catalyst in this process **[2mks]**

……

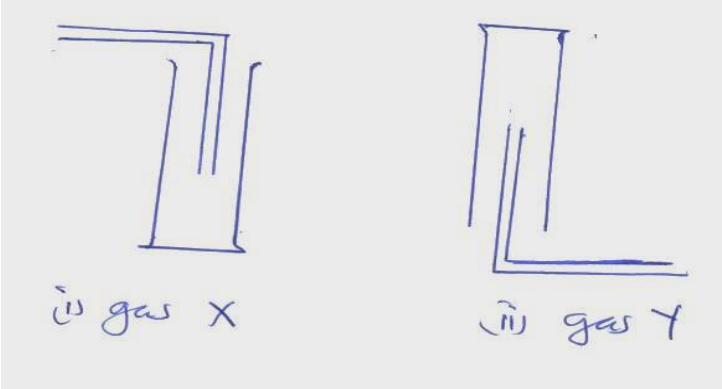
……

{d} State one use of ammonia **[1mk]**

……

……

21. Gas X and Y can be collected as shown below



[a] Name the method used to collect gas Y **[1mk]**

……

[b] How do densities of gas X and gas Y compare? **[1mk]**

……

……

[c] Give an example of a gas that can be collected using the same method as gas Y **[1mk]**

……

22. Element W has two isotopes W – 36 and W-40 which occur in the ratio x:4. Given that R.A.M of W is 37.25, find the value of x **[2mks]**

……

……

……

……

23. Describe an experiment that can be used to determine whether a given sample of a liquid is pure **[2mks]**

……

……

……

……

24. A given mass of gas T diffuses through a porous plug in 48 seconds while a similar mass of gas R diffuse in 70 seconds. Given that the density of gas T is 0.6g/cm3, find the density of gas R **[2mks]**

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25. The electron configuration of elements A, B, C, D and E are as given below

Element	Electron configuration
A	2, 8, 1
B	2, 8
C	2, 7
D	2, 8, 6
E	2, 8, 3

{a} Which element has the highest electrical conductivity **[1mk]**

……

{b} Which letter represents the most reactive metal **[1mk]**

……

{c} Which letter represents the most reactive non-metal **[1mk]**

……

****

KCSE 24

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 7

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS:

a) *Write your name and index number and class in the spaces provided.*

b) *Answer ALL the questions in the spaces provided in the question paper.*

c) *All working MUST be clearly shown where necessary.*

d) *Mathematical tables and electronic calculators may be used.*

FOR EXAMINER'S USE ONLY

QUESTION	MAXIMUM SCORE	SCORE
1	11	
2	9	
3	13	
4	13	
5	10	
6	13	
7	11	
Total score	**80**	

1. 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 element.

				N		S		
K	Q		O			P	F	M
	R							

a) What name is given to the group of elements to which Q and R belong? **(1 mark)**

……

b) Write the formula of the compound formed when Q and P combine. **(1 mark)**

……

c) Name the type of bond formed in (b) above. **(1 mark)**

……

d) How does the atomic radii of O and P compare? Give a reason. **(2 mrks)**

……

……

……

e) Draw a dot (.) and cross (x) diagram for the compound formed between N and F. **(1 mark)**

f) Explain how you would obtain a pure sample of the carbonate of K from its mixture with Lead carbonate powder. **(2 marks)**

……

……

……

g) Give one use of element M. **(1 mark)**

……

h) The melting point of M is -189°C lower than that of F -102°C. Explain this difference in their melting points. **(2 marks)**

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……

……

2. The list below shows the formulae of some organic compounds. Use letters T1 to T6 to answer the questions that follow.

T_1 – $CH_3CH_2CH_2CH_2CH_3$

T_2 – $CH_3CH_2CH_2COOC_2H_5$

T_3 – $CH_3CH_2CH_2CH_2OH$

T_4 – $CH_3CH_2CH_2COOH$

T_5 – $CH_3CH_2CHCH_2$

T_6 – CH_3CCCH_3

(a) i) Select two compounds which are not hydrocarbons **(1mk)**

……

(ii)Would decolorize both bromine water and acidified potassium manganite (VII) **(1mk)**

……

(iii)Would produce hydrogen gas when reacted with potassium metal **(1mk)**

……

(b) Select a compound which would produce bubbles of a gas when reacted with sodium carbonate. **(1mk)**

……

c) (i) Identify the compound that is likely to undergo additional polymerization.

Give a reason for your answer. Using two molecules show how polymerization occurs.

I. Compound **(1mk)**

……

II. Reasons **(1mk)**

……

……

III. Polymerization **(1mk)**

……

.....

(ii) Name the process by which compound T_2 is formed and identify the compounds that were used to form it.

I. Process **(1mk)**

II. Compounds **(1mk)**

(i)

(ii)

3. a) What is meant by the term molar enthalpy of combustion? **(1mks)**

.....

.....

b) The enthalpies of combustion of carbon, hydrogen and ethanol are given below.

$C_{(s)} + O_{2\,(g)} \longrightarrow CO_{2\,(g)}$ $\Delta H = -393 kJmol^{-1}$

$H_{2\,(g)} + \frac{1}{2} O_{2\,(g)} \longrightarrow H_2O_{(l)}$ $\Delta H = -286\ kJmol^{-1}$

Enthalpy of combustion of ethanol $\Delta H = -1369kJ/\ mol$

i) Draw an energy cycle diagram that links the enthalpy of formation of ethanol to enthalpies of combustion of Carbon, hydrogen and ethanol **(2 marks)**

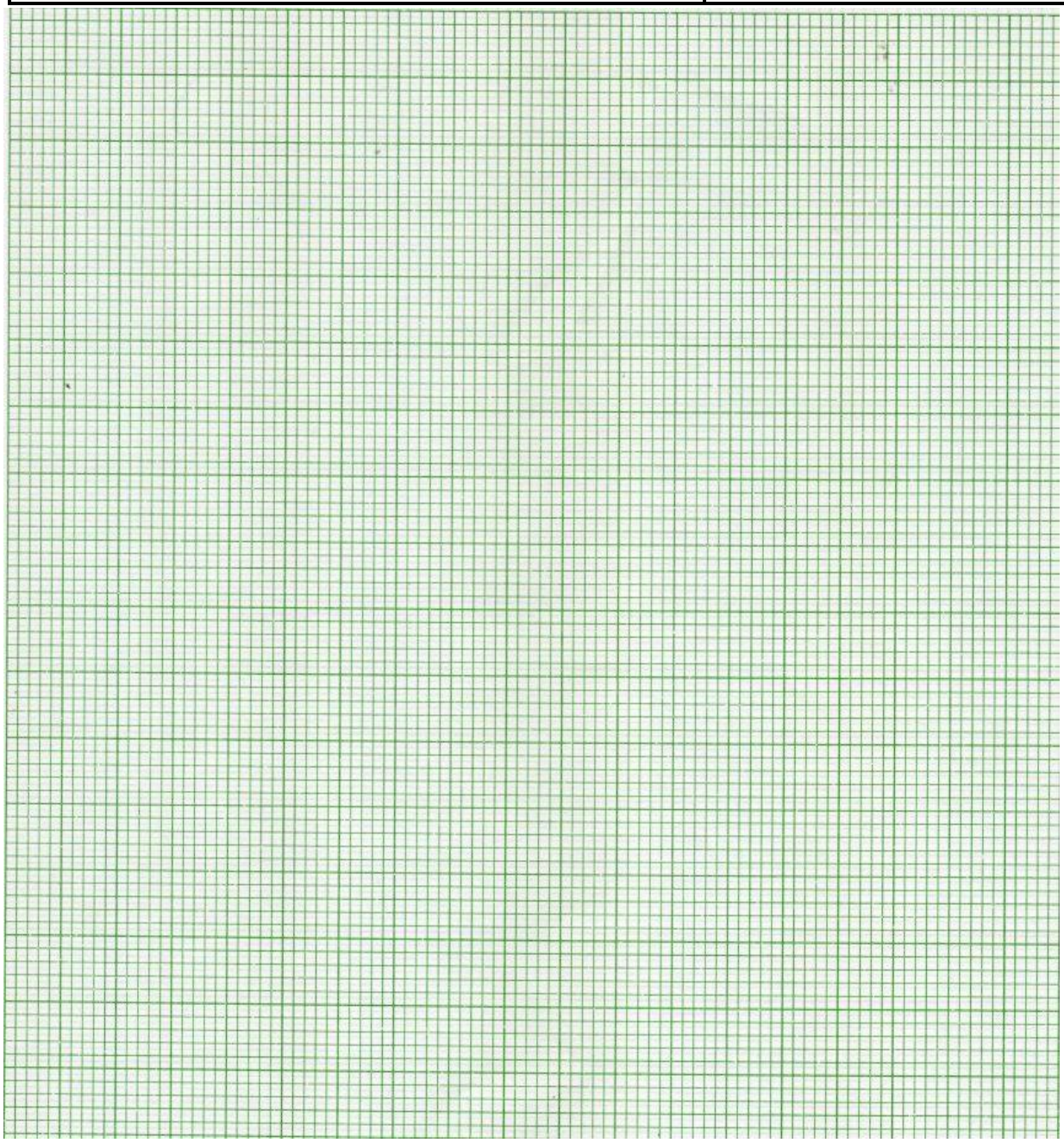
ii) Determine the enthalpy of formation of ethanol **(2 marks)**

c) An experiment was carried out where different volumes of dilute nitric (v) acid and Aqueous potassium hydroxide both at 25°C were mixed and stirred with a thermometer. The highest temperature reached by each mixture was recorded in the table below.

Volume of nitric (V) acid (cm^3)	4	8	12	16	20	24	28	32	36
Volume of potassium hydroxide cm^3	36	32	28	24	20	16	12	8	4
Highest temperature of mixture	19.8	22.2	24.6	27.0	27.0	25.0	23.0	21.0	19.0

i) Plot a graph of highest temperature (vertical axis) against volume of nitric(v) acid. (horizontal axis)

3mks



ii) Using your graph, determine the;

a) Highest temperature reached **(1 marks)**

b) The volume of the acid that reacted when the highest temperature is reached. **(1marks)**

c) The amount of heat liberated during the neutralization process

(Specific heat capacity is $4.2Jg^{-1}K^{-1}$ and the density of solution is $1.0gcm^{-3}$ **(2 marks)**

d) The molar enthalpies of neutralization for dilute hydrochloric acid and dilute nitric (v) acid are -55 kJmol^{-1} while that of ethanoic acid is -52.2kJ/mol. Explain this observation. **(1mks)**

4 (a) The standard electrode potentials for the elements chloride and magnesium are:

$Cl_{2\,(aq)} + 2e^- \rightarrow 2Cl^-_{(aq)}$ $E^\theta = +1.36V$

$Mg^{2+}_{\,(aq)} + 2e^- \rightarrow Mg_{(s)}$ $E^\theta = -2.36V$

i) Which one for the two elements will act as an oxidizing agent? Explain your choice. **(2 marks)**

ii) Calculate the electromotive force of a cell where the overall reaction is:

$Cl_{2(aq)} + Mg_{(s)} \rightarrow MgCl_{2(aq)}$ **(1mark)**

(b) The table below gives the standard electrode potentials for divalent metals represented by the letters P, Q, R and S (not their symbols of elements). Use it to answer the question that follow.

Metal	E^θ (volts)
P	+1.50
Q	+0.44
R	+0.34
S	–0.76

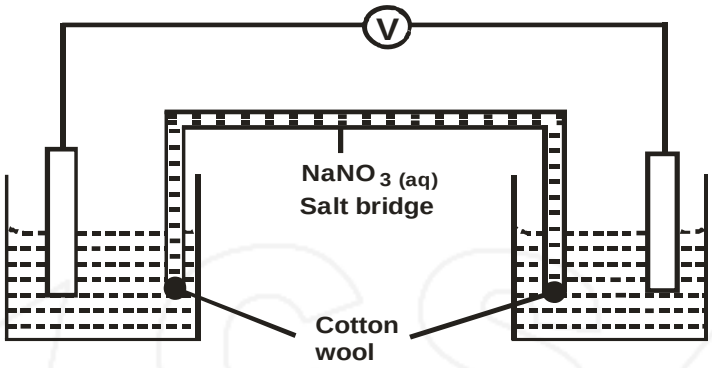
i) Which one of the metals cannot be displaced from a solution of its ions by any other metals in the table? Explain. **(2 marks)**

.....

……

……

ii) Metals P and Q were connected to from a cell as shown in the diagram below.



I) On the diagram label the metals P and Q , the flow of electrons and indicate the ions in solution **(2 marks)**

II) Write equations (half equations) of the reactions taking place at the electrodes.

a) Electrode P **(1 mark)**

b) Electrode Q **(1 mark)**

III) State **two** functions of the salt bridge. **(2 marks)**

……

……

IV) What must be observed about the choice of a salt bridge? **(1 mark)**

……

……

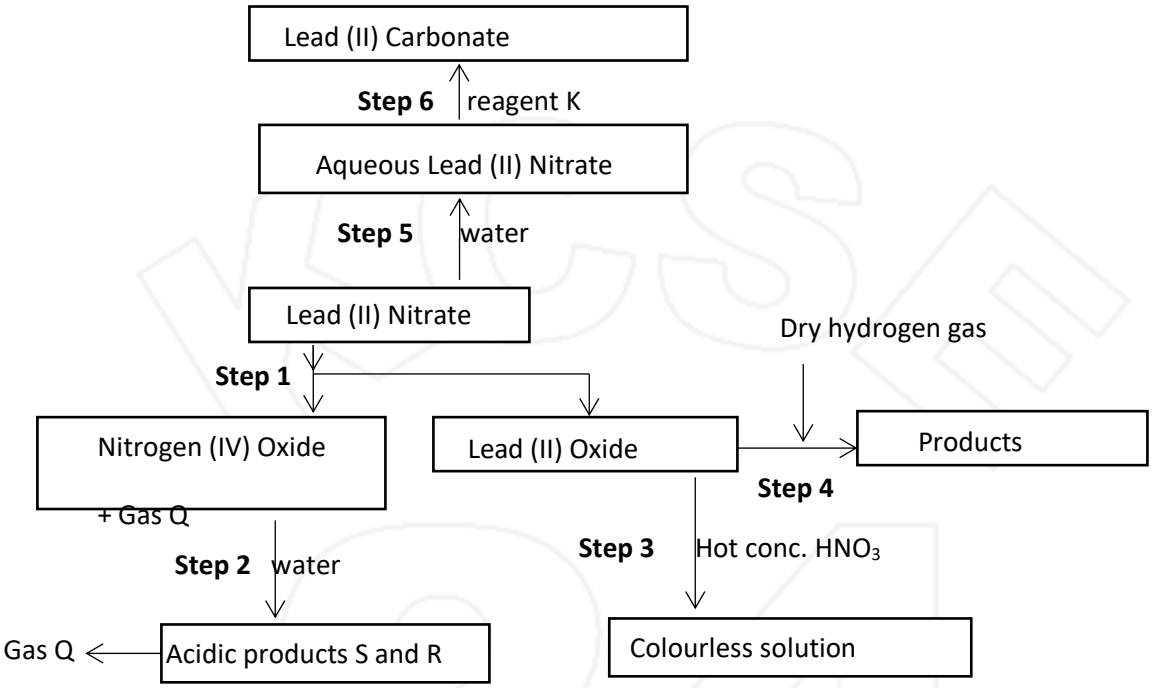
iii) A metallic couple of the metal S and Z produced a voltage of +1.71volts.

(Assume that S has the higher negative electrode potential)

I. Calculate the standard electrode potential for metal Z. **(1 mark)**

II. Arrange the metals P, Q, R and Z in their decreasing order of reactivity. **(1 mark)**

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



(a) i) State the conditions necessary in Step 4 **(1mk)**

……

……

ii) Identify

I) Reagent K **($^1/_2$mk)**

II) Gas Q **($^1/_2$mk)**

III) Acidic products S and R. **(1mk)**

iii) Write

I) The ionic equation for the reaction in step 6. **(1mk)**

II) The equation for the reaction in Step 4. **(1mk)**

b) The use of materials made by Lead in roofing and water pipes is being discouraged. State

i) Two reasons why these materials have been used in the past**.** **(2mks)**

ii) One reason why their use is discouraged. **(1mk)**

c) The reaction between Lead (II) Nitrate and sulphuric (vi) acid starts and stops immediately. Explain **(2mks)**

……

……

……

6.(a) A student was supplied with a colourless liquid suspected to be water.

(i) Describe one chemical test that could have been used to show that the liquid was water **(2mk)**

……

……

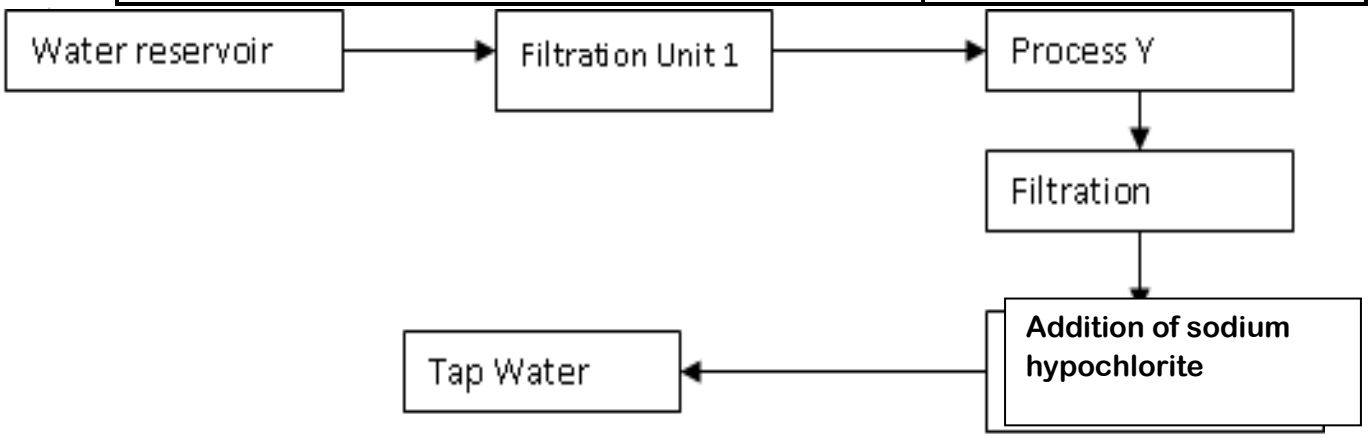
……

ii) How could it have been shown that the liquid was pure water? **(1mk)**

……

……

(b) The flow chart below shows the various stages of water treatment. Study it and answer the questions that follow



(i) Which substances are likely to be removed in filtration unit I? **(1mk)**

……

……

(ii) What is the purpose of process Y **(1mk)**

……

iii) What is the purpose of the addition of sodium hypochlorite **(1mk)**

……

……

(c) It was confirmed that magnesium sulphate was present in the tap water

(i) What type of hardness was present in the water? **(1mk**

……

(ii) Explain one method that can be used to remove the water hardness. **(2mks)**

……

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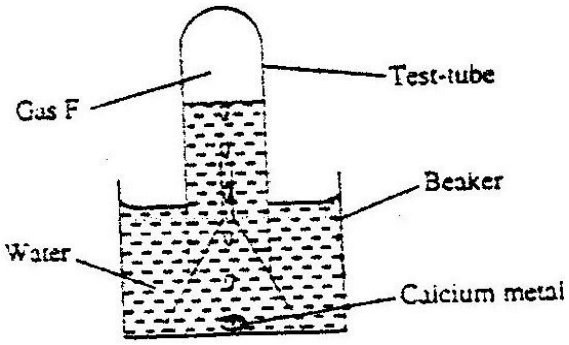
……

d. The set-up below was used to collect gas F, produced by the reaction between water and calcium metal.



(i) Name gas F **(1mk)**

……

(ii) At the end of the experiment, the solution in the beaker was found to be a weak base. Explain why the solution is a weak base. **(2 marks)**

……

……

……

(iii) Give one laboratory use of the solution formed in a beaker. **(1 mark)**

……

……

7 (a) (i) Name the allotropes of sulphur **(1mk)**

……

……

(ii) Sulphur is mined using the Frasch process which uses super-heated water at 170^0c and hot compressed air.

I) Explain how water at 170^0c is obtained. **(1mk)**

II) State one role of the super-heated water **(1mk)**

(iii) State and explain what happens when wet petals of red flowers are put in a gas jar full of sulphur (iv) oxide **(2mark**

……

……

……

iv) Write an equation for the reaction of sulphur (IV) oxide and concentrated Nitric (V) acid.

(1mark)

(v) I) Name the catalyst used in contact process **(1mark)**

(II) An equilibrium exists as

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

State and explain what happens if

a) More oxygen is added to the system **(2 marks)**

b) Pressure is decreased **(2 marks)**

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 8

233/1

CHEMISTRY

PAPER 1

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES:

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

*(b)Answer **ALL** the questions in the spaces provided in the question paper*

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) Candidates should check the question paper to ascertain that **all the pages are printed** as indicated and that **no questions are missing***

(f) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

1. An element Y has the electronic configuration 2.8.5

a) Identify its period **(1mk)**

……

b) Write a formula of the most stable anion formed when Y ionizes. **(1mk)**

……

c) Explain the differences between the atomic radius of element Y and its ionic radius. **(2mks)**

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2. The table below shows tests carried out on a sample of water and the results obtained.

	Test	Results
	ldition of sodium hydroxide solution	hite precipitate which dissolves in excess
	ddition of excess aqueous ammonia	olourless solution obtained
I	ldition of dilute hydrochloric acid and rium chloride	hite precipitate

a) Identify the anion present in the water.

(1mark)

……

b) Write an ionic equation for the reaction in **III.** **(1mark)**

……

Solution	PH - VALUES
K	1.5

3. Solutions can be classified as acids bases or neutral. The table below shows solutions and their pH values.

L	7.0
M	14.0

(i) Select any pair that would react to form a solution of pH 7. **(1mark)**

……

(ii) Identify two solutions that would react with aluminum hydroxide. Explain. **(1marks)**

……

……

4. a) State Graham's Law of diffusion. **(1mk)**

……

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b) 60cm^3 of oxygen gas diffused through a porous partition in 50 seconds. How long would it take for 60cm^3 of sulphur (IV) oxide gas to diffuse through the same partition under the same conditions? (S = 32.0, O = 16.0) **(3 marks)**

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

Metal oxide → Add $NH_{3\,(aq)}$ → White precipitate X → Add excess $NH_{3\,(aq)}$ → Colourless solution Y

For Mark 0

a) Identify the metal oxide. **(1mk)**

……

b) Write an ionic equation leading to the formation of the white precipitate X. **(1mk)**

……

……

c) Give the formula of the ions responsible for the colourless solution Y. **(1mk)**

……

……

6. Two compounds of barium are barium sulfide and barium chloride.

(a) The hazard symbol shown in Figure below is on bottles containing barium metal.



State the meaning of this hazard symbol. **(1mk**

……

(b) Give the names of the elements combined in barium sulfide**.** **(1mk)**

……

(c) Hydrogen sulphide gas is highly poisonous. Sate one safety precaution that should be taken when handling hydrogen sulphide. **(1mk)**

……

……

7. Study the information in the table and answer questions that follow:

otope		
lative abundance %	61.3	.7

(a) Determine the number of neutrons of R_1 . **(1mk)**

……

……

……

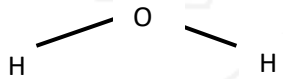
(b) Calculate the relative atomic mass of element **R**. **(2mks)**

……

……

……

8. a) Identify the type of bond formed compound below. **(1mk)**



b) Using dots (crosses (**x**) sent electrons show bonding in magnesium oxide **(2mks)**

9. Show the products formed when the following salts are heated by writing a balanced chemical equation. **(2 marks)**

(i) $KNO_{3(s)} \xrightarrow{Heat}$

(ii) $(NH_4)_2 CO_{3(s)} \xrightarrow{Heat}$

10. Explain why when one is stung by a bee application of a little solution of sodium hydrogen carbonate helps to relieve the pain. **(2 marks)**

……

……

……

11. The following table gives the melting point of oxides of the third period elements.

Study it and answer the questions that follow.

rmula of oxides	$_{2}O$	gO	$_{2}O_3$	O_2	O_{10}	O_2
elting point (^{0}O)	90	80	50	30	0	3

(a) Explain the large difference in the melting points of Na_2O and P_4O_{10}. **(2 mark)**

……

……

……

(b) Write the equation for the reaction between Al_2O_3 with;

(i) NaOH **(1 mark)**

……

(ii) HCl **(1 mark)**

……

12. A hydrocarbon slowly decolourlises bromine in presence of sunlight but does not decolourise acidified potassium permanganate. Name and draw the structural formula of the fourth member of the series to which the hydrocarbon belongs. **(2 marks)**

13. Distinguish between ionization energy and electron affinity. **(2mks)**

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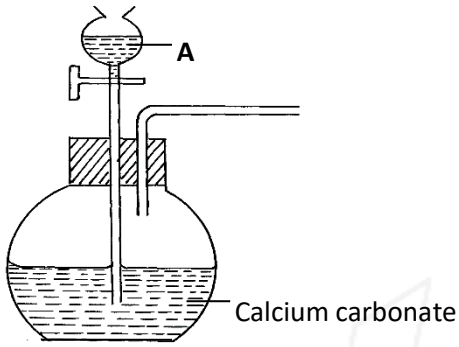
14. The set-up below was used to prepare a carbon (IV) oxide gas.



(a) Give the name of substance **A** **(1mk)**

……

(b) Complete the diagram to show how the **dry** gas can be collected. **(2mks)**

(c) Write the equation for the reaction **(1mk)**

……

……

15. Calculate the mass of sulphur which on complete combustion would yield $7dm^3$ of sulphur (IV) oxide measured at 182^oc and 722 mm Hg pressure. (0=16, S=32, molar gas volume = $24dm^3$ at r.t.p). **(3 mks)**

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16. Form two students from Achiever's secondary school reacted three elements as shown in the table below

ement	action with Oxygen	action with water
	rmed acidic oxide	reaction

	rmed basic oxide	rmed soluble hydroxide gave off hydrogen gas
	rmed acidic oxide	ssolved to form an acidic solution

Which element (s) is likely to be: **(3mks)**

i) Non-metal (s)

……

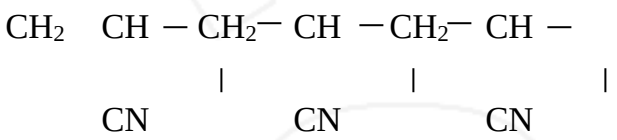
ii) Metal (s)

……

iii) Insoluble in water.

……

17. A polymer has the following structure



A sample of this polymer is found to have a molecular mass of 5194. Determine the number of monomers on the polymer. (H = 1.0, C = 12.0, N = 14.0) **(2 marks)**

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……

18.a) State the likely products of the electrolysis of molten potassium chloride at the:-

(i) Cathode ……(½mk)

(ii) Anode …… (½mk)

b) Write the equations that occur at the anode and cathode. **…….(2mks)**

Anode……..

Cathode……

19. Give two reasons why helium is used in weather balloons. **(2mks)**

……

……

……

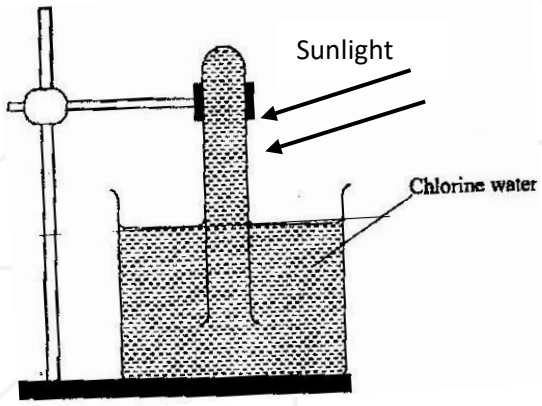
20. A Bunsen burner produces a yellow flame when airhole is close. Explain**.** **(2mks)**

……

……

……

21. In an experiment, a boiling tube full of chlorine gas was inverted into a trough of water as shown below.



a) State and explain the observations. **(2mks)**

……

……

……

b) If the experiment is repeated with tetrachloromethane instead of water.

i) State the observations made**.** **(1mk)**

……

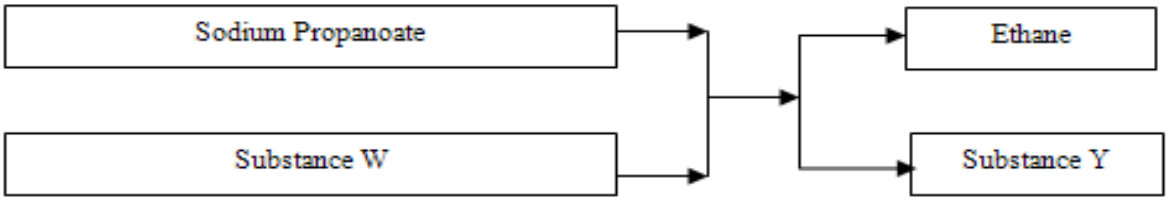
……

ii) Explain your observations in b(i) above**.** **(1mk)**

……

……

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



a) Name substances

W ……..….**(½ mark)**

Y ……..**(½ mark)**

b) An organic compound K reacted with bromine to form 2,3 – dibromobutane. Draw the structural formula of K**.** **(1mks)**

24. Starting with copper metal describe how a solid sample of copper (II) carbonate can be prepared.

(3 marks)

……

……

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……

……

25. Study the information in the table below and answer the questions that follow. The letters do not represent the actual symbols of the elements.

ement	**ectrical conductivity**	**ıctility**	**:tion of water**
	ɔod	ɔod	ɔ reaction
	ɔod	or	ɔ reaction
	ɔod	ɔod	:acts

Select the element which is

(a) Likely to be in group II of the periodic table. **(½ mark)**

……

(b) Could be used to make electric cables. **(½mark)**

……

(c) Likely to be graphite. **(½ mark)**

……

26. In an investigation, sulphur (IV) oxide gas was bubbled through acidified bromine water. This was followed by drops of barium nitrate solution.

(a) State the property of sulphur (IV) oxide under investigation. **(½ mark)**

……

……

(b) i) State the observation that were made on addition on sulphur (IV) oxide into the bromine water. **(1mk)**

……

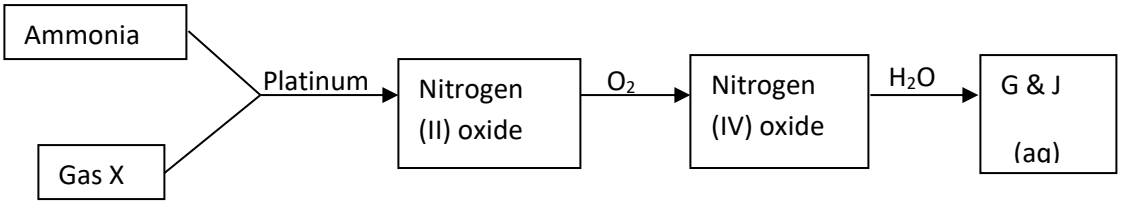
……

ii) Explain the observation. **(1mk)**

……

……

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



a) Identify gas X **(1mk)**

……

b) Write an equation for the reaction between ammonia and gas X **(1mk)**

……

……

c) Write an equation to show the formation of G and J **(1mk)**

……

……

28. (a) Define pollution. **(1 mark)**

……

……

(b) Mention **one** pollutant that is

(i) A Particle **(½ mark)**

……

(ii) Gaseous **(½ mark)**

……

29. Hydrogen gas was burnt in air to form a colourless liquid.

a) Describe a chemical test to identify the colourless liquid. **(2mk)**

……

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……

……

b) State how the purity of the colourless liquid can be determined. **(1mk)**

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KCSE 24

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 8

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

INSTRUCTIONS TO CANDIDATES

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

*(b)Answer **ALL** the questions in the spaces provided in the question paper.*

(c) KNEC Mathematical tables and electronic calculators may be used for calculations.

*(d) All working **MUST** be clearly shown where necessary.*

*(f) Candidates should check the question paper to ascertain that **all the pages are printed** as indicated and that **no questions are missing.***

(g) Candidates should answer the questions in English.

FOR EXAMINERS' USE ONLY.

Questions	Max-score	Candidates score
1	13	
2	10	
3	08	
4	14	
5	11	
6	13	
7	11	
Total score = 80		

1. 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.

				D		**G**		
	B			**E**	**F**		**H**	**J**
A	**C**							
							I	

a) State the elements that can form ions with a charge of -1. Give a reason for your answer. **(2 marks)**

……

……

……

b) What type of structure exists in the oxide of A. Give a reason for your answer? **(1 mark)**

……

……

c) How does the reactivity of I compare with that of H. Explain. **(1 mark)**

……

……

d) The oxide of D has a low melting point than the oxide of element C. Explain. **(1 mark)**

……

……

e) With a reason choose the most;

i) Electropositive element **(2 marks)**

……

……

ii) Electronegative element **(2 marks)**

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……

……

f) Compare the atomic radius of;

i) B and H **(1 mark)**

……

……

ii) D and E **(1 mark)**

……

……

g) State and explain the observations made when concentrated Nitric (V) acid is added to turnings of copper. **(2 marks)**

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……

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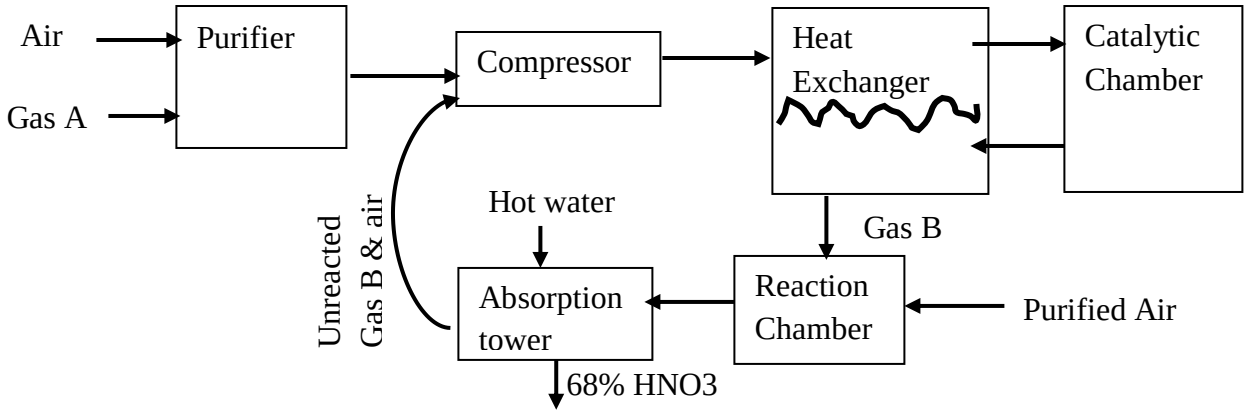
2. The flow chart below shows how nitric (v) acid is produced on a large scale. Study it and answer the questions that follow.



a) State the functions of:

(i) Purifier **(1mark)**

……

(ii) Heat exchanger **(1mark)**

……

b) Identify

(i) Gas **A** **(½mark)**

……

(ii) Catalyst C **(½mark)**

……

c) Write equations for the reaction that take place;

(i) in catalytic chamber. **(1mark)**

……

……

(ii) in absorption tower. **(1mark)**

……

……

d) Calculate the molarity of the commercial nitric (v) acid, given that it is 68% pure and has a density of 1.42g/cm^3. (N=14, H=1,)=16) **(3mark)**

……

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……

(e).(i) State the observation made when concentrated nitric (v) acid is added to acidified sulphur powder and warmed. **(1mark)**

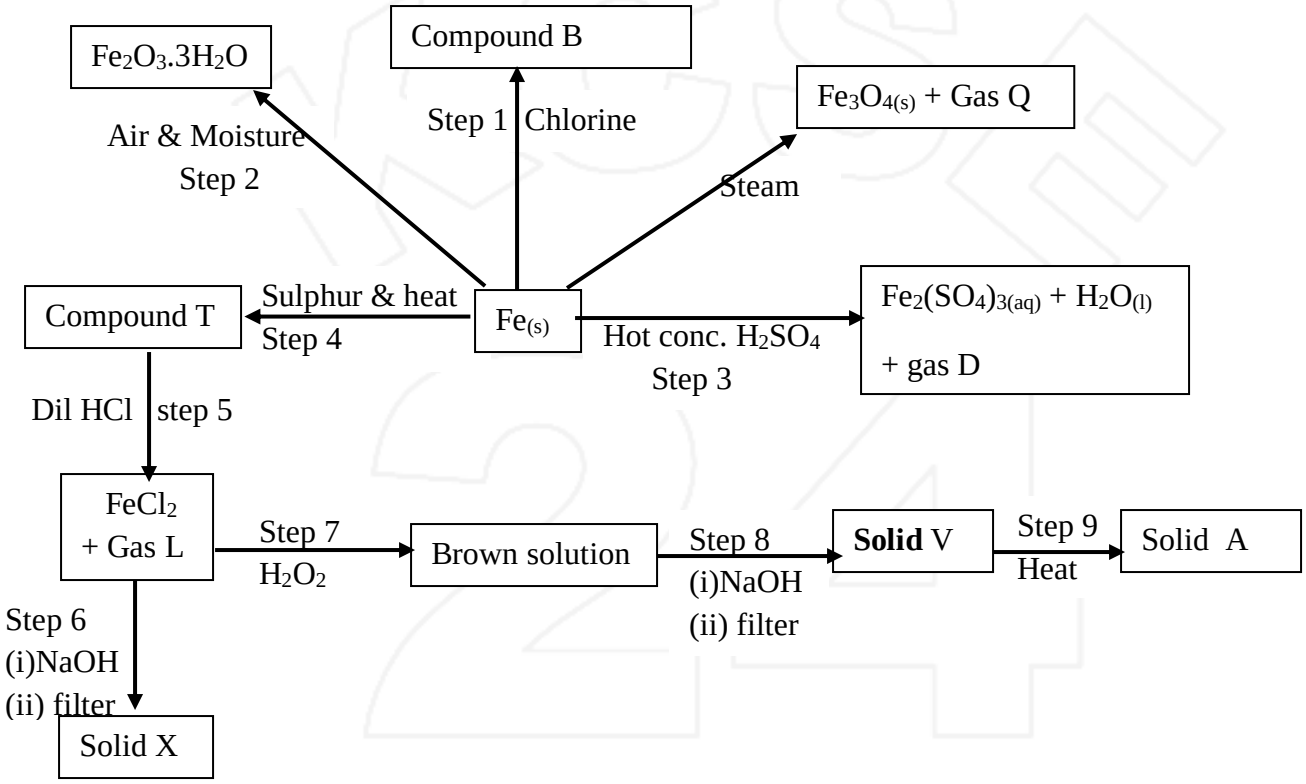
……

ii) Give a reason for the answer given in c (i) above. **(1mark)**

……

……

3. Study the flow chart below starting from iron metal.



(a) Name gases **(1½mk)**

D……

L……

V……

(b) Identify the following substances. **(2 ½mk)**

(i) Compound B……

(ii) Compound T……

(iii) Solid A……..……..

(iv) Solid V……..……..

(v) Solid X……..……..

c) What name is given to the reaction in step 2? **(½mk)**

……..……

d) State the colour of solid X **(½mk)**

……..…… …..

e) Write balanced equations for the reactions that occurred in:- **(2mks)**

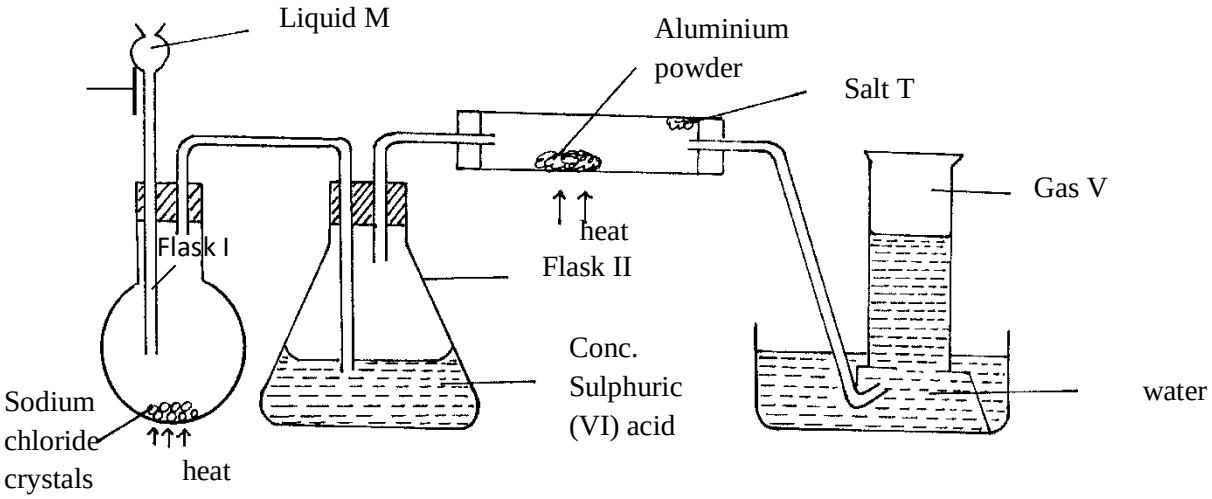
Step 1……..……...

Step 5……..……...

f) What property of hydrogen peroxide (H_2O_2) is indicated in step 7 of the flow chart? **(1mk)**

……..

4. The set up below was used to prepare hydrogen chloride gas and salt T.



a) **I**. Name the following

i) Liquid M **(½ mark)**

……..……..

ii) Gas V **(½ mark)**

……

II. Write the formula of Salt T **(1mark)**

……

b) Write balanced chemical equations for reactions that occur at

i) Flask I **(1mark)**

……

ii) Combustion tube. **(1mark)**

……

c) Name the process that formed salt T as shown in the diagram. **(1mark)**

……

d) Sulphuric (VI) acid is used as a drying agent in this experiment. Explain why calcium oxide is unsuitable for the same purpose in this reaction **(2marks)**

……

……

……

e) The water in the trough was found to have a pH of 2.0 at the end of the experiment. Explain. **(1mark)**

……

……

f) Calculate the mass of salt T formed if 480cm^3 of hydrogen chloride gas measured at r.t.p was reacted with aluminium powder. (Al=27, Cl = 35.5, MGV=24dm^3**)** **(2marks)**

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……

g) In the space provided below, draw a well labelled diagram showing how you would dissolve hydrogen chloride gas in water. **(1mark)**

h) A solution of hydrogen chloride in methylbenzene does not react with carbonates. However, on adding water and then shaking the resulting mixture, there is vigorous effervescence. Explain the above observation. **(2marks)**

……

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……

i) Using equation, state the observation made when a gas jar containing hydrogen chloride gas is opened near an open bottle of liquid ammonia. **(1mark)**

……

……

5. Name each of the processes described below which takes place when salts are exposed to air for sometime.

(i) Anhydrous copper (II) sulphate becomes wet. **(1 mark)**

……..

(ii) Common table salt forms an aqueous solution **(1 mark)**

……..

(iii) Fresh crystals of sodium carbonate $Na_2CO_3.10H_20$ becomes covered with white powder of formula $Na_2CO_3.H_2O$ **(1mark)**

……..

(b)Write the formula of the complex ion formed in each of the reactions described below.

(i) Zinc metal dissolves in hot potassium hydroxide solution **(1mark)**

……

……

(ii) Copper hydroxide dissolves in excess ammonia solution **(1mark)**

……

……

(c) A hydrated salt has the following composition by mass. Iron 20.2%, Oxygen 23%, Sulphur 11.5% and water 45.3%. Its relative formula mass is 278. Determine the formula of the hydrated salt. (Fe = 56, S = 32, O = 16, H = 1) **(3marks)**

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(d) Describe how a solid sample of lead (II) chloride can be prepared using the following reagents:- dilute nitric acid, dilute hydrochloric acid and lead carbonate. **(3marks)**

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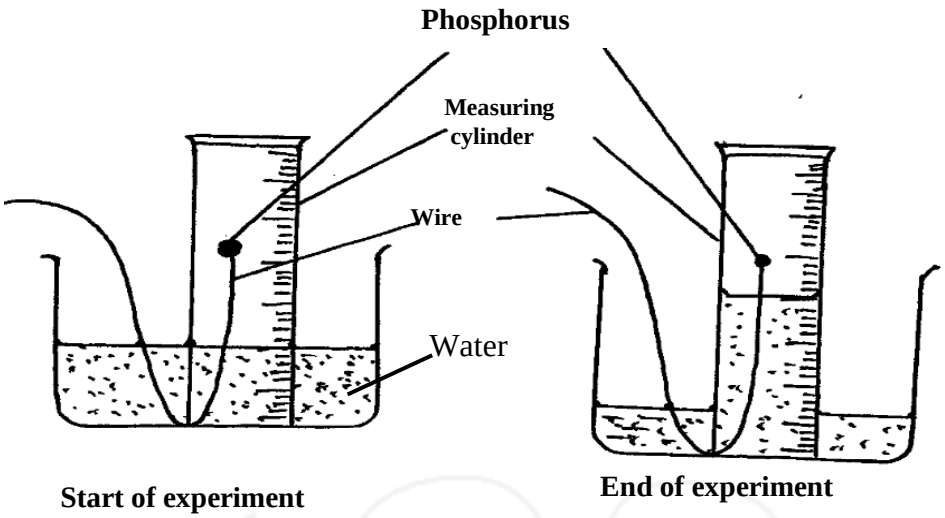
6. A student set-up the apparatus shown below in order to determine the percentage by volume of oxygen in the air. Study it and answer the questions that follow.



(a)(i) State one observations 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. **(2marks)**

……

……

……

(iii) The volume of air in the measuring cylinder at the end f the experiment was measured.
study the data given below and answer the questions that follow.
-Volume of air at start of the experiment = 30.65 cm^3
-Volume of air at the end of the experiment = 24.28 cm^3
Determine the percentage volume of oxygen in the air. **(2marks)**

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……

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

……

……

……

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

……

……

(d) A group of students burnt a piece of magnesium ribbon in air and its ash collected in a Petri dish. The ash was found to comprise of magnesium Oxide and Magnesium nitride

(i) Write an equation for the reaction leading to formation of the magnesium nitride**. (1mk)**

……..

(ii) A little water was added to the products in the Petri dish. State and explain the observation made. **(2mks)**

……..……

……..

(iii) A piece of **blue** litmus paper was dipped into the solution formed in (b) above. State the observation made. **(1mk)**

……..

7(a) A compound has an empirical formula $\mathbf{C_3H_6O}$ and a relative formula mass of 116.

i) Determine its molecular formula. (H =1, C = 12, O =16) **(2 marks)**

……

……

……

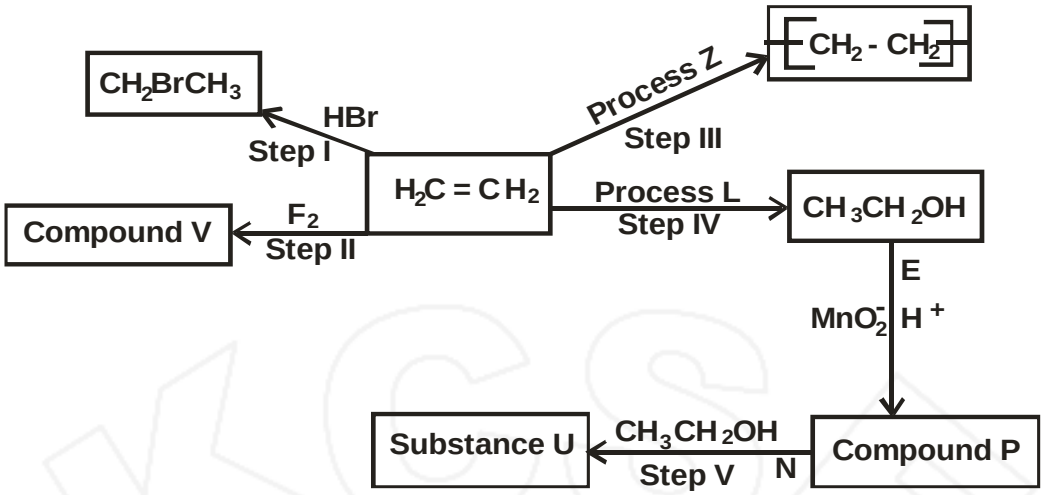
ii) Calculate the percentage composition of carbon by mass in the compound. **(1 mark)**

……

……

……

(b) Study the scheme below and answer the questions that follow.



I. State the conditions for process in step V. **(1 mark)**

……..

II. Name the **reaction** represented by process.

i) Z **(1 mark)**

……..

ii) L **(1mark)**

……..

iii) E **1 mark)**

……..

iv) N **(1 mark)**

III. Draw and name the structure of the substance.

i) V **(1 mark)**

……..

ii) P **(1 mark)**

……..

iii) U **(1 mark)**

……..

KCSE 24

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 9

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

1. *Write your name and index number in the spaces provided above*
2. *Sign and write date of examination in the space provided.*
3. *All working must be clearly shown where necessary.*
4. *Mathematical tables and silent electronic calculations may be used*
5. *Answer all questions in English.*

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-26	80	

1. Give two difference between a thistle funnel and a dropping funnel **(2marks)**

……

……

……

2. Give names of the following processes used to

a) Separate calcium carbonate from water **(1mark)**

……

b) Separate a mixture of nitrogen and Helium **(1mark)**

……

3. The table below shows some solutions and their pH value

Solution	pH values
P	**1.5**
Q	**6.0**
R	**14.0**
S	**8.0**

Which of the above solutions is likely to be of

a) Sodium carbonate **(1mark)**

……

b) Solution with high concentration of Hydrogen ions **(1mark)**

……

4. In the laboratory preparation of oxygen gas, Hydrogen peroxide is used.

a) Name the catalyst used **(1mark)**

……

b) Write a balanced chemical equation for the reaction **(1mark)**

……

5) State three observation made when a piece of potassium metal is dropped into cold water giving a reason for each. **(3marks)**

……

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……

6. In the extraction of iron, the iron ore is reduced to iron in a blast furnace

a) Name the main ore used in extraction of iron **(1mark)**

……

b) What is the main reducing agent in the blast furnace **(1mark)**

……

c) Write the equation for the reaction through which the iron ore is reduced to iron in the blast furnace **(1mark)**

……

7. Draw the structure of the following

a) Mg^{+} **(1mark)**

b) Hydroxonium ion **(1mark)**

8. When 27.8g of hydrated aluminium oxide $(Al_2O_3 \bullet XH_2O)$ was heated to a constant mass 20.6 g of aluminium oxide was obtained. Determine the value of X (Al=27, O=16, H=1**(3marks)**

9. In the haber process, the industrial manufacture of ammonia is given by the following equation

$N_{2(g)} + H_{2(g)} \rightleftharpoons 2NH_{3(g)} \quad \Delta H = -97kJ/mol$

a) Name one source of nitrogen gas used in this process **(1mark)**

……

b) Name the catalyst used in the above reaction **(1mark)**

……

c) What is the effect of increasing temperature on the yield of ammonia? Explain **(2marks)**

……

……

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……

10. Describe the correct process of heating a liquid in a test-tube using a bunsen burner.

(3marks)

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……

11. Draw a labelled diagram of a set up that can be used to prepare dry sample of carbon (IV) oxide using calcium carbonate **(3marks)**

12.a) Draw structural formulae of two positional isomers with molecular formula C_4H_8 **(2marks)**

b) Study the equation below and answer the questions that follow

$$C_6H_{14} + Cl_2 - C_6H_{13}Cl + HCl$$

i)State the condition under which this reaction occurs **(1mark)**

……

ii) Give the general name of this type of reaction **(1mark)**

……

13.a) Define hydration energy **(1mark)**

……

……

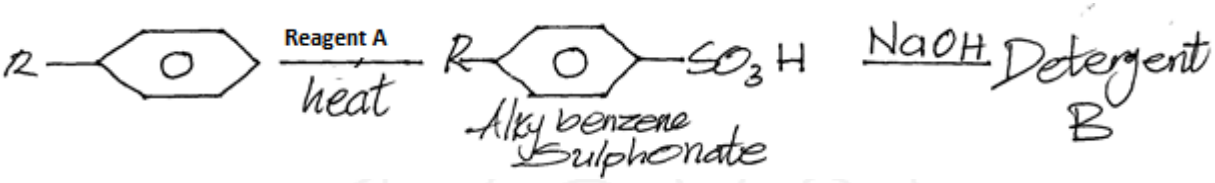
.....

b) Given that the lattice energy of NaCl is +781kJ/mol and hydrated energy of Na^+ and Cl^- are -390kJ/mol and -384kJ/mol respectively. Calculate the heat of solution of one mole of $NaCl_{(s)}$ using energy cycle. **(3marks)**

14. 240cm^3 of nitrogen (I) oxide gas takes 16 seconds to diffuse through a certain porous pot. 300cm^3 of x takes 12 seconds to diffuse through the same pot calculate the relative molecular mass of gas x. (N=14, O=16) **(3marks)**

15. Draw a well labelled diagram that can be used during electrolysis of molten sodium chloride in the laboratory **(3marks)**

16. The figure below describes the manufacture of detergent B



a) What type of detergent is B (1mark)

……

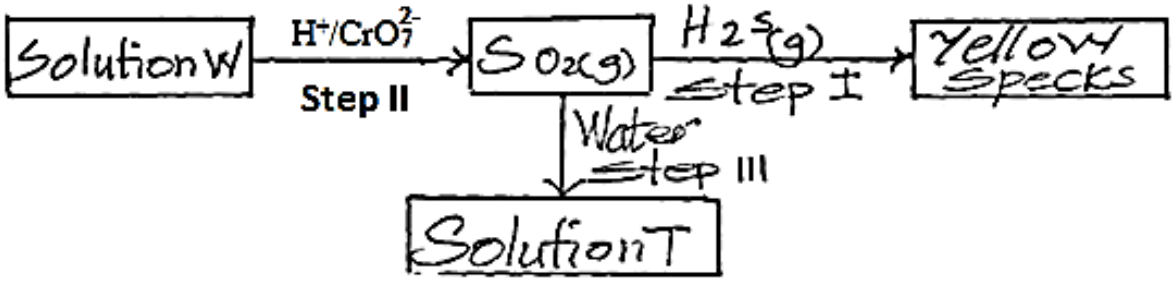
b) Draw the structure of detergent B **(1marks)**

c) State two disadvantage of using detergent B **(2marks)**

……

……

17. Use the flow chart below to answer the question below



a) Explain the observation in step II **(1mark)**

……

……

b) Name the process that takes place when flower petals are put into solution T (1mark)

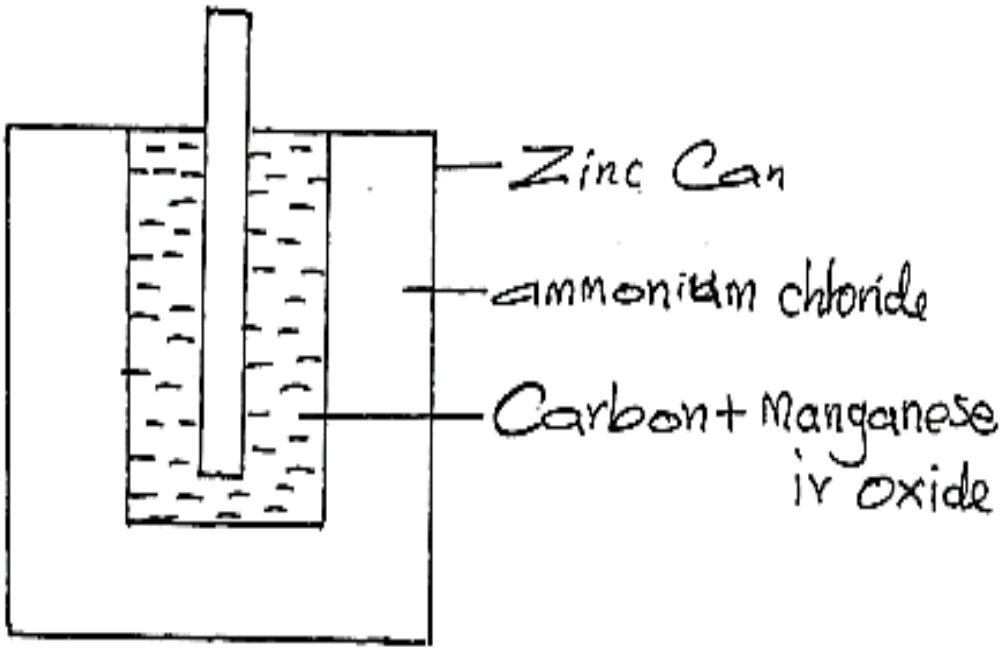
……

c) Reaction in step I takes place only in presence of moisture. Give a reason for this **(1mark)**

……

……

18. The diagram below represent a dry cell with Zinc can and graphite as the electrodes and ammonium chloride paste as an electrolyte



a) Write an ionic equation for the reaction taking place at

i) Anode **(1mark)**

……

……

ii) Cathode **(1mark)**

……

……

b) State the property of carbon powder that make it suitable for use in the cell **(1mark)**

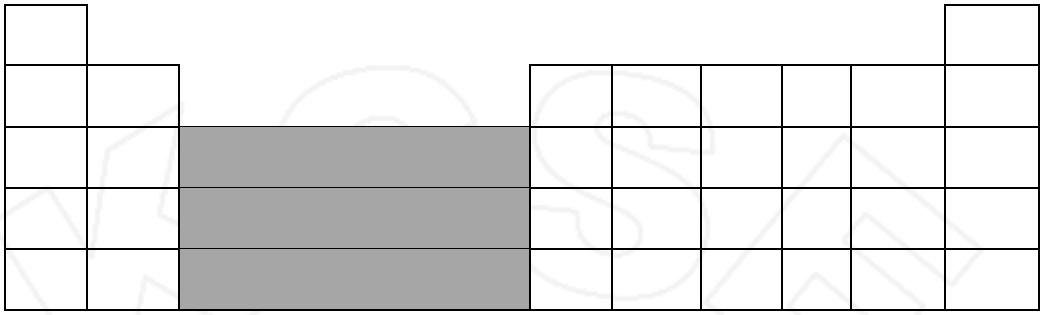
……

c) State one other substance that could be used in place of manganese (IV) oxide **(1mark)**

……

……

19. The diagram bellow represents part of periodic table. Use it to answer the question that follow



a) Write the electronic arrangement for the stable ion formed by X **(1mark)**

……

b) Write an equation for the reaction between W and Q **(1mark)**

……

c) Compare the ionization energy of element A and Z. Explain. **(2marks)**

……

……

……

20. Write equations to show the effect of heat on each of the following

a) Ammonium nitrate **(1mark)**

……

b) Potassium nitrate **(1mark)**

……

c) Anhydrous iron (II) sulphate **(1mark)**

……

21. When excess chlorine gas is bubbled through diluted sodium hydroxide solution; the resulting solution act as a bleaching agent

a) **Write** an equation for the reaction between chlorine gas and sodium hydroxide solution **(1mark)**

……

b) **Name** the bleaching agent **(1mark)**

……

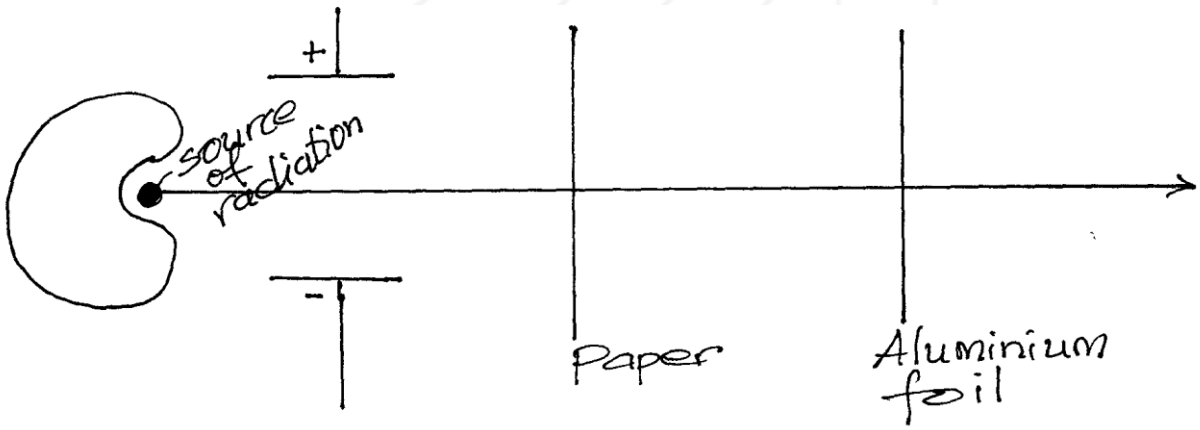
c) Write an equation to show the bleaching and explain how it occurs **(2marks)**

……

……

……

22 . Alpha (α)and beta (ß) particles can be distinguished using papers, aluminium foil and an electric field complete the diagram below to show how this is done **(3marks)**



23. During electrolysis of magnesium sulphate, a current of 0.3A was passed for 30 minutes calculate the volume of gas produced at the anode (molar gas volume =24dm^3 IF=96500C **(3marks)**

KCSE 24

24. Starting with sodium metal, describe how a sample of crystal of sodium hydrogen carbonate may be prepared **(3marks)**

……

……

……

……

……

25. When $20cm^3$ of 0.5M sulphuric (VI) acid was mixed with $20cm^3$ of 1M NaOH, the temperature of the solution rose from 24.0°C to 32.0°C calculate the molar heat of neutralisation (Specific heat capacity of the solution is $4.2Jg^{-1}$ density is $1g/cm^3$ **(3marks)**

26. The table below shows the test carried out on a sample of water and results obtained

mple	**st**	**servation**
	ldition of NaOH solution drop wise until in xcess	hite precipitate souble in xess
	lding of $NH_{3(aq)}$ solution	hite precipitate
	ldition of dilute HNO_3 followed by $Ba(NO_3)_2$	hite precipitate

a) Identify the anion present in the water **(1mark)**

……

b) Write the ionic equation for the reaction in C **(1mark)**

……

c) Write the formula of the complex ion in A **(1mark)**

……

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KCSE 24

KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 9

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

1. *Write your name and index number in the spaces provided above*
2. *Sign and write date of examination in the space provided.*
3. *All working must be clearly shown where necessary.*
4. *Mathematical tables and silent electronic calculations may be used*
5. *Answer all questions in English.*

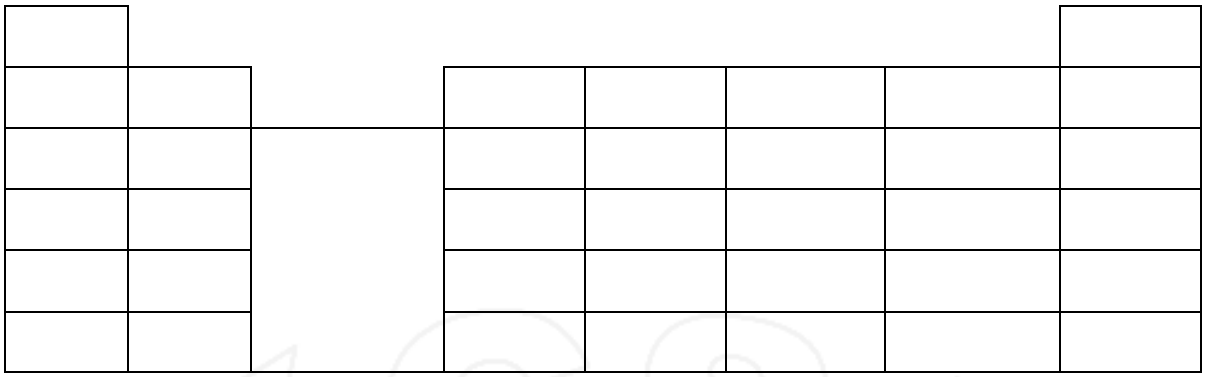
For examiners use only

Question	Candidates Score	Students Score
1	14	
2	13	
3	13	
4	11	
5	14	
6	15	
Total	80	

For Marking Schemes Contact 0746 222 000 / 0742 999 000

KCSE 24

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



a)i) Select elements which belong to the same chemical family **(1mark)**

……

……

ii) Write the formulae of ions for two elements in the same period **(1mark)**

……

b) The first ionization energies of two elements K and M at random are 577kJ/mol and 494kJ/mol.

i) Write equations for the 1st ionisation energies for elements K and M and indicate their energies **(2marks)**

……

……

……

ii) Explain the answer in b (i) **(1mark)**

……

……

iii) Write the formula of the compound formed when I and L react **(1mark)**

……

……

iv) Give one use of element L **(1mark)**

……

c) I) How do the reactivity of elements K and L compare? Explain **(2marks)**

……

……

……

II) Element L and M form chlorides. Complete the table by writing the formulae of each chloride and state the nature of the solutions **(2marks)**

ement	rmula of chloride	ture of chloride solution

III) The chloride of element M vaporizes easily while its oxide has a high melting point. Explain **(2marks)**

……

……

……

IV) Which elements forms a trivalent:

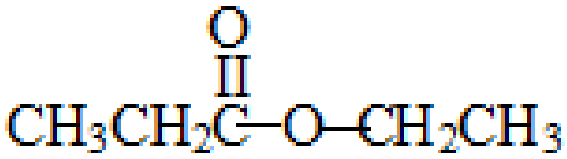
a) Cation **(½mark)**

……

b) Anion **(½mark)**

……

2. i) The following is a structure of an organic compound.



KCSE 24

a) Which organic series does the compound belong? **(1mark)**

……

……

b) Give the structures and names of the reactants that form the above compound **(2marks)**

……

……

……

ii) The table shows structural formula of some organic compounds

Compound	**Structural formula**
A	$CH_3CH_2CH_2CH_3$
B	CH_3CH_2COOH
C	CH_3CHCH_2
D	$CHCCH_3$
E	$CH_3CH_2CH_2CH_2OH$

a) Give the chemical test that can be used to identify compound C. **(1mark)**

……

……

b) Compare the boiling points of compound E and A **(2marks)**

……

……

……

c) State and explain the observation made when Sodium carbonate is added to compound G.

(2marks)

……

……

……

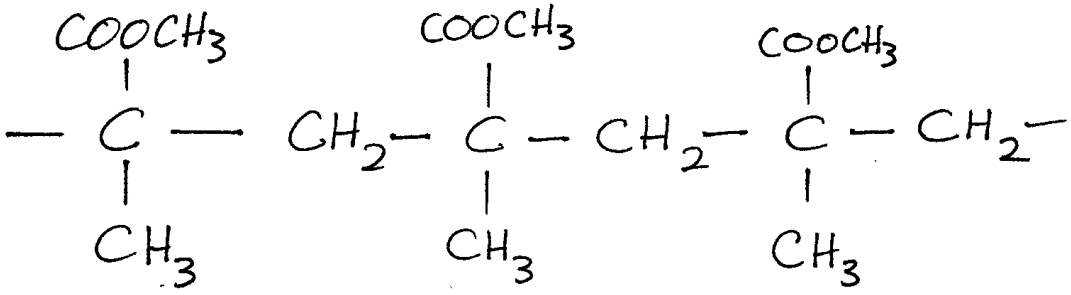
d) Write an equation to show the reaction between compound E and magnesium metal and give the name of the product formed. **(2marks)**

……

……

……

e) The following is a structure of a section of a polymer



i) Draw the structure of the monomer **(1mark)**

ii) Give the name of the polymer **(1mark)**

……

iii) State one use of the polymer. **(1mark)**

……

3.a) Dry chlorine gas was passed over heated iron resulting in P. P was dissolved in water resulting in the formation of a solution of P. To a little of the solution P a few drops of Sodium hydroxide were added and solid Q was obtained.

I) Name substance **(2marks)**

i) P –……

ii) Q – ……

II Write equations to show how substances P and Q were formed. **(2marks)**

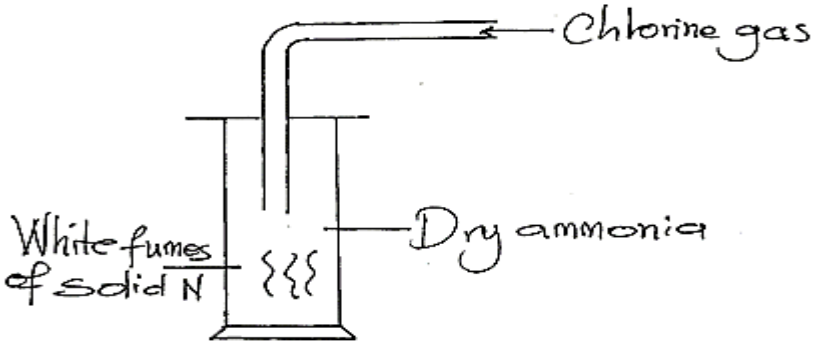
……

……

III) Name a suitable drying agent for chlorine gas **(1mark)**

……

b) Chlorine burns in dry ammonia gas as shown in the diagram below



i) Identify solid N **(1mark)**

……

ii) A colourless and odourless gas is produced. Identify the gas **(1mark)**

……

iii) Write the equation for the burning of chlorine in dry ammonia gas **(1mark)**

……

iv) 3g of divalent metal X (atomic mass=24) react with dilute hydrochloric acid.Calculate the volume of hydrogen gas produced at STP. (X=12, H=1 molar gas volume at STP=22.4dm^3

(3marks)

……

……

……

……

……

v) When excess chlorine was bubbled into hot concentrated sodium hydroxide, the following reaction occurred.

$3Cl_{2(g)} + 6NaOH_{(aq)} \rightarrow NaClO_{3(aq)} + 5NaCl_{(aq)} + 3H_2O_{(l)}$. In which product did chlorine under oxidation.

Explain **(2marks)**

……

……

……

4a) Aqueous potassium sulphate was electrolysed using platinum electrodes in a cell.

i) Shows the product formed at the anode and cathode with the help of an equation (2marks)

Anode

……

Cathode

……

ii) Why would it not be advisable to electrolyse aqueous potassium sulphate using potassium metal electrodes? **(1mark)**

……

……

b) **Use** the standard electrode potential for elements A, B, C, D and F given below to answer that follow;

E^0 (volts)

$A^{2+}_{(aq)} + 2e^- \rightleftharpoons$ -2.90

$B^{(2+)}_{(aq)} + 2e^- \rightleftharpoons$ -2.38

$C^{+}_{(aq)} + e^- \rightleftharpoons$ 0.00

$D^{2+}_{(aq)} + 2e^- \rightleftharpoons$ -0.34

$\frac{1}{2}F_{2(g)} + e^- \rightleftharpoons$ $+2.87$

I) Which element is likely to be hydrogen? Explain **(1mark)**

……

……

II) What is the E^o value of the strongest reducing agent? **(1mark)**

……

……

III) In the space provided draw a labelled diagram of the electrochemical cell that would be formed when the half cells of elements B and D are combined. **(3marks)**

IV) Calculate the E^o value of the electrochemical cell constructed in (III) above **(1mark)**

c) During electrolysis of aqueous copper (ii) sulphate using copper electrodes, a current of 0.2 amperes was passed through the cell for 5 hours.

i) Write an ionic equation for the reaction that took place at the anode (**1mark**

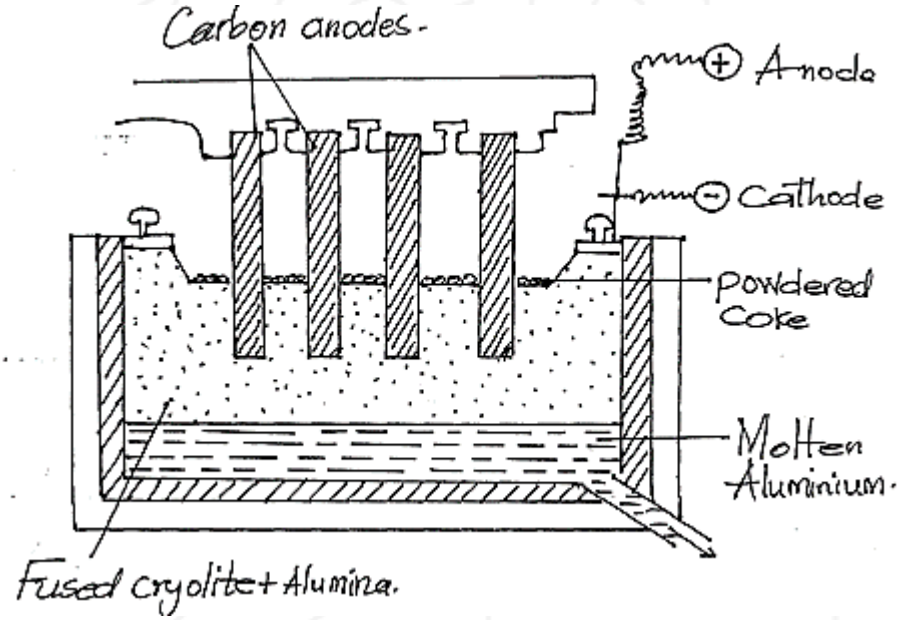
……

……

ii) Determine the change in mass of the anode which occurred as a result of electrolysis

$[Cu = 63.5, I\ Faraday = 96500C]$ **(1mark)**

5.a) The diagram below represent the electrolytic cell used for extraction of aluminium.



i)Write the formula of the main ore in which aluminium is extracted **(1mark)**

……

……

ii) Explain why the ore is first dissolved in hot concentrated sodium hydroxide. **(2maks)**

……

……

……

iii) Write equations for the reactions that takes place at

I)The anode **(1mark)**

……

II) The cathode **(1mark)**

……

iv) State why the graphite lining is used as the cathode **(1mark)**

……

……

v) Give two reasons for mixing aluminium oxide with cryolite in the electrolyte cell**(2marks)**

……

……

……

b) Aluminium is resistant to corrosion while iron corrodes very fast.

I) Why is aluminium not used to make window frames? **(1mark)**

……

……

II) State one reason why galvanised iron is resistant to corrosion even when the protective surface of zinc is broken? **(1mark)**

……

……

III) Write an equation to show the reaction between aluminium and concentrated sodium hydroxide solution **(1mark)**

……

IV) Explain how one word obtain aluminium oxide given the following; aluminium chloride solid, sodium hydroxide solid and distilled water. **(3marks)**

……

……

……

……

……

6.a) What are isotopes **(1mark)**

……

……

b) The table below shows the isotopic composition of naturally occurring neon

rticle	$^{22}_{10}Ne$	$^{21}_{10}Ne$	$^{20}_{10}Ne$
Abundance	2	3	.5

i)Which is the most stable isotope of Neon? Explain **(2marks)**

……

……

……

ii) Calculate the relative mass of Neon **(2marks)**

iii) Balance the nuclear equation below

$^{14}_{6}C \rightarrow ^{14}_{7}N +$ _____ **(1mark)**

iv) Distinguish between nuclear fission and nuclear fusion. **(1mark)**

……

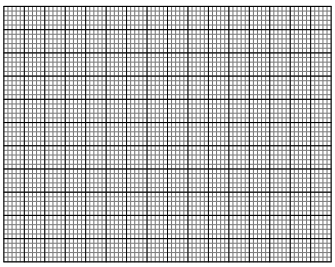
……

……

c) Bismuth undergoes radioactive decay. The table below shows the mass of Bismuth remaining at different times.

me (min)							0
ıss of Bismuth remaining (g)		.5	.5		.5		5

i) Plot a graph of mass of bismuth remaining (vertical axis) against time. **(3marks)**



ii) From the graph determine

I) Mass of Bismuth remaining after 30 minutes **(1mark)**

II) The half life of bismuth **(1mark)**

III) What would happen to the rate of disintegration of bismuth if the temperature is increased? Explain **(2marks)**

……

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……

d) State one application of radio isotopes in agriculture **(1mark)**

……

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 10

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

INSTRUCTIONS TO CANDIDATES

- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

For Examiners Use Only

Questions	Maximum Score	Students Score
1-29	80	

1. Element T has atomic number 9 while V has atomic number 11.

(a) Write down the electronic configurations of elements T and V.

T …… **(½ mark)**

V …… **(½ mark)**

(b) State the type of bond formed when T and V combine. **(1 mark)**

……

2. The table below shows the Ph values of solutions I, II, III, and IV.

Solution	I	II	III	IV
PH	2	7	11	14

a) Which solution is likely to be sodium chloride solution. **(1 mark)**

……

b) A few drops of phenolphthalein indicator were added to solution (IV). State and explain the observations made. **(2 marks)**

……

……

……

3. Iron roofs usually turn brown after some time as a result of formation of rust on their surfaces.

a. Explain whether rusting is a physical or a chemical change. **(2 marks)**

……

……

……

b) State one way of preventing rusting. **(1 mark**

……

……

4. State and explain the observation that would be made when hydrated copper (II) sulphate crystals are heated in an evaporating dish. **(2marks)**

……

……

……

……

5. When magnesium is heated in air, it forms a solid Q and solid P. when solid Q is reacted with water it produces a gas W that turns moist red litmus paper to blue. Identify;

a) Solid Q ……..…… **(1 mark)**

b) Solid P ……. **(1 mark)**

c) gas W ……. **(1 mark)**

6a). Elements X and Y has atomic number of 12 and 13 respectively, compare the electrical conductivity of elements X and Y**.** **(1mark)**

……

……

b) Explain your answer in (a) above**.** **(2mark)**

……

……

……

7. The table below shows some properties of substances A, B, C and D

Substance	Action with water	Melting point	Thermal conductivity
A	Un reactive	High	Poor
B	Reactive	High	Poor
C	Unreactive	High	Good
D	Unreactive	Low	Good

Select the substance that would be most suitable

a) For making electrical cables. **(1mark)**

……

a) For making cooking pot handle. **(1mark)**

……

8. Propane reacts with one mole of chlorine gas under a certain condition.

a) What is that condition necessary for the above reaction to take place? **(1mark)**

……

b) Draw the structural formula and name the compound formed. **(2marks)**

9. (a) What is meant by solubility? **(1 Mark)**

……

……

(b) In an experiment to determine the solubility of solid x in water at 30^0C the following results were obtained;

Mass of evaporating dish = 26.2g

Mass of evaporating dish + saturated solution = 42.4g

Mass of evaporating dish + dry solid x = 30.4g

Using the information, determine the solubility of solid x at 30^0C in g/100g water. **(2 Marks)**

……

……

……

……

10. On strong heating, sodium nitrate produces oxygen gas. In the spaces provided below, draw a labeled diagram of a set-up that could be used for heating sodium nitrate and collecting the oxygen gas liberated. **(3marks)**

11. Chlorine and iodine are elements in the same group in the periodic table. Chlorine gas is yellow while aqueous iodine; $I_2(aq)$ is brown.

a) What observation would be made if chlorine gas is bubbled through aqueous sodium iodide? Explain using an equation. **(2marks)**

……

……

……

b) Under certain conditions chlorine and iodine react to give iodine chloride, $ICl_3(s)$

What type of bonding would you expect to exist in iodine trichloride? Explain. **(2marks)**

……

……

……

12. a) Give the name of each of the processes described below which takes place when the following salts are exposed to air overnight. **(3marks)**

i) Anhydrous copper sulphate becomes wet.

……

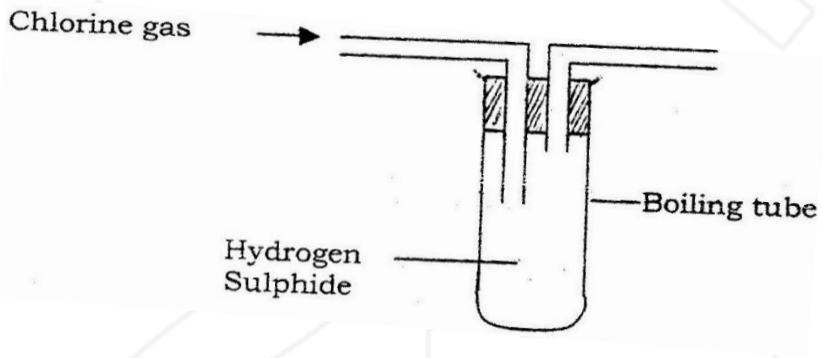
ii) Magnesium chloride forms an aqueous solution.

……

iii) Fresh crystals of sodium carbonate, $Na_2CO_3.10H_2O$ forms white powder.

……

13. In an experiment, chlorine gas was passed into moist hydrogen sulphide contained in a boiling tube as shown in the diagram



a) What observation was made in the boiling tube? **(1mark)**

……

b) Write an equation for the above reaction. **(1mark)**

……

c) What precaution should be taken in carrying out this experiment? Give a reason. **(1mark)**

……

……

14. Using dots (.)and crosses (x) to represent outermost electrons, draw diagrams to show the bonding in H_3O^+ (Atomic numbers; H = 1.0, O = 8**).** **(2marks)**

15. Diamond and graphite are allotropes of carbon. In terms of structure and bonding explain the following.

(a) Diamond is used in drilling through hard rocks. **(1mark)**

……

……

(b) Graphite is used as a lubricant. **(1mark)**

……

……

16. The table below gives the energy required to remove the outermost electron for some group I elements.

a)

ement				
ergy kJmol-1	4	8	9	6

Arrange the elements in order of their reactivity starting with the most reactive**.** **(1mark)**

……

b) suggest possible identity of element IV**.** **(1mark)**

……

17. X gm of potassium hydroxide were dissolved in distilled water to make 100cm^3 of solution. 50cm^3 of the solution- required 50cm^3 of 2 M nitric acid for complete neutralization. Calculate the mass X, of potassium hydroxide. (Relative formula mass of KOH = 56). **(3marks)**

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18. State and explain how the rate of reaction between zinc granules and steam can be increased holding temperature constant. (**2marks)**

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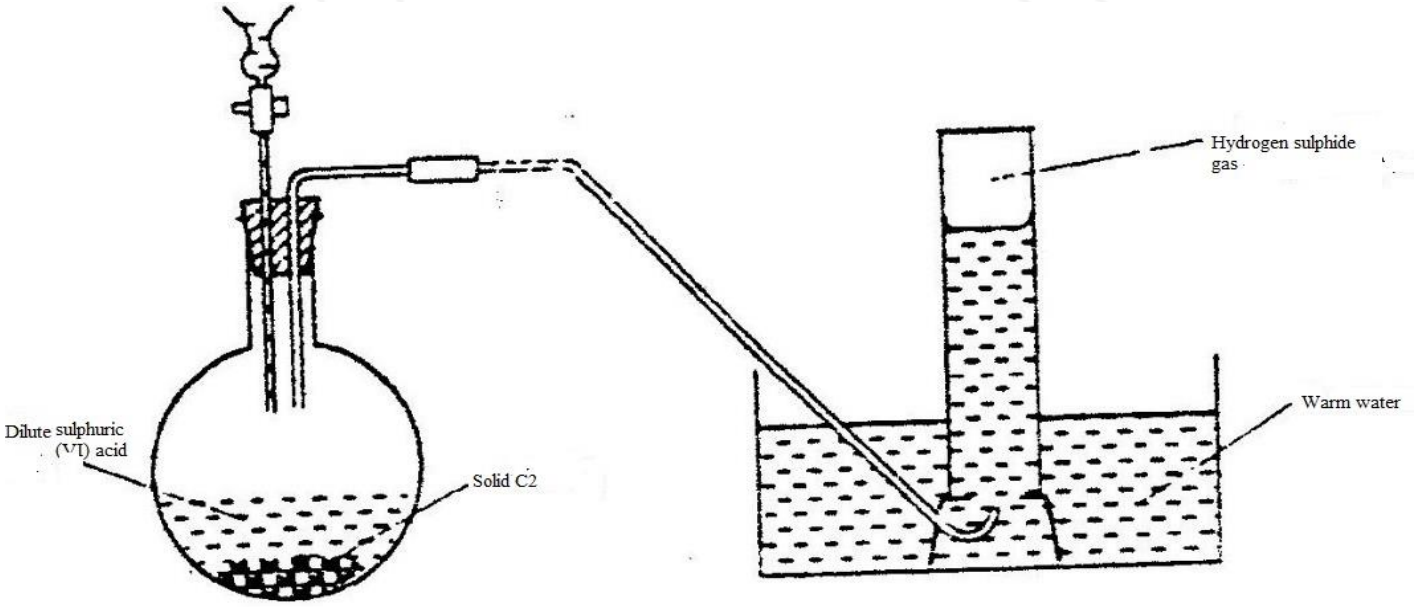
19. The apparatus shown below was set to prepare and collect hydrogen sulphide



a) Name solid C2. **(1mark)**

.....

b) Give a reason why warm water is used. **(1mark)**

.....

.....

(c) What observation would be made if hydrogen sulphide gas was bubbled into a solution of lead (II) nitrate? **(1mark)**

……

……

20. Concentrated nitric (V) acid was added to iron (II) sulphate acidified with sulphuric (VI) acid and the mixture heated. The solution turned from pale green to yellow with evolution of brown gas. Explain these observations. **(3marks)**

……

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……

21. Describe how a solid sample of Zinc (II) carbonate can be prepared in the laboratory starting with zinc oxide. **(3marks)**

……

……

……

……

……

22. But -2- ene undergoes addition hydrogenation when reacted with hydrogen gas.

(a) Name the product formed when but -2 – ene reacts with hydrogen gas. **(1mark)**

……

b) Name the conditions necessary for hydrogenation process. **(1mark)**

……

……

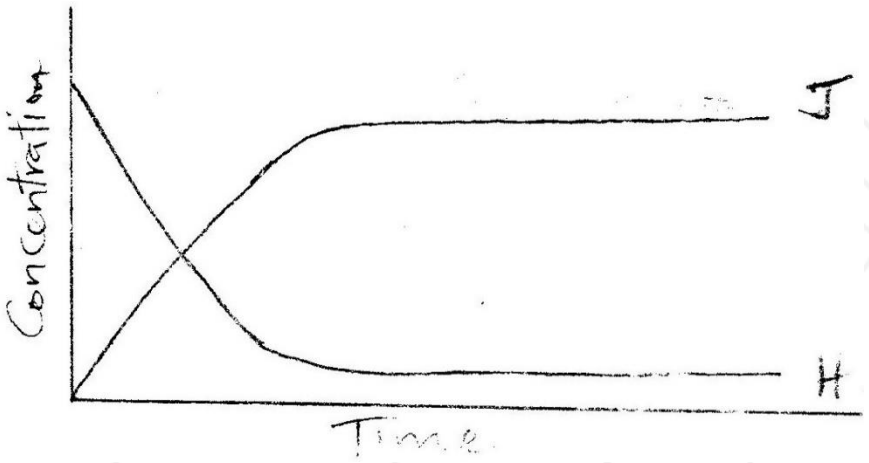
c) State one industrial use of hydrogenation. **(1mark)**

……

……

……

23. The sketch below shows substance H being converted to substance J. study it and answer the question that follows.



Why do the two curves become horizontal after sometime**?** **(2marks)**

……

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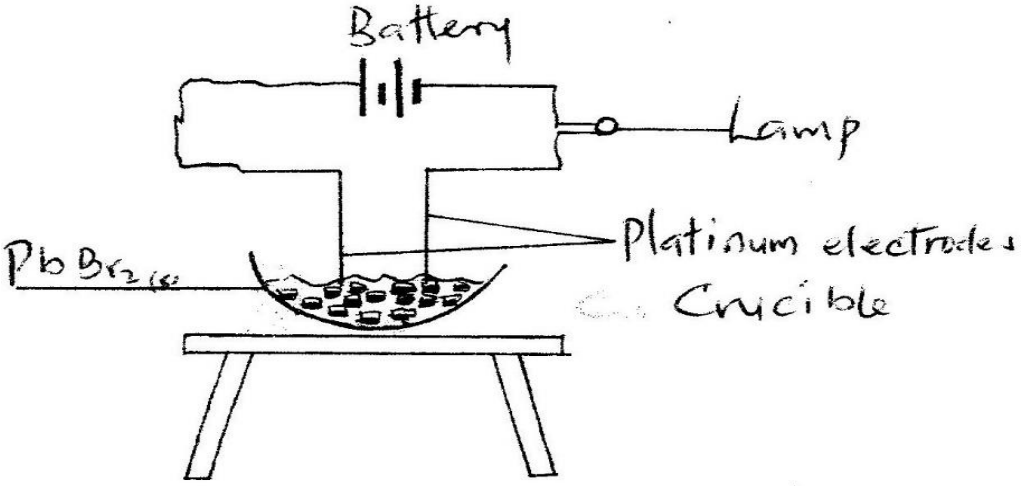
……

24. In an experiment to investigate the conductivity of substances, a student used the set – up shown below.



The Student noted that the bulb did not light

(a) What had been omitted in the set- up? **(1mark)**

……

……

(b) Explain why the bulb lights when the omission is corrected. **(2marks)**

……

……

……

25. a) State the Graham's law diffusion. **(1mark)**

……

……

b) The molar masses of gases W and X are 16.0 and 44.0 respectively. If the rate of diffusion of W through a porous material is $12cm^3s^{-1}$ calculate the rate of diffusion of X through the same material. **(2marks)**

……

……

……

……

26. When solid B_1 was heated, a gas which formed a white precipitate when passed through lime water was produced. The residue was dissolved in dilute nitric (V) acid to form a colourless solution B_2. when dilute hydrochloric acid was added to solution B_2 a white precipitate which dissolved on warning was formed.

a) Write the formula of the;

I Cation in solid B_1 **(1mark)**

……

II anion in solid B_1 **(1mark)**

……

b) Write an ionic equation for the reaction between the residue and dilute nitric (V) acid. **(1mark)**

……

……

27. Hardness of water may be removed by either boiling or addition of chemicals.

a) write an equation to show how boiling removes hardness of water. **(1 mark)**

……

……

b) Name two chemicals that are used to remove hardness of water. **(2 marks)**

……

……

28. Study the information in the table below and answer the questions below the table.

Bond	Bond energy (kJmol-1)
C-H	414
Cl-Cl	244
C-Cl	326
H-Cl	431

Calculate the enthalpy change of the reaction**:** **(3marks)**

$CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$

……

……

……

……

29. Distinguished between dilute acid and a weak acid. Give an example in each. **(3marks)**

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KCSE 2024 FINAL PREDICTION

EXPECTED EXAM 10

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

(Kenya Certificate of Secondary Education)

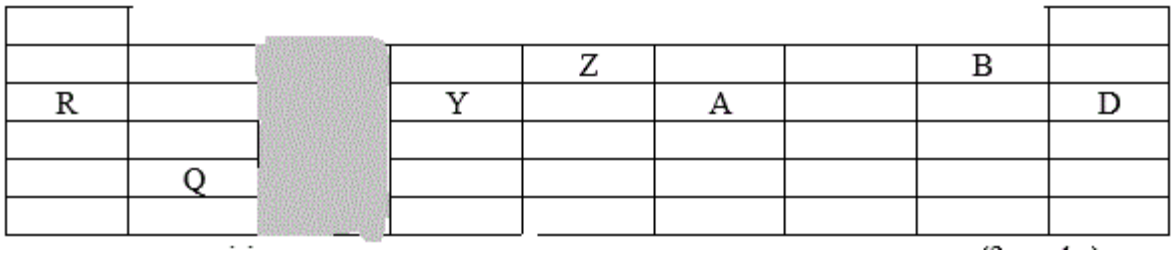
Instructions to candidates

(k) *Write your name and admission number in the spaces provided above.*
(l) *Answer **all** the questions in the spaces provided in the question paper.*
(m) *Non-programmable silent electronic calculators and KNEC mathematical tables may be used.*
(n) *All working **must** be clearly shown where necessary.*
(o) *Candidates should answer the questions in English.*

For Examiner's Use Only

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	13	
2	11	
3	12	
4	10	
5	12	
6	11	
7	11	
Total score	80	

1. 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.



a) Compare the melting points of R and Y. **(2 marks)**

……

……

……

b) Basing on the structure and bonding, state the structure in; **(2 marks)**

i) Z……..

ii) Oxide of Q……..…

a) Which element has the lowest ionization energy. **(1 mark)**

……

b) State the nature of ; **(2 marks)**

i) Oxide of A…….....

ii) Oxide of Y…….....

c) Choose the letter representing an element that; **(2 marks)**

i) Is the most electronegative…….....

ii) Exist as a monoatomic gas…….....

d) Nitrogen falls in the same group as A.

i) Write the formula of the compound when A reacts with magnesium. **(1 mark)**

……

……

ii) Write an equation for the reaction between the compound in f (i) above and water. **(1mark)**

……

……

e) State the general property common to elements in the group containing D. Explain. **(2 marks)**

……

……

……

2. Study the table below and use it to answer the questions that follow.

ydrocarbon	oiling point (K)
H_4	2
H_6	4
H_8	1
H_{10}	3
H_{12}	9
H_{14}	2

a) These organic compounds belong to the same homologous series;

i) What is meant by the term homologous series? **(1 mark)**

……

……

ii) To which homologous series do the above hydrocarbons belong? **(1 mark)**

……

ii) **S**elect one hydrocarbon that would be a liquid at room temperature, 298K. give a reason.

(2 marks)

……

……

iii) What is the relationship between the boiling point and the relative molecular masses of the hydrocarbons in the table above? Explain**.** **(2 marks)**

……

……

……

iv) Describe one chemical test used to distinguish between C_2H_6 and the third member of the homologous series with the general formula C_nH_{2n} **(2 marks)**

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……

b) Ethene gas can be prepared in the laboratory by heating ethanol with concentrated sulphuric (vi) acid.

i) Name the type of reaction which takes place**.** **(1mark)**

……

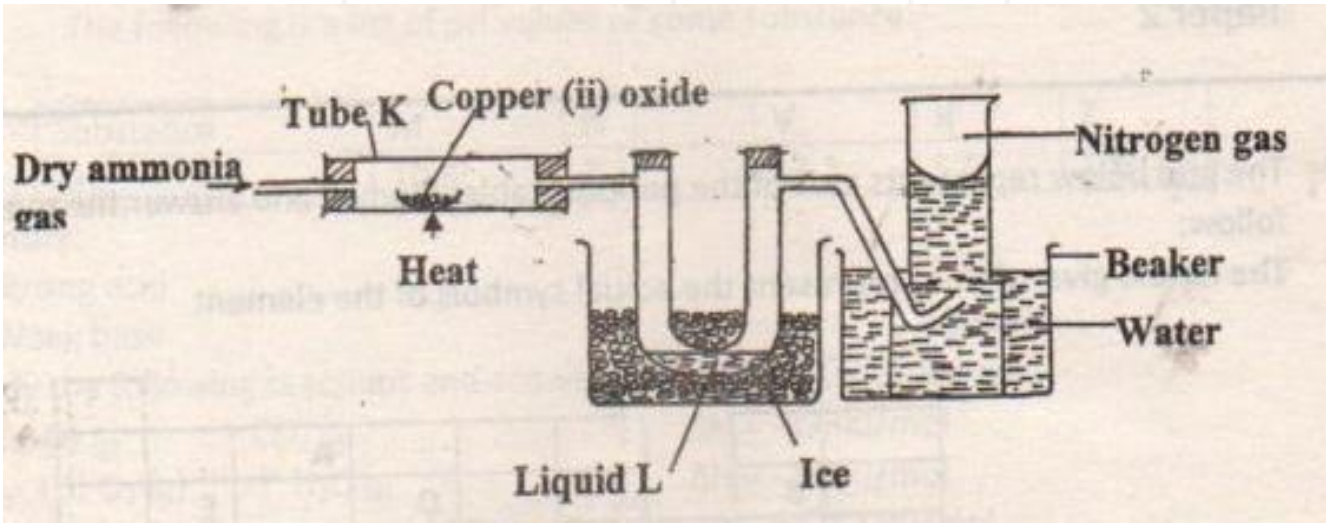
ii) State the temperature required in the reaction b i) above**.** **(1 mark)**

……

iii) Write the chemical equation for the reaction which produces ethene gas. **(1 mark)**

……

3. a) The diagram below shows the set up that can be used to obtain nitrogen gas in an experiment carried out by form three students.



i. How is the ammonia gas for this process dried? **(1mark)**

……

……

ii. Name liquid L. **(1 mark)**

……

iii. What observation would be made at tube **K** at the end of the experiment. **(1 mark)**

……

……

iv. Write an equation for the reaction that took place in the tube **K**. (**1 mark)**

……

v. At the end of the experiment the pH of water in the beaker was found to be 10.0 Explain.

(1mark)

……

……

b) **i)** Ammonia decompose if sparked electrically. What would you expect to be the products of the decomposition? **(1 mark)**

……

……

ii) Describe the chemical test of ammonia**.** **(2 marks)**

……

……

……

……

c) Ammonia gas reacts with water according to the equation below.

$$NH_{3\,(g)} + H_2O_{(l)} \longrightarrow NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$$

i)Identify the species that acts as a base. Give a reason**.** **(2 marks)**

……

……

……

ii) What effect does addition of sodium hydroxide solution have on the position of the equilibrium? Explain**.** **(2 marks)**

……

……

……

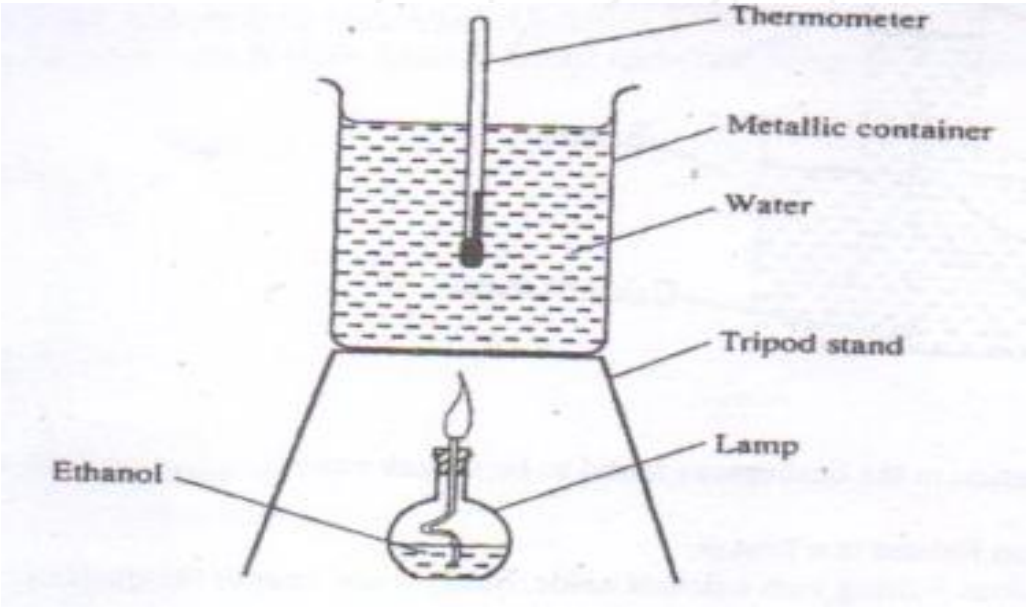
4. State two factors that should be considered when choosing fuel for cooking. **(2 marks)**

……

……

……

(b) The diagram below represents a set –up that was used to determine the molar heat of combustion of ethanol



During the experiment, the data given below was recorded

Volume of water	$450cm^3$
Initial temperature of water	25^0 C
Final temperature of water	46.5^0 C

Mass of ethanol + Lamp before burning 125.5g

Mass of ethanol + Lamp after burning 124.0g

Calculate the:

i. Heat evolved during the experiment (density of water=1g/cm^3**)** **(2marks)**

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

……

……

……

ii. Molar heat of combustion of ethanol (C=12.0, O=16.0, H=1.0) **(2marks)**

……

……

……

(c) Write the thermal chemical equation for the complete combustion of ethanol. **(1mark)**

……

……

(d) The value of the molar heat of combustion of ethanol obtained (b) (ii) above is lower than the theoretical value. State two sources of error in the experiment**.** **(2 marks)**

……

……

……

e) Define the term molar heat of combustion **(1 mark)**

……

……

5. An impure solid of Copper (II) Carbonate weighing 10.8grams was placed in a beaker containing 50cm^3 of dilute Nitric (V) acid. The volume of Carbon (IV) Oxide evolved was recorded at 20 second interval in the table below.

me from start of reaction (se)						0	0
olume of CO_2 at S.T.P(litres)	0	55	90	07	10	12	12

a) Write an equation for the reaction between copper (II) carbonate and nitric (V) acid. **(1mark)**

……

……

b) Calculate the reaction between:

i. 20 seconds and 40 seconds intervals**.** **(1 mark)**

……

……

……

ii. 40 seconds and 60 seconds intervals. **(1 mark)**

……

……

……

c) Explain the difference in the reaction rates in (b) above**.** **(2marks)**

……

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……

……

d) Why was there no increase in volume of the gas after 100 seconds? **(1 mark)**

……

……

e) How many moles of Carbon (IV) oxide were there in the maximum gas produced from this reaction? (M.G.V at S.T.P 22.4 litres**).** **(2 marks)**

……

……

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……

f)What mass of copper (II) carbonate that will have reacted with the acid after 100 seconds? (Cu=64, C=12, O=16) **(2 marks)**

……

……

……

……

g) Calculate the original concentration of the nitric (V) acid in moles per litre. **(2marks)**

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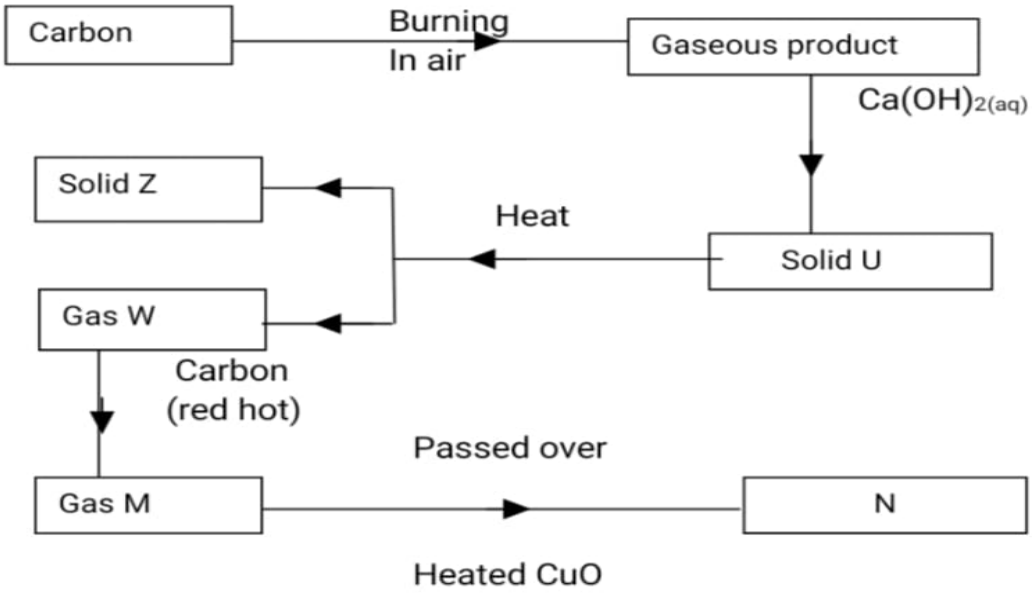
……

6. a) The diagram below shows several reactions starting with carbon.



i. Identify the following U**, Z, W, M** **(2marks)**

U……

Z……

W……

M……

ii. State the observation made when gas **M** is passed over heated copper (II) oxide. **(1 mark)**

……

……

iii. State one agricultural application of solid **Z**. **(1mark)**

……

iv. Write an equation for the formation of gas **M** from gas **W.** **(1mark)**

……

……

v. Explain the precaution to be taken in the reaction taking place in (iv) above **(1mark)**

……

……

(b) (i) Compare the boiling point of Sulphuric (VI) acid to that of water. Explain **(2marks)**

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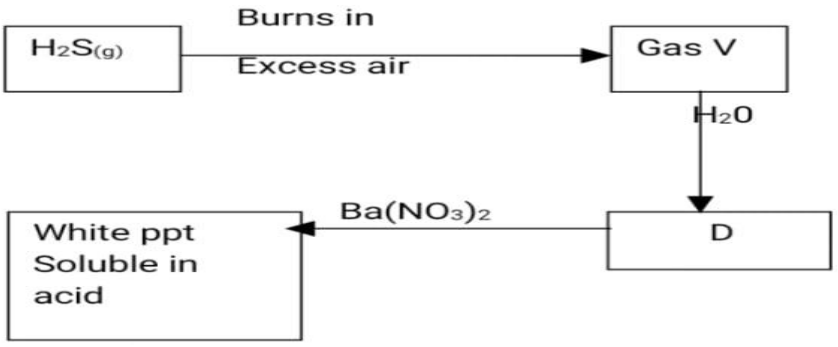
(ii) Study the flow chart below and answer the questions that follow



I. Name Gas **V,D** **(1mark)**

V……

D……

II. Write an ionic equation for the formation of white precipitate. **(1mark)**

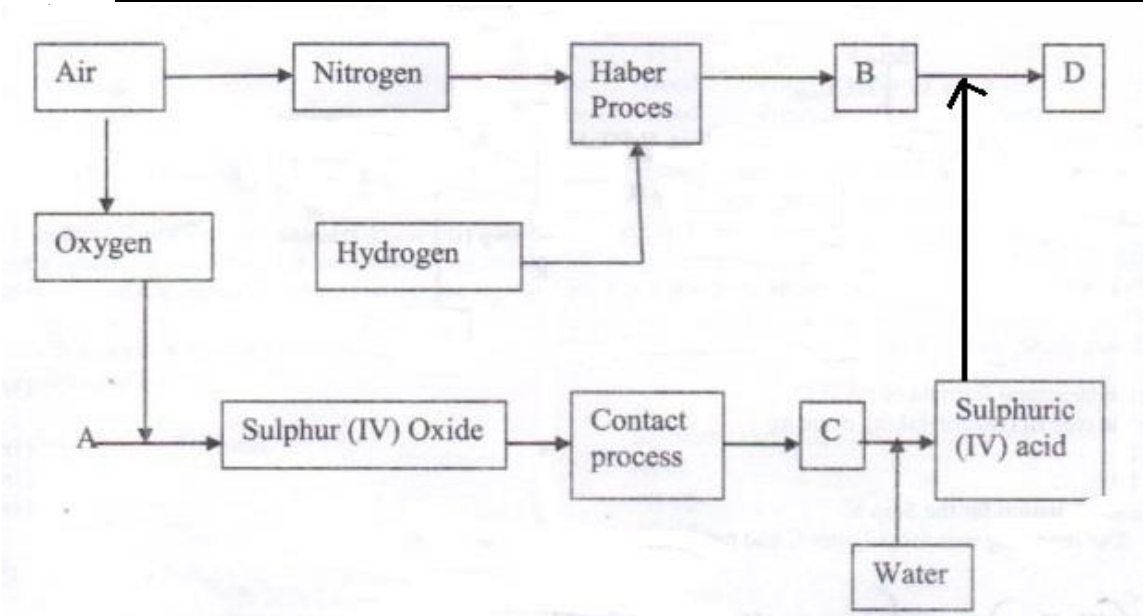
……

III State the observation made when dilute nitric acid is added to the white precipitate in II above. **(1 mark)**

……

……

7. The flow charts below illustrate two industrial processes, Haber process and the Contact process.



a) i. Give the name of the process by which air is separated into oxygen and nitrogen **(1mark)**

……

ii. Apart from oxygen and nitrogen gases produced from process a (i) name one other gas produced.

(1 mark)

……

b) Name substances represented by the letters **A, B, C** **(3marks)**

A……

B……

C……

c) Name the catalyst used in:

i) Haber process……. **(1mark)**

ii) Contact Process…… (**1mark)**

d) Explain the role of the catalysts both the Haber process and the Contact processes **(1mark)**

……

……

……

e) Write a chemical equation for the formation of compound **B**. **(1mark)**

……

……

f) Calculate the percentage by mass of the nitrogen present in compound **D**. **(1mark)**

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……

g) State how compound C is formed. **(1mark)**

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KCSE 24