KCSE 2023 FINAL PREDICTION

CHEMISTRY

(KCSE PREDICTIONS 1-10)

Confidential Analysis of Possible Expected sample KCSE Questions most likely to be tested in the Forthcoming KNEC examinations scheduled for November 2023.

The following are Expected Questions in KCSE 2023 EXAM.

CONFIDENTIAL!

For Marking Schemes

Mr Isaboke 0746 222 000 / 0742 999 000

SUCCESS TO ALL CANDIDATES

KCSE 2023 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

QUESTIONS	MAXIMUM SCORE	STUDENTS SCORE
	80	

*Answer **all** questions*

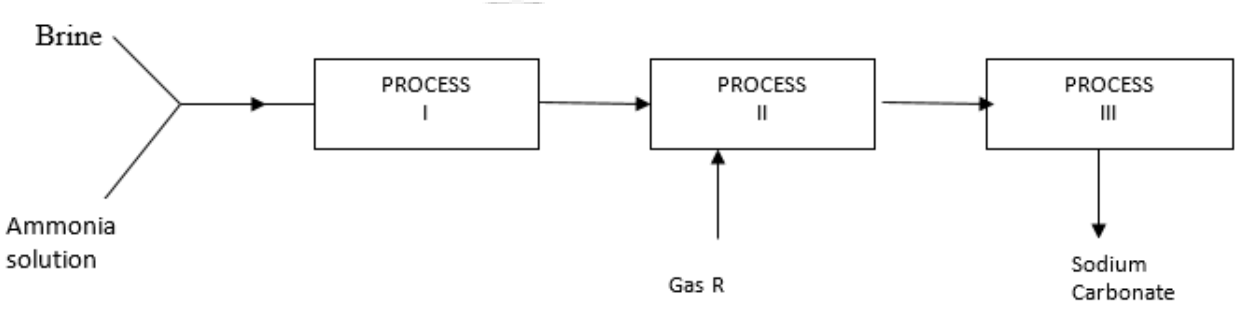
1. When magnesium metal is burnt in air, a white ash is formed. Write the formula of the two components of the white ash. **(2marks)**

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

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

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)**

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



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

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

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

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

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

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

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)**

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)**

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

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

(1mark)

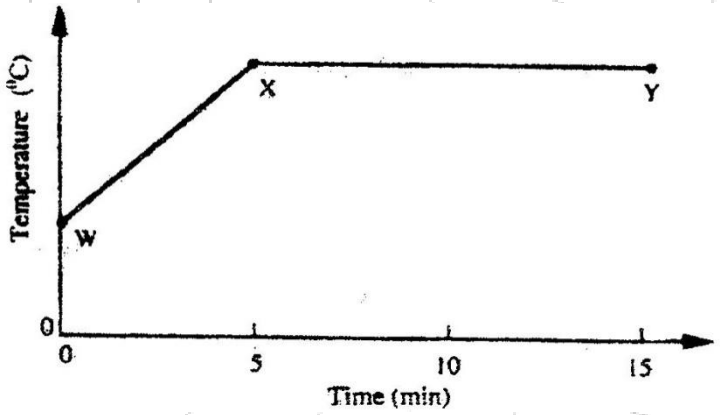
8. a) Complete the table below to show the colour of the given indicator in. **(1mark)**

Indicator	Colour in	
	Acid solution	Basic solution
Methyl orange	…….	Yellow
Phenolphthalein	Colorless	……

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

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)**

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

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

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

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

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

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)**

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.

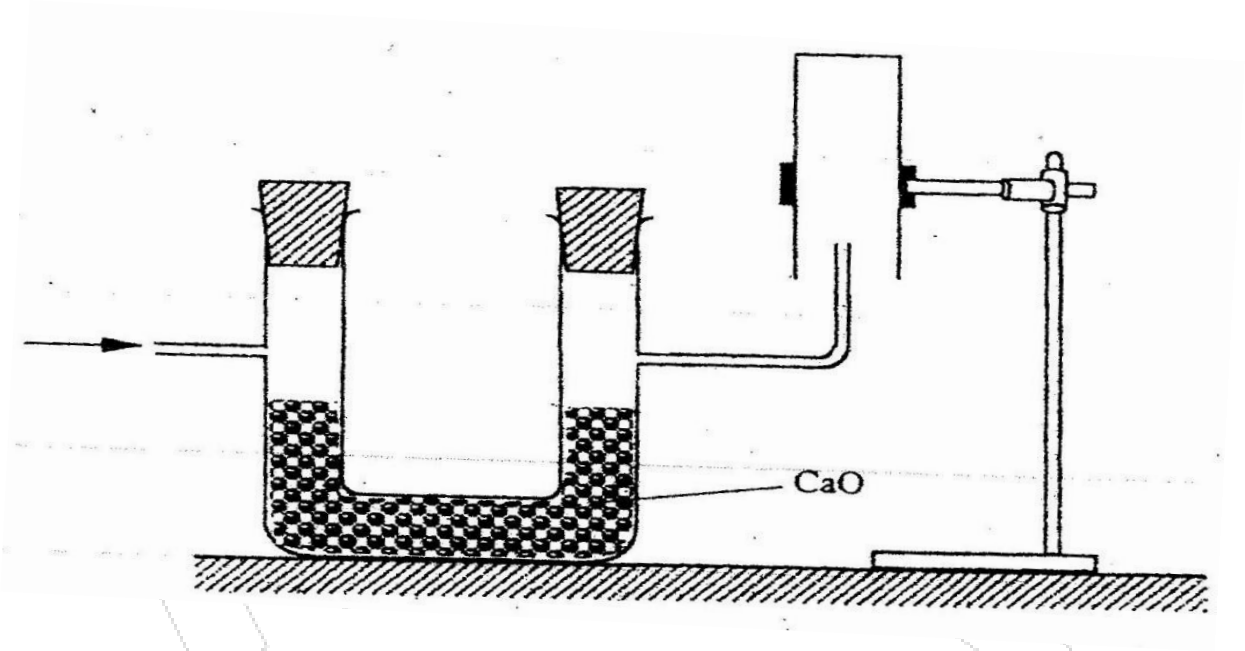
a) State the observations that were made when:

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

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

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

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)**

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)**

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

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

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)**

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

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)**

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

18. a) State the Graham's law of 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)**

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)**

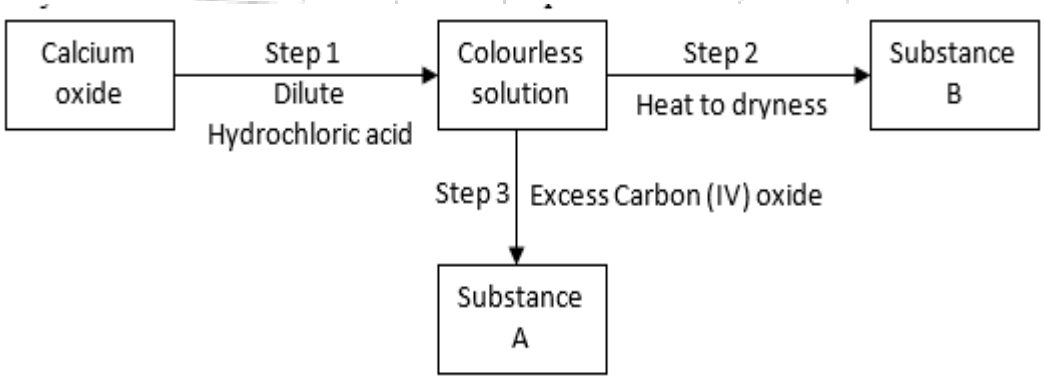
20.In an experiment to determine the percentage of magnesium hydroxide in an anti-acid, a solution containing 0.50 g of the anti-acid was neutralized by 23.0 cm^3 of 0.1M hydrochloric acid (Relative formula mass of magnesium hydroxide =58)

Determine the,

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

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

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)**

b) **Give;**

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

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

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)**

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

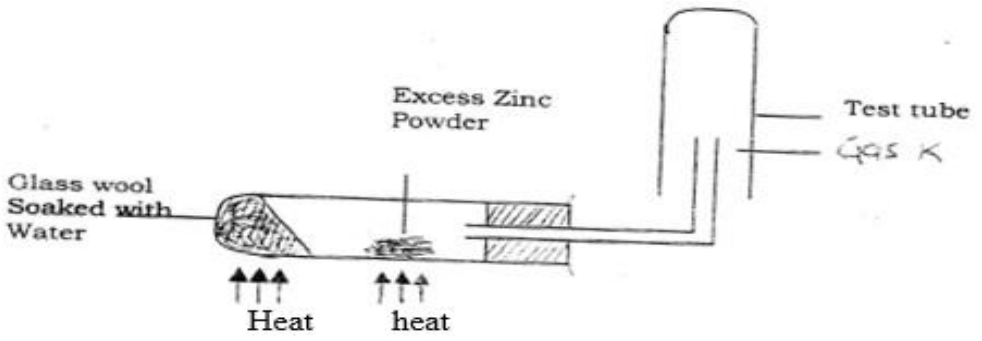
Equation	Enthalpy of formation
$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l)$	$\triangle H = -286\ kjmol^{-1}$
$C(s) + O_2(g) \rightarrow CO_2(g)$	$\triangle H = -394 kjmol^{-1}$
$2C(s) + 3H_2(g) + \frac{1}{2} O_2 \rightarrow C_2H_5OH(i)$;	$\triangle H = 277 kjmol^{-1}$

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

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

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

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)**

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

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)**

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

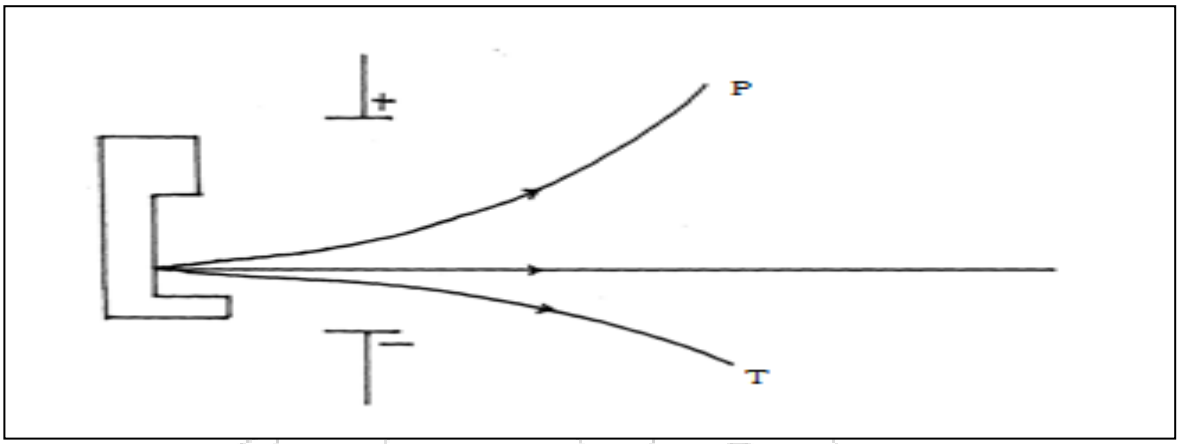
27. But -2- ene undergoes hydrogenation according to the equation given below

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

(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)**

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

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

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

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

THIS IS THE LAST PRINTED PAGE

KCSE 2023 FINAL PREDICTION

EXPECTED EXAM 1

233/2

CHEMISTRY

PAPER 2 (THEORY)
TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

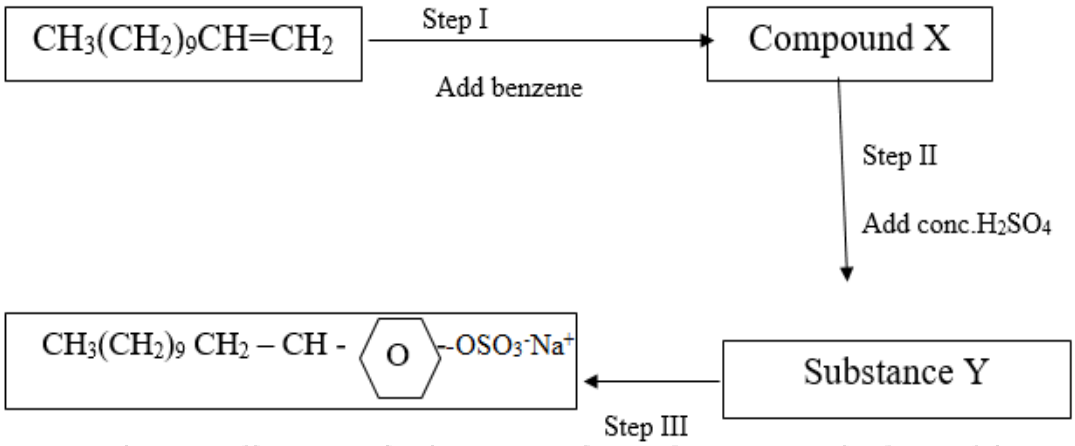
- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- All working **must** be clearly shown where necessary.
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All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

FOR EXAMINERS USE ONLY

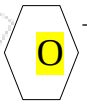
QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

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)**

(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)**

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

(1 mark)

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

(ii) Give the reagent in step III. **(1mark)**

(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.

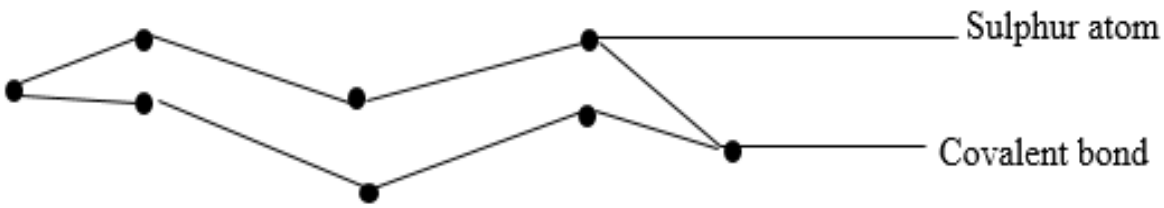
(i) What is the name given to the above type of reaction? (1mark)

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

Name the catalyst. (1mark)

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

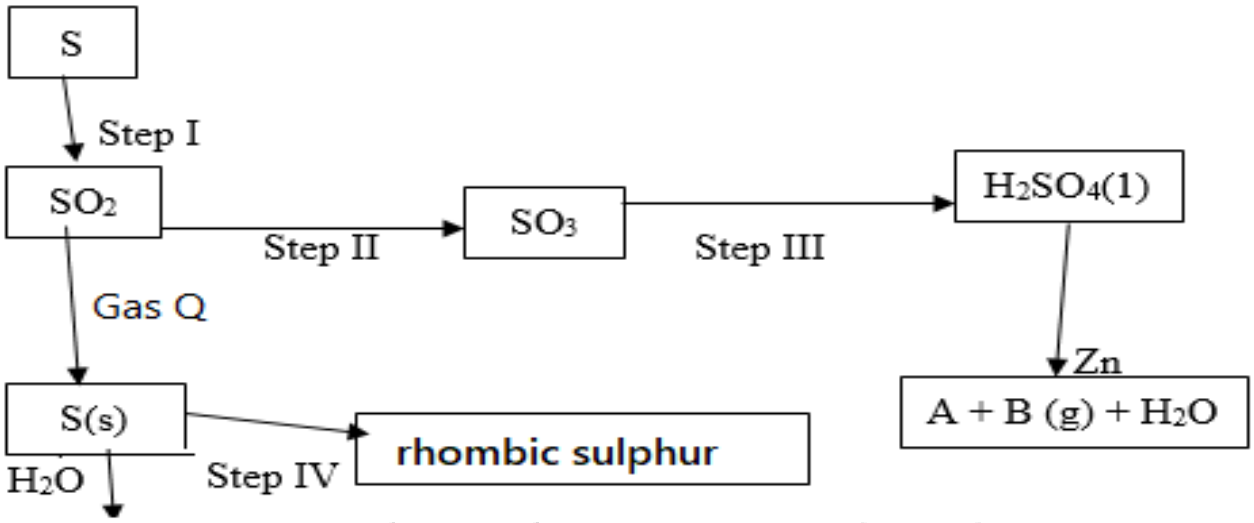
2. Study the structure below and use it to answer the questions that follows



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

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

(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)**

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

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

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

(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)

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)
$P^{+}_{(aq)} + e^{-} \longrightarrow P(s)$	-2.92
$Q^{+}_{(aq)} + e^{-} \longrightarrow Q(s)$	+0.52
$R^{+}_{(aq)} + e^{-} \longrightarrow \frac{1}{2}R_2(g)$	0.00
$S^{2+}_{(aq)} + 2e^{-} \longrightarrow S(s)$	-0.44
$\frac{1}{2}T_{2(g)} + e^{-} \longrightarrow T^{-}_{(aq)}$	+1.36

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

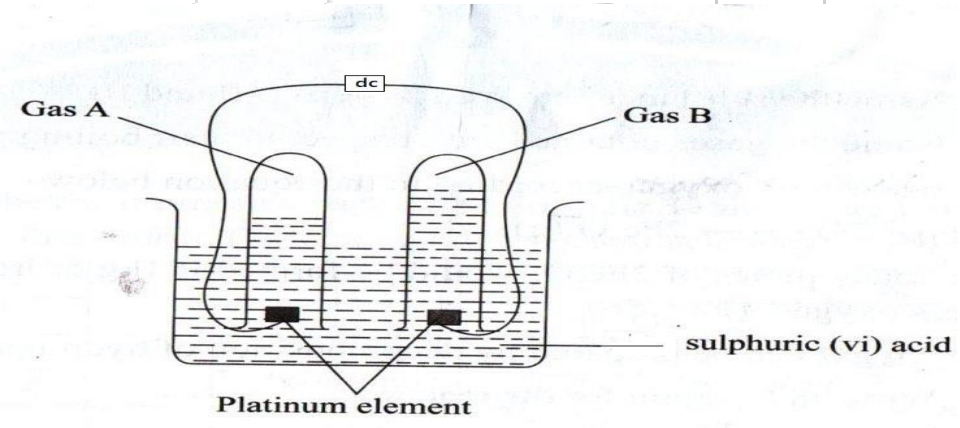
(b) Which half cells would produce the highest potential difference when combined**?** **(1 mark)**

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

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

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

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



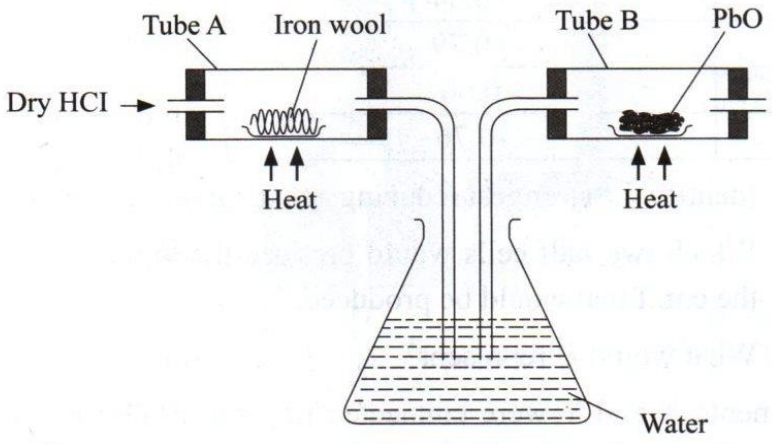
(i) Write an equation for the reaction that produces gas B.

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

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

(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)**

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)**

(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)**

(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)**

(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)

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)**

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

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

(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)**

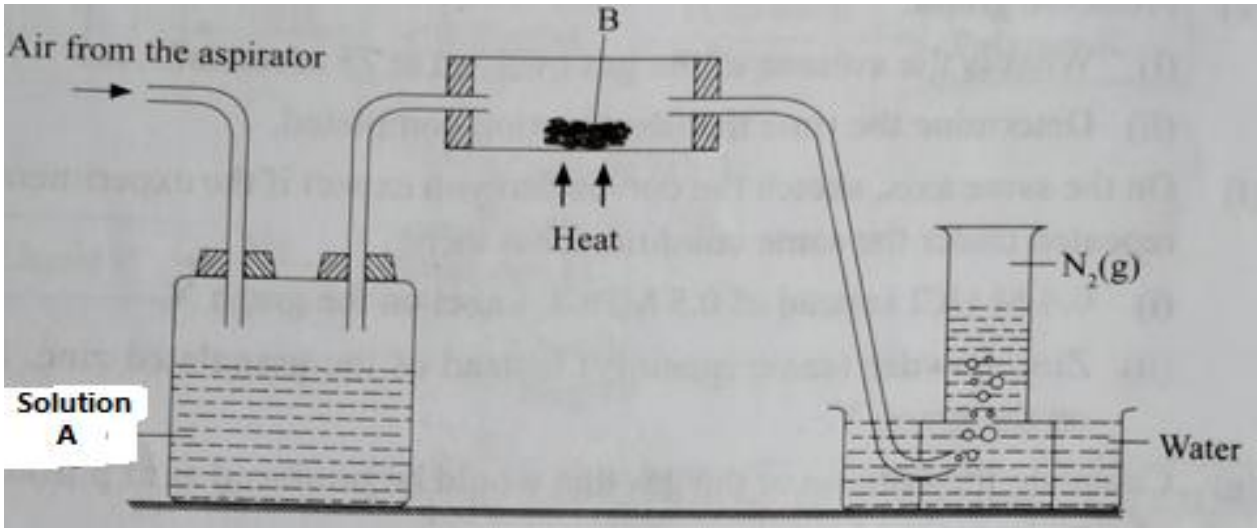
(e) Give the formula of the compound formed between K and P. **(1mark)**

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

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

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

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)**

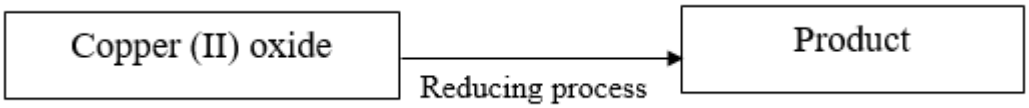
(b) Name what is contained in: **(2marks)**

(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)**

(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)**

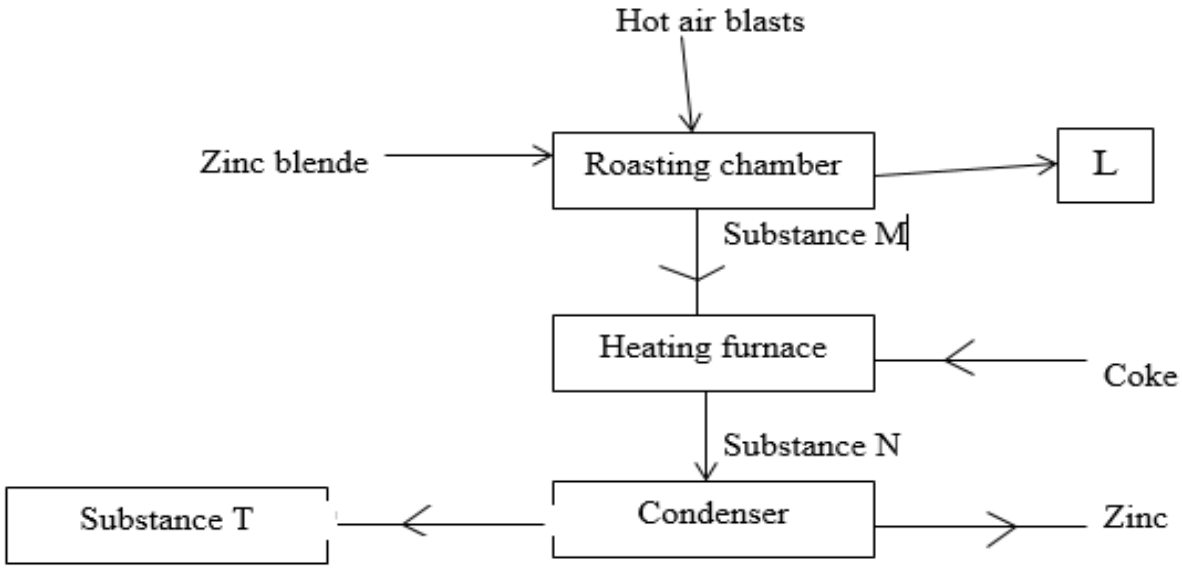
(ii) Explain what will be observed when the above reaction takes place. **(1 mark)**

(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? **(2marks)**

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)**

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

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

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

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

(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)**

(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)**

THIS IS THE LAST PRINTED PAGE.

KCSE 23

KCSE 2023 FINAL PREDICTION

EXPECTED EXAM 2

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
	80	

*Answer **all** questions*

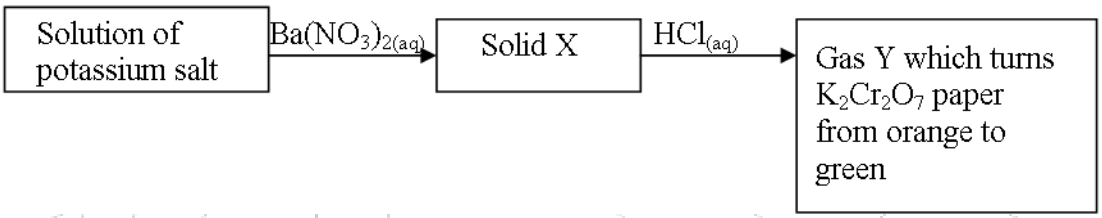
1.Molten sodium chloride and graphite both conduct electricity. State their difference in electrical conductivity. **(2mks)**

2. Element R has atomic number 8 and a mass number 16.

(i) Draw the atomic structure of element R. **(1mk)**

(ii) Explain why R forms a hydride with a low boiling point. **(1mk)**

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

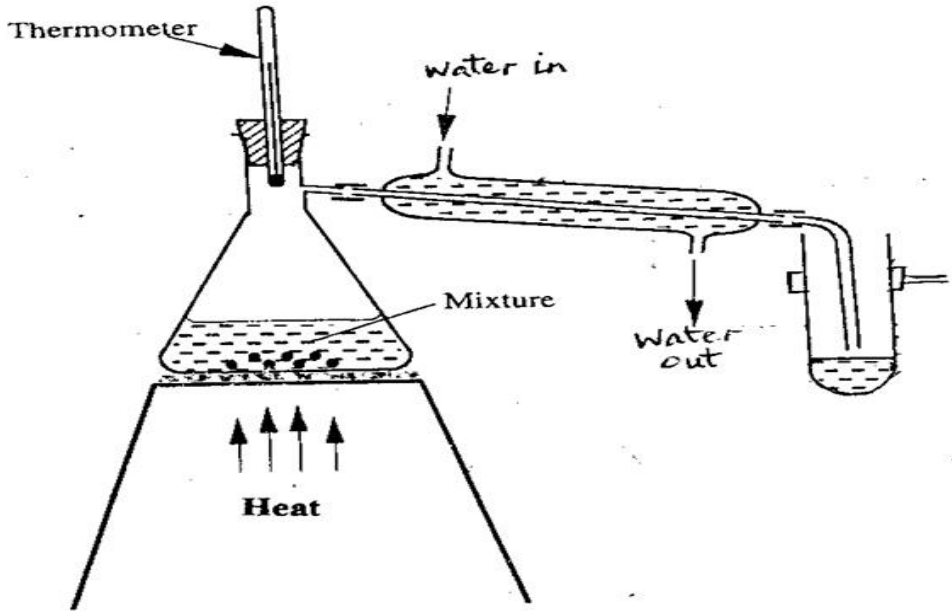


(a) Name (i) Solid X **(1mk)**

(ii) Gas Y **(1mk)**

4. Compare the second ionization energy of magnesium with its first ionization energy. Explain your answer. **(2mks)**

5. The set-up represented below can be used to separate ethanol from its mixture with water.



(a) Identify an error in the set-up. **(1 mk)**

(**b**) **Name this** method of separation. **(1 mk)**

(c) What properties make it possible to separate ethanol from water by this method? **(1 mk)**

6. Element K has two isotopes ^{20}**K** and ^{22}**K** with relative abundance of 90% and 10% respectively.

a) What are isotopes? **(1 mk)**

b) Determine the relative atomic mass of element K. **(2 mks)**

7. Xg of Potassium hydroxide were dissolved in water to make 100cm^3 of solution.50cm^3 of solution required 50cm3 of 2M Nitric acid for complete neutralization. **Calculate** the mass X of Potassium hydroxide. **(3mks)**

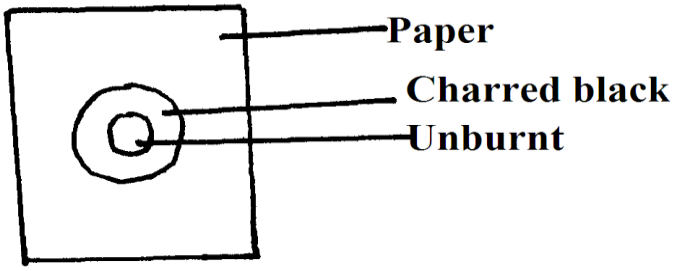
8. Sulphur burns in air to form a gaseous product.

i) What is the colour of the flame of burning sulphur? **(1 mk)**

ii) Give an equation for the reaction that takes place when the gaseous product is bubbled through water. **(1 mk)**

iii) State one importance of the product formed in (ii) above. **(1 mk)**

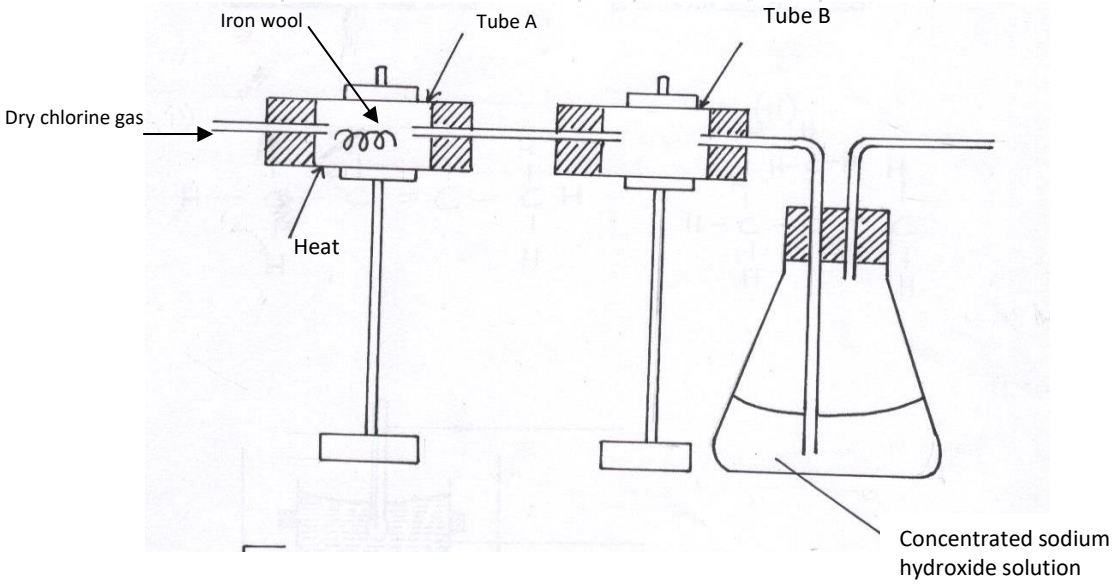
9. The figure below shows a paper that was placed horizontally across the middle of a non-luminous flame and quickly withdrawn.



(a) Explain the observations. (1mk)

(b) Why is luminous flame not used for heating in the laboratory? (1mk)

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



(i) What is observed when the hot iron wool reacts with chlorine gas? **(1mk)**

(ii) What is the purpose of:

a) Tube B **(1mk)**

b) Concentrated Sodium hydroxide solution. **(1mk)**

11. The table below shows results obtained from experiment carried out on a suspect salt solution M.

Experiment	Results
I. A few drops of Barium nitrate added to solution M	No ppt/ colourless solution
II. A few drops of lead (II) nitrate added to solution M.	White ppt
III. Ammonia solution added dropwise until in excess	White precipitate Colourless solution

(a) Identify the cation and anion present in solution M. (1mk)

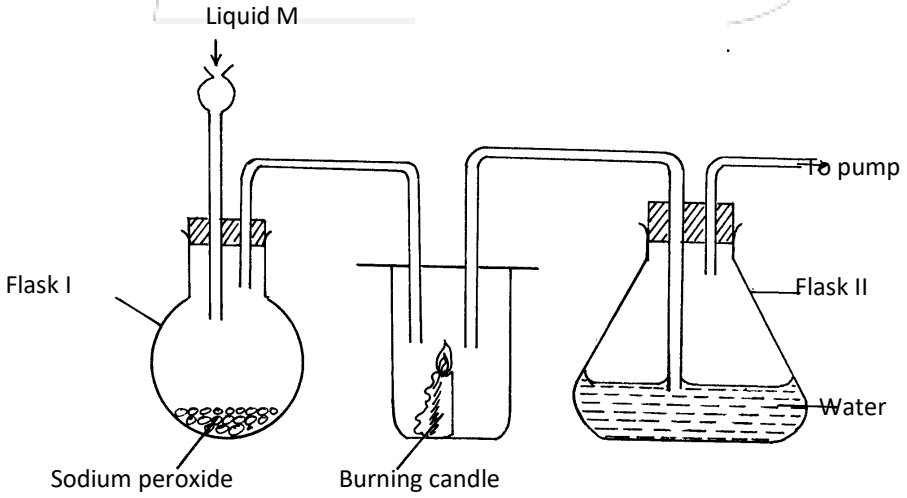
Cation **(½ mk)**

Anion **(½ mk)**

b) Write an ionic equation for the formation of white precipitate in experiment II **(1mk)**

c) Write the formula of the Ion responsible for formation of colourless solution in experiment III **(1mrk)**

12. The diagram below shows a set-up of apparatus used to prepare oxygen gas and pass it over burning candle. The experiment was allowed to run for several minutes.



(i) Identify liquid M. **(1mk)**

(ii) The pH of the solution in flask II was found to be less than 7. Explain. **(2mks)**

iii) Write an equation for the reaction that forms oxygen gas in the set up. **(1mk)**

13. Briefly explain the following

(i) Alkaline earth metals are generally less reactive than alkali metals. **(1mk)**

(ii) Melting point of alkali metals decrease down the group while melting point of halogens increases down the group. **(2mks)**

(iii) Group VIII elements are gases at room temperature. **(1mk)**

14. How would you obtain a sample of pure iodine from a mixture of iodine and lead (II) sulphate. **(2mks)**

15. The table below indicates the PH values of solutions labelled A, B, C, D and E

Solution	A	B	C	D	E
pH value	5	13	2	10	7

Identify the solution:

(i) Containing highest concentration of hydrogen ions. **(½ mk)**

(ii) That is likely to be ethanoic acid. Give a reason. **(1mk)**

(iii) That is likely to be common salt solution. **(½ mk)**

16. The table below shows physical properties of some substances. Use the information to answer the questions that follow.

Substance	ensity (gm^{-3})	I-P (^{O}c)	.P (^{O}c)	Electrical conductivity	
				Solid	Liquid
M	3.5	801	1413	POOR	GOOD
O	0.8	-114	-84.9	POOR	POOR
P	3.8	3550	4827	POOR	POOR
Q	21.4	-39	357	GOOD	GOOD
R	1.53	660	2470	GOOD	GOOD

(i) Which of the elements is a liquid at room temperature. Explain **(1mk)**

(ii) Identify the type of structure in

P……

R…… **(1mk)**

(iii) Which element would be the most suitable for use in over-head electric wire transmission? **(2 mks)**

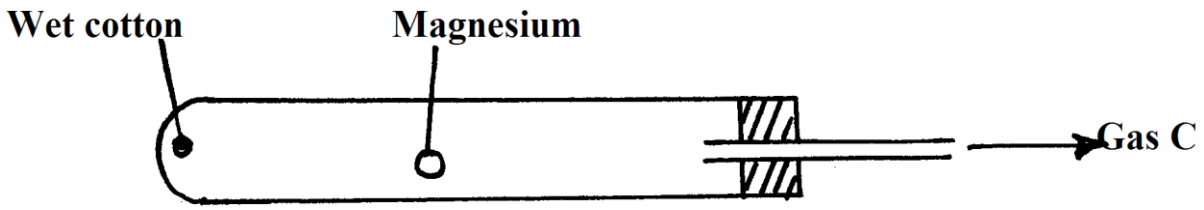
17. **An** element Y has relative atomic mass 6.939 and atomic number 3. it has two isotopes with atomic mass 6.015 and 7.016. Calculate the relative abudance of the isotopes. **(3mks)**

18. (a) Give the name of the organic compound formed when methanol and ethanoic acid reacts in the presence of concentrated sulphuric (VI) acid. **(1mk)**

(b) Write the structural formula of

2 – methylpropane **(1mk)**

19. The diagram below shows how magnesium reacts with steam.



(i) Gas C would not be produced as in the set-up but when certain condition is introduced gas C is produced. On the diagram indicate the condition that was omitted. **(1mk)**

(ii) Describe how gas C is produced after the mistake was corrected in the set-up. **(1mk)**

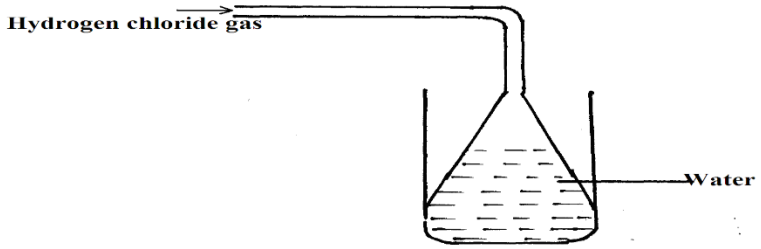
20. Study the information in the table below and answer the questions that follow. The letter do not represent the actual symbols of the elements.

Element	Atomic number	Electronic arrangement
X	16	
Y	19	

(a) Complete the table by writing the electronic arrangement of the elements **(1mk)**

(b) Which type of bond is formed between X and Y. Explain **(2mks)**

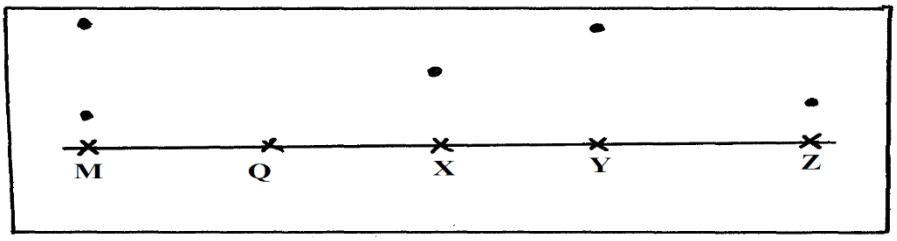
21. Hydrogen chloride gas was passed into water as shown below.



(a) When a blue litimus paper was dropped into the resulting solution, it turned red. Give a reason for the observation. **(1mk)**

(b) What is the function of the funnel? **(1mk)**

22. The paper chromatogram below shows the identification of unknown metal ions in mixture M. The reference ions X, Y and Z are also shown. The experiment was done in an ascending method.



X – Vanadium (IV) ion (V^{4+})

Y – Chromium (III) ion (Cr^{3+})

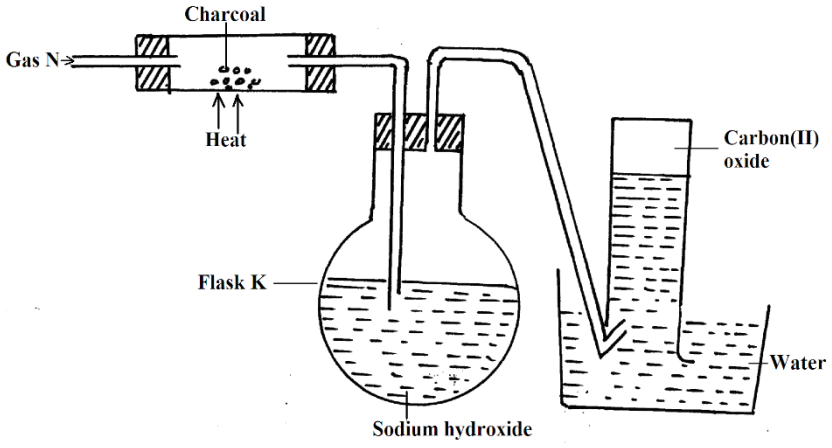
Z – Copper(II) ion (Cu^{2+})

(a) Name the ions present in the mixture M. **(1mk)**

(b) Indicate the solvent front on the diagram. **(1mk)**

(c) Mixture Q contains all the three ions. Show the chromatography of Q. **(1 ½ mks)**

23. The set-up below shows the preparation of carbon (II) oxide.



(a) Name gas N **(1mk)**

(b) What is the purpose of sodium hydroxide in flask K? **(1mk)**

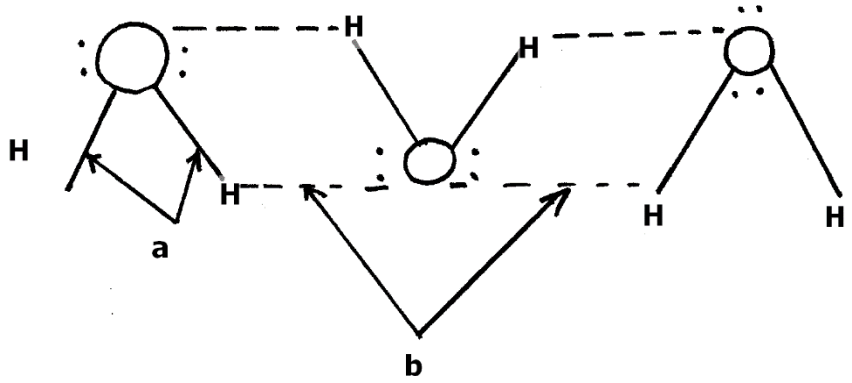
(c) Why is it necessary to carry out this experiment in a fume cupboard? **(1mk)**

24. Determine the oxidation states of the underlined elements **(2mks)**

i) $\underline{Fe}(CN)_6^{3-}$ ii) $K[\underline{Cr}(CN)_6]^{4+}$

Oxidation state of Fe Oxidation state of Cr

25. The diagram below shows a structure (i) of water molecules



i) Name the bonds labelled **(1 mk)**

a) …….

b……

ii) Using dots (.) and cross(x) diagram show the bonding in the compound phosphonium ion PH_4^+ (H = 1, P = 15) **(1mks)**

26. When dry hydrogen gas was passed over a heated lead (II) oxide sample in a combustion tube and the gaseous product cooled, a colourless liquid was obtained.

(a) (i) Name the colourless liquid. **(½ mk)**

(ii) Describe a chemical test you would use to confirm the colourless liquid in a (i) above **(2mks)**

(b) What observation can be made in the combustion tube at the end of the experiment? **(½ mk)**

(c) Write a chemical equation for the reaction between hydrogen and heated lead (II) oxide. (1mk)

27. State one use of:

a) Calcium nitrate **(1 mrk)**

b) Magnesium hydroxide **(1 mrk)**

28. Coloured flower placed in a gas jar containing gas X immediately turned colourless. A solution of gas X in water formed a white precipitate with silver nitrate solution. The precipitate was insoluble in nitric (V) acid but dissolved in excess aqueous ammonia.

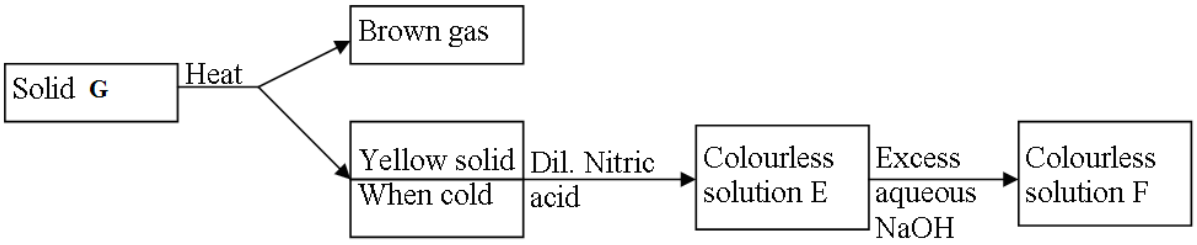
(a) What is the identity of gas X? **(1mk)**

(b) Write down the balanced chemical equation of the reaction that took place when:

(i) Solution of gas X in water reacted with silver Nitrate solution. **(1mk)**

(ii) Aqueous ammonia was added to the resulting mixture in b(i) above. **(1mk)**

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



(a) Identify solid G **(1mk)**

(b) Write the formula of the complex ion in solution F **(Imk)**

30. Describe how you would obtain solid sample of sodium carbonate from a mixture of lead carbonate and sodium carbonate powders. **(2mks**

THIS IS THE LAST PRINTED PAGE

KCSE 2023 FINAL PREDICTION

EXPECTED EXAM 2

233/2

CHEMISTRY

PAPER 2 (THEORY)
TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

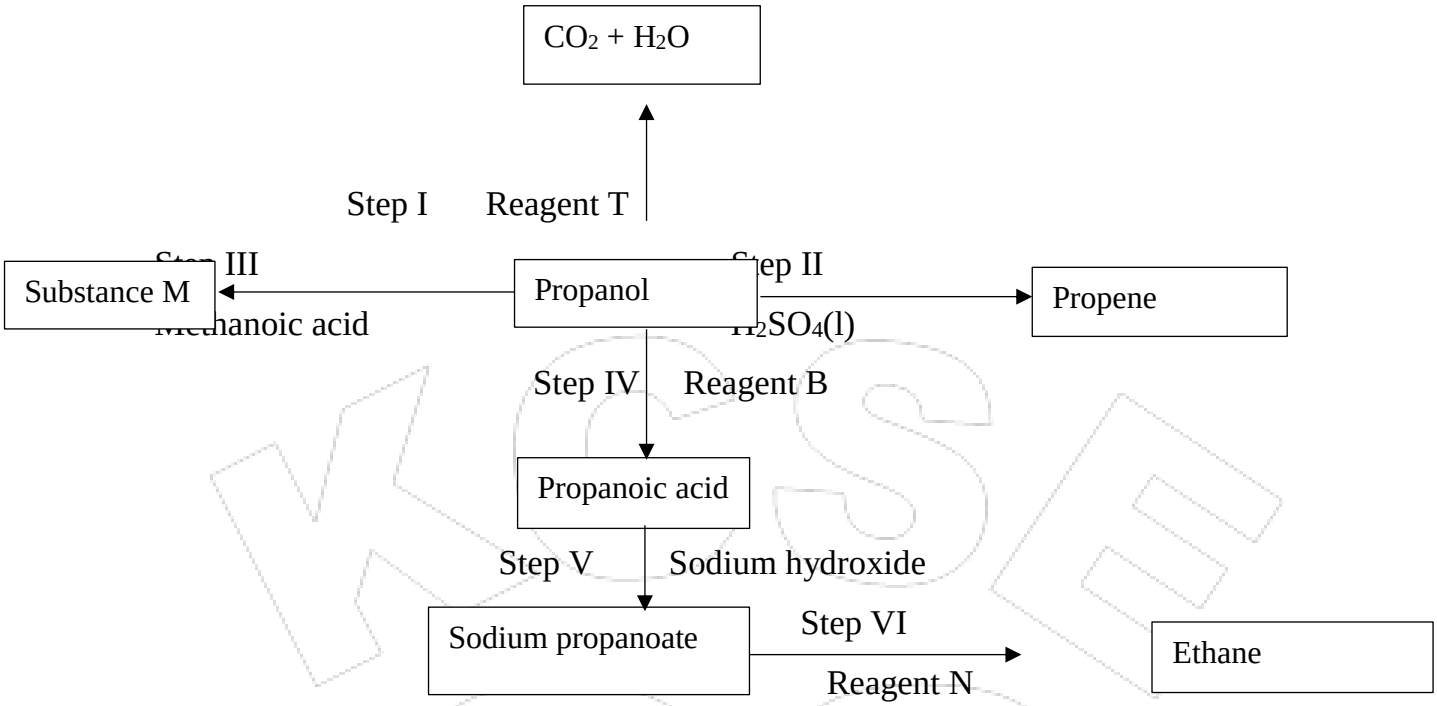
INSTRUCTIONS TO CANDIDATES

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

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

1. The flow diagram below shows some reactions starting with propanol. Study it and use it to answer the questions that follow.



a. Name the process in step; **(3 marks)**

I ……

III ……...

IV ……..

b. Write an equation for the reaction in step **(2 marks)**

I ……

V ……

c. Give the name and structural formula of substance M **(2 marks)**

Name ……

Structural formula

d. Name the reagent; **(2 marks)**

B ……

N ……

e. State the condition necessary for reaction in step II **(1 mark)**

f. The diagram below shows the structure of a detergent.



i. Identify the detergent **(1 mark)**

ii. A sample of water was found to contain magnesium ions. Explain why the detergent above is a suitable reagent to be used in the water. **(1 mark)**

2. The table below shows properties of four substances. Study it and use it to answer the questions that follow.

Substance	Melting point (^{0}C)	Electrical conductivity	
		Solid	Molten
A	– 33	Poor	Poor
B	801	Poor	Good
C	1083	Good	Good
D	1417	Poor	Poor

i. Identify the structure in the following: **(2 marks)**

A ……

C ……

ii. Explain the conductivity in substance B **(2 marks)**

iii. Give a reason why substance D has a h-igh melting point. **(1 mark)**

b.Draw dot and cross diagram showing bonding in the following; **(2 marks)**

i.Ammonia gas (N=7, H=1)

ii.Sodium sulphide (Na=11, S=16)

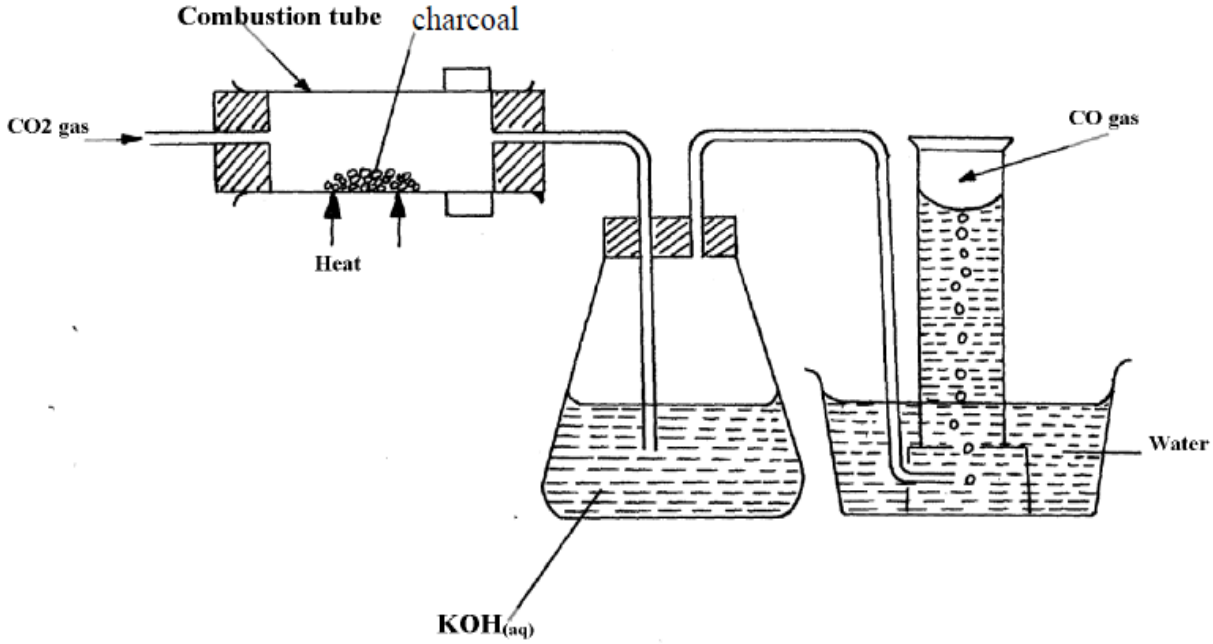
c. Explain the following; **(3 marks)**

i. Magnesium and sulphur are in the same period of the periodic table. However, magnesium oxide is a solid while sulphur (IV) oxide is a gas at room temperature (Mg = 12, S=16, O=8)

ii. Ethanol is molecular but it dissolves in water

iii. Solid copper metal is a better electrical conductor than molten copper

3. The diagram below shows the set-up used to test a property of carbon in the laboratory. Study it and use it to answer the questions that follow.

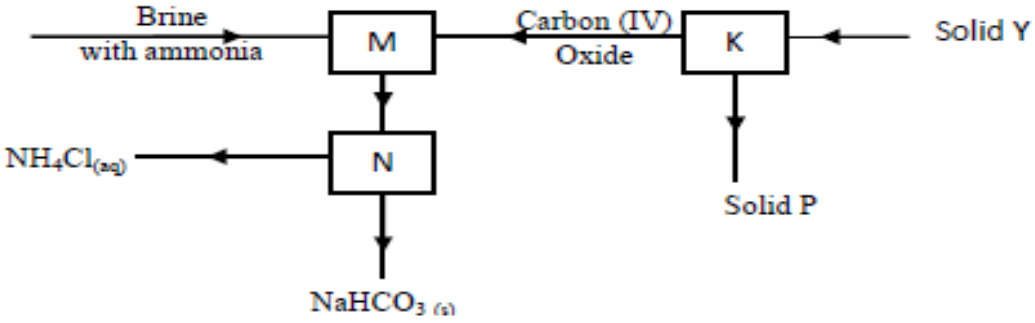


i. State the role of potassium hydroxide solution **(1 mark)**

ii. Write an equation for the reaction in the combustion tube **(1 mark)**

iii. State the property of carbon being investigated. **(1 mark)**

b.Sodium carbonate is prepared industrially using Solvay process. The flow diagram below shows some of the reactions in the process. Study it and use it to answer the questions that follow.



i. Identify; **(2 marks)**

Solid Y ……

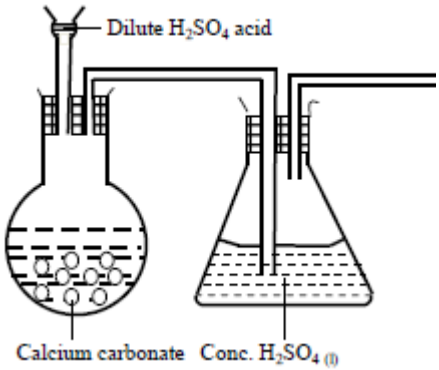
Solid P ……

ii. Write an equation for the reaction taking place in chamber M **(1 mark)**

iii. Name the process taking place in chamber N. **(1 mark)**

iv. State two uses of sodium carbonate **(2 marks)**

c. The set-up below was used to prepare carbon (IV) oxide gas in the laboratory. Study it and answer the questions that follow.



i. Identify the mistake in the set-up and suggest a possible correction. **(2 marks)**

ii. Complete the diagram showing how the gas can be collected **(1 mark)**

4. The list below shows reduction potentials of element M, N, P and Q

	E^{θ}(volts)
$M^{2+}_{(aq)} + 2e \rightarrow M_{(s)}$	; -0.76
$N^{2+}_{(aq)} + 2e \rightarrow N_{(s)}$	;-2.37
$P^{+}_{(aq)} + 2e \rightarrow P_{(s)}$	; +0.80
$Q^{2+}_{(aq)} + 2e \rightarrow Q_{(s)}$	;-0.14

a. Identify the element that is strongest reducing agent **(1 mark)**

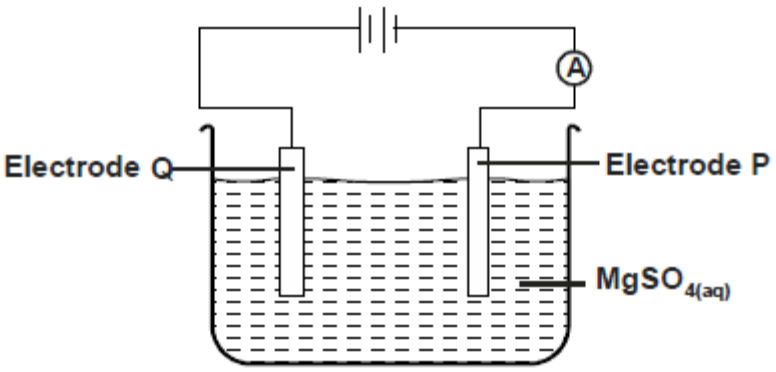
b. Which elements would form an electrochemical cell with the highest e.m.f. **(1 mark)**

c. The half cells of M and P were combined to form an electrochemical cell.

i. Draw the electrochemical cell formed **(3 marks)**

ii. Calculate the e. m. f of the cell formed **(1 mark)**

d. The set-up below was used during the electrolysis of a solution of Magnesium sulphate using inert electrodes.



i. State the observation made in electrode Q. Explain **(2 marks)**

ii. Write an equation for the reaction in electrode P **(1mark)**

iii. A current of 0.5 Amperes was passed through the cell for 16 minutes and 5 seconds. Calculate the volume of product at the anode at RTP (1M= 24l ,I F=96500C) **(3 marks)**

e. Give one application of electrolysis **(1 mark)**

5. a) Define molar heat of neutralization **(1mark)**

b) The table below shows temperature reached when equal volumes of an alkaline solution of 1.5M concentration was reacted with 0.95M sulphuric (VI) acid.

Total volume of Sulphuric VI acid added	0	5	10	15	20	25	30	35	40
Volume of alkaline solution	30	30	30	30	30	30	30	30	30
Highest temperature reached	23	24	25	26	27	28	28	27	26

Plot a graph of temperature against volume of acid used **(3mks)**

c. From the graph determine

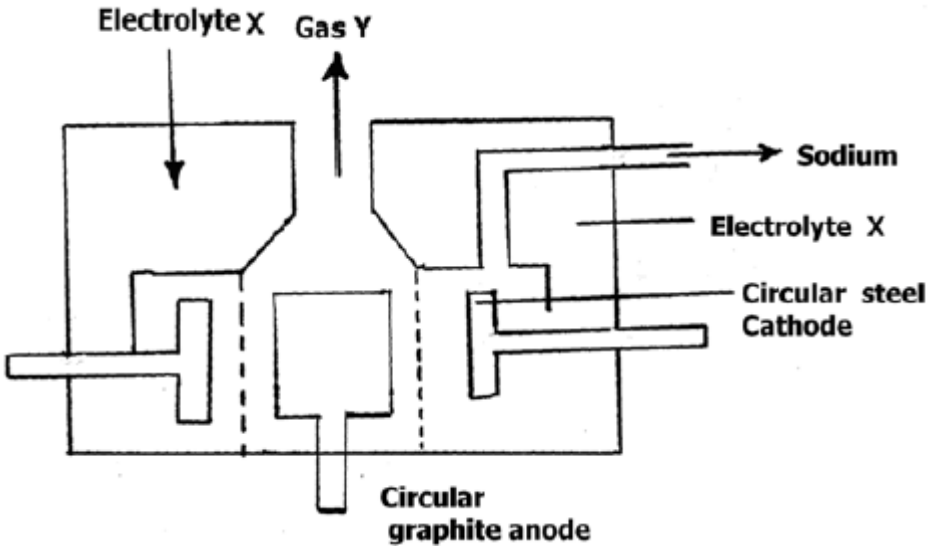
i. the volume of sulphuric VI acid needed to completely neutralize $30cm^3$ of the alkali solution **(1mk)**

the temperature change **(1mk)**

d. Calculate the heat change for the above reaction density of solution $1g/cm^3$, Specific Heat Capacity 4.2g/J/K **(2mks)**

e. Calculate the molar heat of neutralization for the reaction **(2mks)**

6. The diagram below shows the set-up used to extract sodium metal.



a. Identify; **(2 marks)**

i. Electrolyte X

ii. Gas Y

b. During extraction of sodium using the down's process, calcium chloride is added to the ore. Give a reason for the addition of calcium chloride. **(1 mark)**

c. State two uses of sodium **(2 marks)**

d. Give a reason why sodium is extracted using electrolysis **(1 mark)**

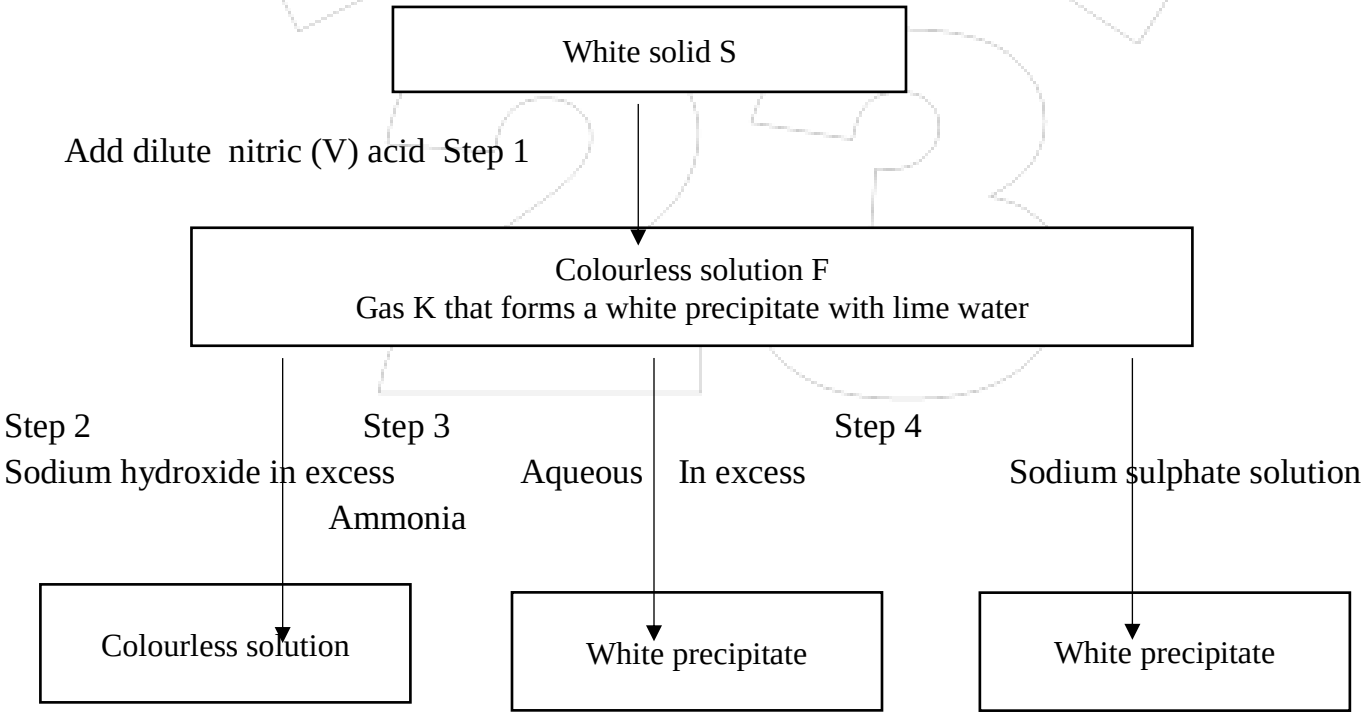
e. Why is the anode made of graphite and not steel? **(1 mark)**

f. On the diagram, label the steel diaphragm. **(1 mark)**

g. State the role of the steel diaphragm (**1 mark)**

h. State and explain two observations made when sodium metal is placed in a trough of cold water. **(3 marks)**

7. a. The figure below shows some properties and reactions starting with solid S. Study it and answer the questions that follow.



i. Identify; **(2 marks)**

Solid S

Gas K

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

iii. State the property of solution F that makes the reaction in step 2 possible. **(1mark)**

iv. Write an **ionic equation** for the reaction in step 2 **(1 mark)**

b. Starting with Zinc oxide, describe how a dray sample of zinc carbonate can be prepared in the laboratory **(3 marks)**

c. Name the process taking place when the following reactions take place **(3 marks)**

i. Calcium chloride placed on a watch glass overnight forms a solution

ii. Sodium hydroxide reacts with sulphuric (VI) acid to form a colourless solution

iii. Silver nitrate and potassium chloride react to form a white solid

KCSE 23

KCSE 2023 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

- *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
	80	

*Answer **all** questions*

1. What is the difference between chromatography and chromatology? **(1mark)**

2. When dilute Sulphuric (VI) acid is connected in a circuit to test conduction of electricity, the bulb lights while when concentrated Sulphuric (VI) acid is used in the same set-up, the bulb does not light. Explain this observation. **(2marks)**

3. Explain why Aluminium Chloride has **PH 3** when dissolved in water? **(2marks)**

4. Below is a list of substances.

Soap solution, common salt, urine, lemon juice and baking powder.

Select:

(a) A substance that is likely to give a PH of 3.0 when tested? **(1mark)**

(b) A substance (s) which is likely to resemble sodium hydrogen carbonate. **(1mark)**

(c) Two substances when reacted are likely to give the product with same **PH** as that of common salt. **(1mark)**

5. Briefly explain the observation made when a small piece of sodium metal is dropped into a bowl of water. **(3marks)**

6. (a) Define Le Chatelier's principle. **(1mark)**

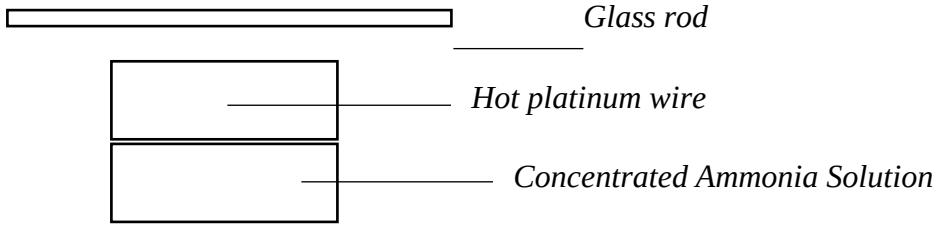
(b) A fixed mass of a gas has a volume of **400cm^2** at **20°C,** what temperature rise would produce a 10% increase in volume if the pressure remains constant. **(3marks)**

7. Using Dots (.) and (x) diagram, show the number of electrons used in bonding of H_3O^+ **(2marks)**

8. Explain why a luminous flame appears yellow. **(2marks)**

9. Some sodium chloride was found to be contaminated with copper (II) oxide. Describe how a dry sample of sodium chloride can be separated from the mixture. **(2marks)**

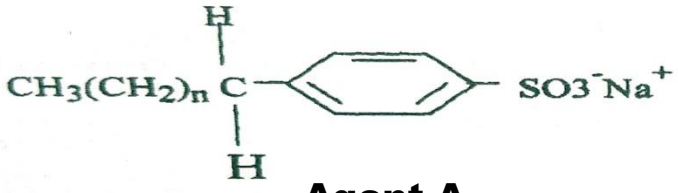
10. Hot platinum wire was lowered into a flask containing concentrated ammonia solutions shown below.



State and explain observations made **(3marks)**

11. Give three characteristics of gases according to Kinetic theory of matte**r.** **(3marks)**

12. The formula below represents active ingredients of two cleansing agents **A** and **B**



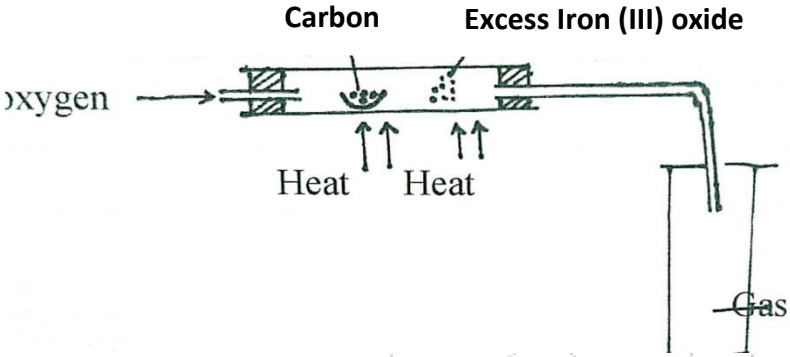
Agent A

$CH_3(CH_2)_6COO^-Na^+$

Agent B

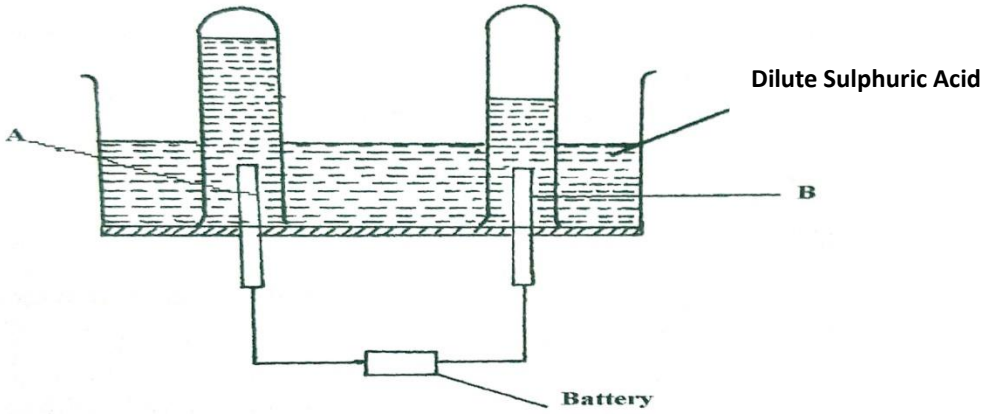
Which one of the cleansing agents would be suitable to be used in water containing magnesium hydrogen carbonate? Explain. **(2marks)**

13. The set-up below was used to obtain a sample of iron



Write **two** equations for the reactions which occur in the combustion tube. **(2marks)**

14. The diagram below represents a set-up that can be used for the electrolysis of dilute Sulphuric acid.



(a) Name the electrodes A and B **(1mark)**

(b) Write an equation for the reaction taking place at electrode B. **(1mark)**

(c) What happens to the concentration of dilute sulphuric acid as the reaction continues? **(1mark)**

15. Describe one physical and one chemical test that can be used to identify Ethane gas. **(2marks)**

16. 15cm^{3}of a solution containing 2.88g/dm^3 of an alkali XOH completely reacts with 20cm^3 of 0.045M sulphuric acid. Calculate the reactive atomic mass of X present in the alkali. **(3marks)**

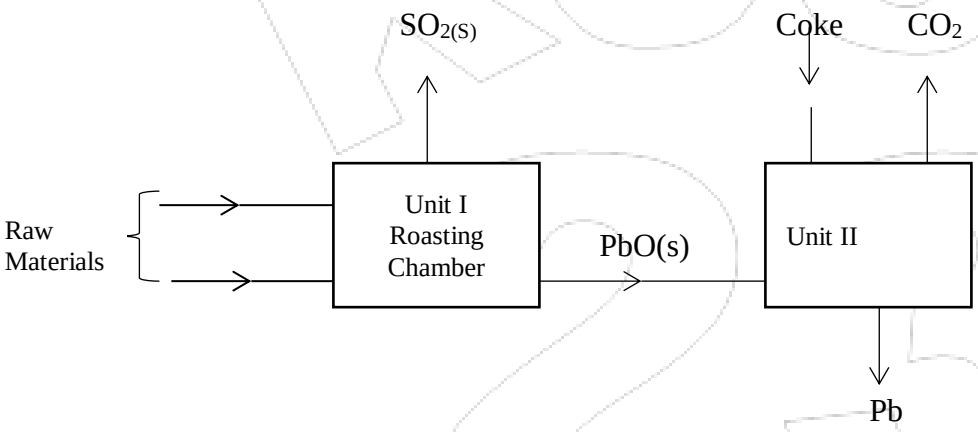
17. Using equations, state and explain the changes in mass that occur when the following are heated separately in open crucible. **(3marks)**

(a) Magnesium metal

(ii) Zinc carbonate

18. In the space provided below, draw a set-up that can be used to show the reaction between nitrogen (I) oxide with copper to give Nitrogen gas. **(3marks)**

19. The flow chart below shows some process in extraction of lead metal. Study it and answer the questions that follow;



(a) Name two raw materials that were fed into Unit I **(1mark)**

(b) State one environment hazard associated with the process in Unit I. **(1mark)**

(c) What is the function of Coke in Unit II **(1mark)**

20. Sulphur exhibits as an allotropy.

(a) What is allotropy? **(1mark)**

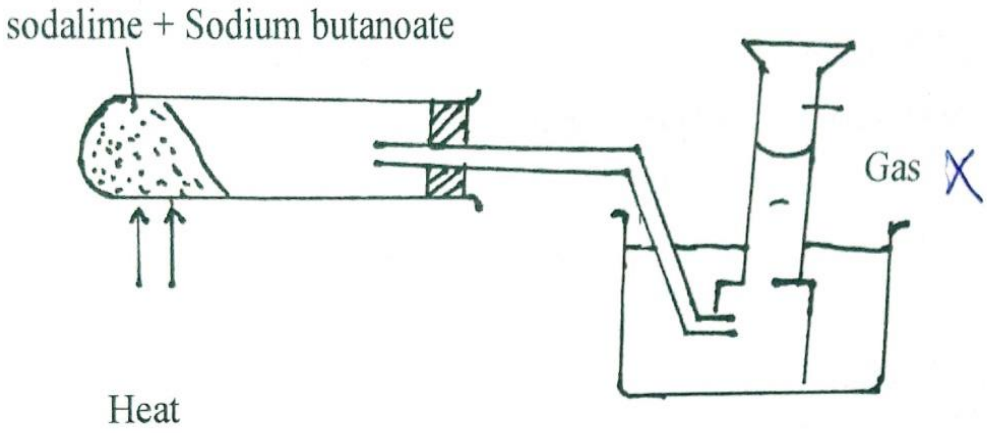
(b) Name the two allotropes of sulphur. **(1mark)**

(c) Sulphur powder was placed in a deflagrating spoon and heated on a Bunsen burner.

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

(ii) The product obtained was dissolved in water. Comment on the PH of the solution formed. **(1mark)**

21. The set-up below was used to prepare a sample of an organic compound X.



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

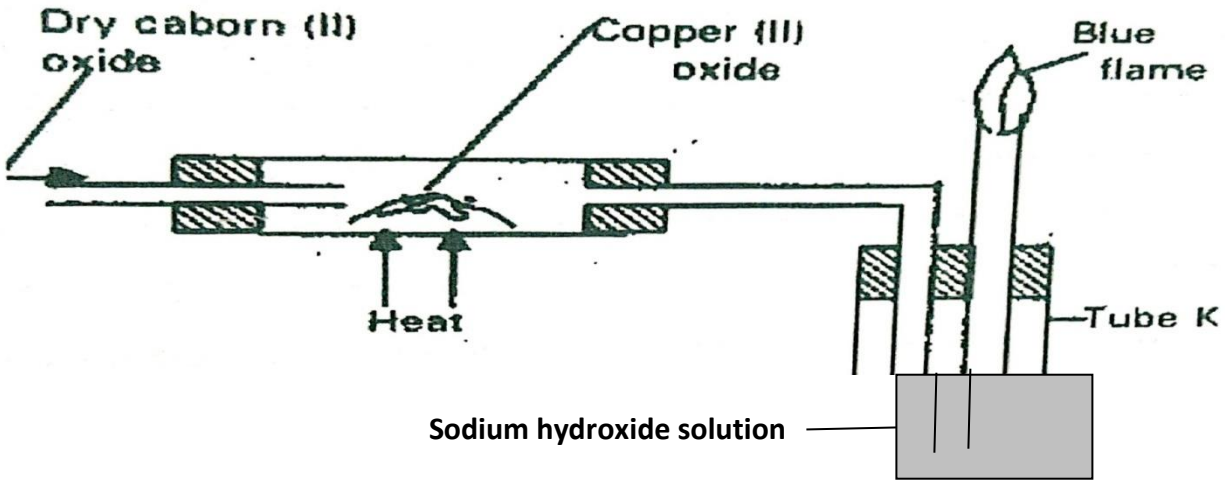
(b) Write the equation for the reaction that produces gas X. **(1mark)**

(c) 1 Mole of chlorine was reacted with gas X in presence of sunlight.

(i) State one observation made. **(½ mark)**

(ii) Name the major product formed. **(½ mark)**

22. 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. **(1mark)**

(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)**

23. The equation below represents changes in the physical state of ions metal:

$Fe_{(s)} \longrightarrow Fe_{(l)} \quad \Delta H = +15.4 Kjmol^{-1}$

$Fe_{(1)} \longrightarrow Fe_{(g)} \quad \Delta H = +354 Kjmol^{-1}$

Calculate the amount of heat energy required to change 10kg of solid iron to gaseous iron. (Fe = 56)

(3marks)

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

				Q				
X			**B**	**H**		**M**	**T**	
Y		**A**					**V**	
Z							**S**	

(a) Explain why the atomic radius of T is smaller than that of M **(1mark)**

(b) Compare the electrical conductivity of element X and B. **(2marks)**

25. Read the following passage and answer the questions.

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

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

(b) What is X most likely to be? **(1mark)**

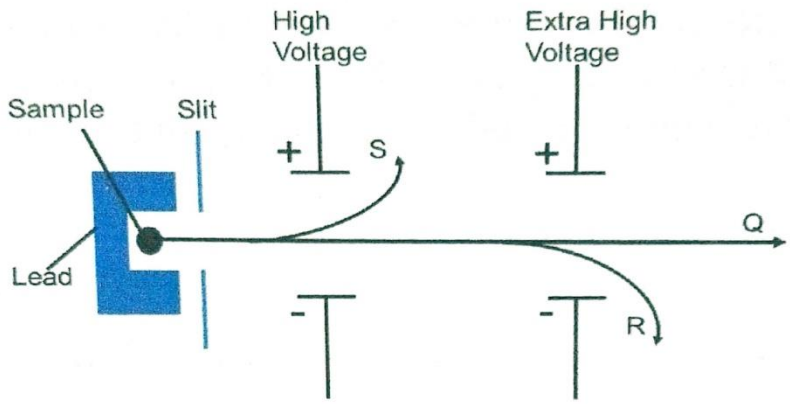
(c) Write an equation for the reaction between X and slaked lime. **(1mark)**

26. Consider the following reaction:

$A_{2(g)} + B_{2(g)} \rightleftharpoons 2AB_{(g)}, \quad \Delta H = +75kj$

Sketch an energy level diagram showing the relative activation energies for the catalyzed and uncatalyzed reactions using the axes below. **(2marks)**

27. The diagram below shows the radiations emitted by a radioactive sample.



(i) Identify radiation particles S and R **(2marks)**

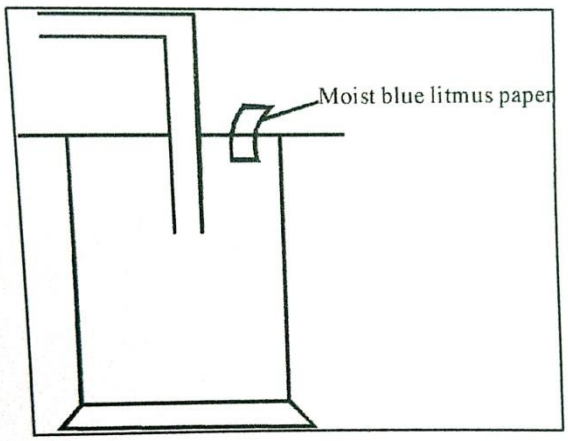
28. (a) Starting with red roses, describe how a solution containing the red pigments may be prepared? **(2marks)**

(c) How can the solution be used as an indicator? **(1mark)**

29. (a) Give one reason why some of the laboratory apparatus are made of ceramics. **(1mark)**

(b) Name the two apparatus that can be used to measure approximately $75cm^3$ of dilute sulphuric (VI acid**. (2marks)**

30. Dry chlorine was collected using the set-up below.



(a) Name a suitable drying agent for chlorine gas? **(1mark)**

(b) State one property of chlorine gas which facilitates this method of collection. **(1mark)**

(c) State one observation made on the moist blue litmus paper. **(1mark)**

KCSE 2023 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

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

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

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

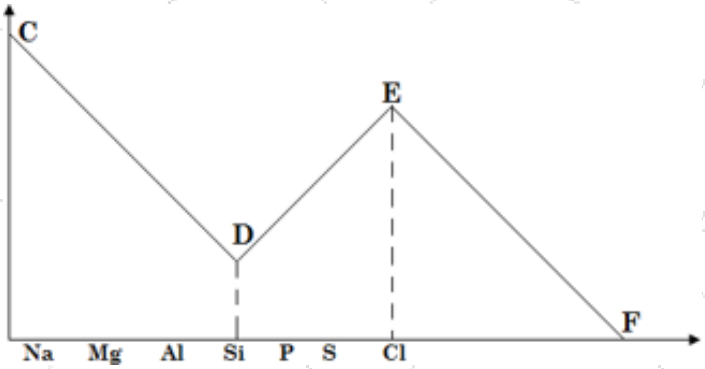
J							M				
	K			N	O				P		
L											
								H			

i) Write the formula of the compound formed by element J and M. **(1mk)**

ii) Identify the least reactive element. Give a reason for your answer**.** **(1mk)**

iii) Compare the atomic size of K and O. Explain. **(2mks)**

b)The following graph shows the reactivity of elements in period 3.



Explain the Trend at D and E (1mks)

c)The table below gives information on the Melting Points of compounds of period 3 elements. The letters do not represent the actual symbols.

Elements	R	S	T	U	V	W
Atomic number	11	12	13	14	15	16
M.pt of chloride ^{0}C	801	714	-	-70	-90	-80
M.pt of oxide ^{0}C	1190	3080	2050	2750	560	-73

a. Write the formula of

(i) Chloride of **T** **(1mk)**

(ii) Oxide of U **(1mk)**

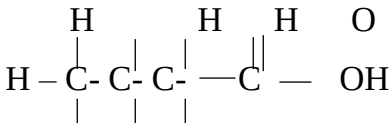
b. (a) Using the information above, suggest the type of bonding present in the chloride of V. Explain. **(2mks)**

(ii)The difference in melting point of chloride and oxide of U in terms of structure and bonding. **(2mks)**

(iii)Why there is no melting point in the chloride of T. **(1mk)**

2.(a) Give the systematic names of the compounds whose structural formulae are given below.

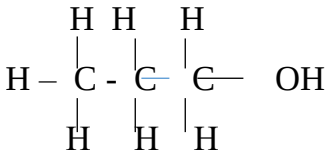
i.



(½ mark)

……

ii.



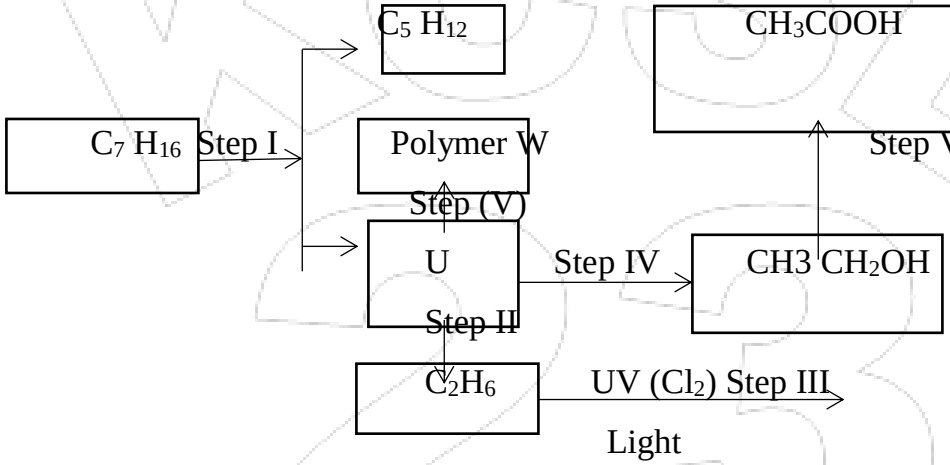
(½ mark)

……

(b) Draw and name the structural formulae of the compound obtained when compounds in (a) react.

(1 mark)

c). Study the reaction scheme below and answer the questions that follow.



(i) Name the process labeled Step I **(½ mark)**

(ii) Identify substance U **(½ mark)**

(iii) State the name of the fifth member of the homologous series to which U belongs. **(1 mark)**

(iv) Explain how acidified potassium manganite (VII) can be used to distinguish U from C_2H_6.

(2 marks)

(v) State one industrial application of the process in step II. **(1 mark)**

(vi) Write the equation for the reaction in step III. **(1 mark)**

(vii) Identify the reagent and condition required in step (IV) **(1 mark)**

(viii) State **one** use of the polymer W. **(1 mark)**

(c) $R - COO^- Na^+$ (A) and R  $OSO_3^- Na^+$ (B) represent two types of cleaning agents

(i) Name the class of the cleaning agent to which A belongs. **(1 mark)**

(ii) Which cleaning agent would be suitable to use with water containing Magnesium Chloride? Explain **(2 marks)**

3.a) In an experiment $50cm^3$ of 1M copper (II) Sulphate solution was placed in a $100cm^3$ plastic beaker. The temperature of the solution was measured. Excess metal A powder was added to the solution, the mixture stirred and the maximum temperature recorded. The procedure was repeated using powders of metal B and C. The results obtained were given in the table below.

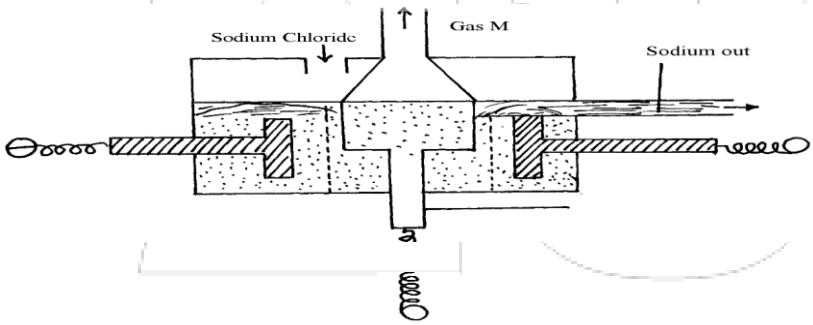
Metal	A	B	C
Maximum temperature(^{0}C)	26.3	31.7	22.0
Initial temperature (^{o}C)	22.0	22.0	22.0

(i) Arrange the metal A, B, C and Copper in ascending order of reactivity. **(1mark)**

(ii) (State one observation that was made when the most reactive metal than copper was added to the copper (II) Sulphate solution. (1mk)

iii)Other than temperature state two factors that affect rate of **reaction** **1mk**

b). The diagram below shows the extraction of sodium metal using the Down's cell. Study it and answer the questions that follow.



(i) Explain why in this process sodium chloride is mixed with calcium chloride. **(1 marks)**

(ii) Why is the anode made of graphite and not iron? **(1 mark)**

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

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

(v) Write ionic equations for the reactions which take place at;

I Cathode **(1 mark)**

II Anode **(1 mark)**

(v) Why is sodium metal stored under kerosene? **(1 mark)**

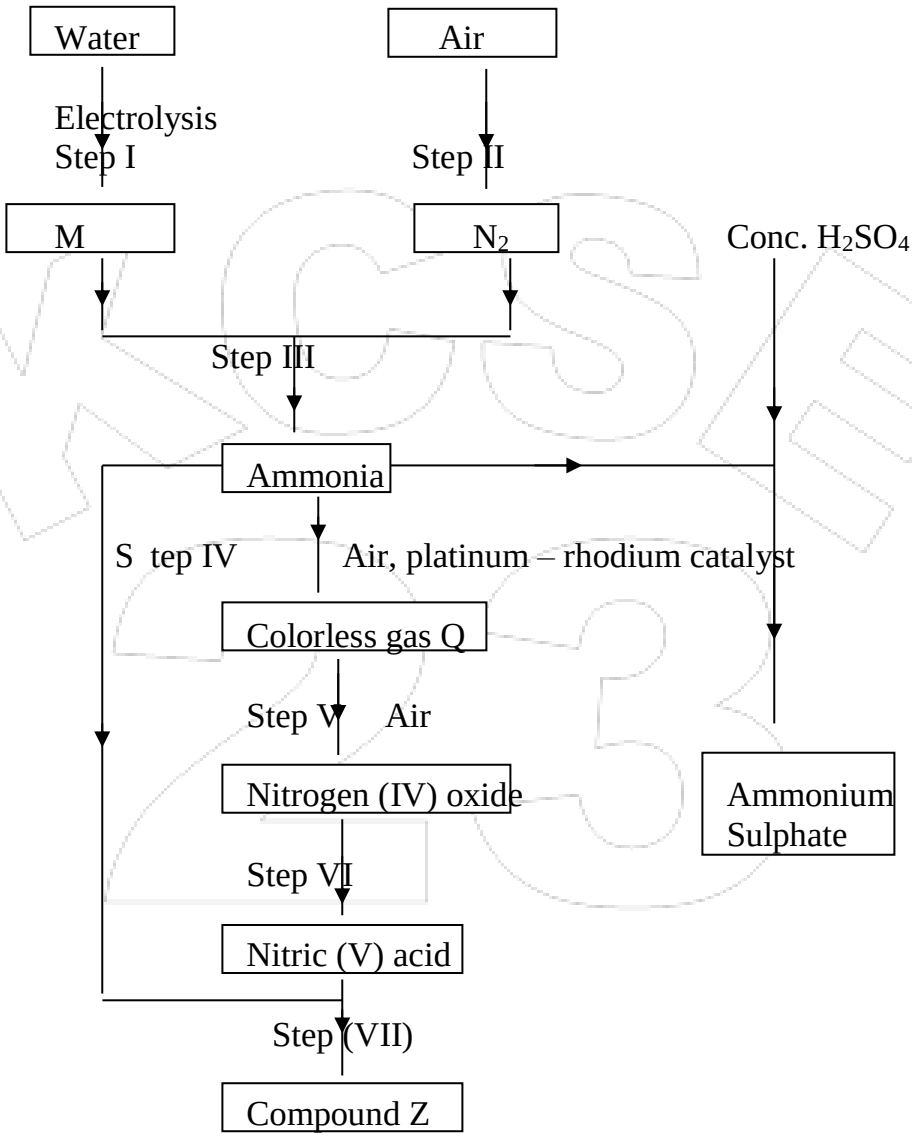
4.(a) Fractional distillation of liquid air is mainly used to obtain nitrogen and oxygen.

(i) Name one substance other than sodium hydroxide that is used to remove carbon (IV) oxide from the air before it is changed into liquid. **(1 mark)**

(ii) Describe how nitrogen gas is obtained from the liquid air.

(Boiling points nitrogen = -196^{0}C, Oxygen = -183^{0}C) **(3 marks)**

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



(i) Name substance M ……. **(1 mark)**

(ii) Identify gas Q …… **(1 mark)**

(iii) State one use of compound Z …….. **(1 mark)**

(iv) A fertilizer manufacturing industry uses 1400dm^3 of ammonia gas per hour to produce ammonium sulphate. Calculate the amount of ammonium sulphate produced in kg for

one day if the factory operates for 18 hours.

(N = 14, H = 1, S = 32, O = 16, 1 mole of gas = $24dm^3$) **(3 marks)**

5.. a) Define the term Half -life **(1mk)**

(b) **Table 2** contains information from the measurements made of the radioactivity in counts per minutes from a radioisotope iodine – 128.

Counts per min	240	204	180	156	138	122	108
Time (min)	0	5	10	15	20	25	30

Table 2

(i) Plot a graph of counts per minute against time. **(3marks)**

(ii) Use the graph to determine the half-life of iodine – 128. **(1mark)**

(iii) What is the counts rate after 22 minutes? **(½ mark)**

(iv) After how many minutes were the counts rate 160 counts per minute? **(½ mark)**

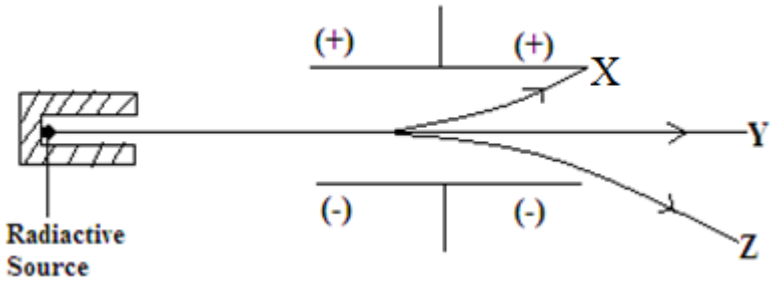
c) Potassium has two isotopes ${}^{39}_{19}K$ and radioactive ${}^{40}_{19}K$.

(i) State how the two isotopes differ. **(1mark)**

(ii) The half-life of ${}^{40}_{19}K$ is 1.3 x 10^9years. Determine how long it would take for 4g of the isotope to decay to 1g. **(1mark)**

(iii) ${}^{39}_{19}K$ undergoes beta decay to form an isotope of calcium. Write the nuclear equation for this decay. **(1mark)**

d) **Fig 2** shows how a radioactive material emitted radiations from its source. Study it and answer the questions that follow as shown below.



I) Identify the radiation that: **(2 marks)**
Has no mass?

i. Contains Helium particles?

II) State two applications of radioactivity in medicine **(2 mks)**

(6.a) State the Hess's law **(1 mark)**

a) Use the information below to answer the questions that follow.

$C_{(s)} + O_{2(g)} \longrightarrow CO_2 \quad \Delta H = -394KJmol^{-1}$

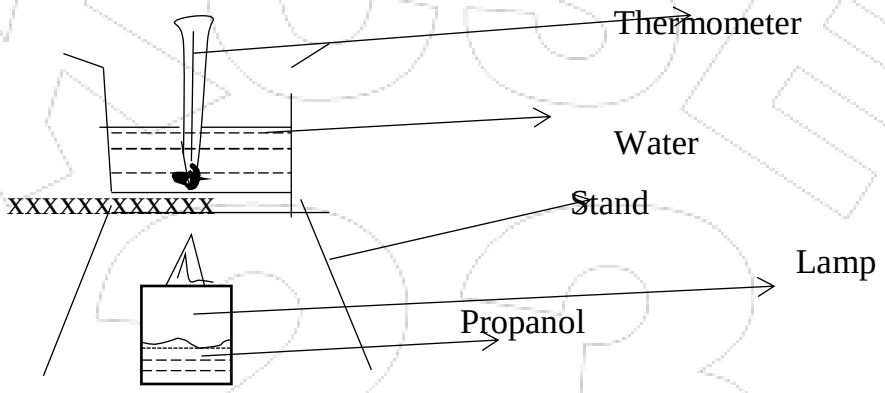
$H_{2(g)} + ½\ O_{2(g)} \longrightarrow H_2O_{(l)} \quad \Delta H = -286KJmol^{-1}$

$C_2H_{2(g)} + 5O_{2(g)} \longrightarrow 2CO_2 + H_2O \quad \Delta H = -1300KJmol^{-1}$

(i) Draw an energy cycle diagram that links the heat of formation of ethyne with its heat of combustion and the heats of combustion of carbon and hydrogen. **(2marks)**

(ii) Calculate the standard 'enthalpy of formation' of ethyne. **(2mark)**

(b) The diagram below represents a set-up that was used in determining the molar heat of combustion of propanol. (C_3H_7OH)



During the experiment the data given below was recorded.

Volume of water = $100cm^3$

Final temperature of water = 43.5^0c

Initial temperature of water = 20.5^0c

Mass of propanol + lamp before burning = 126.5g

Mass of propanol + lamp after burning = 124.7g

Calculate

(i) The molar heat of combustion of propanol **(3marks)**

(Density of water = $1g/cm^3$, specific heat capacity of water = 4.2 kJ/kg/k, C=12.0, O = 16.0, H = 1.0)

(ii) The heating value of propanol. **(1 mark)**

(iii) Give **two** disadvantages of using hydrogen as a source of fuel. **(1 mark)**

(d) Study the information given in the table below and answer the questions that follow.

Bond	Bond energy in $kJmol^{-1}$
C – H	414
Cl – Cl	244
C – Cl	326
H - Cl	431

Calculate the enthalpy change for the reaction. **(2mks)**

$$CH_{4(g)} + 4Cl_{2(g)} \longrightarrow CCl_{4(g)} + 4HCl_{(g)}$$

7(a) Explain the meaning of the following in terms of oxidation numbers: **(2mks)**

i) Reduction

ii) Oxidation

iii) Determine **the oxidation number of chlorine in the ion.** **(1mk)**

ClO_3^-

b) The standard electrode potentials (E^{θ}) of elements Dand G are-2.38Volts and -2.87 Volts respectively.

i) Identify the strongest oxidizing agent **1mk**

ii) Draw a labeled diagram of the cell formed when the two are connected. **(3mks)**

iii) Determine the e.m.f of the cell formed above. **(2mks)**

c) During electrolysis of aqueous Copper(II) Sulphate using carbon electrodes a current of 2.0A was passed for 3 hours.

i) Find the mass of copper metal deposited at the cathode (Cu=64;1F=96500**) (3mks)**

ii) State two factors that determine preferential discharge in electrolysis. **(1 mark)**

KCSE 2023 FINAL PREDICTION

EXPECTED EXAM 4

233/1

CHEMISTRY

PAPER 1 (THEORY)
TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

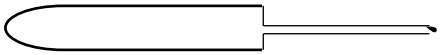
- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

FOR EXAMINERS USE ONLY

QUESTIONS	MAXIMUM SCORE	STUDENTS SCORE
	80	

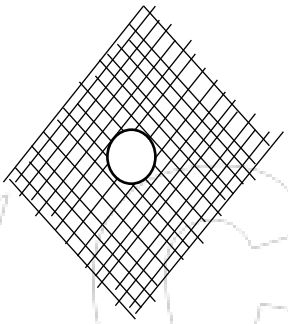
*Answer **all** questions*

1. a) Name and provide the function of the following pieces of apparatus.



Name: ..... **(½ Mark)**

Function ..... **½ mark**



b) Name: ..... **(½ Mark)**

Function ..... **½ mark**

2. A mixture consists of sulphur and iron filings.

a) Describe how to obtain sulphur from the mixture using methylbenzene. **(2 marks)**

b) Is the mixture homogenous or heterogeneous? Explain. **(1 mark)**

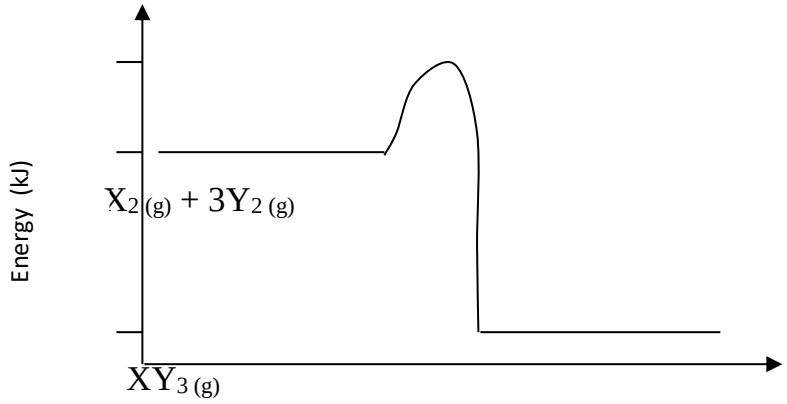
3. Proteins are obtained from amino acid monomers. Complete the equation below to show how the polymer is formed. **(1 mark)**

$H_2N\ CH_2\ COOH + H_2N\ CH_2CH_2COOH \rightarrow$

b) Name the type of polymerization shown above. **(1 mark)**

4. The energy level diagram below is for the reversible reaction.

$X_2(g) + 3\ Y_{2(g)} \rightleftharpoons 2\ XY_{3\ (g}$

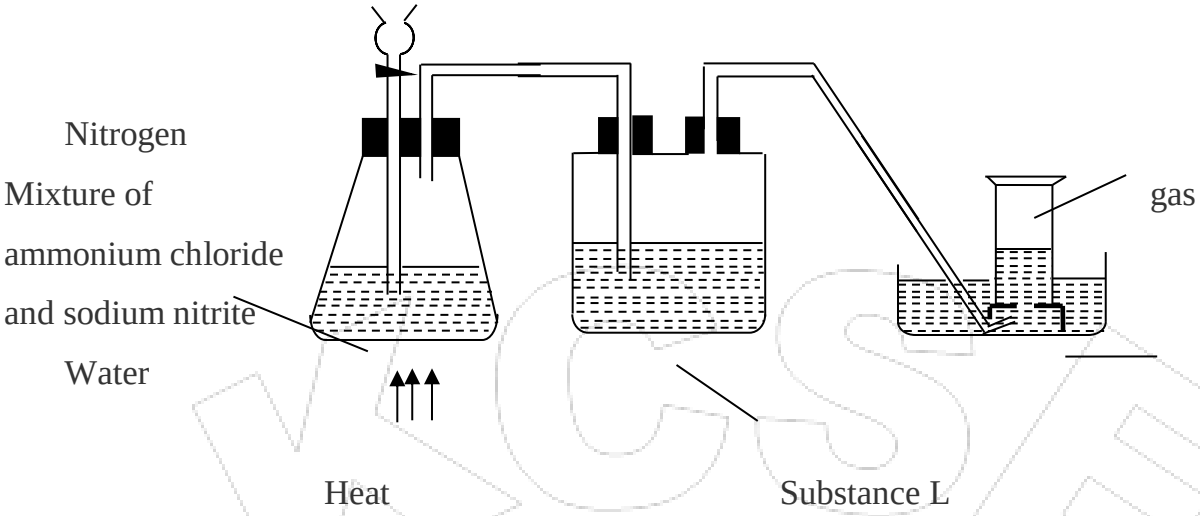


Reaction path

a)Explain how the decrease in temperature will affect the above **reaction** **(2 marks)**

b) Sketch on the same axes the energy level diagram for a catalyzed reaction assuming that the above energy level diagram is for uncatalysed reaction. **(1 mark)**

5. The set-up below shows how nitrogen gas is prepared in the laboratory.



a) Describe how nitrogen gas is formed in the flask. **(2 marks)**

b) Nitrogen gas is inert. State one use of the gas based on this property. **(1 mark)**

6. Unstable nuclide had the equation below occurring. Study the equation and answer the question that follows:

$${}^{1}_{0}n \longrightarrow {}^{1}_{1}P + Y$$

a) Name particle Y **(1 mark)**

b) What is the effect of particles towards a magnetic field? **(1 mark)**

c) Precisely classify the radioactive process above. **(1 mark)**

7. Starting with copper turnings describe how a sample of copper (II) carbonate can be prepared. **(3 marks)**

8. When dilute hydrochloric acid was added to iron (II) sulphide, a colourless gas W with a characteristic smell of rotten eggs was produced.

a) Name gas W. **(½ mark)**

b) Explain how the above gas can be collected. **(1 ½ mark)**

c) Give the test for gas W. **(1 mark)**

9. a) Name the chief ore from which lead is extracted and give its chemical formula. **(1 mark)**

b) Describe the froth floatation process in the extraction of lead metal. **(2 marks)**

10. a) Determine the oxidation number of sulphur in $S_2O_8^{2-}$ hence write the electron arrangement of sulphur. **(2 marks)**

b) The standard electrode potentials of a metal G and iron are given below.

$Fe^{2+}(aq) + 2e \longrightarrow Fe_{(s)}$ - 0.44V

$G^{2+}{}_{aq} + 2e^- \longrightarrow G_{(s)}$ - 0.91V

A piece of iron is coated with metal G. If the coating is scratched, would the iron be protected from rusting. Explain. **(2 marks)**

11. Study the equation below

$$Al_2Cl_{6\,(g)} \underset{\text{Process P}}{\overset{\text{Process Q}}{\rightleftharpoons}} 2AlCl_3\,(s)$$

A B

a) Name process Q. **(1 mark)**

b) Of what application is this equation? **(1 mark)**

c) List two other substances which show this process. **(1 mark)**

12. $R - OO^- Na^+$ and $R - CH_2\,OSO_3^-\,Na^+$ represent two types of cleansing agents. **(1 mark)**

a) Name the class of cleansing agent to which each belongs.

$R - COO^- - Na^+$ **(½ mark)**

$R - CH_2\,OSO_3^-\,Na^+$ **(½ mark)**

b) Which of the above cleansing agent is likely to pollute the environment? Explain. **(2 marks)**

13. Ammonia gas in solution dissociates according to the equation below.

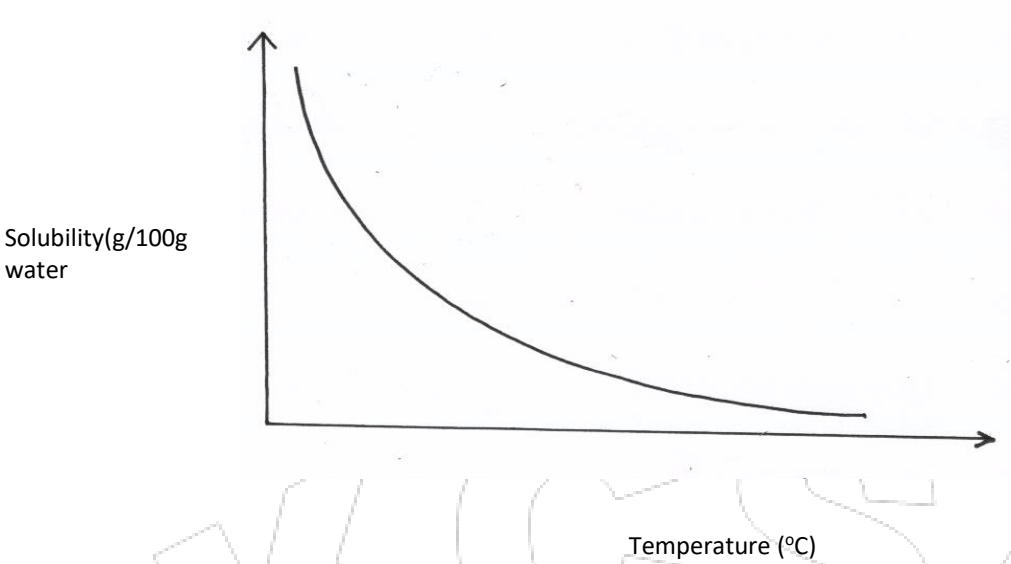
$$NH_{3(g)} + H_2O_{(l)} \rightleftharpoons NH_4^+ + OH^-$$

a) Identify the acidic species in the forward reaction. Explain. **(1 mark)**

b) Write the formula of the complex formed when ammonia is added to copper (II) sulphate solution until in excess. **(1 mark)**

c) What observation is made in (b) above. **(1 mark)**

14. The graph below represents the solubility curve of a gas in water.



(a) State and explain the conclusion that can be drawn from this curve about the solubility of the gas.

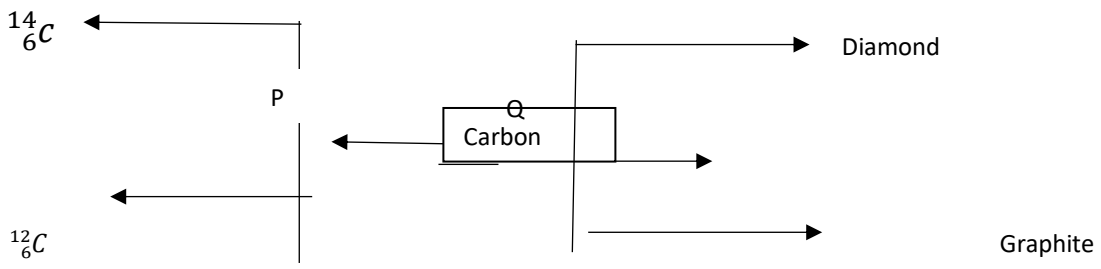
(1mark)

b) Study the information in the table below on solubility and answer the questions that follow.

Salt	**Solubility (g 1 100 g H_2O**	
	At 60^0 C	At 40 °C
Cu SO4	40	28
Pb $(N0_3)_2$	99	79

Calculate the mass of copper (II) sulphate that will crystalize if 40g of a saturated solution is cooled from 60 °C to 40 °C. **(2 marks)**

15. Carbon is known to occur in different forms is solid form. Study the diagram below and answer the question that follow.



a) Name the natural phenomena exhibition by the path.

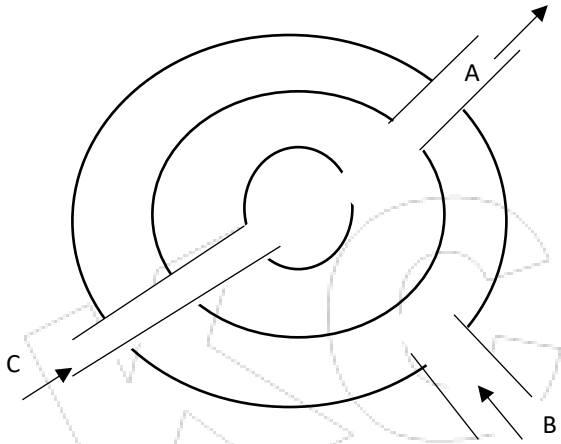
i) P **(1 mark)**

ii) Q **(1 mark)**

b) Give one use of $^{14}_{6}c$ **(1 mark)**

c) Provide an explanation why graphite is used in the HB pencil. **(1 mark)**

16. a) The diagram below represent the Frasch process.

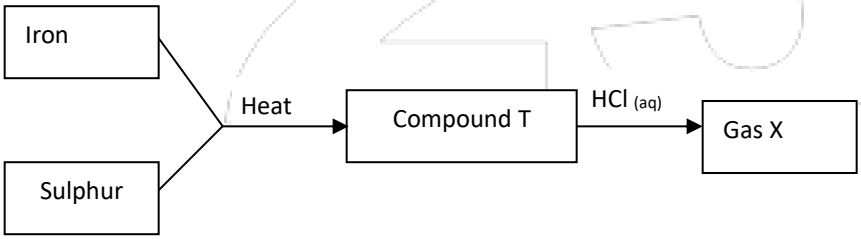


Name the substances that pass through A and C.

A……..(1 mark)

C…….. (1 mark)

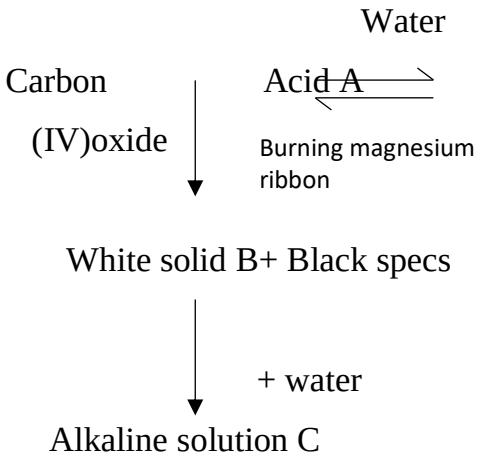
b)Study the flow chart below and answer the questions that follow.



a) Name gas X. (1 mark)

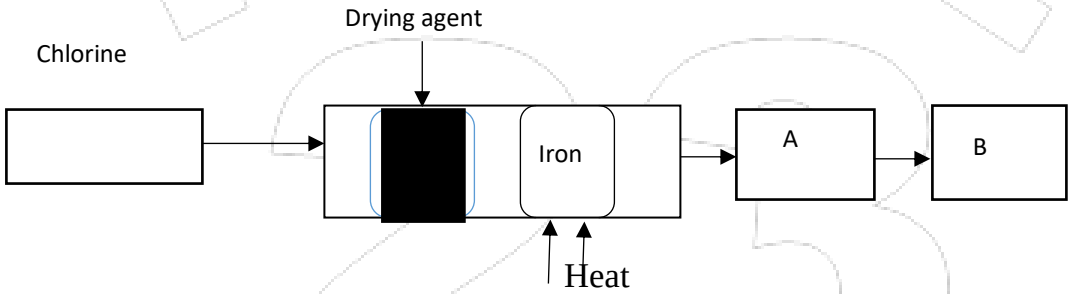
b) State the observation made when gas X is bubbled through a tube containing Iron (III) chloride (1 mark)

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



Write the formula of substances A, B and **C** **(3 marks)**

19. Below is a sketch required to investigate the reaction between chlorine and heated iron. Use it to answer the question that follow.



a) Name a suitable drying agent shown above. **(1 mark)**

b) The iron powder is heated before chlorine is passed over it. What would be observed when chlorine comes in contact with hot iron. **(1 mark)**

c) Write an equation for the reaction in A. **(1 mark)**

19. In Turkana, gnawing chalk was used to fight excess stomach acid. A patient suffering from intestinal ulcer released 30 cm^3 of 1M hydrochloric acid in his stomach. He chewed 5g of impure chalk to neutralize the acid released. (Ca = 40, C = 12, O = 16)

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

b) Calculate the number of moles of calcium carbonate used up. **1 mark)**

c) Calculate the percentage impurity of calcium carbonate (chalk) used. **(1 mark)**

20. The table below show elements represented by letters P, Q, R, S, T, U and V and their atomic numbers.

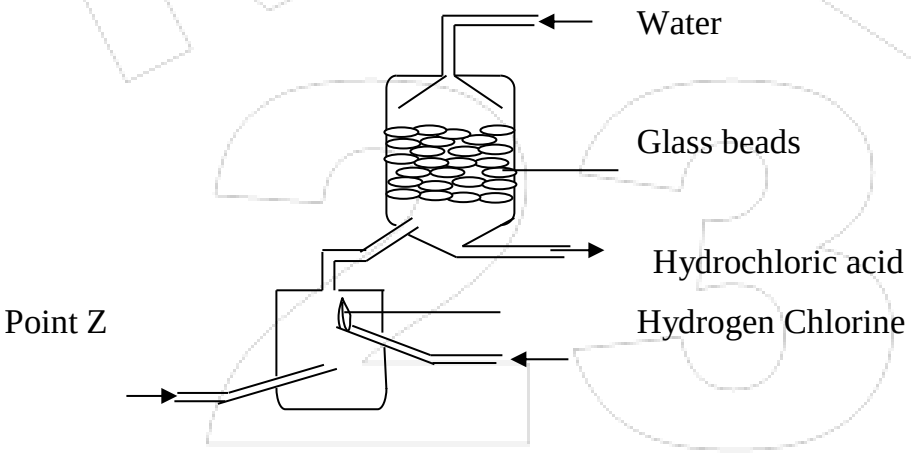
Elements	P	Q	R	S	T	U	V
Atomic number	11	12	13	14	15	16	17

a) In which period of the periodic table do these elements belong? **(1 mark)**

b) How does the atomics radius of P compared with that of U? **(2 marks)**

c) Which of these ions P^+ and Q^+ is more stable? Explain. **(1 ½ marks)**

21. The diagram below represents the industrial manufacture of hydrochloric acid, study it and answer the questions that follow.



a) Name one source of hydrogen and chlorine in this process.

Hydrogen **(1 mark)**

Chlorine **(1 mark)**

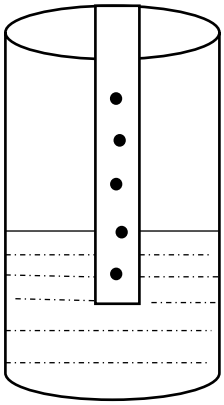
b) The reaction between chlorine and hydrogen can be explosive. How can this be avoided. **(1 mark)**

c) What is the role of glass beads in the absorption chamber? **(1 mark)**

d) Explain why copper reacts with concentrated nitric (v) acid but doesn't react with concentration hydrochloric acid. **(1 mark)**

22. Draw a well labelled diagram of an electrolytic cell that can be used to purify impure copper metal. **(2 marks)**

23. A mixture of phenolphthalein and methyl orange was separated as shown in the diagram.



a) Name the method used in the separation of the mixture. **(1 mark)**

b) State the colour of methyl orange in this experiment. **(1 mark)**

c) Phenolphthalein is usually colourless. Explain why it is pink in this experiment? **(1 mark)**

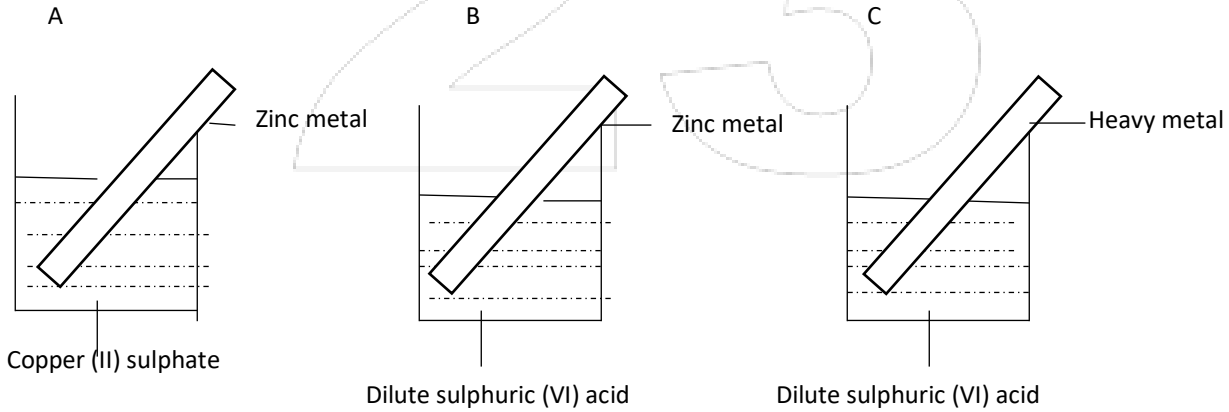
24. Calcium reacts with cold water. Explain two observations during the above reaction. **(2 marks)**

25. a) M grams of a radioactive isotope decayed to 5 grams in 100 days. The half life of the isotope is 25 day.

a) Define the term half life. **(1 mark)**

b) Calculate the initial mass of M of the radioactive isotope. **(2 marks)**

26 a) A student set up experiments as illustrated by the diagrams below. Before introducing each metal into the solution it was cleaned.



i) Why is it necessary to clean the metal pieces before introducing them into their respective beakers **(1 mark)**

ii) What observation were made immediately the metal pieces were introduced into the beakers A, B and C? **(3 marks)**

KCSE 2023 FINAL PREDICTION

EXPECTED EXAM 4

233/2

CHEMISTRY

PAPER 2 (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.*
- All working **must** be clearly shown where necessary.
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

*Answer **all** questions*

1. In an experiment of diluting concentrated sulphuric (vi) acid, 2 cm^3 of acid were carefully poured into a plastic cup containing exactly 40cm^3 of distilled water with a room temperature of 20^0c. the mixture was stirred with a thermometer; the highest temperature noted was 35^0c. (density of acid = 1.84g/cm^3 while that of solution is assumed to be 1g/cm^3. The acid is 98% pure, S.H.C. =4.2J/g/k H = I S = 32 O = 16)

a). i). Determine the number of moles of the acid that dissolved **(2 marks)**

ii). Determine the enthalpy change for the reaction. **(2marks)**

iii). Determine the enthalpy change when one more of the acid is dissolved in water. **(2 marks)**

b). use the information below to answer the questions that follow;

Equation	Enthalpy of formation
$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$	$DH_1 = -394KJMol^-$
$C_{(S)} + o_{2(g)} \rightarrow CO_{(g)}$	$DH_2 = -170KJMol^-$

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

b)Calculate the molar enthalpy of combustion :DH_3 of carbon (ii) oxide **(3marks)**

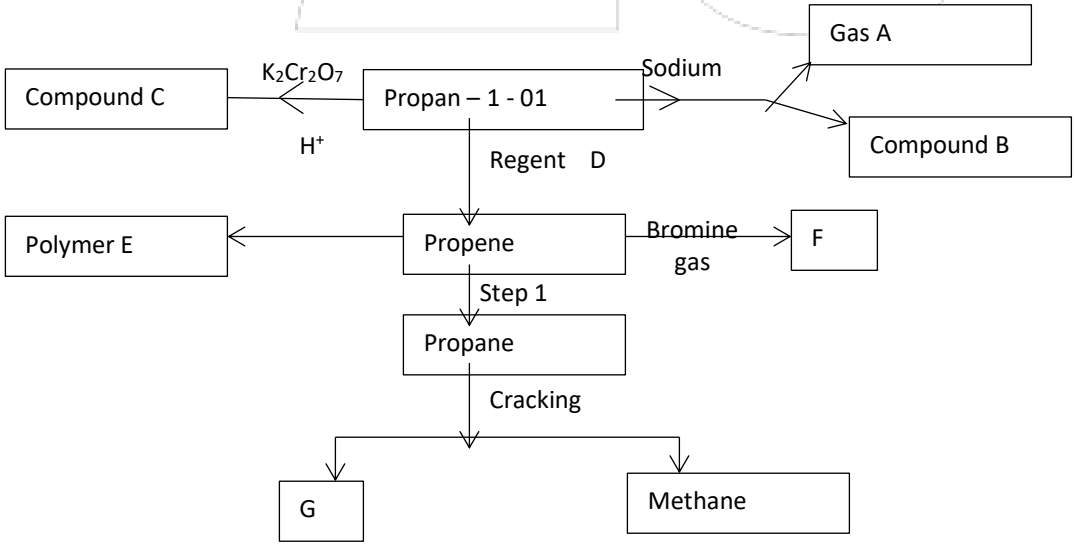
2. Name the following compounds **(3 marks)**

a) i). $CH_3CH_2CH_2OH$

ii). $CH_3\ CH_2\ CH_2\ COOH$

iii). $CH_3CH_2CH_2COOCH_2CH_3$

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



i. Identify product

A...... **(1 mark)**

F...... **(1 mark)**

ii. Name the compound C **(1 mark)**

iii. State the conditions for step 1 **(1 mark)**

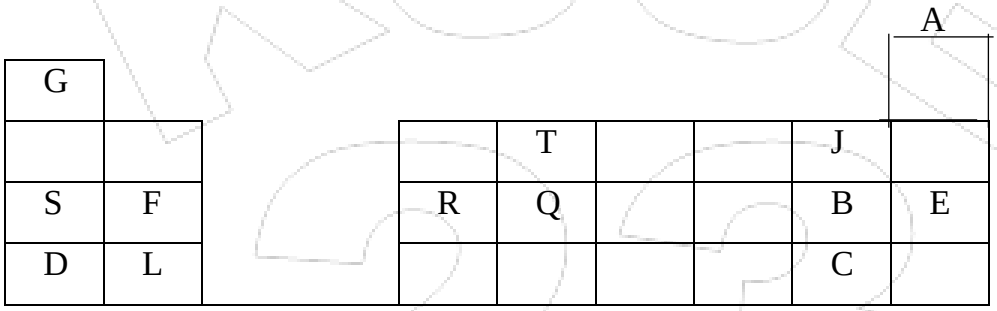
iv. Name the process leading to formation of compound C **(1 mark)**

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

vi. Identify reagent D. **(1 mark)**

vii. Draw the structure of F. **(1 mark)**

3. The grid below is a section of the periodic table (letters used are not actual symbol) use it to answer questions that follow.



i. Select the most electro-negative element. **(1 mark)**

ii. The boiling point of the oxide of Q is much higher than that of the oxide of T. Explain the difference **(2 marks)**

iii. Identify with a reason the chemical family to which F and L belong. **(2 marks)**

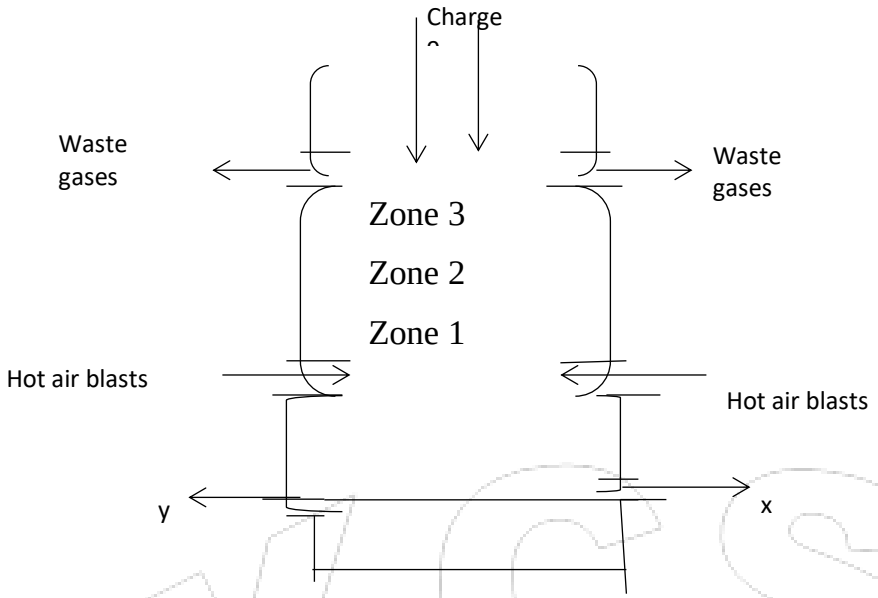
iv. Use dot (.) and cross (x) diagram to show bonding in the compound formed when F reacts with B. **(1 mark)**

v. State and explain the nature of chloride of R when it is dissolved in water to form an aqueous solution. **(2 marks)**

vi. Compare the atomic radius of elements D and L. **(2 marks)**

vii. The elements S and D belong to group I, which element is more reactive, explain. **(2 marks)**

4. The diagram below shows a blast furnace in the extraction of iron from haematite.



i. Name two other ores that can be used to extract iron. **(2marks)**

ii. Name the components of the charge (raw materials). **(1 marks)**

iii. Identify two components of the waste gases. **(1 marks)**

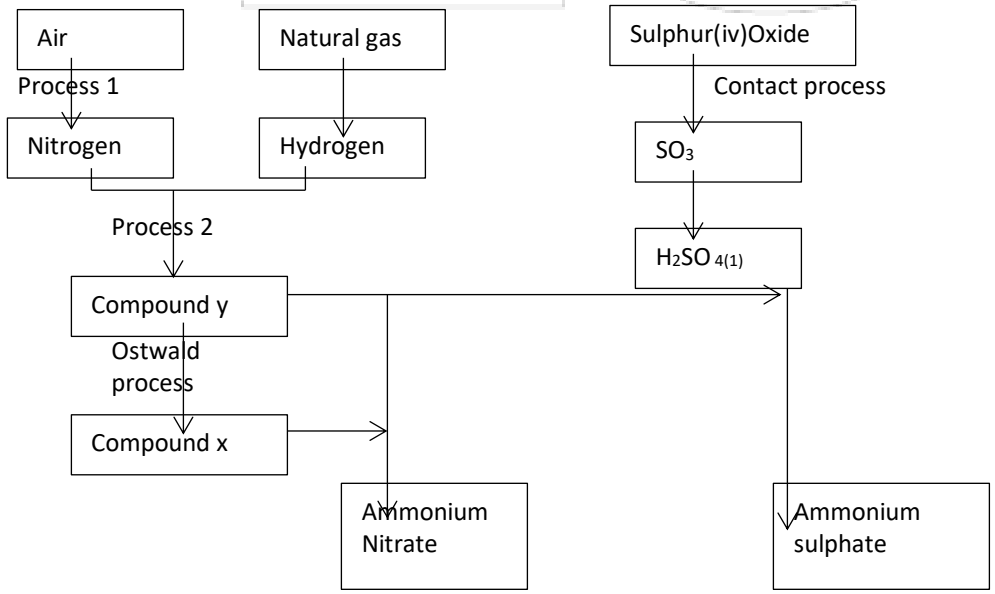
iv. Give the identity of X and Y. **(2 marks)**

v. Identify two reducing agents in the blast furnace. **(1 marks)**

vi. Write the chemical equation for the reduction of haematite to iron metal using the main reducing agent. **(1 mark)**

vii. Which zone is the hottest? Explain. **(1 marks)**

5. The flow chart below represents some industrial processes leading to the formation of two nitrogenous fertilizers.



a) Name the catalyst used in **(2 marks)**

i.a). Process 2

ii.b). Ostwald's process

b) Name each of compounds X and Y **(1 mark)**

X.....

Y.....

c) Other than the catalyst named in (b) above, state two optimum conditions for process labeled 2. **(1 mark)**

d) Briefly describe process 1 that leads to production of nitrogen from air. **(3 marks)**

e) Other than ammonium nitrate being used as a fertilizer name one other use **(1 marks)**

f) Ammonium nitrate and ammonium sulphate are used as fertilizers, one would you recommend to a farmer and why? show your working (N=14,O=16,S=32,H=1) **(3Marks)**

g) Write an equation for the formation of Sulphur(iv) oxide in contact process. **(1mark)**

h) Sulphur (iv) oxide is an acid anhydride of sulphuric vi acid, but in contact process Sulphur (iv) oxide is first dissolved in sulphuric (vi) acid. Explain why this is so. **(2marks)**

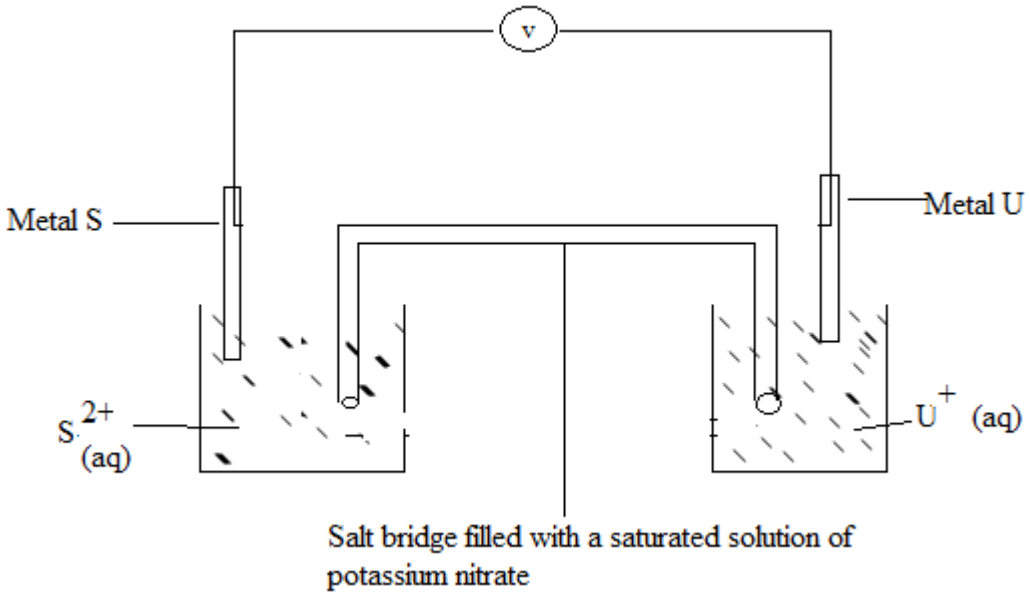
6. a) The table below gives standard electrode potentials for the metals represented by the letters R, S, T and U. study and answer the questions that follow.

METALS	Standard Electrode Potential (Volts)
R	- 0.34
S	- 0.85
T	+ 0.34
U	- 0.76

i.Identify the metal which is the strongest reducing agent **(1 mark)**

ii.Which metal can be displaced from a solution of its salts by all the other metals in the table? Give a reason **(2 marks)**

b. Metal S and U were connected to form a cell as shown in the diagram below.



i. Write the equation for the cell above **(1 mark)**

ii. Calculate the e.m.f, for the cell above **(1 mark)**

iii. On the diagram, indicate with an arrow the direction in which electrons would flow on the diagram above **(1 mark)**

iv. State one function of the salt bridge. **(1 mark)**

c. In an experiment to electroplate a copper spoon with silver, a current of 0.5 A was passed for 18 minutes.

i. Draw a well labeled diagram showing how the copper spoon was electroplated. **(2 marks)**

ii. Other than electroplating state one use of electrolysis **(1 mark)**

7. A group of form four students of Cockelbet Secondary School carried out an experiment to determine the solubility of potassium chlorate. The table below shows the results obtained.

Total volume of water added(cm3)	10.0	20.0	30.0	40.0	50.0
Mass of $KClO_3$(g)	5.0 5.0	5.0	5.0	5.0	
Temperature at which crystals appear(0C)	80.0	65.0	55.0	45.0	30.0

Solubility of $KClO_3$(g/100gH2O)

(a) Complete the table to show the solubility of KClO3 at different temperatures**. (3marks)**

(b) Plot a graph of mass of KClO3 per 100g water against temperature at which crystals form. **(3marks)**

(c) From the graph, determine ;

(i) The solubility of $KClO_3$ at 40oC. **(1mark)**

(ii) The temperature at which the solubility of KClO3 is 35g/100g water. **(1mark)**

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

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

f) In an experiment soap solution was added to three separate samples of water. The table below shows the volumes of soap solution required to form lather with 100cm^3 of each sample of water before and after heating/boiling

SAMPLE	A	B	C
Volume of soap before water is boiled in (cm^3)	30	4	12
Volume of soap after water is boiled in (cm^3)	30	4	4

I) Which water sample is likely to be soft. Explain **2Marks)**

II) Explain the change in the volume of soap solution used in sample C **(1Mark)**

THIS IS THE LAST PRINTED PAGE

KCSE 2023 FINAL PREDICTION

EXPECTED EXAM 5

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
	80	

*Answer **all** questions*

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)***

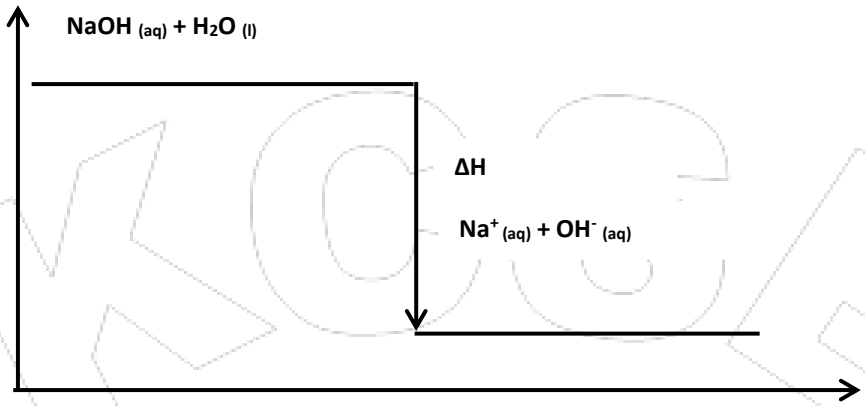
7. (a) State Boyles Law. ***(1 mark)***

(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)***

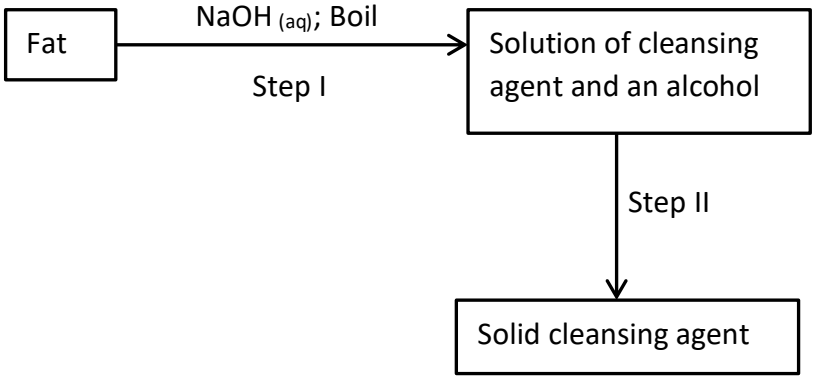
10. Magnesium chloride dissolves in water to form a neutral solution while aluminium (III) chloride forms an acidic solution. Explain. ***(3 marks)***

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.

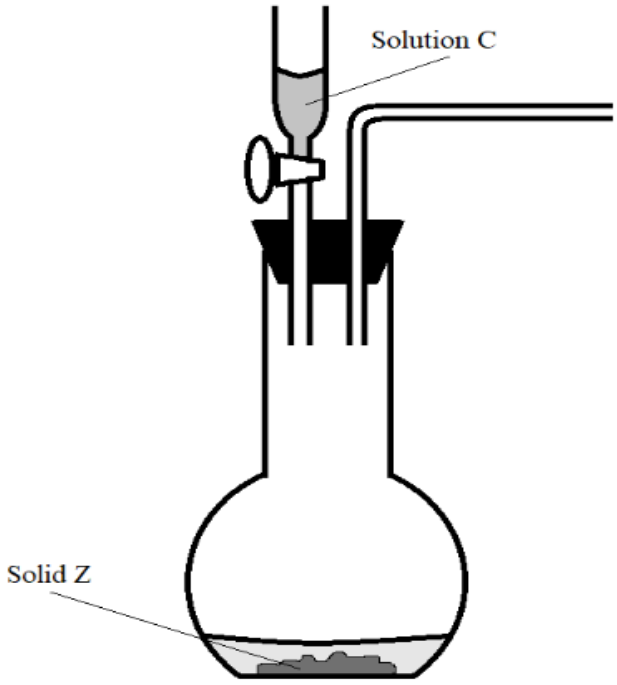


(a) What name is given to the type of cleansing agent prepared by the method shown in the scheme? ***(1 mark)***

(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)

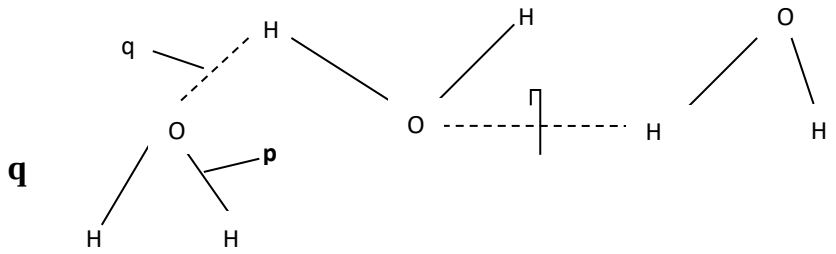
(a) What is meant by a dynamic equilibrium? ***(1 mark)***

(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)***

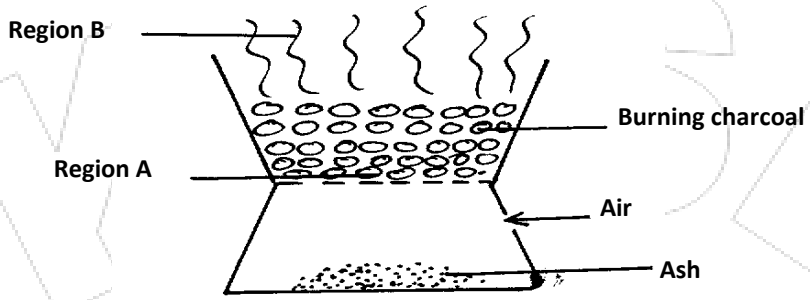
(b) Identify the type of bonds represented by **p** and **q** in the substances below.



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.

Formula of oxides	Na_2O	MgO	Al_2O_3	S_iO_2	P_4O_{10}	SO_2
Melting point (^0O)	1190	3080	3050	1730	560	-73

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

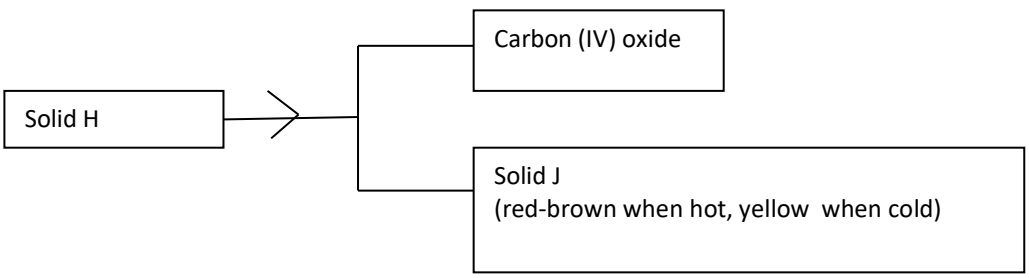
(b) Write the equation for the reaction between Al_2O_3 with;

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

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

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

N



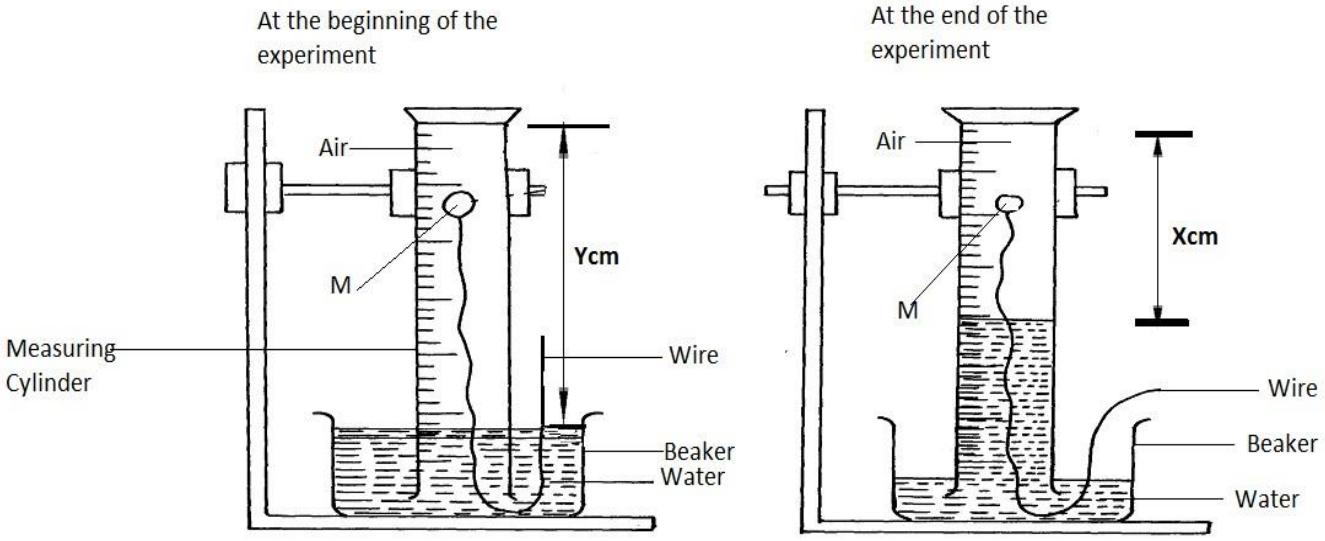
(a) Identify **process N**. ***(1 mark)***

(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)***

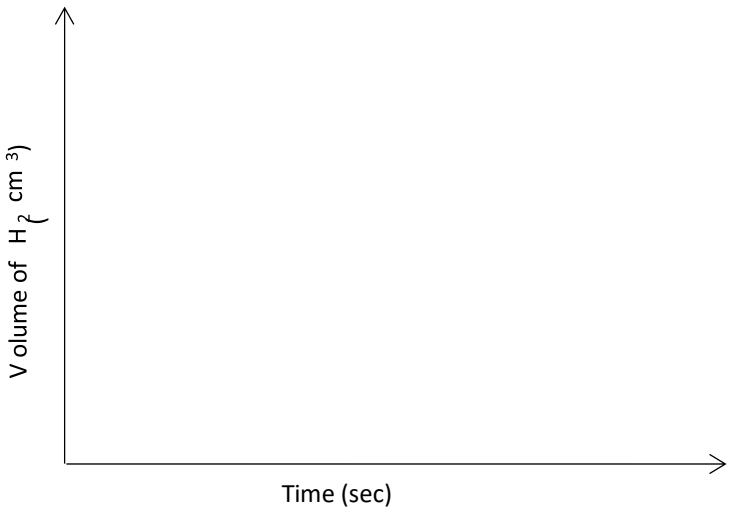
(c) Write the equation for the reaction of substance **M** and the active part of air ***(1 mark)***

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.

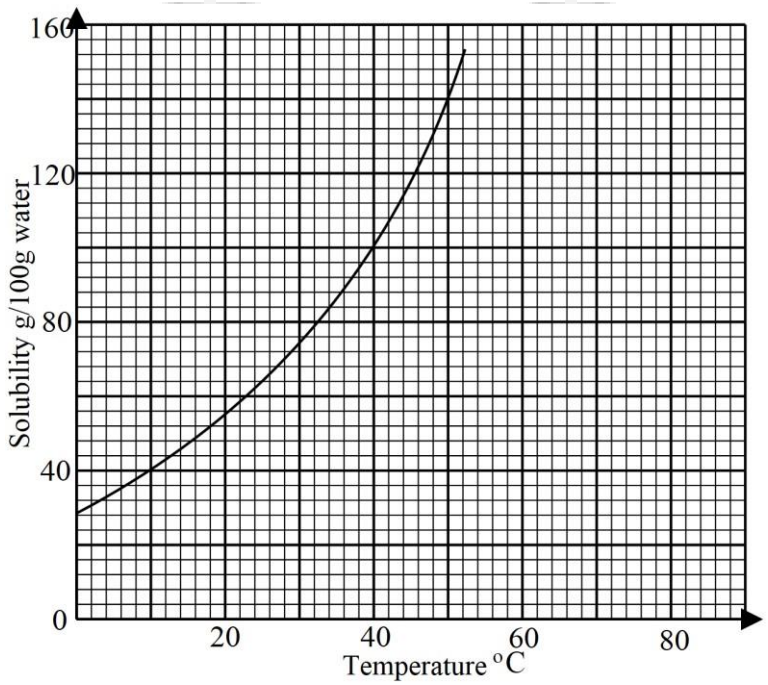
(3 marks)



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	Energy (kJ/Mol)
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.

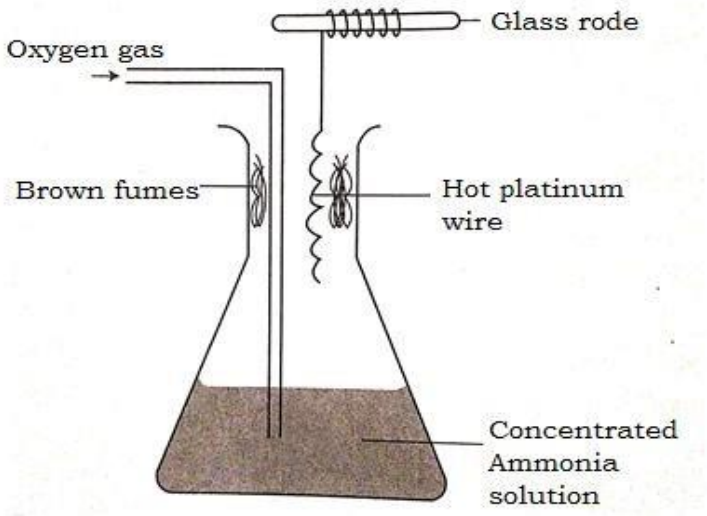
Nitrate of	Products formed
J	Metal oxide + Nitrogen (IV) oxide + Oxygen
Y	Metal + Nitrogen (IV) oxide + Oxygen
W	Metal nitrite + Oxygen

(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)***

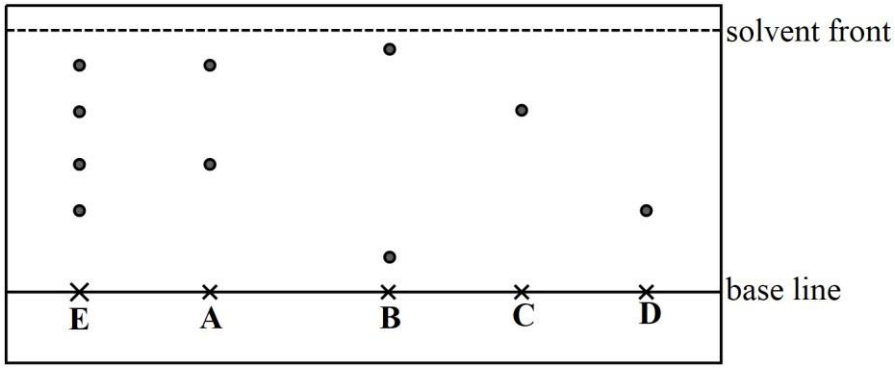
27. Use the set up below to answer the questions that follow.



(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 2023 FINAL PREDICTION

EXPECTED EXAM 5

233/2

CHEMISTRY

PAPER 2 (THEORY)
TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

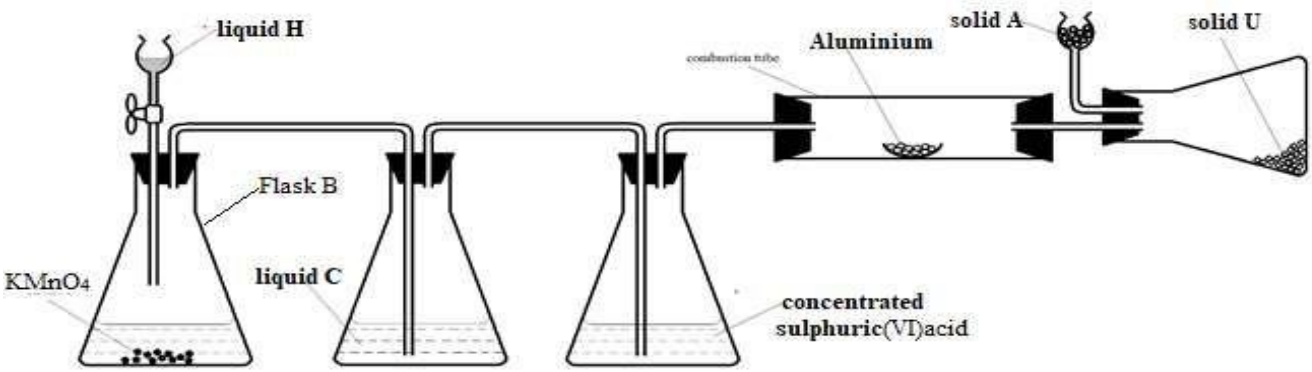
- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- All working **must** be clearly shown where necessary.
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All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

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

*Answer **all** questions*

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



(a) i) Suggest a suitable reagent that can be used as **solid A** *(1 mark)*

ii) Name liquids **C** and **H.** *(2 marks)*

iii) Write a balanced chemical equation for the reaction in conical flask **B** *(1 mark)*

iv) Explain why **solid U** collects further away from aluminium metal *(1 mark)*

(b) During a class experiment, chlorine gas was bubbled into a solution of potassium iodide.

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

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

(c) Write a balanced chemical equation for the reaction between hot concentrated sodium hydroxide and chlorine gas. *(1 mark)*

(d) Explain the difference in bleaching by chlorine and bleaching by sulphur (IV) oxide gas. *(2 marks)*

(e) Describe how to test for the presence of chloride ions in a water sample *(2 marks)*

2. **(a)** Give the systematic name of the following organic compound:

i) $CH_3CH(CH_3)CH(OH)CH_3$ *(1 mark)*

ii) $CHC(CH_2)_2CH_3$ *(1 mark)*

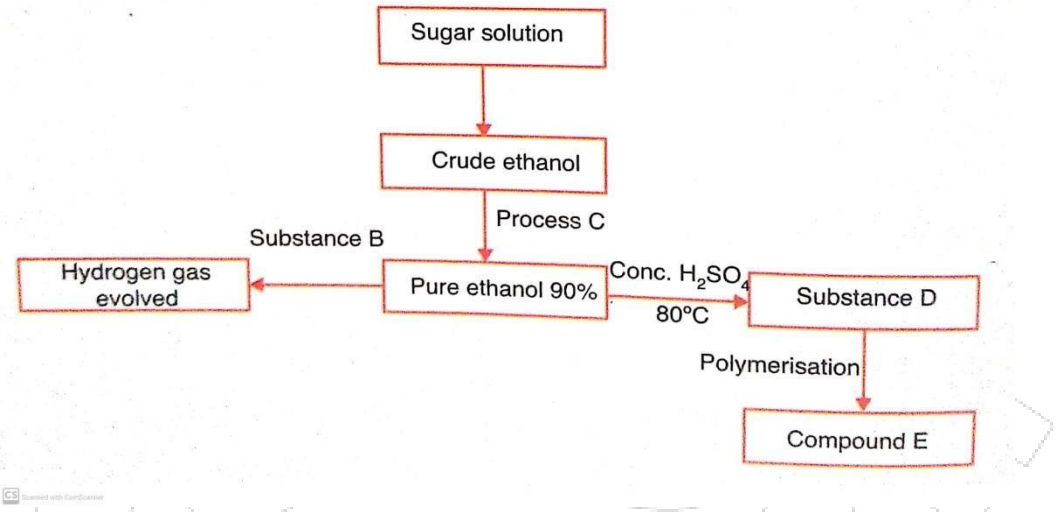
(b) The following tests were carried out on some organic compound Q. Study the information in the table and use it to answer the questions that follow.

Test	Observation
i) Three drops of acidified potassium manganate (vii) was added to Q	The acidified potassium manganate (vii) was decolourised
(ii) Universal indicator solution was added to Q	pH 6

i) Identify the functional group of the organic compound Q. ***(1 mark)***

ii) Draw the structural formula of the first member of the homologous series in which the organic compound Q belongs. ***(1 mark)***

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



Give the name of:

I. Substance B …… ***(1 mark)***

II. Substance D …….. ***(1 mark)***

III. Compound E …….. ***(1 mark)***

(d) Explain the effect of continued use of the polymer E on the environment. ***(2 marks)***

(e) Describe the role of sugar solution in the scheme above. ***(2 marks)***

(f) Give two commercial uses of ethanol other than the manufacture of alcoholic drinks. ***(2 marks)***

3. The figure below represents a section of the periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbol of the element.

B								
C	L		D	E				
H	J							

(a) Give the chemical family to which element J belongs to. ***(1 mark)***

(b) Compare the reactivity of elements C and H. Explain your answer. ***(2 marks)***

(c) Give one property of elements found in the shaded region. ***(1 mark)***

(d) Write the chemical formula of the chloride of D. ***(1 mark)***

(e) i) Name the type of structure of the chloride in (d) above. ***(1 mark)***

ii) Identify the bonds that exist in the compound in (d) above. ***(1 mark)***

iii) Using dots and crosses to represent the valence electrons show the bonding in the compound formed in (d) above. ***(2 marks)***

(f) State and explain the difference in atomic and ionic radius of element W. ***(2 marks)***

(g) Give one observation made when element C is placed in water. ***(1 mark)***

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

(b) The table below gives standard reduction potentials for some half cells.

Half-cell	Half-cell equation	E^{θ} /V
I	$Cr^{3+}(aq) + e^- \rightarrow Cr^{2+}(aq)$	-0.41
II	$Cd^{2+}(aq) + 2e^- \rightarrow Cd(s)$	-0.40
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	$Br_2(aq) + 2e^- \rightarrow 2Br^-(aq)$	+1.07
VII	$2H^+(aq) + 2e^- \rightarrow H_2(g)$	0.00
VIII	$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$	-0.44V
IX	$O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$	+0.40V
X	$H_2O_2(aq) + 2H^+(aq) + 2e^- \rightarrow 2H_2O(l)$	+1.23V

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

I. The strongest oxidizing agent.

II. The strongest reducing agent.

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

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

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

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

vi) Give one reason why electroplating is necessary. ***(1 mark)***

5. In an experiment to determine the heat of combustion of compound **X**, a pupil used heat from the burning compound of **X** to heat 100cm^3 of water in a beaker. He obtained the following results:

Volume of water in the beaker = 100cm^3

Initial temperature of water = 17°C

Final temperature of water = 42^{0}C

Initial mass of burner + compound X = 10.5g

Final mass of burner + compound X = 10.2g.

(a) Determine the mass of the compound burnt. ***(1 mark)***

(b) Calculate the rise in temperature. ***(1 mark)***

(c) Determine the amount of heat produced by the compound. ***(2 marks)***

(specific heat capacity 4200Jg^{-1}K^{-1}, density of H_2O = 1g/cm^3)

(d) Calculate the molar heat of combustion of **compound X** (R.M.M. of X = 256) ***(2 marks)***

(e) Use the following thermochemical equations below to answer the questions that follow.

$C_2H_{6\,(g)} + {}^7/_2\ O_{2\,(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{\,(s)}$ ΔH_1, = -1560kJmol^{-1}

$C_{\,(graphite)} + O_{2(g)} \rightarrow CO_{2\,(g)}$ ΔH_2 = - 394 kJ mol^{-1}

$H_{2\,(g)} + ½\ O_{2(g)} \rightarrow H_2O_{(l)}$ ΔH_3 = - 286 kJ mol^{-1}

i) Calculate the molar enthalpy of formation of C_2H_6. ***(2 marks)***

ii) Draw an energy level diagram for the reaction represented by the first equation above. ***(3 marks)***

6. **(a)** Define nuclear fission. ***(1 mark)***

(b) State two similarities between nuclear fission and nuclear fusion. ***(2 marks)***

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

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

(i) Plot a graph of activity against time. ***(3 marks)***

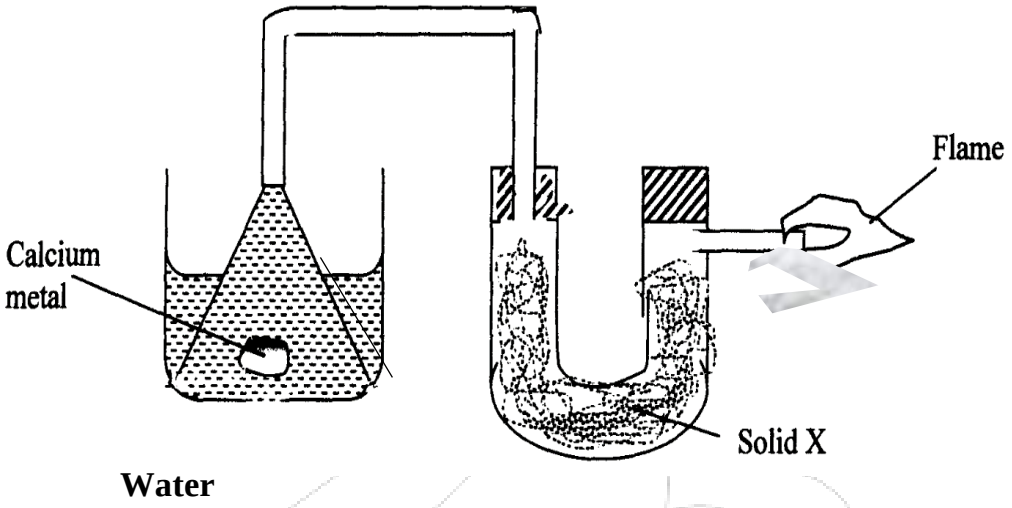
(i) From the graph, determine:

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

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

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

7. (a) The setup below was used to investigate the reaction between metals and water.



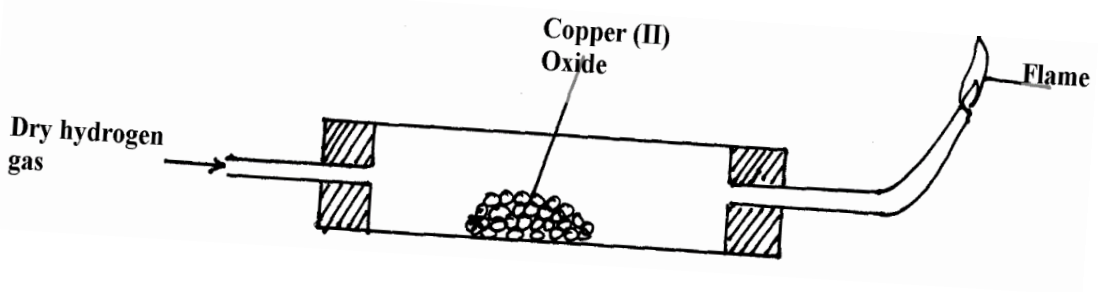
i) Identify solid **X** and state its purpose.

Solid X …… ***(½ mark)***

Purpose …… ***(½ mark)***

ii) Write a chemical equation for the reaction that produces the flame. ***(1 mark)***

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



i) On the diagram, indicate what should be done for the reaction to occur. ***(1 mark)***

ii) Hydrogen gas is allowed to pass through the tube for some time before it is lit. Explain. ***(1 mark)***

iii) Write an equation for the reaction that occurs in the combustion tube. ***(1 mark)***

iv) When the reaction is complete, hydrogen gas is passed through the apparatus until it cools down. Explain. ***(2 marks)***

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

vi) What observation confirms the property stated in (**v)** above? ***(1 mark)***

vii) Why is zinc oxide not used to investigate this property of hydrogen gas? ***(2 marks)***

KCSE 23

KCSE 2023 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
	80	

*Answer **all** questions*

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)**

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)**

10. Describe the correct process of heating a liquid in a test-tube using a bunsen burner. **(3marks)**

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)**

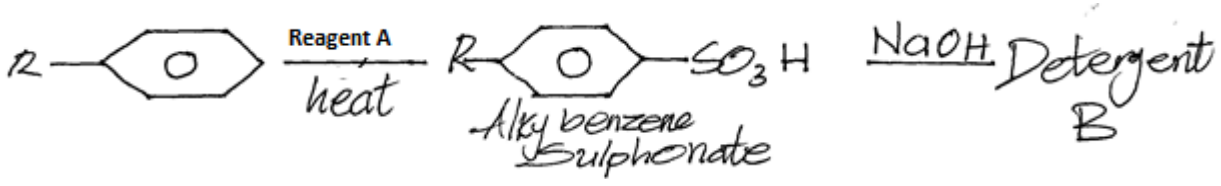
13.a) Define hydration energy **(1mark)**

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

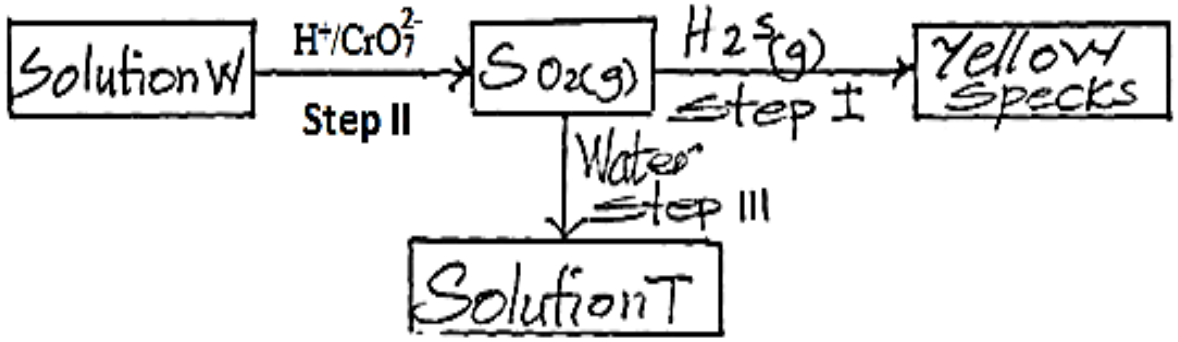


a) What type of detergent is B **(1mark)**

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

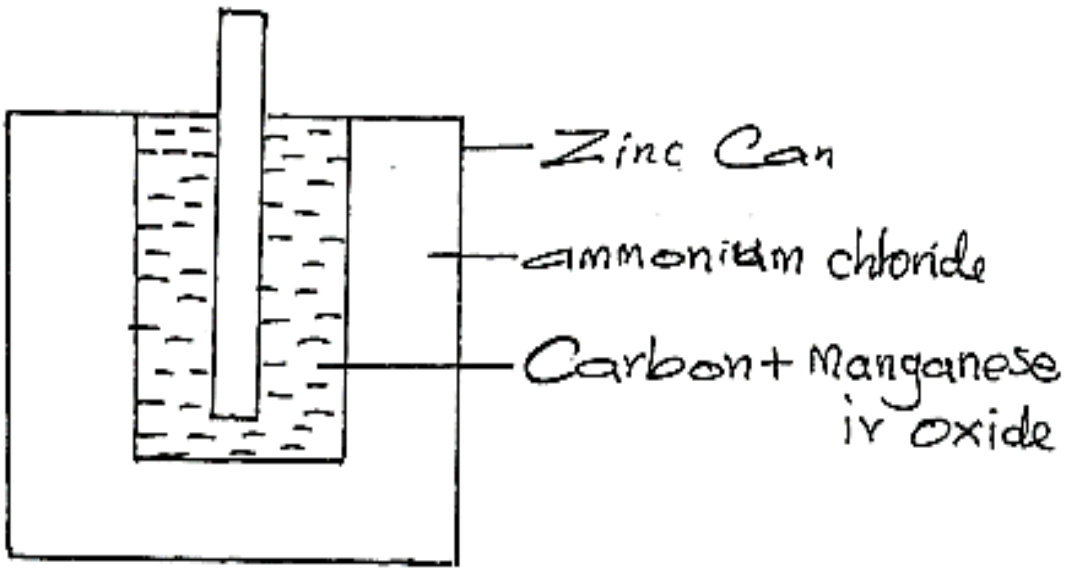


a) Explain the observation in step II **(1mark)**

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					Q			
Z	W		X					

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)**

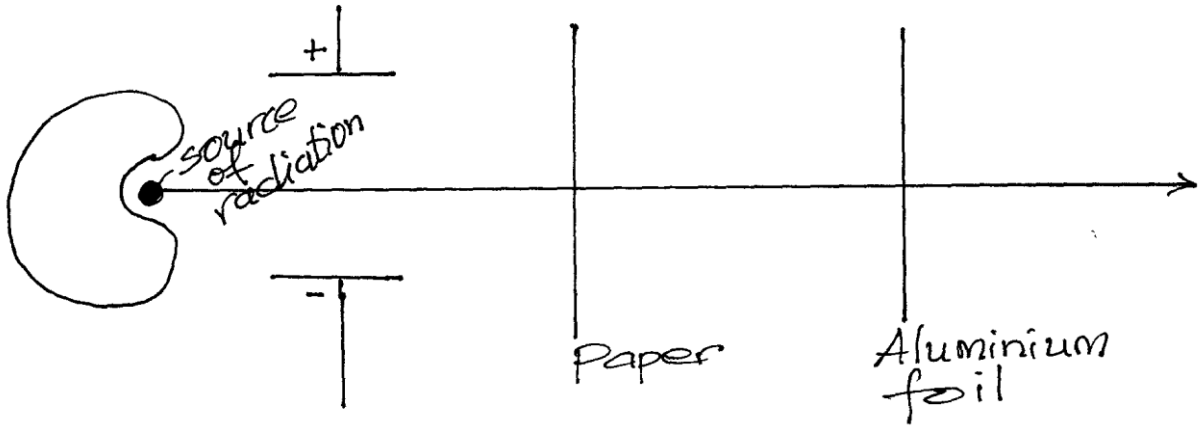
21. When excess chlorine gas is bubbled through diluted sodium hydroxide solution; the resulting solution act as a bleaching agent

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)**

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^{o}C to 32.0^{o}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

Sample	Test	observation
A	ddition of NaOH solution drop wise until in excess	White precipitate souble in exess
B	Adding of $NH_{3(aq)}$ solution	White precipitate
C	Addition of dilute HNO_3 followed by $Ba(NO_3)_2$	White 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)**

THIS IS THE LAST PRINTED PAGE!

KCSE 2023 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

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

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

*Answer **all** questions*

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.

G							
					I		V
K							
J	L		M				

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)**

Element	Formula of chloride	Nature of chloride solution
L		
M		

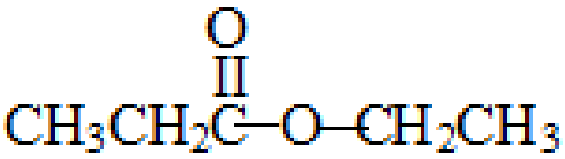
III) The chloride of element M vaporizes easily while its oxide has a high melting point. Explain (2marks)

IV) Which elements forms a trivalent:

a) Cation **(½mark)**

b) Anion **(½mark)**

2.i) The following is a structure of an organic compound.



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)**

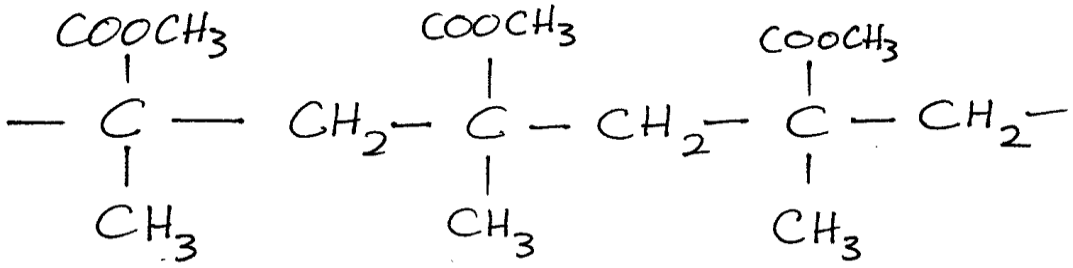
b) Compare the boiling points of compound E and A **(2marks)**

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)**

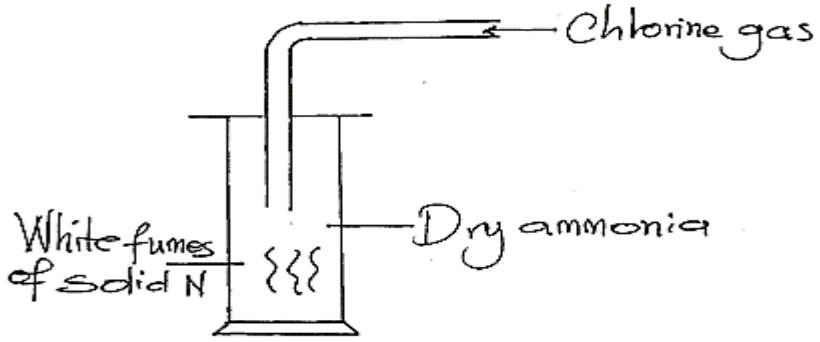
i) P –

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)
$A^{2+}_{(aq)} + 2e^-$	-2.90
$B^{(2+)}_{(aq)} + 2e^-$	-2.38
$C^{+}_{(aq)} + e^-$	0.00
$D^{2+}_{(aq)} + 2e^-$	-0.34
$\frac{1}{2}F_{2(g)} + e^-$	$+2.87$

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)**

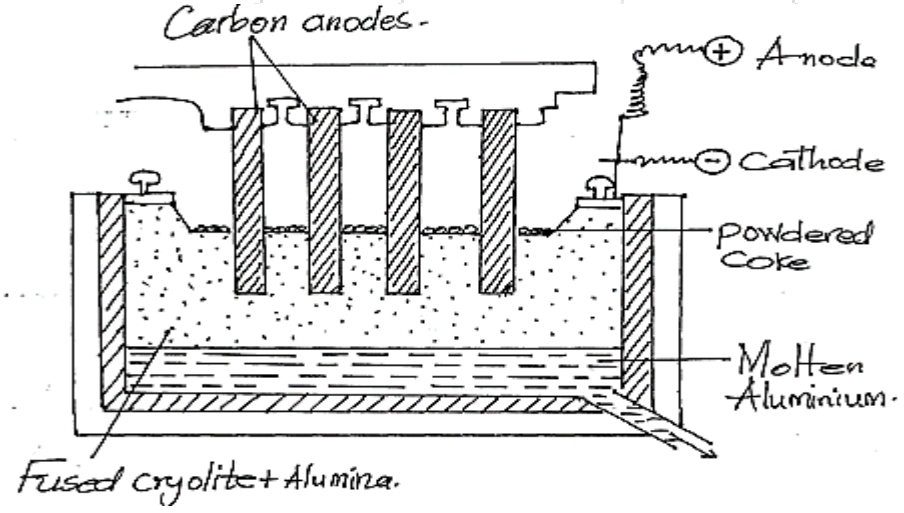
IV) Calculate the E^o value of the electrochemical cell constructed in (III) above **(1mark)**

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

particle	$^{22}_{10}Ne$	$^{21}_{10}Ne$	$^{20}_{10}Ne$
% Abundance	9.2	0.3	90.5

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.

Time (min)	0	6	12	22	38	62	100
mass of Bismuth remaining (g)	50	41.5	32.5	23	14.5	6	1.5

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)**

d) State one application of radio isotopes in agriculture **(1mark**

KCSE 2023 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 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
	80	

*Answer **all** questions*

1. a) A hydrocarbon consists of 92.3% carbon. Its molecular mass is 26. Calculate it's Molecular formula. **(2 marks)**

b) Draw the structure of the hydrocarbon. **(1 mark)**

2. a) Explain why melting point of chlorine gas is greater than that of Argon. **(l mark)**

b) Using dot(•) and cross (×) to represent electrons draw a diagram to show bonding in carbon (iv) oxide. **(l mark)**

c) In terms of structure and bonding. Explain why Graphite is used as a lubricant. **(1 mark)**

3. a) What is observed when a few drops of phenolphthalein indicator is added to a solution whose pH value is 3.0? **(l mark)**

b) Write an equation for the reaction between Lead (ii) oxide and dilute Nitric acid. **(l mark)**

4. State and explain the observation that would be made when zinc powder is heated with copper (II) oxide. **(2 marks)**

5. Why is it dangerous to run a motor car engine in a closed garage? **(2 marks)**

6. 2 grams of sodium hydroxide is added to 30 cm3 of IM sulphuric (VI) acid. What volume of 0. 1M potassium hydroxide solution will be needed to neutralize the excess acid. (Na23,016,H1) **(3 marks)**

7. An aqueous solution of hydrogen chloride gas reacts with manganese (IV) oxide to form chlorine gas while a solution of hydrogen chloride gas in methylbenzene does not react with manganese (iv) oxide. Explain **(2 marks)**

8. A small piece of potassium Manganate (VII) was placed in a glass of water and was left standing for 6 hrs without shaking. State and explain the observations made. **(2 marks)**

9. Magnessium reacts with both dilute and concentrated sulphuric (VI) acid. Write a balanced equation for the two reactions**.** **(2 marks)**

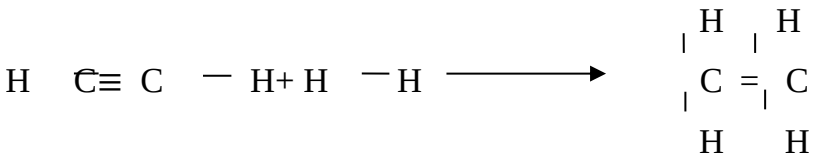
10. The table below gives the atomic numbers of elements **W, X, Y** and **Z**.

Element	W	X	y	Z
Atomic number	14	17	16	19

a) Name the type of bonding that exists in the compound formed when **X** and **Z** reacts. **(1 mark)**

b) Select the letter representing the strongest reducing agent. Give a reason for your answer. **(2 marks)**

11. Ethyne reacts with hydrogen as shown below



Use the bond energies below to calculate the enthalpy changes for the above reaction. **(3 marks)**

BOND	ENERGY
H-H	435
C-H	413
C ≡ C	835
C=C	611

12. a) Explain the role of common salt in defrosting ice on roads in ice cold countries. **(1 mark)**

b) Explain why the long term effects of use of common salt is costly to motorists. **(1 mark)**

13. Given the equation below

$NH_{3(aq)} + H_2O_{(l)} \rightarrow NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$

Identify the species that acts as;

i) A base. Explain **(1 mark)**

ii) An acid. **(½ mark)**

14. a) State Grahams law of diffusion**.** **(1mark)**

b) The rate of diffusion of sulphur(IV)oxide gas through a porous material is 40cm3s $^{-1}$.

Calculate the rate of diffusion of carbon(IV)oxide gas through the same porous material *(S=32,O=16,C=12)* **(2 marks)**

15. 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 **(3 marks)**

16. The production of ammonia is given by the equation

$$3H2\,(g) + N_2(g) \rightleftharpoons 2NH_3\,(g);\ \Delta H = -ve$$

(i) State and explain the effect of addition of dilute hydrochloride acid on equilibrium. **(2 marks)**

(ii) Explain the effect of increase in temperature on the yield of ammonia. **(2 marks)**

17. $Cr_2O_7^{2-} + 14\ H^+\ (aq) + 6Fe^{2+} \rightarrow Cr_2^{3+} + 7H_2O(l) + 6Fe^{3+}$.

The above equation show a redox reaction

(a) Calculate the oxidation state of chromium in $Cr_2O_7^{2-}$ **(2 marks)**

(b) What is the role of H^+ in the above reaction. **(1 mark)**

18. a) Define the standard heat of formation. **(1 mark)**

b) Draw energy cycle diagram to show how the standard heat of formation of ethanol (C_2H_5OH) can be determined from standard heats of combustion of its elements**. (2 marks)**

c) Given that $\Delta H_C(C) = -393 kJmole^{-1}$, $\Delta H_C(H_2) = -286 kJmole^{-1}$ and $\Delta H_C(C_2H_5OH) = -1368 kJmole^{-1}$. Calculate the enthalpy of formation of C_2H_5OH. **(2 marks)**

19. 3.78g of a hydrated salt of iron (II) sulphate, $FeSO_4$, in H_2O were heated until all the water of crystallization was driven off. The anhydrous salt left had a mass of 1.52g. Determine the formula of the hydrated salt. (Fe = 56, S = 32, H = 1, O = 16) **(3 marks)**

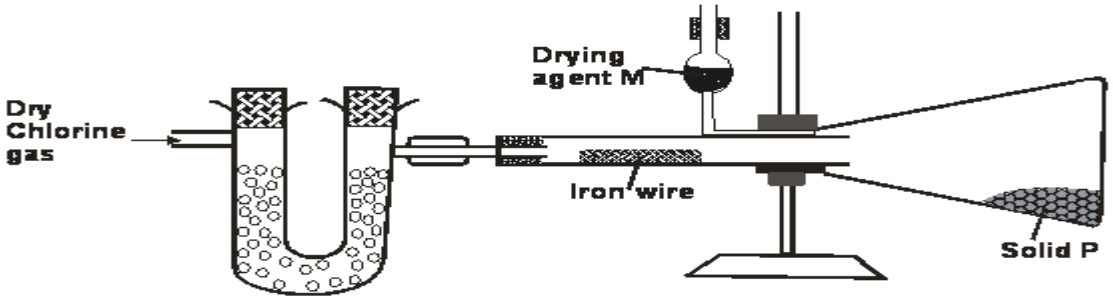
20. A steady current of 0.2 Amperes was passed through molten silver bromide for 80 minutes.

a) Calculate the quantity of electricity that passed through the set up. **(1 mark)**

b) Calculate the mass of product deposited at the cathode. (1F = 96500C; Ag = 108, Br = 80) **(2 marks)**

c) If a sample of cobalt has an activity of 1000 counts per minute, determine the time it would take for its activity to decrease to 62.50 if the half-life of the element is 30 minutes. **(2 marks)**

21. The apparatus set up below was used to prepare an anhydrous solid P



a) Write an equation for formation of solid P **(1 mark)**

b) Suppose the gas used in the set up was dry hydrogen chloride gas; what would be the product obtained after the reaction? Give a reason for your answer. **(1 mark)**

22. Aluminium is obtained from the ore with the formula $Al_2O_3.2H_2O$. The ore is first heated and refined to obtain pure aluminium oxide (Al_2O_3). The oxide is then electrolysed to get Aluminium and oxygen gas using carbon anodes and carbon as cathode.

a) Give the common name of the ore from where aluminium is extracted from**. (½ mark)**

b) What would be the importance of heating the ore first before refining it? **(1 mark)**

c) The refined ore has to be dissolved in cryolite first before electrolysis. Why is this necessary? **(1 mark)**

d) Why are the carbon anodes replaced every now and then in the cell for electrolysing aluminium oxide? **(1 mark)**

23. Use the cell representation below to answer the questions that follow

$V(s) / V^{3+}(aq) // Fe^{2+}(aq) / Fe(s)$

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

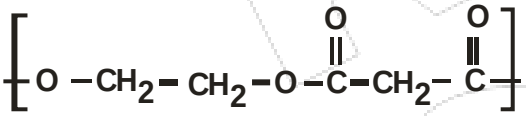
ii. If the E.M.F of the cell is 0.30 volts and the E^{θ} value for $V^{3+}aq / V(s)$ is -0.74V, calculate the E^{θ} of $Fe^{2+}(aq)/ Fe(s)$ **(2 marks)**

24. When $50cm^3$ 1M potassium hydroxide was reacted with $50cm^3$ of 1M hydrochloric acid, the temperature rose by 8^0C. When the same volume of Potassium hydroxide was reacted with $50cm^3$ of 1M Pentanoic acid, the temperature rose by 3^0C.

i) Give reasons for the above difference in temperature. **(2 marks)**

ii) Write an equation to show dissociation of pentanoic acid? **(1 mark)**

25. The following is structural formula of polyester.



a) Draw the structural formula and name the alkanoic acid and alkanol that react to form the polymer. **(2 marks)**

b) Give **one** use of polyester. **(1 mark)**

26. A heavy metal P was dissolved in dilute nitric acid to form a solution of compound $P(NO_3)_2$. Portions of the resulting solution were treated as follows:

a) To the first portion a solution of dilute hydrochloric acid is added, where a white precipitate (S) is formed, which dissolves on warming.

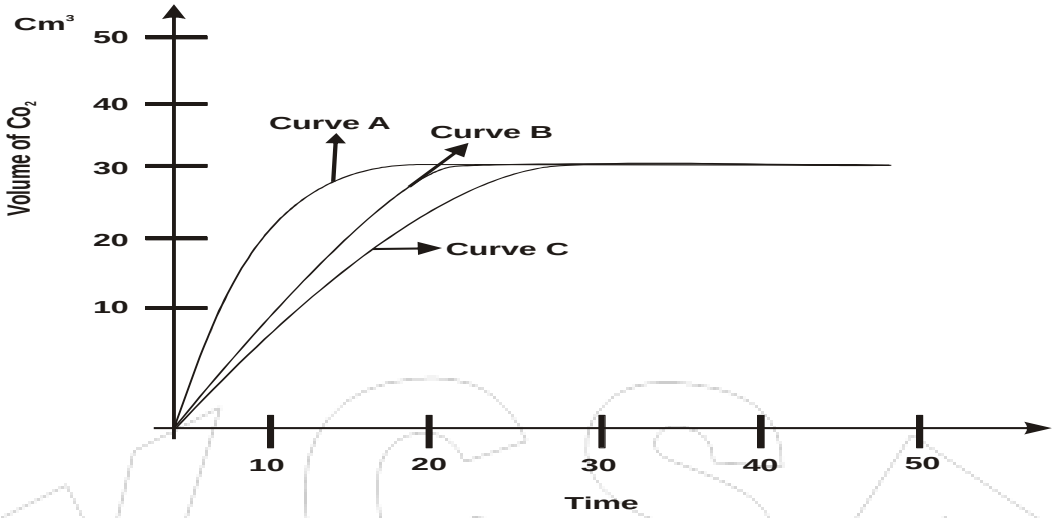
b) The second portion is treated with two drops of 2M Sodium hydroxide solution where a white precipitate T is formed. The white precipitate dissolved in excess sodium hydroxide to form a colourless solution.

c) A solution of potassium iodide is added to the third portion where a yellow precipitate (U) is formed.

d) When the resulting solution is evaporated to dryness and heated strongly a yellow solid (V) is formed and a brown gas (W) and a colourless gas (X) are formed.

i. Identify the substances P, S, T, U, V, W. **(3 marks)**

27. The graphs below were drawn when 15g of marble chips in different physical states were reacted with 50cm^3 of 2M Hydrochloric acid. They are drawn by measuring the volume of carbon (iv) oxide produced with time.



a) Which curves corresponds to the reactions involving powdered calcium carbonate and large sized marble chips with the dilute acid?

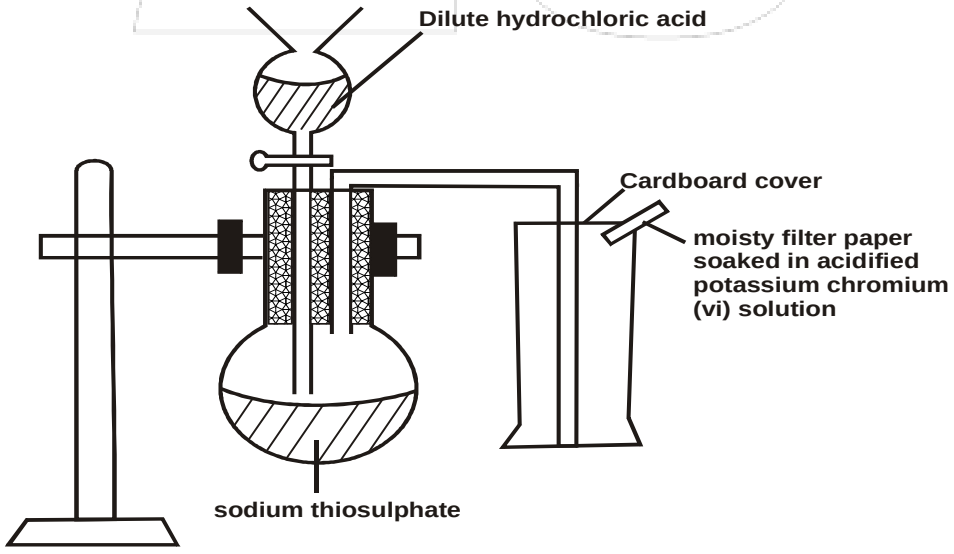
(i) Powdered calcium carbonate **(½ mark)**

(ii) Large sized calcium carbonate **(½ mark)**

b) All the graphs eventually flatten out at the same level but at different time. Why do the graphs flatten out at the same level? **(1 mark)**

c) Why is curve A very steep at any given point compared to the other curves. **(1 mark)**

28. Sodium thiosulphate was reacted with dilute hydrochloric acid in a round bottomed flask as shown below. The gas evolved was collected by downward delivery in a gas jar.



a) Write an equation to show the reaction going on in the reaction in vessel. **(1 mark)**

b) State the observation noted on the filter paper. Give a reason for your answer. **(1 mark)**

c) Give a reason why the filter paper soaked in the acidified potassium chromium (VI) is used at the top of the flask **(1 mark)**

KCSE 23

KCSE 2023 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 TO CANDIDATES

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

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

*Answer **all** questions*

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

E									**F**
G	**D**				**K**		**N**		
			W		**T**			**M**	
R	**Q**						**Y**		

a) i) Which letter represents an element that is least reactive? **(1 mark)**

ii) Why are elements D and Q referred to alkali earth metals? **(1 mark)**

b) How does the atomic radius of W and T compare? Explain. **(2 marks)**

c) Select **two** letters representing elements that would react most explosively. **(2 mark)**

d) Write the equation showing how Y forms its ion. **(1 mark)**

e) Write the formula of:-

i) Chloride of D. **(½ mark)**

ii) Nitrate of W. **(½ mark)**

f) What type of bonding exists between;

i) G and N. **(½ mark)**

ii) K and Y. **(½ mark)**

g) Explain why melting point of Y is higher than N. **(1 mark)**

h) The 1st, 2nd and 3rd ionization energies (in KJ/mol) of elements G and R are given below.

lement	st I.E	nd I.E	rd I.E
G	520	7,300	9,500
R	420	3,100	4,800

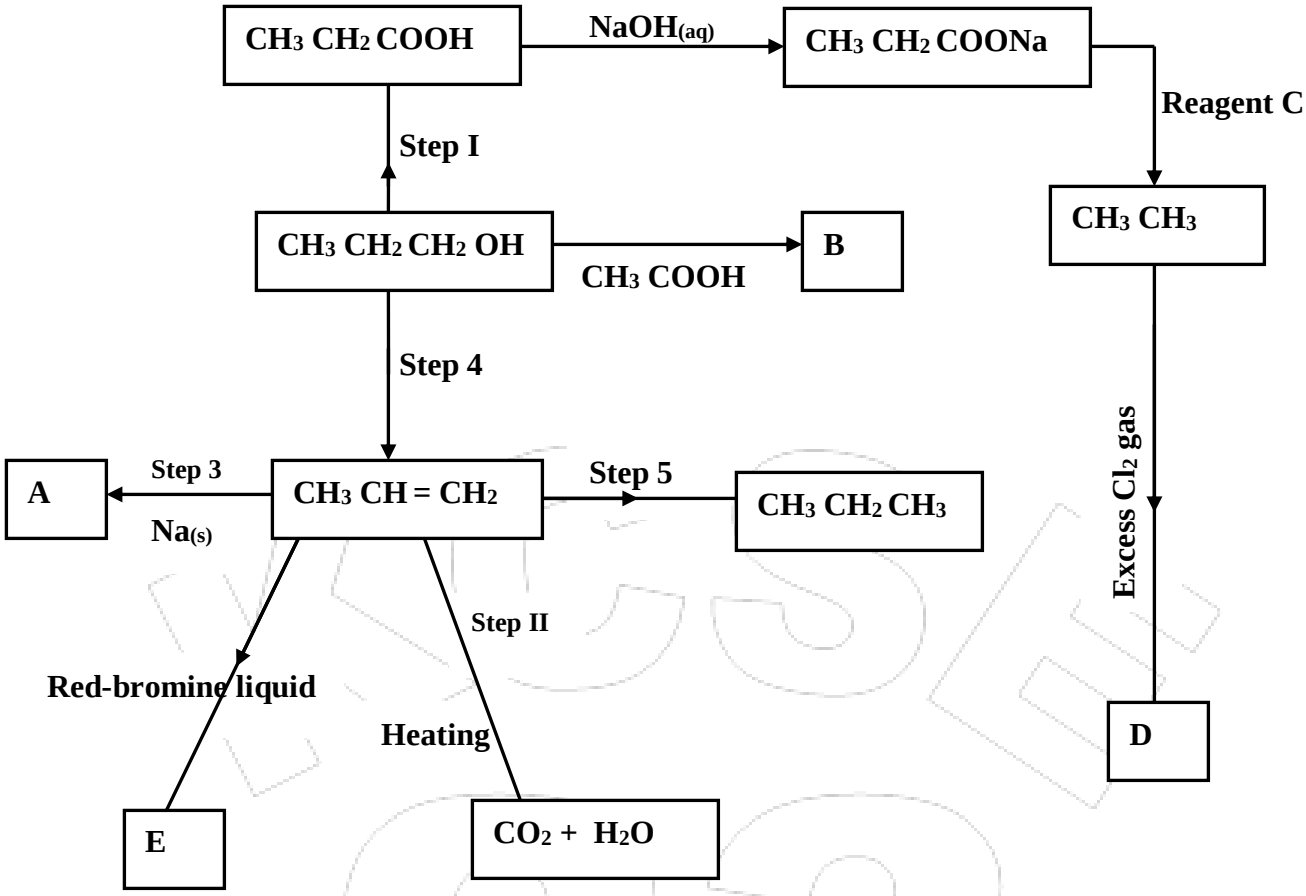
i) Define the term ionization energy. **(1 mark)**

ii) Apart from the decrease in energy levels, explain the big difference between 1st and 2nd ionization energies. **(1 mark)**

iii) Calculate the amount of energy in KJ/mol for the process. **(1 mark)**

$R_{(g)} \longrightarrow R^{3+}_{(g)} + 3e^-$

2. I. The scheme below shows some organic reactions. Study it carefully and answer the questions that follow.



a) Write the formula of compounds. (2 marks)

i) B

ii) A

b) Name the type of reaction, reagent and conditions for the reactions of the following steps.

i) Step 1: **(2 marks)**

Type……

Reagent……

ii) Step 4: **(2 marks)**

Type……

Reagent……

iii) Step 5: **(2 marks)**

Type……

Reagent

c) Name reagent C.

d) Draw and name the structural formula of D. **(2 marks)**

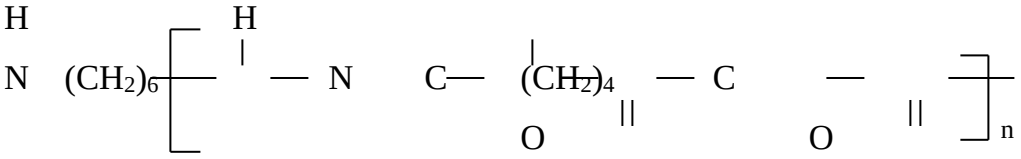
e) Name the structure E. **(1 mark)**

f) Give **one** property of compound B. **(1 mark)**

II. Polymers and fibres are either synthetic or natural.

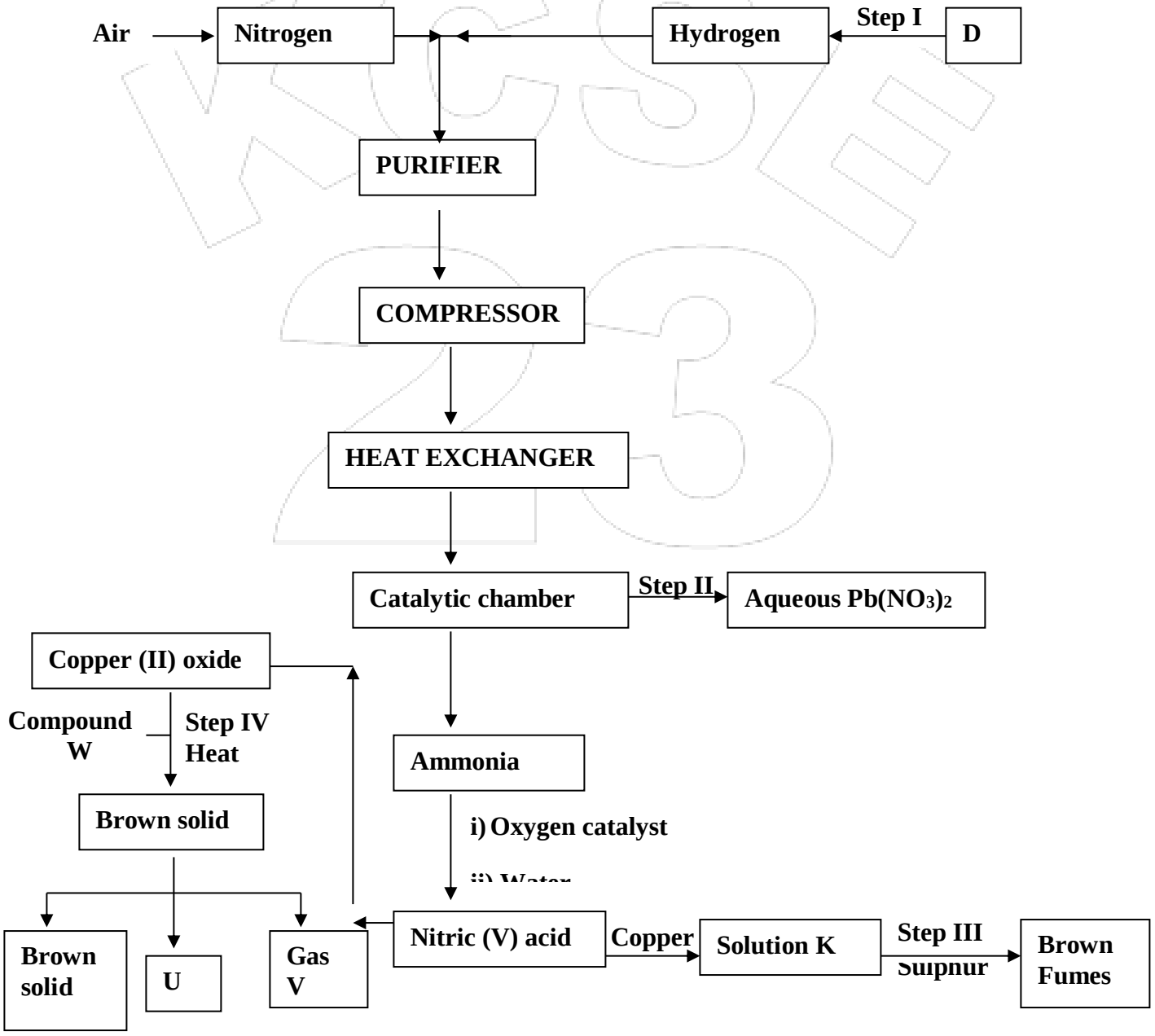
i) Give **two** examples of synthetic fibres and polymers. **(1 mark)**

ii) A polymer is formed whose formula is;



Draw the structural formula of the monomers. (2 marks)

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



a) Name the impurities removed by the purifier. **(2 marks)**

b) What is the work of the heat exchanger? **(1 mark)**

c) Write down the chemical equation for the reaction taking place where Nitric (V) acid is formed. **(1 mark)**

d) Name;

i) Compound W. **(1 mark)**

ii) Substance U. **(1 mark)**

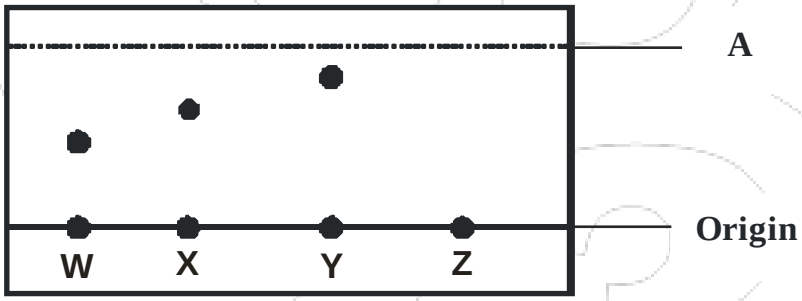
iii) Gas V. **(1 mark)**

e) Write down the formula of compound P. **(1 mark)**

f) Other than manufacture of ammonia write down **one** other use of Nitrogen. **(1 mark)**

g) Calculate the mass of Nitrogen in 6.6g of Ammonium Sulphate. (H = 1, S = 32, O = **16). (2 marks)**

4. The diagram below represents a paper chromatogram of pure substances W, X, Y and Z.



a) Name A. **(1 mark)**

b) Explain why substance Y moves faster from origin than X. **(1 mark)**

c) Explain the observation made on substance Z in the chromatogram. **(1 mark)**

d) The relationship between pressure and volume of a fixed mass of a gas was studied at 25°C. The data was recorded as shown in table below.

Volume (dm^3)	0.5	1	2	3
Pressure (atmosphere)	6	3	1.5	1
Product of volume and pressure				

i) Complete the table by calculating the products of volume and pressure. (2 marks)

ii) Using the data comment on the relationship between volume and pressure of fixed mass of gas at constant temperature. (1 mark)

e) Use the information below to answer the questions that follow.

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H_1 = -393.5\ Kj/mol^{-1}$

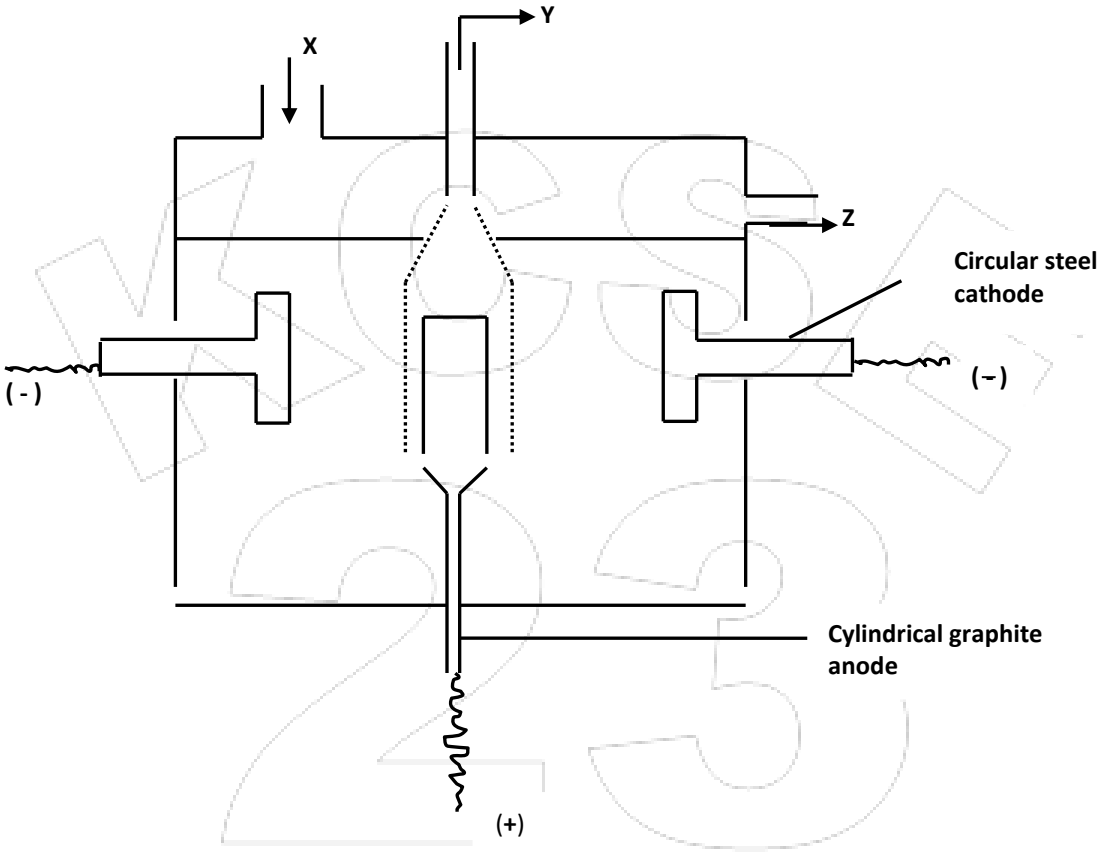
$H_{2(g)} + ½\ O_{2\ (g)} \longrightarrow H_2O_{(g)}$ $\Delta H_2 = -285.8\ Kj/mol^{-1}$

$C_2H_5OH_{\ (l)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(l)}$ $\Delta H_3 = -1370\ Kj/mol^{-1}$

i) Define the term heat of formation. **(1 mark)**

ii) Calculate the heat of formation of ethanol. **(3 marks)**

5. a) Sodium is extracted in the Downcell shown below.



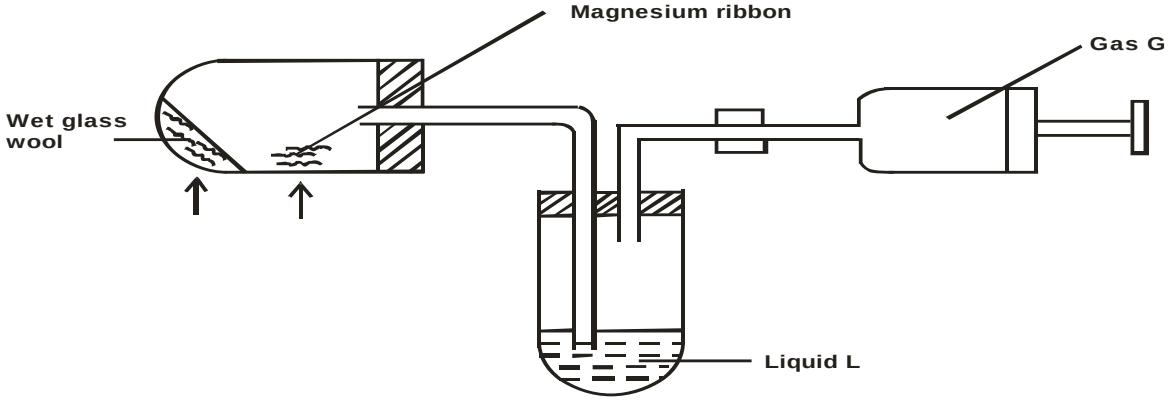
i) Name Y. **(1 mark)**

ii) Down's cell must operate at high temperature of about 600°C. Explain. **(2 marks)**

iii) Explain why anode is made of graphite instead of steel though it's a better conductor.(**1 mark)**

iv) State the purpose of steel diaphragm. **(1 mark)**

b) The set up below was used to prepare and collect dry sample of gas G. During the experiment, cleaned magnesium ribbon was strongly heated before heating the wet glass wool.



i) Why was the magnesium ribbon cleaned before it was used? (1 mark)

ii) State the observations that would be noted in the reaction tube. (1 mark)

iii) Name;

a) Gas G. (1 mark)

b) Suitable liquid L. (1 mark)

iv) Write equation of reaction in the reaction tube. (1 mark)

6. I) Study the standard electrode potential below and answer the questions that follow.

The letters are not the actual symbols of the elements.

$M^{2+}_{(aq)} + 2e^- \longrightarrow M_{(s)}$ $E^\theta = -0.76V$

$N^{2+}_{(aq)} + 2e^- \longrightarrow N_{(s)}$ $E^\theta = -2.37V$

$2P^+ + 2e^- \longrightarrow 2P_{(s)}$ $E^\theta = +0.80V$

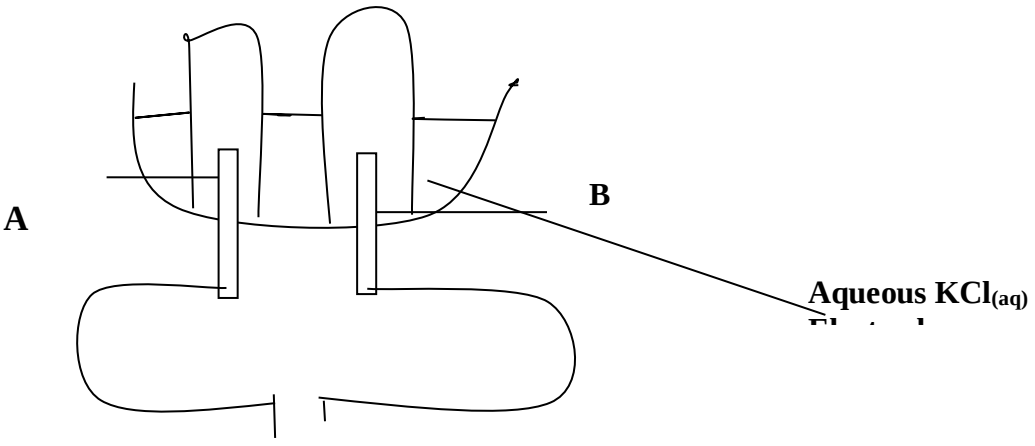
$R^{2+} + 2e^- \longrightarrow R_{(s)}$ $E^\theta = -0.14V$

a) The standard electrode potential of Fe^{2+} is -0.44 volts. Select the element which would be best to protect iron from rusting. (1 mark)

b) i) Calculate the E^θ value for cell represented as $M_{(s)} / M^{2+}_{(aq)} // P^+_{(aq)} + P_{(s)}$. (2 marks)

ii) Draw the electrochemical cell represented in b(i) above. (2 marks)

II) The diagram below represents an experiment by a student using electrodes A and B.



a) Name the products at the electrodes. **(1 mark)**

b) Write equation of reaction at each electrode. **(1 mark)**

III) During purification of copper by electrolysis, 1.48g of copper was deposited when a current was passed through aqueous copper (II) sulphate for 2½ hours. Calculate the amount of current that was passed. Cu = 63.5 and 1 Faraday = 96500C. **(3 marks)**

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

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

Temp ^oC	0	8	20	40	60	80
Solubility in g/100g of the H_2O	254	225	140	80	25	10

i) Plot a graph of solubility in g/100g of water of copper (II) sulphate against temperature. **(4 marks)**

ii) From the graph,

a) How does the solubility of Copper (II) sulphate vary with temperature? **(1 mark)**

b) Determine solubility of Copper (II) sulphate in g/100g water at 35°C. **(1 mark)**

iii) If 30g of Copper (II) sulphate are dissolved in 100g of water at 30°C, is the resulting solution saturated, supersaturated or unsaturated. **(1 mark)**

iv) A saturated solution of copper (II) sulphate is cooled from 70°C to 20°C.

a) Should the mass of copper (II) sulphate be reduced or increased for the solution to remain saturated. **(1 mark)**

b) Determine the mass in (iv) (a) above. **(2 marks)**

KCSE 2023 FINAL PREDICTION

EXPECTED EXAM 8

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

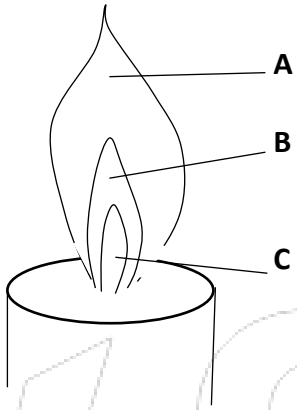
QUESTIONS	MAXIMUM SCORE	STUDENTS SCORE
	80	

*Answer **all** questions*

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

(2 marks)

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)**

(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)**

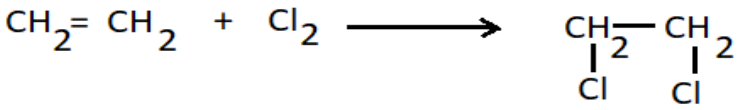
b) Write an equation showing how lime is slaked. **(1 mark)**

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

4. The following is a list of bond energies.

Bond	Energy kJ/mol
C – C	348
C = C	612
Cl Cl	242
C Cl	338

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



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)**

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

Substance	M.P (°C)	Solubility in water	Electrical conductivity	
			Solid	Liquid
D	3700	Insoluble	Non conductor	Non-conductor
E	801	Soluble	Non conductor	Conductor
F	1083	Insoluble	Conducts	Conducts

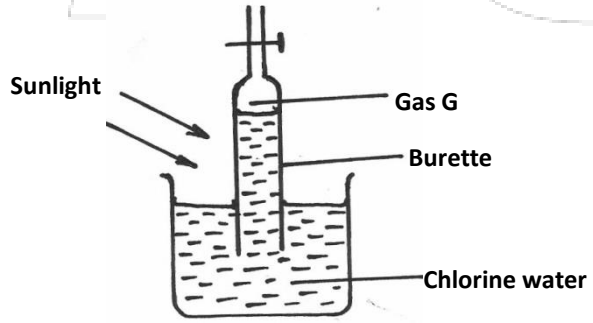
Identify the substance that has ;

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

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

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

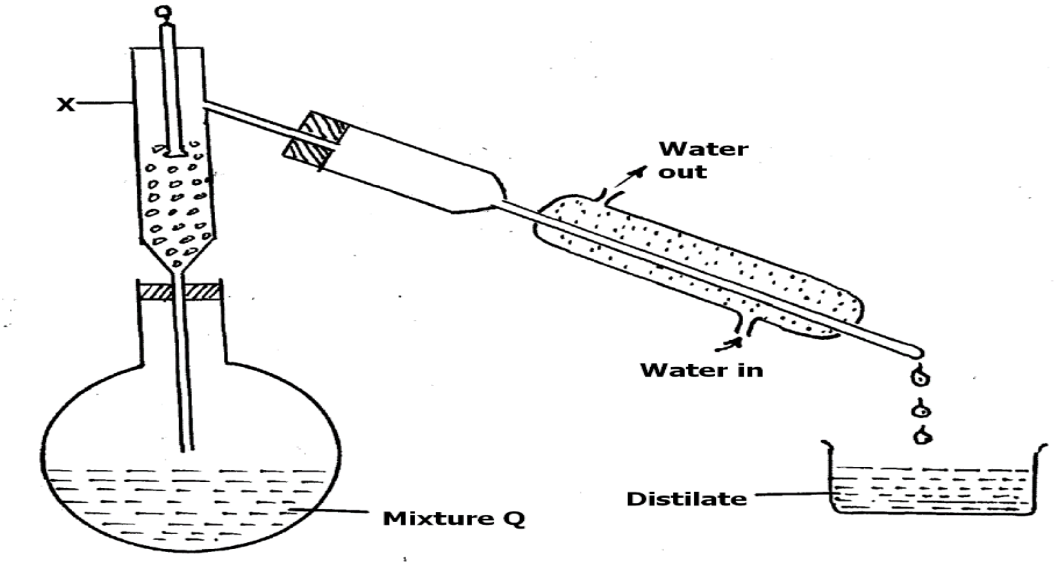
7. An experiment was set up using chlorine water as shown below;



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

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

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)**

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

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

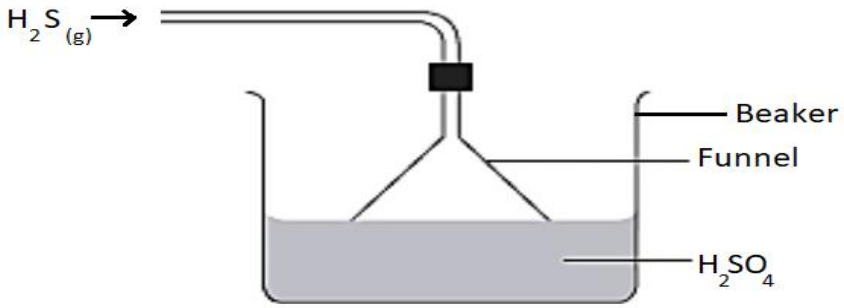
J - ……

L - ……

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

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)**

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



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

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

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

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

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)**

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)**

GAS	SUITABLE DRYING AGENT
Ammonia	
Hydrogen 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)**

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.

Gas	Density	Effect on H_2SO_4	Effect on NaOH
W	Lighter than air	React to form salt	Dissolve without reacting
Y	Heavier than air	Not affected	Not affected

(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)**

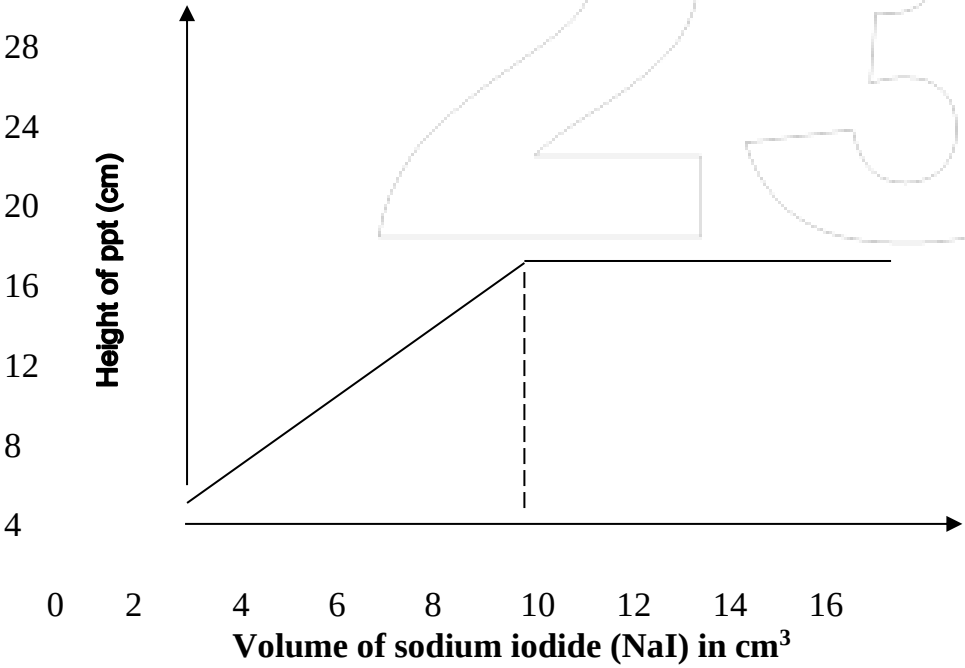
(b) The table below gives the rate of decay of a radioactive element Z.

Number of days	Mass 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)**

THIS IS THE LAST PRINTED PAGE.

KCSE 23

KCSE 2023 FINAL PREDICTION

EXPECTED EXAM 8

233/2

CHEMISTRY

PAPER 2 (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.*
- All working **must** be clearly shown where necessary.
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

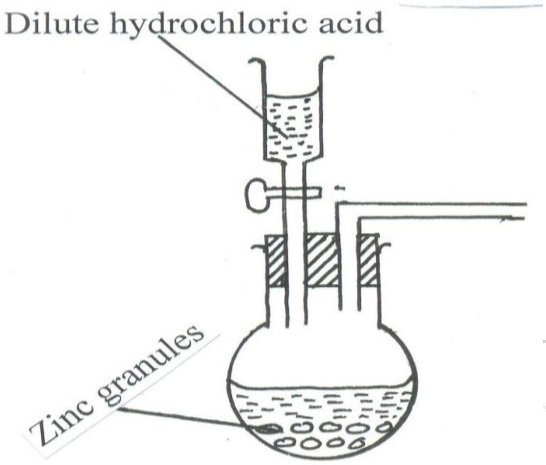
FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

*Answer **all** questions*

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 mrks)**

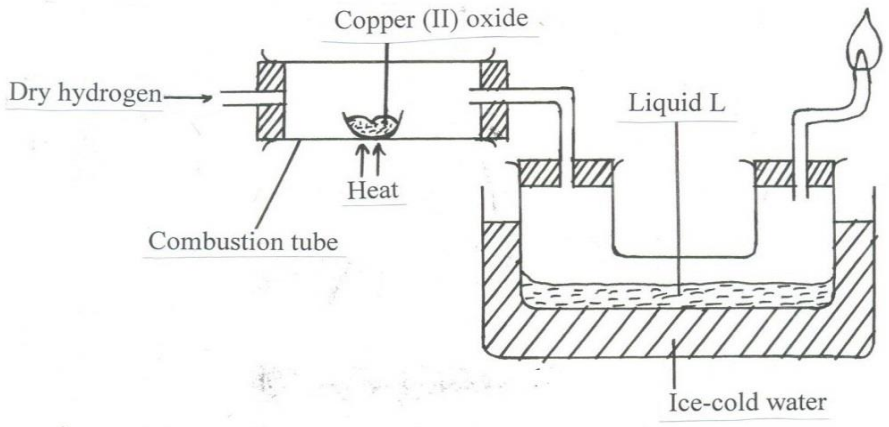


(b) Write the chemical equation for above reaction. **(1 mark)**

(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)**

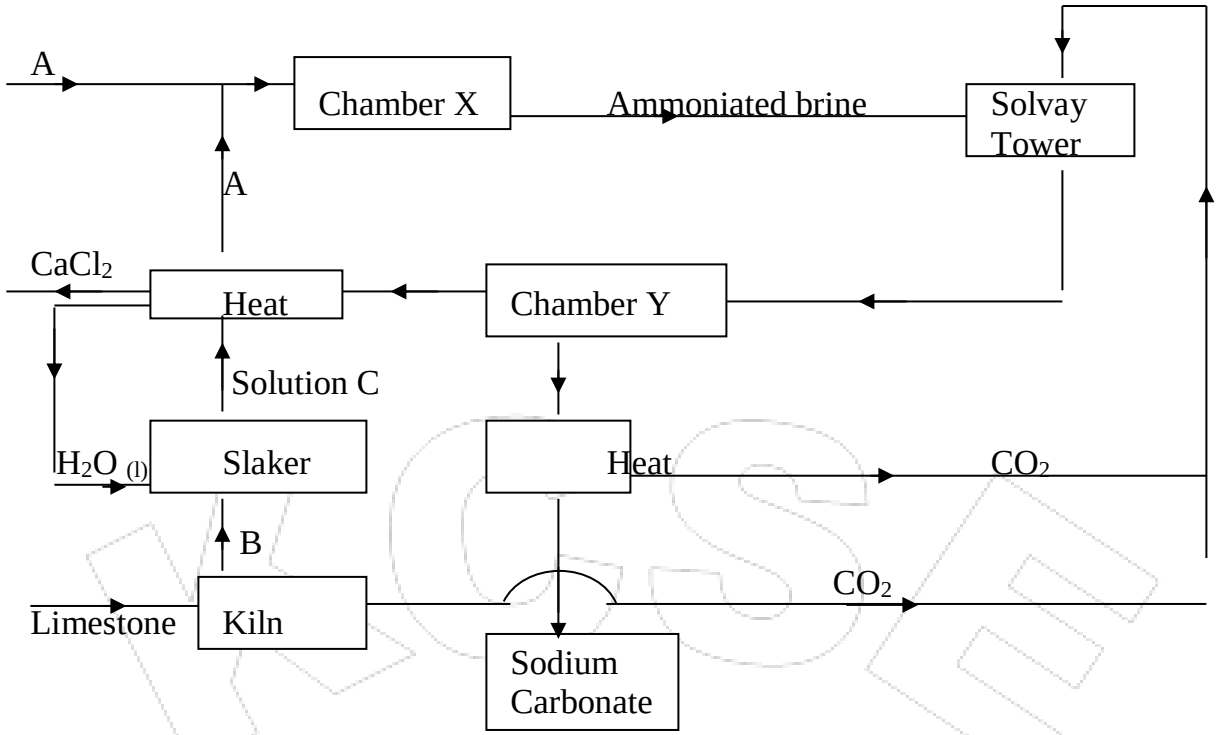
(iii) What property of hydrogen is being investigated? **(1 mark)**

(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

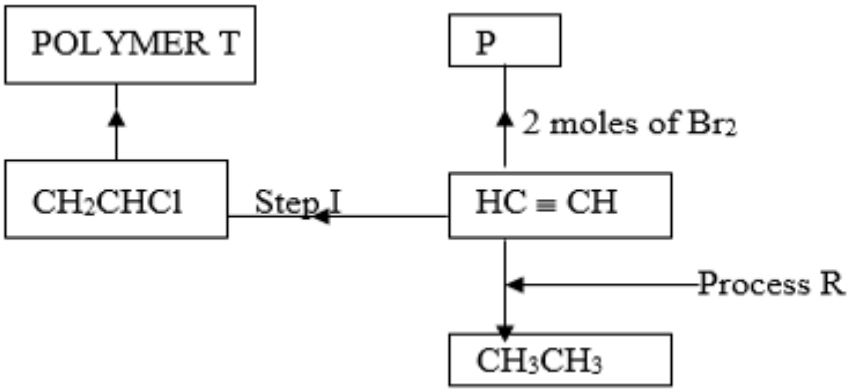
(i) Name compound M …… **(1 mark)**

(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.

K	**L**				**M**		**N**	**P**
	Q		**R**	**S**		**T**	**V**	
W								

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)**

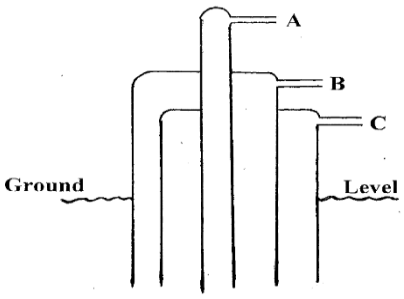
Property (½ **mark)**

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)**

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

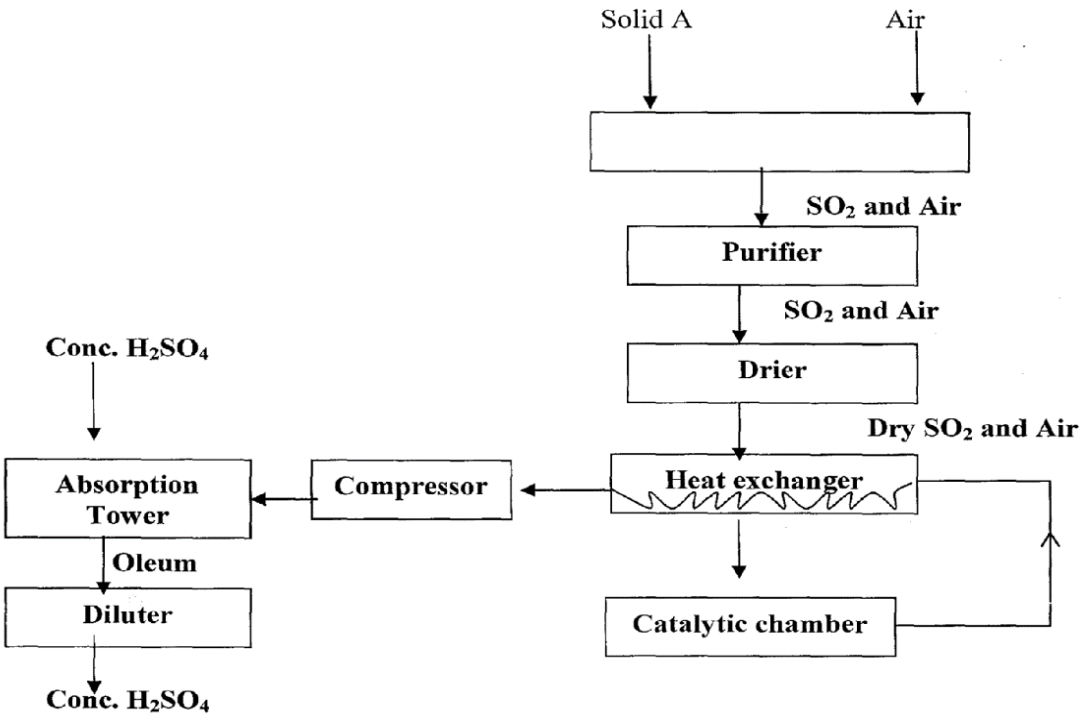
$$\text{Rhombic} \underset{96^{o}C}{\rightleftharpoons} \text{Monoclinic}$$

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

II. State the difference in crystalline appearances between rhombic and monoclinic crystals.

(l mark)

(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)**

7. 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.

Time (minutes)	olume of Hydrogen produced using zinc granules	Volume of Hydrogen produced using zinc 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)**

This is the last printed page

KCSE 2023 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

- *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
	80	

*Answer **all** questions*

1 a) Bauxite is the chief ore found in the extraction of Aluminium. **Name** two impurities found in bauxite **(2mks)**

b) **Name** the chief ores of both zinc and copper **(1mk)**

2. a) **Identify** the products formed when dinitrogen tetra oxide is dissolved in water **(2mks)**

b) Write the balanced **equation** for the reaction above **(1mk)**

3. **State** one use of the following substances **(3mks)**

i. AgBr……..

ii. $CaSO_4.XH_2O$……

iii. Tincture of iodine……..

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

						A		
	B		C		D		E	
F	G							
							H	

i. **Select** the element that can form a divalent anion **(½mk).**

ii. **Name** type of **structure** would the oxide of C have? **(½mk).**

iii. How does the **melting point** of A compare with that of E? **(½mk).**

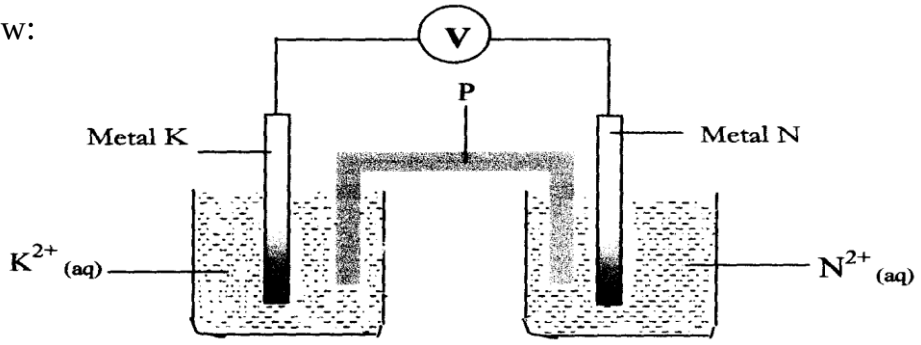
iv. **2.6 g** of B reacts completely when heated with 2.42 litres of chlorine gas (Cl_2) at s.t.p, **calculate** the relative atomic mass of B.(1 mole of gas occupies 22.4 litres at s.t.p.) **($1\frac{1}{2}$mk).**

5. **Explain** the differences in bleaching properties of chlorine and sulphur (use equations where necessary) **(3mks)**

6. Metals **K** and **N** were connected to form a cell as shown in the diagram below. Their reduction potentials are as shown below:

$K^+_{(aq)} / K_{(s)} \equiv -0.17V$

$N^+_{(aq)} / N_{(s)} = +1.1\ 6V$



i. **P** is made by dipping a filter paper in a solution of sodium nitrate, on the salt bridge **show** the direction of flow of ions (1mk)

ii. On the diagram, **show** the flow of electrons (1mk)

iii. **Write** the equation for the half-cell reaction that occurs at (1mk)

Metal **K** electrode.....

Metal **N** electrode.....

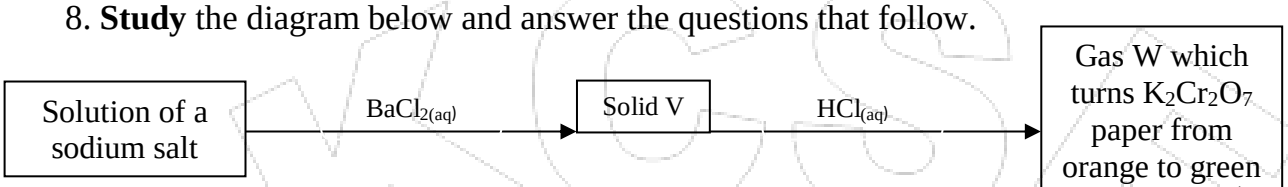
7**. Write equations** for the reactions between the following metals and steam. (3mks)

Iron……

Zinc……

Copper……

8. **Study** the diagram below and answer the questions that follow.



a. **Name** **(1mk)**

i. Solid V …….....

ii. Gas W ……

b. **Describe** a chemical test for chloride ions **(2mks)**

9. Starting with ethanol, describe how a sample of tetrachloroethane can be prepar**ed (3mks)**

10. A solution of bromine in water is a chemical reaction in equilibrium. The reaction involved is represented by the equation below;

$Br_{2(aq)} + H_2O_{(l)} \longleftrightarrow 2H^{+(aq)} + Br^-_{(aq)} + OBr^-_{(aq)}$

Yellow Colourless

i. **State** and explain the observation made when dilute sulphuric (VI) acid is added to the mixture at equilibrium. **(2mks)**

ii. **Define** the term dynamic equilibrium **(1mk)**

11. Apart from downward delivery **name** another method that can be used to collect the following gases **(2mks)**

Nitrogen (IV) oxide ……..

Sulphur(VI) oxide …….

ii) **Name one** gas that can be dried using anhydrous calcium oxide **(1mk)**

12. Starting with magnesium metal **describe** how a sample of magnesium carbonate can be prepared. **(3mks)**

13. With aid of **well labelled diagrams** show how a sample of sodium chloride, iodine and sand can be separated **(3mks)**

14. Explain the following **(3mks)**

i. Why number of protons and electrons are equal in an atom

ii. The role of neutrons in the nucleus of an atom

iii. Cations are positively charged

15. (a)In an experiment 10.6g of a mixture of a anhydrous Sodium Carbonate and Sodium chloride were dissolved in water to make 100cm^3 of solution .25$cm^3$of this solution required 20cm^3 of 1M Hydrochloric acid solution for complete neutralization.

(i) **Calculate** the number of moles of Hydrochloric acid used **(1mk)**

(ii) **Write** a balanced equation for the above reaction. **(1mk)**

(iii) **Calculate** the mass of Sodium Carbonate in 25 cm^3 of this mixture. **(1mk)**

16. Briefly **describe** how caffeine can be extracted from tea leaves. **(3mks)**

17. State the two roles of platinised-platinum in a standard hydrogen electrode **(2mks)**

18. **Explain** the following **(3mks)**

i. Yellow phosphorus is stored under water

ii. Sodium is stored under paraffin oil

iii Lime water and not potassium hydroxide is used to test for carbon(iv) oxide

18. Study the information below and use it to answer the questions that follow

ΔH^{θ}lattice $=MgCl_2$ $-2477 kjmol^{-1}$

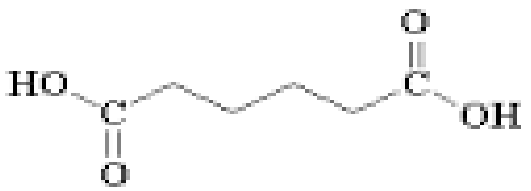
ΔH^{θ} hydration Cl^{-1} (aq) $-363 kjmol^{-1}$

ΔH^{θ} hydration Mg^{+2} (aq) $-1891 jmol^{-1}$

i. **Differentiate** between hydration energy and lattice energy? **(1mks)**

ii **Calculate** the heat of solution of Magnesium Chloride (2mks)

19. Nylon 6,6 is formed from two monomers, hexan-1,6-dioic acid(adipic acid) and hexan-1,6-diamine (hexamethylene diamine) through condensation polymerisation as shown in the diagrams below .



adipic acid

+



hexamethylene diamine

a. **Define** condensation polymerisation **(1mk)**

b. **Write** the equation for the formation of Nylon 6,6 **(2mks)**

20. According to Bronsteäd-Lowry theory**, define** an acid **(1mk)**

$NH_{3(aq)} + H_2O_{(l)} \longrightarrow NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$

Identify the species that acts as;

i) A base.……

Explain ……**……..(1mks)**

ii) An acid. …….

Explain……..(1mk)

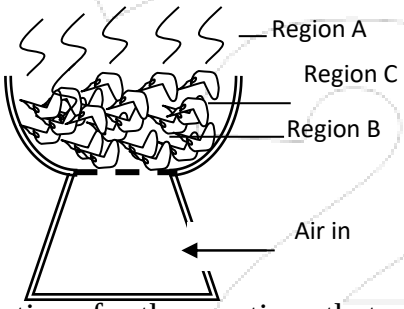
21. a) Explain how painting prevents iron from rusting **(1mk)**

b. Apart from protection from rusting **state** another reason for electroplating **(1mk)**

c. **What** is sacrificial protection , use an example to **explain** your answer. **(2mks)**

22. The structure of $RCOO^-Na^+$ below represents a type of cleansing agent. **Describe** how the cleansing agent removes grease from a piece of cloth. **(3mks)**

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



(i)**Write** equations for the reactions that occur in region

I: B **(1 mk)**

II: C **(1 mk)**

(ii) **Explain** what happens in region A. **(1 mks)**

24. A compound contains 82.75% carbon and the rest is Hydrogen. (C=12, H=1)

(a) **Determine** its empirical formula. **(2 Mrks)**

(b) **Determine** the molecular formula if its molecular mass is 58. **(1 Mks)**

25. Determine the oxidation state of ***manganese*** in the following; **(3mks)**

$KMnO_4$

Mn_2O_3

26. **Explain** why the melting point of magnesium oxide is 3080°C while that of carbon IV oxide is -79°C. **(2mks)**

THIS IS THE LAST PRINTED

KCSE 2023 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

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

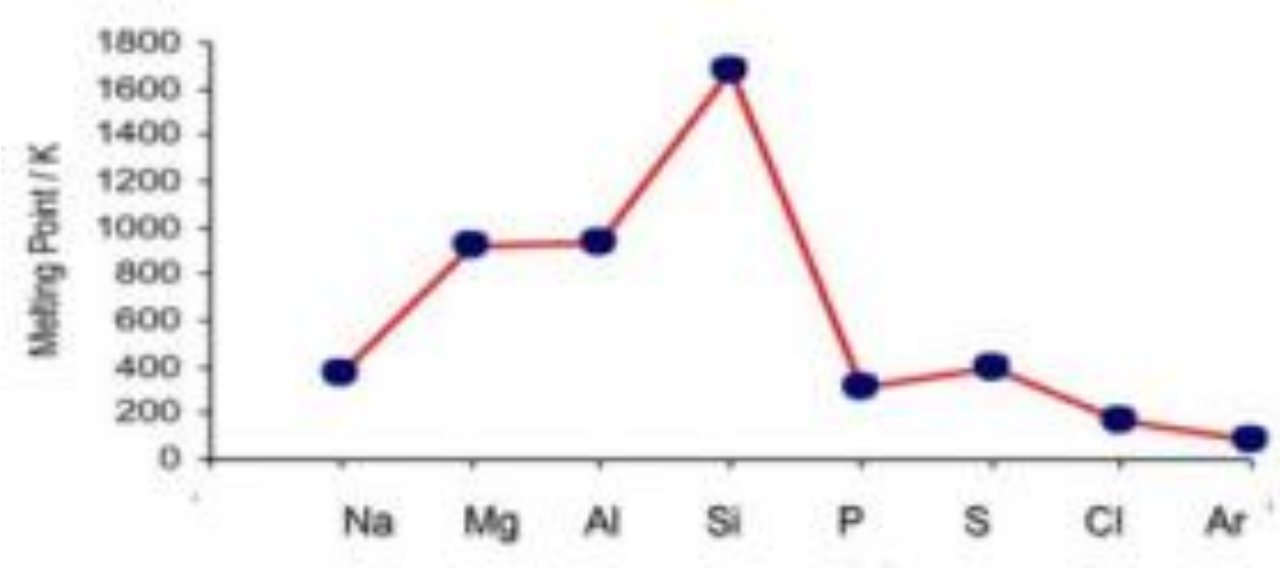
FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	80	

*Answer **all** questions*

1. a) The graph below represents the trend in melting points of elements in period 3.

Study it and use it to answer the questions that follow



i. **Explain** the trend in melting point between Aluminum and Phosphorous. **(2 marks)**

ii. Give a reason why Argon has the lowest melting point **(1 mark)**

b) The table below shows the properties of several elements. **Study it** and use it to answer the questions that follow.

Element	Atomic radius (nm)	Ionic radius (nm)
P	0.136	0.065
Q	0.174	0.099
R	0.099	0.181
S	0.203	0.133

i. Giving a reason, identify the non metal **(2 marks)**

ii. Given that, element P and S belong to the same period of the periodic table, identify the element with a lower ionization energy. **Explain.** **(2 marks)**

c) An element X forms an ion with the formula X^{2+}. The electronic configuration of the ion is 2.8

i. State the group and period to which element X belongs. **(1mark)**

Group ……..…….

Period ……

ii. Draw dot and cross diagram showing bonding when X combines with chlorine **(1 mark)**

d) **Explain** the following observations;

i. Carbon has more than one melting point **(1 mark)**

ii. Silicon and phosphorous are in the same period but at room temperature, the oxide of silicon is a solid, while the oxide of sulphur is gaseous **(1 mark)**

2. a) Determine the oxidation state of the element indicated in brackets **(3 marks)**

i. MnO_4^- (Mn)

ii. $K_2Cr_2O_7$ (Cr)

iii. H_3PO_4 (P)

b) Below is a list of standard reduction potentials of some elements. Use it to answer the questions that follow.

$A^{2+}(aq) + 2e^- \rightarrow A(s)$ + 0.34 V

$N^{2+}(aq) + 2e^- \rightarrow N(s)$ – 0.76 V

$G^+(aq) + 2e^- \rightarrow \frac{1}{2}G(s)$ 0.00 V

$Y^{2+}(aq) + 2e^- \rightarrow Y(s)$ + 0.88 V

$L^{2+}(aq) + 2e^- \rightarrow L(s)$ – 2.16 V

i. Identify the strongest reducing agent **(1 mark)**

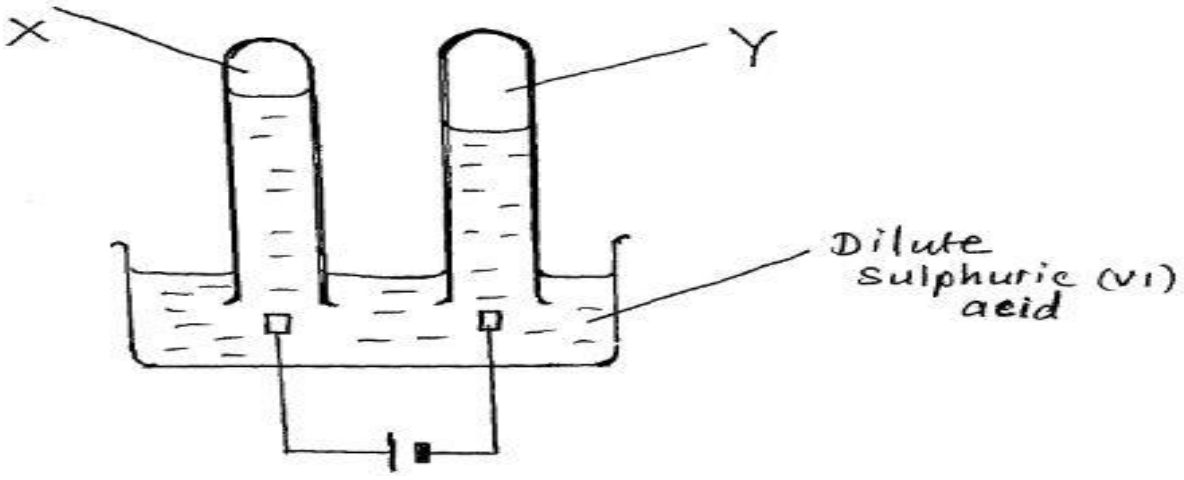
ii. Explain why a solution containing A^{2+} ions cannot be stored in a container made of metal N **(1 mark)**

iii. The half cells of Y and L were combined to form an electrochemical cell.

I Draw a well labelled diagram of the cell formed **(3 marks)**

II Calculate the e.m.f of the cell formed above **(1 mark)**

c) The diagram below shows the set up used to investigate electrolysis of dilute sulphuric (VI) acid solution



i. Identify product X **and Y** **(1 mark)**

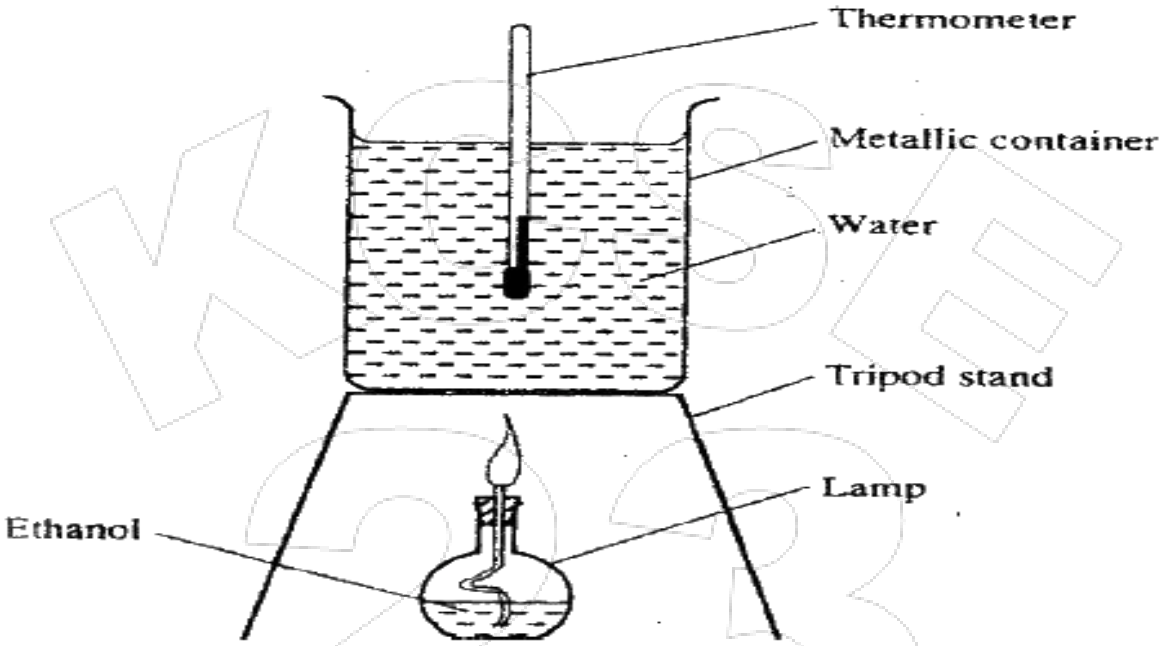
X ……

Y ……

ii. Write an equation for the reaction at the anode **(1 mark)**

iii. Explain what happens to the solution after 2 hrs sometime **(1 mark)**

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



a. During the experiment, the following data was collected

Volume of water	=	400 cm^3
Initial temperature of water	=	23.0^0 C
Final temperature of water	=	35.0^0 C
Initial mass of lamp and ethanol	=	99.07 g
Final mass of lamp and ethanol	=	98.23 g
Specific heat capacity	=	4.2 kJ Kg^{-1} K^-

Calculate the;

i. Temperature change **(1 mark)**

ii. Heat change for the reaction **(2 marks)**

iii. Mass of ethanol that reacted **(1 mark)**

iv. Molar enthalpy of combustion of ethanol (C=12, H=1.0, O=16.0) **(2 marks)**

b. Use the information in the table below to answer the questions that follow

$Na^+(g) + Cl^-(g) \rightarrow NaCl(s)$ $\Delta H_1 = -776$ kJ/ Mol

$Na^+(g) + aq \rightarrow Na^+(aq)$ $\Delta H_2 = -390$ kJ/ Mol

$Cl^-(g) + aq \rightarrow Cl^-(aq)$ $\Delta H_3 = -384$ kJ/ Mol

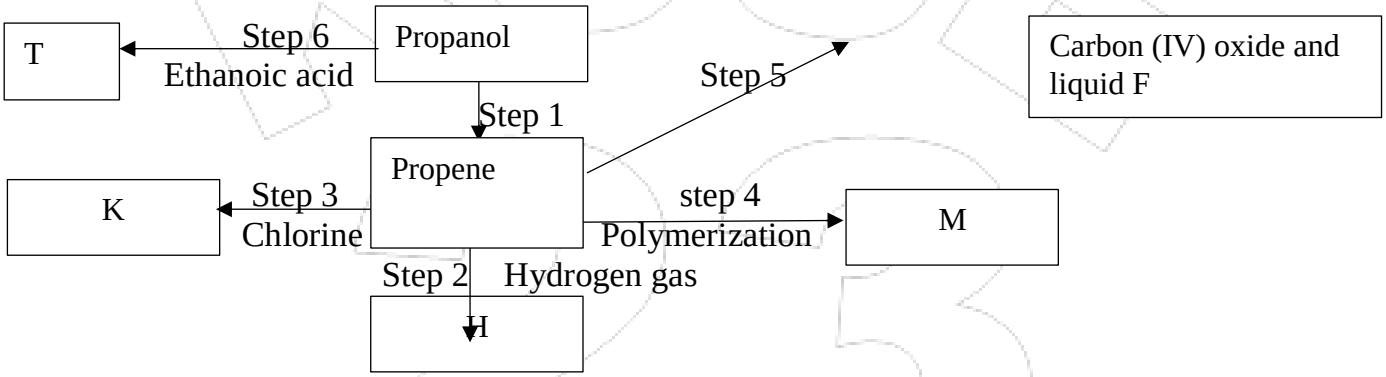
i. Give the name of **(2 marks)**

ΔH_1 ……..

ΔH_3 ……..

ii. Using an energy cycle diagram, calculate the molar enthalpy of solution of sodium chloride **(3 marks)**

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



a. Name substance; **(3 marks)**

i. H ……

ii. T ……

iii. F ……

b. State the conditions for **(2 marks)**

i. Step 1

ii. Step 2

c. Write an equation for the reaction in **(2 marks)**

i. Step 6

ii. Step 5

d. Draw the structural formula of substance M **(1 mark)**

e. A sample of substance M was found to have a molar mass of 47,208. Calculate the number of monomers in the sample. **(2 marks)**

f. Name the process taking place in step 1 **(1 mark)**

g. Identify the reagent used in step 5 **(1 mark)**

5. a) Define the following terms

i. radioactivity **(1 mark)**

ii. Define half-life (1 mark)

b) In an experiment to determine the half life of Radon – 220, the following results were obtained.

Time (seconds)	0	10	20	30	40	50	60	70
Count rate per second	30	26	23	21	18	16	14	12

i) On the grid provided, draw a graph of count rate against time **(3 marks)**

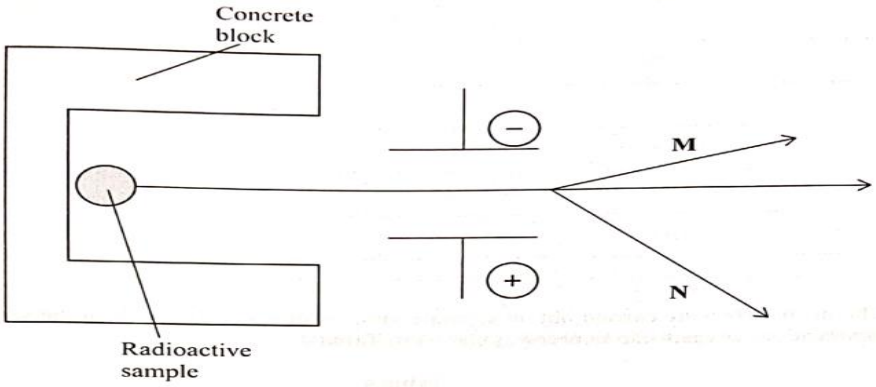
ii) from the graph, determine the half-life of radon – 220 **(1 mark)**

iii) State one application of radioactivity in; **(2 marks)**

Agriculture

Medicine

c) The diagram below shows the radiations emitted by a radioactive sample.



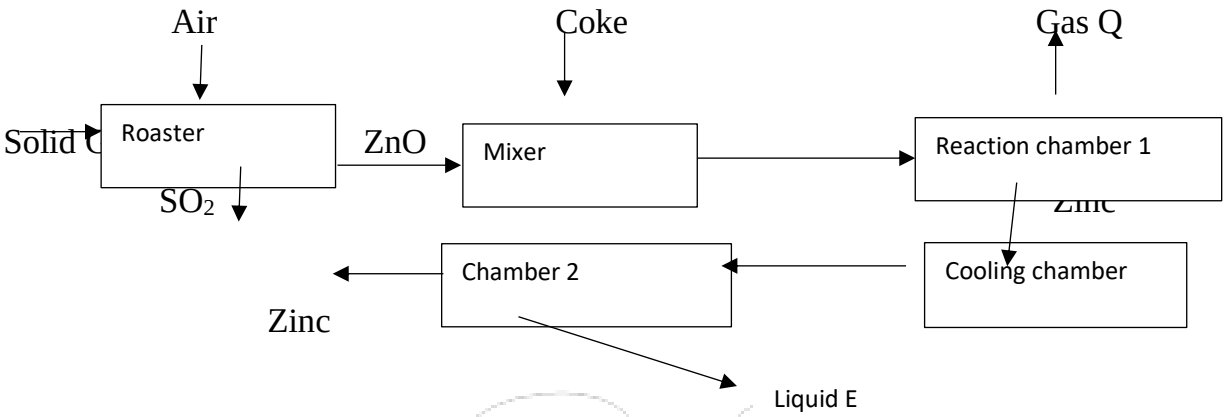
i) Identify radiation (2 marks)

M …….

N ……

ii) Explain the difference in the deflection of M and N (1 mark)

6. The flow chart below shows the process of extraction of zinc. Study it and answer the questions that follow.



a. Identify (1 mark)

i. Solid G

……

ii. Gas Q ……

b. Name the other substance introduced into the mixer and state its role **(2 marks)**

c. write an equation for the reaction in; **(2 marks)**

i. Roaster

ii. Reaction chamber 1

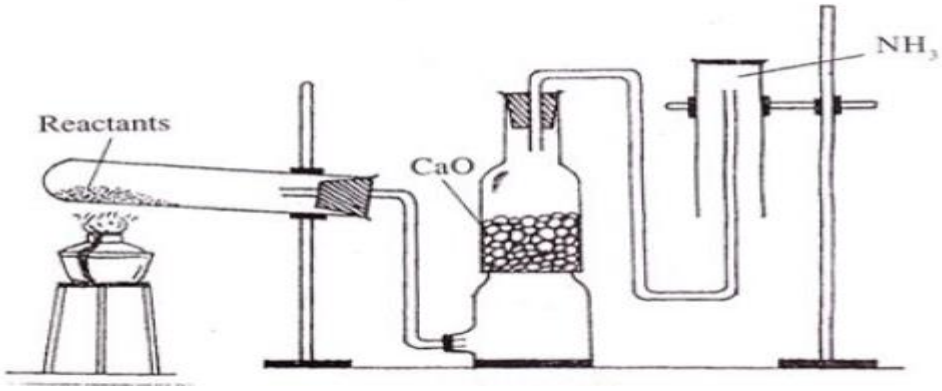
d. Describe the process that takes place in the cooling chamber **(2 marks)**

e. Name the main impurity found in the zinc ore **(1 mark)**

f. Explain one danger caused by this process **(1 mark)**

g. A student found a piece of metal that he suspected could be zinc (II) ions. Describe **three successive tests** he would carry out to confirm the solid is zinc and give the observations expected in each test. **(3marks**

7. The diagram below shows the laboratory preparation of ammonia gas. Study it and use it to answer the questions that follow.



a. Name the reactants used **(1 mark)**

b. Give the role of calcium oxide **(1 mark)**

c. State 2 physical properties of ammonia gas **(1 mark)**

d. Write an equation for the reaction **(1 mark)**

e. Ammonia reacts with oxygen in the presence of a catalyst to produce nitric (V) acid industrially.

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

ii. Describe how the product in e above is converted to nitric (V) acid **(2 marks)**

f. Ammonia and sulphuric (VI) acid are reacted to form a fertilizer.

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

ii. Calculate the volume of ammonia required at STP to manufacture 1500kg of the fertilizer at STP (N= 14.0, H= 1.0, S= 32, O= 16.0, MGV at STP = 22.4L) **(3 marks)**

THIS IS THE LAST PRINTED PAGE

KCSE 2023 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

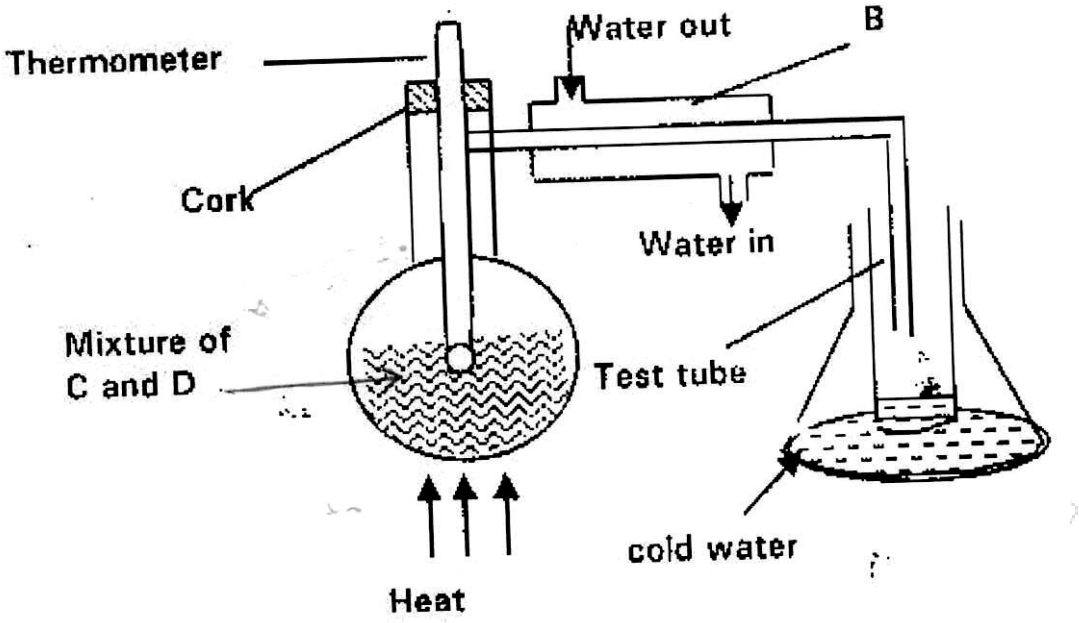
- *Write your name, admission number, class, date and then sign in the spaces provided.*
- *Answer **all** questions in the spaces provided.*
- *KNEC mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*

FOR EXAMINERS USE ONLY

QUESTIONS	MAXIMUM SCORE	STUDENTS SCORE
	80	

*Answer **all** questions*

1. The set-up below represents apparatus that may be used to separate a mixture of two miscible liquids "C" and "D" whose boiling points are 80^0C and 100^0C respectively.



(a) Name B. **(1mk)**

(b) What is the purpose of the thermometer? **(1mk)**

(c) Which liquid is collected in the test tube? **(1mk)**

2. The table below gives some properties of gas D and E.

Gas	Density	Effect on H_2SO_4	Effect on NaOH
D	Lighter than air	React to form salt	Dissolve without reacting
E	Heavier than air	Not affected	Not affected

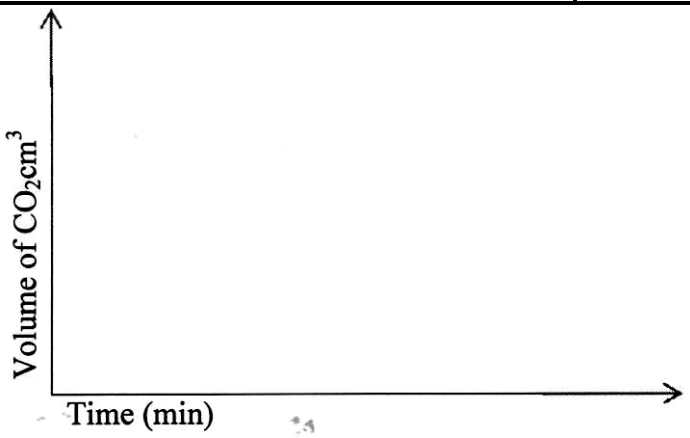
(c) Describe how you would obtain a sample of gas E from the mixture of gas D and E. **(2mks)**

(d) Suggest a possible identity of gas D. Give reasons for your answer. **(2mks)**

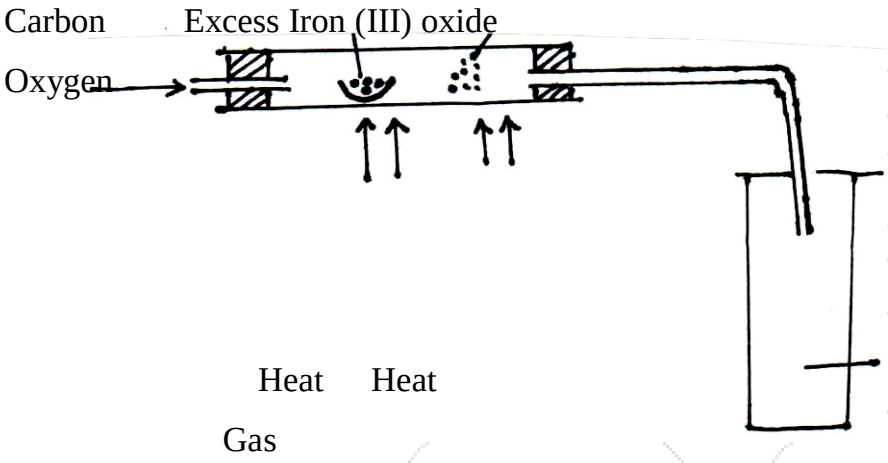
3. (a) What is meant by a strong base? **(1mk)**

(b) In an experiment, $20cm^3$ of 2M hydrochloric acid was reacted with excess sodium carbonate and the volume of carbon (IV) oxide produced recorded with time. In another experiment, the same volume and concentration of ethanoic acid was also reacted with excess sodium carbonate and the volume of carbon (IV) oxide produced recorded with time.

On the grid below, sketch and label the curves if the volumes of carbon (IV) oxide were plotted against time. **(2mks)**



4. The set-up below was used to obtain a sample of Iron.



Write **two** equations for the reactions which occur in the combustion tube. **(2mks)**

5. Give the name of the product formed when magnesium reacts with phosphorus. **(1mk)**

6. The table below gives the energy required to remove the outer most electrons from same group.

Elements	I	II	III	IV
Energy kJ / Mole	494	418	519	376

Arrange the elements in the order of their reactivity starting with the most reactive. **(2mks)**

7. The electronic structures for elements represented by letters A, B, C and D are:-

A = 2:8:6 B = 2:8:2 C = 2:8:1 D = 2:8:8

(a) Select the element which forms:

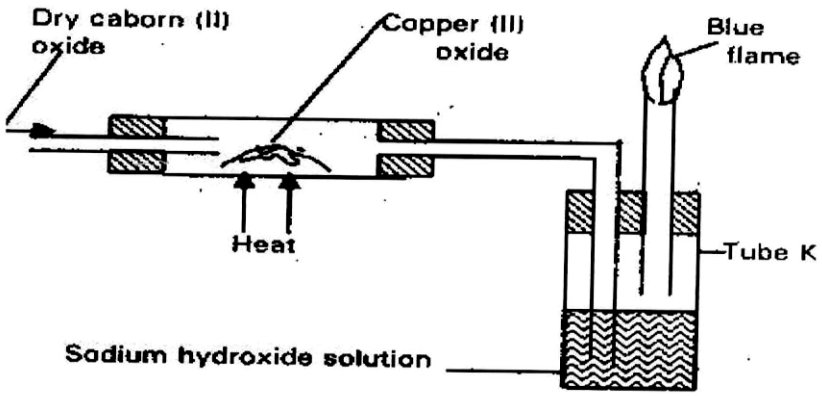
(i) Double charged cation. **(1mk)**

(ii) A solobule carbonate **(1mk)**

(b) Which element has the smallest atomic radius? **(1mk)**

8. State any **two** differences between luminous flame and non luminous flame. **(2mks)**

9. 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. **(1mk)**

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

10. (a) State Graham's Law of Diffusion. **(1mk)**

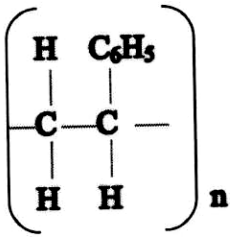
(b) If it takes 30 seconds for $100cm^3$ of carbon (IV) oxide to diffuse across a porous plate, how long will it take $150cm^3$ of nitrogen (IV) oxide to diffuse across the same plate under similar conditions? (C = 12.0, N = 14.0, O = 16.0) **(2mks)**

11. (a) Given the IUPAC names of the following compounds:- **(2mks)**

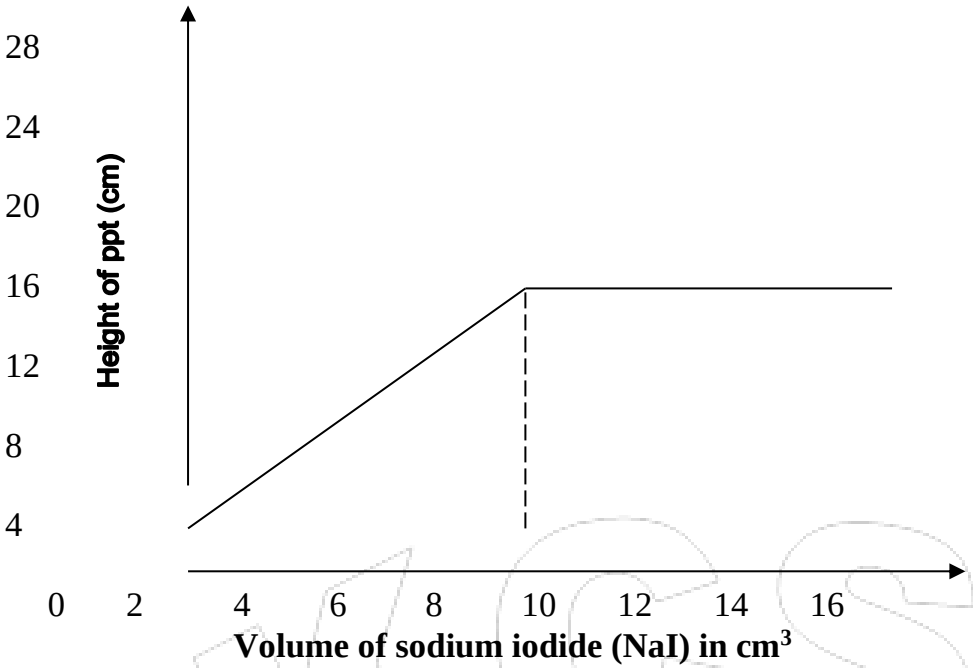
(ii) $CH_3(CH_2)CH_2OH$

(iii) $CH_3CH_2CH(CH_3)COOH$

(b) Given the following polymer, draw the structure of the monomer. **(1mk)**



12. In an experiment, various volumes of 1M sodium iodide solution was added to the same volume of 1M lead (II) nitrate solution. The height 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. **(1mk)**

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

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

13. When excess zinc powder is added to $30cm^3$ of solution containing copper (II) ions and the mixture stirred, the temperature is noted to have risen by 15^0C.

(a) State the observation made after stirring the mixture. **(1mk)**

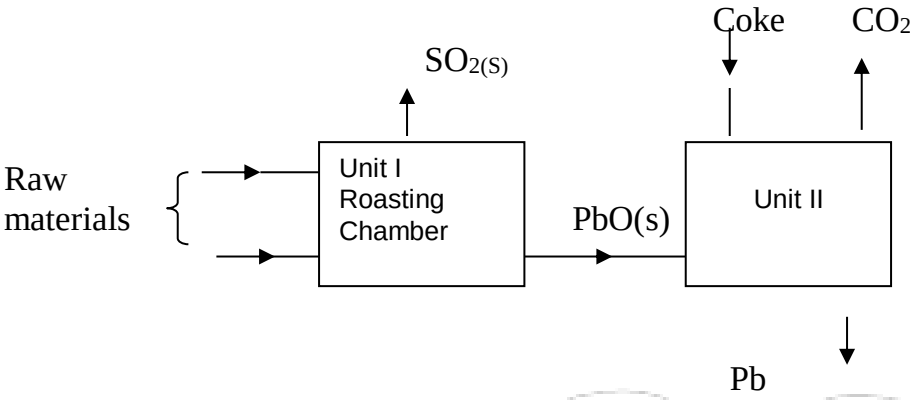
(b) Calculate the heat change for the reaction (specific heat capacity of H_2O = $4.2KJkg^{-1}k^{-1}$) **(2mks)**

14. When bismuth (III) chloride is added to water, a reaction occurs and a white precipitate forms as shown below.

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

What would be the effect on the amount of the precipitate formed if sodium hydroxide solution is added to the equilibrium mixture? Explain your answer. **(2mks)**

15. The flow chart below shows some process in extraction of lead metal. Study it and answer the questions that follow.



(a) Name **two** raw materials that were fed into Unit I. **(1mk)**

(b) State **one** environment hazard associated with the process in Unit I. **(1mk)**

(c) What is the function of coke in unit II? **(1mk)**

16. (a) Radioactive Polonium – 216 decays as shown below.

$$^{216}_{84}Po \longrightarrow {}^{208}_{82}Pb + M + n\beta$$

Determine the value of m and n. **(2mks)**

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

Number of days	Mass in g
0	48
270	1.5

Calculate the half-life of the radioactive element y. **(2mks)**

17. Water reacts with sodium peroxide forming sodium hydroxide and oxygen gas. Draw a well labelled diagram showing how a sample of oxygen gas can be prepared and collected in the laboratory using the above reagents. **(3mks)**

18. 15g of sodium chloride was dissolved in $120cm^3$ of distilled water. Calculate the concentration of the resulting solution in moles per litre. (Na = 23, Cl = 35.5) **(3mks)**

19. (a) State Boyle's law. **(1mk)**

(b) The volume of a gas at 30^0C and 780mmHg is $400cm^3$. What will be its volume at 50^0Cat 600mmHg. **(2mks)**

20. Sulphur exhibits allotropy.

(a) What is allotropy? **(1mk)**

(b) Name the **two** allotropes of sulphur. **(1mk)**

(c) Sulphur powder was placed in a deflagrating spoon and heated on a Bunsen burner.

(i) State the observation made. **(1mk)**

(ii) The product obtained was dissolved in water. Comment on the PH of the solution formed. **(1mk)**

21. (a) A luminous flame has a yellow zone. Explain how the yellow zone is produced. **(1mk)**

(b) Explain why a non-luminous flame is preferred for heating substances in a laboratory. **(2mks)**

22. (a) State **two** differences between the terms electrolyte and non-electrolyte. **(2mks)**

(b) Graphite is a non-metal yet it conducts electric current. Explain. **(1mk)**

23. 0.318g of an oxide of metal M was completely reduced by hydrogen gas to 0.254g of metal. Calculate empirical formula of the metal oxide. (M = 63.5, O = 16). **(3mks)**

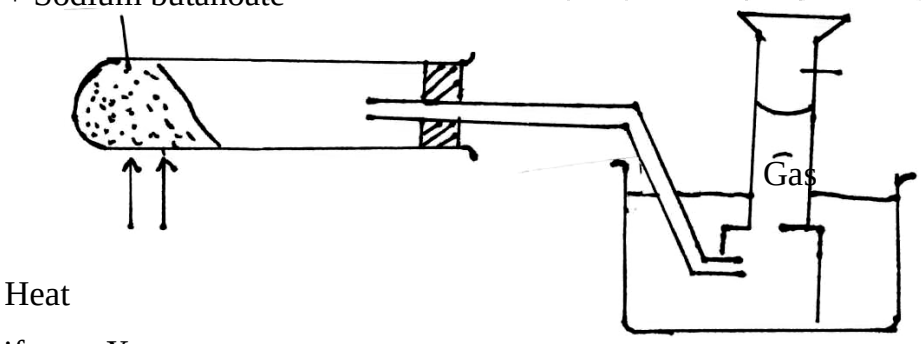
24. In an experiment to electroplate iron with silver, a current of 0.5A was passed through a solution of silver nitrate for 60 minutes.

(i) Give **two** reasons why it is necessary to electroplate iron with silver. **(1mk)**

(ii) Calculate the mass of silver that was deposited on iron. (Ag = 108, 1 Faraday = 96500C). **(2mks)**

25. Given the following reagents: solid sodium carbonate, water, solid lead (II) nitrate. Describe how a sample of lead (II) carbonate can be prepared in the laboratory. **(3mks)**

26. The set-up below was used to prepare a sample of an organic compound X.



(a) Identify gas X. **(1mk)**

(b) Write the equation for the reaction that produces gas X. **(1mk)**

(c) 1 Mole of Chlorine was reacted with gas X in presence of sunlight.

(i) State **one** observation made. **(½mk)**

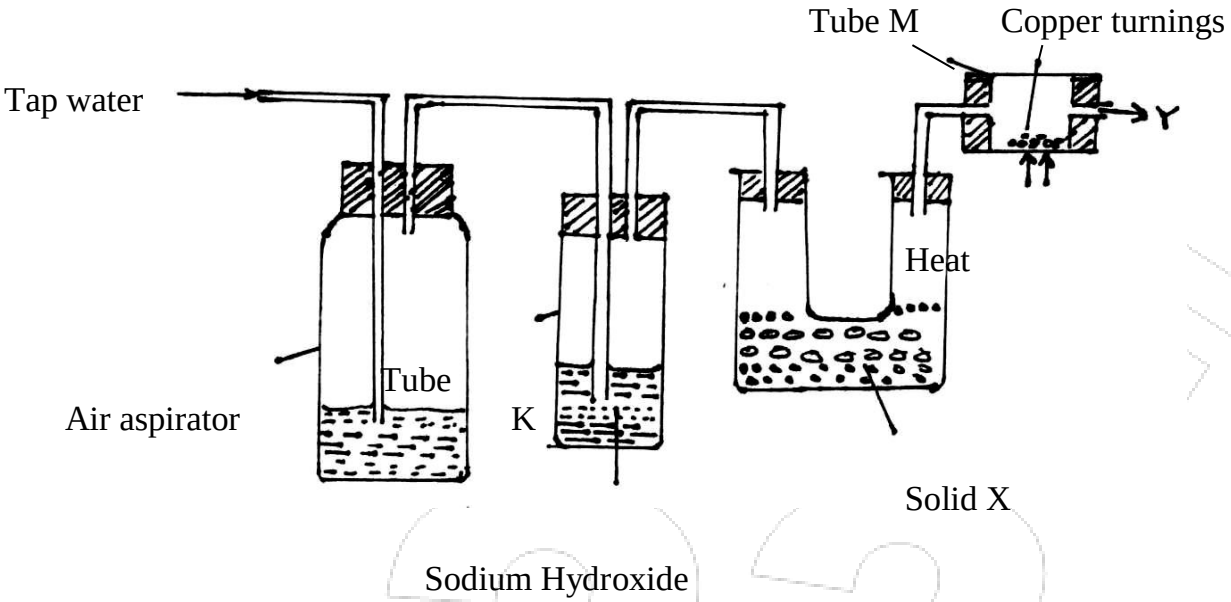
(ii) Name the major product formed. **(½mk)**

27. Draw dot (•) an cross (x) diagram to show bonding in:

(i) Nitrogen molecule (N_2) **(1mk)**

(ii) Hydroxonium ion. (H_3O^+) **(1mk)**

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



(i) What is the purpose of passing tap water through the air aspirator? **(1mk)**

(ii) State and explain the observation that would be made in tube M after sometime. **(1mk)**

(iii) The sample of nitrogen collected at point Y had greater density than expected. What conclusion could be made about the gas? **(1mk)**

KCSE 2023 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.

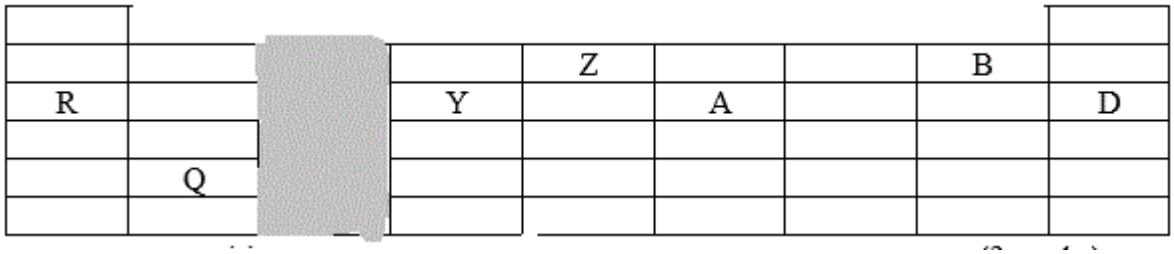
INSTRUCTIONS TO CANDIDATES

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

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 7	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.

Hydrocarbon	Boiling point (K)
CH_4	112
C_2H_6	184
C_3H_8	231
C_4H_{10}	273
C_5H_{12}	309
C_6H_{14}	342

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) Select 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 $\mathbf{C_nH_{2n}}$ **(2 marks)**

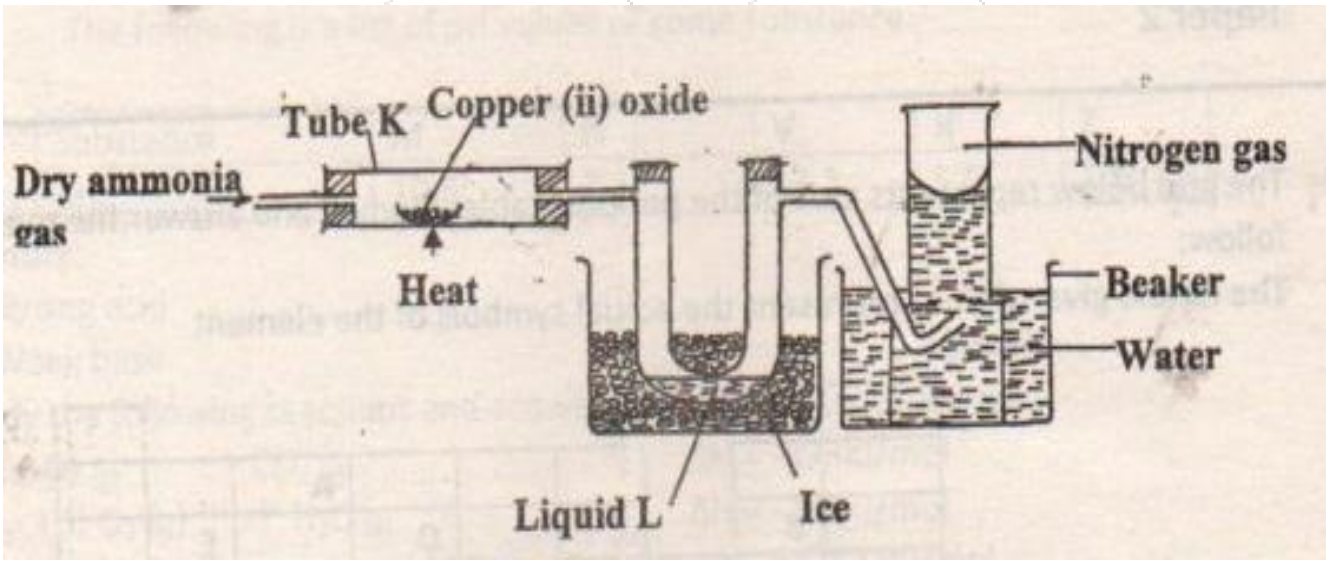
b) Ethene gas can be prepared in the laboratory by heating ethanol with concentrated sulphuric (vi) acid.

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.

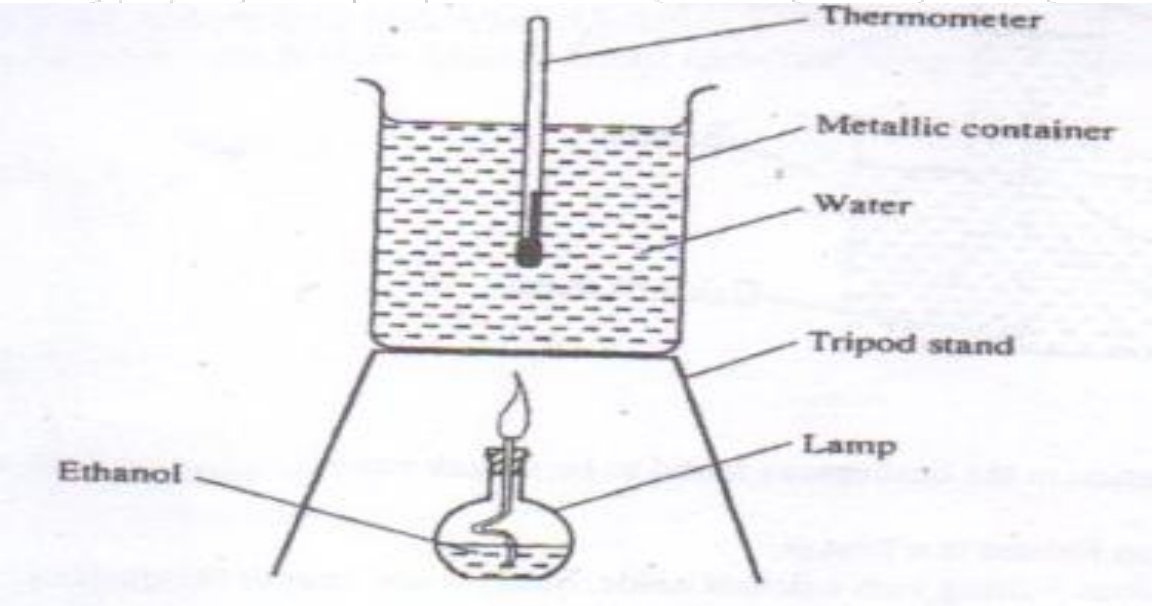
$$NH_{3\,(g)} + H_2O_{(l)} \longrightarrow NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$$

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.

Time from start of reaction (se)	0	20	40	60	80	100	120
Volume of CO_2 at S.T.P(litres)	0.0	0.65	0.90	1.07	1.10	1.12	1.12

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)**

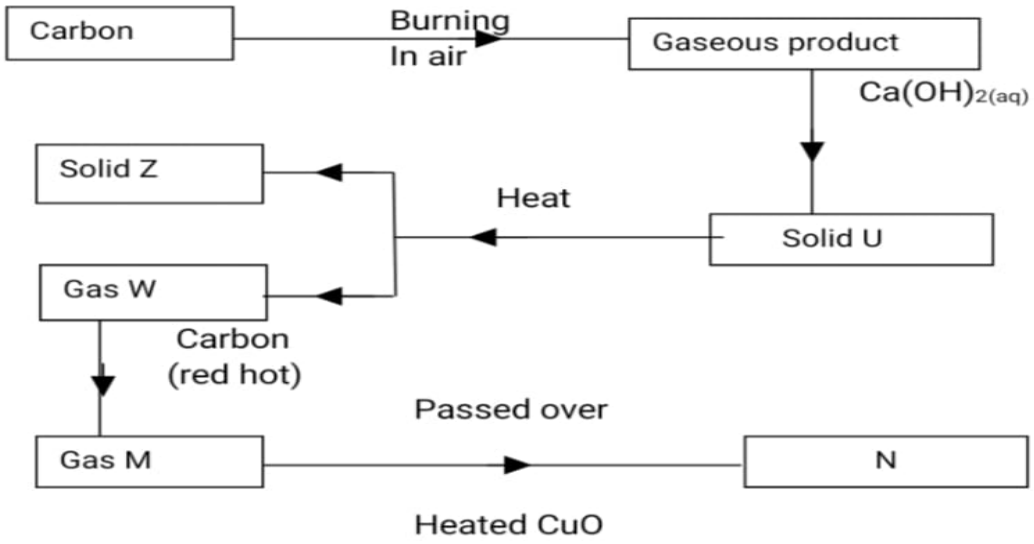
d) Why was there no increase in volume of the gas after 100 seconds? **(1 mark)**

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)**

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)**

6. a) The diagram below shows several reactions starting with carbon.



i. Identify the following U**, Z, W, M** **(2marks)**

ii. State the observation made when gas **M** is passed over heated copper (II) oxide. **(1 mark)**

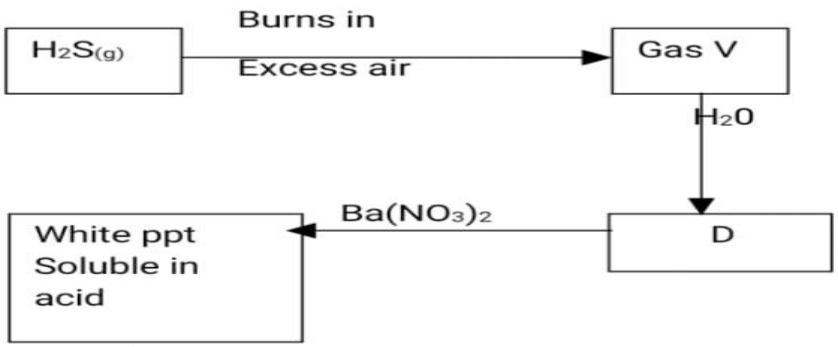
iii. State one agricultural application of solid **Z.** **(1mark)**

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)**

(ii) Study the flow chart below and answer the questions that follow

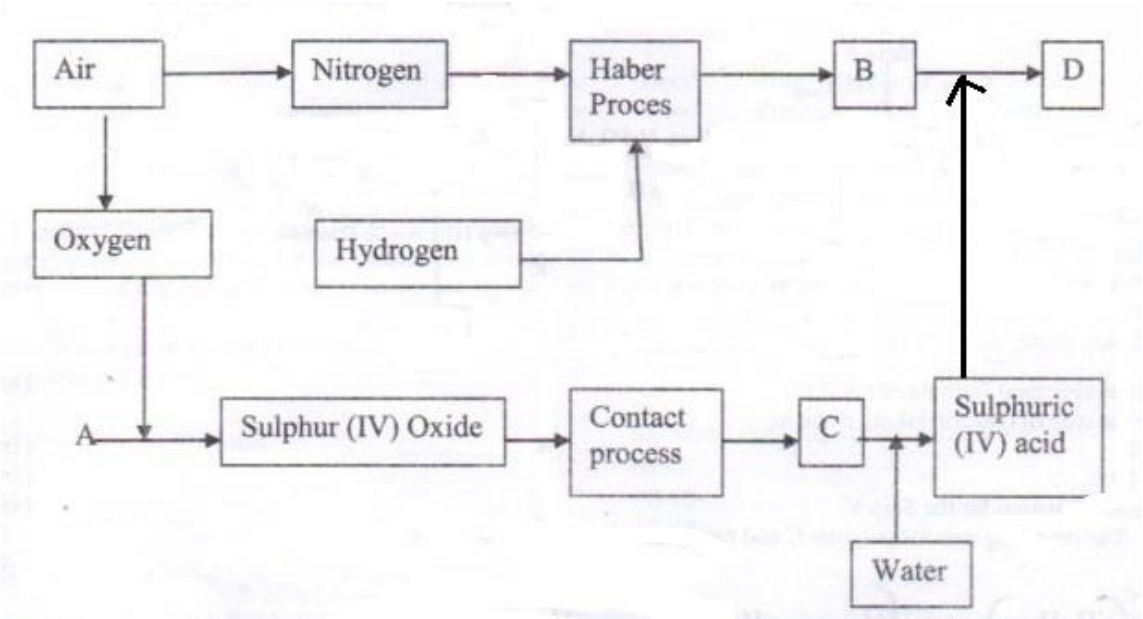


I. Name Gas **V,D** **(1mark)**

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)**

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)**

g) State how compound C is formed. **(1mark)**

This is the last printed page.