CHEMISTRY PP1 2024 KCSE MOCK

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NAME……**ADM**……

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233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

SERIES 1 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) This paper consists of **10 printed pages***

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

(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

Turn Over

1. An element Y has the electronic configuration 2.8.5

a) Identify its period (1mk)

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b) Write a formula of the most stable anion formed when Y ionizes. (1mk)

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c) Explain the differences between the atomic radius of element Y and its ionic radius. (2mks)

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2. The table below shows tests carried out on a sample of water and the results obtained.

	Test	**Results**
I	Addition of sodium hydroxide solution	White precipitate which dissolves in excess
II	Addition of excess aqueous ammonia	Colourless solution obtained
III	Addition of dilute hydrochloric acid and barium chloride	White precipitate

a) Identify the anion present in the water. (1mark)

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b) Write an ionic equation for the reaction in **III.** (1mark)

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3. Solutions can be classified as acids bases or neutral. The table below shows solutions and their pH values.

Solution	PH - VALUES
K	1.5
L	7.0
M	14.0

(i) Select any pair that would react to form a solution of pH 7. 1mark)

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(ii) Identify two solutions that would react with aluminum hydroxide. Explain. (1marks)

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4. a) State Graham's Law of diffusion. (1mk)

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b) 60cm^3 of oxygen gas diffused through a porous partition in 50 seconds. How long would it take for 60cm^3 of sulphur (IV) oxide gas to diffuse through the same partition under the same conditions? (S = 32.0, O = 16.0) (3 marks)

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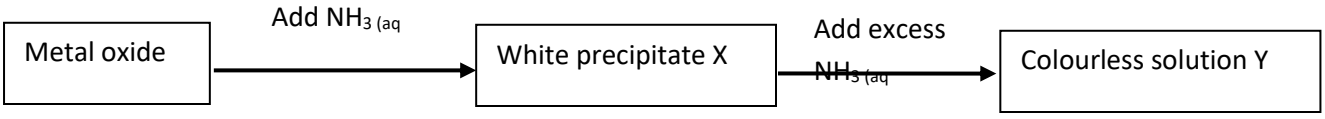
5. Study the flow chart below and answer the questions that follow.



a) Identify the metal oxide. (1mk)

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b) Write an ionic equation leading to the formation of the white precipitate X. (1mk)

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c) Give the formula of the ions responsible for the colourless solution Y. (1mk)

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6. Two compounds of barium are barium sulfide and barium chloride.

(a) The hazard symbol shown in Figure below is on bottles containing barium metal.

State the meaning of this hazard symbol. (1mk

……

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(b) Give the names of the elements combined in barium sulfide. (1mk)

……

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(c) Hydrogen sulphide gas is highly poisonous. Sate one safety precaution that should be taken

when handling hydrogen sulphide. (1mk)

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7. Study the information in the table and answer questions that follow:

Isotope	^{69} R_1	^{71} R_2
Relative abundance %	61.3	38.7

(a) Determine the number of neutrons of R_1. (1mk)

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(b) Calculate the relative atomic mass of element **R**. (2mks)

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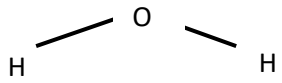
8. a) Identify the type of bond formed compound below.

(1mk)



b) Using dots (•) and crosses (**x**) to represent electrons show bonding in magnesium oxide

(2mks)

9. Show the products formed when the following salts are heated by writing a balanced chemical equation. (2 marks)

(i) $KNO_{3(s)} \xrightarrow{Heat}$

(ii) $(NH_4)_2\ CO_{3(s)} \xrightarrow{Heat}$

10. Explain why when one is stung by a bee application of a little solution of sodium hydrogen carbonate helps to relieve the pain. (2 marks)

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11. 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 P_4O_{10}. (2 mark)

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

(i) NaOH (1 mark)

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(ii) HCl (1 mark)

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12. A hydrocarbon slowly decolourlises bromine in presence of sunlight but does not decolourise acidified potassium permanganate. Name and draw the structural formula of the fourth member of the series to which the hydrocarbon belongs. (2 marks)

13. Distinguish between ionization energy and electron affinity. (2mks)

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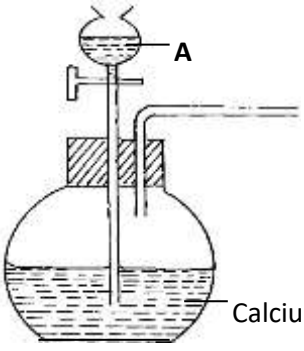
14. The set-up below was used to prepare a carbon (IV) oxide gas.



(a) Give the name of substance **A** (1mk)

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(b) Complete the diagram to show how the **dry** gas can be collected. (2mks)

(c)Write the equation for the reaction (1mk)

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15. Calculate the mass of sulphur which on complete combustion would yield $7dm^3$ of sulphur (IV)

oxide measured at 182^oc and 722 mm Hg pressure. (0=16, S=32, molar gas volume = $24dm^3$

at r.t.p). (3 mks)

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16. Form two students from Achiever's secondary school reacted three elements as shown in the table

below

Element	Reaction with Oxygen	Reaction with water
X	Formed acidic oxide	No reaction
Y	Formed basic oxide	Formed soluble hydroxide gave off hydrogen gas
Z	Formed acidic oxide	Dissolved to form an acidic solution

Which element (s) is likely to be: (3mks)

i) Non-metal (s)

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ii) Metal (s)

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iii) Insoluble in water.

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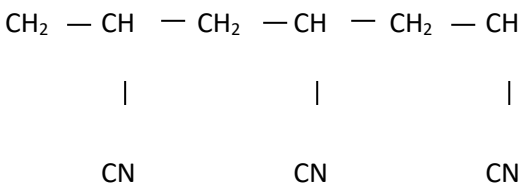
17. A polymer has the following structure



A sample of this polymer is found to have a molecular mass of 5194. Determine the number of monomers on the polymer. (H = 1.0, C = 12.0, N = 14.0) (2 marks)

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18. a) State the likely products of the electrolysis of molten potassium chloride at the:-

(i) Cathode ……(½mk)

(ii) Anode …… (½mk)

b) Write the equations that occur at the anode and cathode. …….(2mks)

Anode

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……...……...

Cathode

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19. Give two reasons why helium is used in weather balloons. (2mks)

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20. A Bunsen burner produces a yellow flame when airhole is close. Explain. (2mks)

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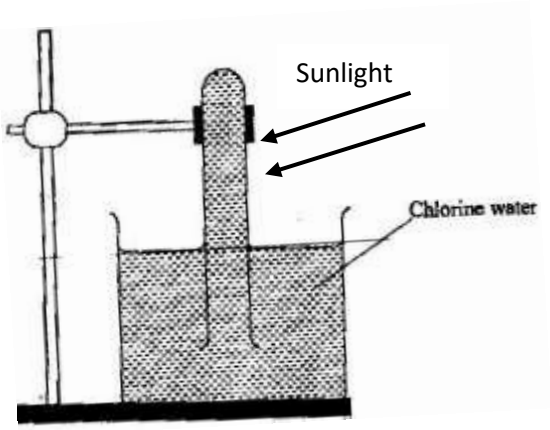
21. In an experiment, a boiling tube full of chlorine gas was inverted into a trough of water as shown below.



a) State and explain the observations. (2mks)

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b) If the experiment is repeated with tetrachloromethane instead of water.

i) State the observations made. (1mk)

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ii) Explain your observations in b(i) above. (1mk)

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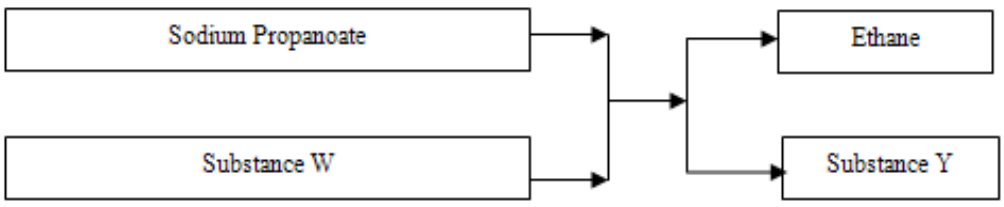
23. Study the flow chart below and answer the questions that follow.



a) Name substances

W ……..….(½ mark)

Y ……..…..(½ mark)

b) An organic compound K reacted with bromine to form 2,3 – dibromobutane. Draw the structural formula of K. (1mks)

24. Starting with copper metal describe how a solid sample of copper (II) carbonate can be prepared. (3 marks)

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

Element	**Electrical conductivity**	**Ductility**	**Action of water**
A	Good	Good	No reaction
B	Good	Poor	No reaction
C	Good	Good	Reacts

Select the element which is

(a) Likely to be in group II of the periodic table. (½ mark)

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(b) Could be used to make electric cables. (½mark)

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(c) Likely to be graphite. (½ mark)

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26. In an investigation, sulphur (IV) oxide gas was bubbled through acidified bromine water. This was followed by drops of barium nitrate solution.

(a) State the property of sulphur (IV) oxide under investigation. (½ mark)

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(b) i) State the observation that were made on addition on sulphur (IV) oxide into the bromine water.

(1mk)

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ii) Explain the observation. (1mk)

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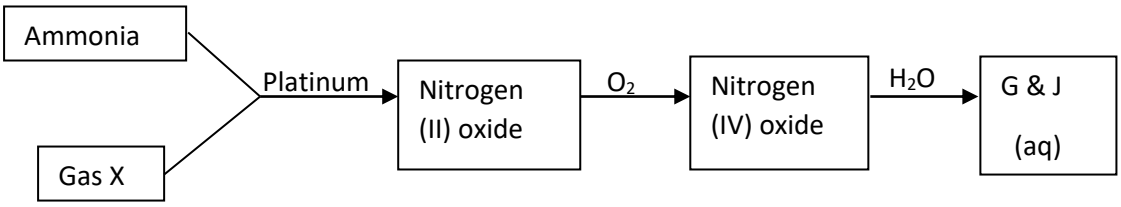
27. Study the flow chart below and answer the questions that follow



a) Identify gas X (1mk)

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b) Write an equation for the reaction between ammonia and gas X (1mk)

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c) Write an equation to show the formation of G and J (1mk)

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28. (a) Define pollution. (1 mark)

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(b) Mention **one** pollutant that is

(i) A Particle (½ mark)

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(ii) Gaseous (½ mark)

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29. Hydrogen gas was burnt in air to form a colourless liquid.

a) Describe a chemical test to identify the colourless liquid. (2mk)

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b) State how the purity of the colourless liquid can be determined. (1mk)

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NAME……**ADM**……

SCHOOL……**INDEX**……

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233/1

CHEMISTRY Theory Paper 1
Time: 2 Hours

SERIES 2 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

Turn Over

1. Element T has atomic number 9 while V has atomic number 11.

(a) Write down the electronic configurations of elements T and V.

T …… ($^1/_2$ mark)

V ……..…… ($^1/_2$ mark)

(b) State the type of bond formed when T and V combine. (1 mark)

……

1.
2. The table below shows the Ph values of solutions I, II, III, and IV.

Solution	I	II	III	IV
PH	2	7	11	14

a) Which solution is likely to be sodium chloride solution. (1 mark)

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b) A few drops of phenolphthalein indicator were added to solution (IV). State and explain the observations made. (2 marks)

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3. Iron roofs usually turn brown after some time as a result of formation of rust on their surfaces.

a. Explain whether rusting is a physical or a chemical change. (2 marks)

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b) State one way of preventing rusting. (1 mark

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4. State and explain the observation that would be made when hydrated copper (II) sulphate crystals are heated in an evaporating dish. (2marks)

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5 When magnesium is heated in air, it forms a solid Q and solid P. when solid Q is reacted with water it produces a gas W that turns moist red litmus paper to blue. Identify;

a) Solid Q ……..…… (1 mark)

b) Solid P ……. (1 mark)

c) gas W ……. (1 mark)

6a). Elements X and Y has atomic number of 12 and 13 respectively, compare the electrical conductivity of elements X and Y. (1mark)

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b) Explain your answer in (a) above. (2mark)

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7. The table below shows some properties of substances A, B, C and D

Substance	Action with water	Melting point	Thermal conductivity
A	Un reactive	High	Poor
B	Reactive	High	Poor
C	Unreactive	High	Good
D	Unreactive	Low	Good

Select the substance that would be most suitable

a) For making electrical cables. (1mark)

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a) For making cooking pot handle. (1mark)

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8. Propane reacts with one mole of chlorine gas under a certain condition.

a) What is that condition necessary for the above reaction to take place? (1mark)

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b) Draw the structural formula and name the compound formed. (2marks)

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9. (a) What is meant by solubility? (1 Mark)

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(b) In an experiment to determine the solubility of solid x in water at 30^0C the following results were obtained;

Mass of evaporating dish	=	26.2g
Mass of evaporating dish + saturated solution	=	42.4g
Mass of evaporating dish + dry solid x	=	30.4g

Using the information, determine the solubility of solid x at 30^0C in g/100g water. (2 Marks)

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10.On strong heating, sodium nitrate produces oxygen gas. In the spaces provided below, draw a labeled diagram of a set-up that could be used for heating sodium nitrate and collecting the oxygen gas liberated. (3marks)

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11.Chlorine and iodine are elements in the same group in the periodic table. Chlorine gas is yellow while aqueous iodine; I_2(aq) is brown.

a) What observation would be made if chlorine gas is bubbled through aqueous sodium iodide? Explain using an equation. (2marks)

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b) Under certain conditions chlorine and iodine react to give iodine chloride, $ICl_3(s)$

What type of bonding would you expect to exist in iodine trichloride? Explain. (2marks)

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12. a) Give the name of each of the processes described below which takes place when the following salts are exposed to air overnight. (3marks)

i) Anhydrous copper sulphate becomes wet.

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ii) Magnesium chloride forms an aqueous solution.

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iii) Fresh crystals of sodium carbonate, $Na_2CO_3.\ 10H_2O$ forms white powder.

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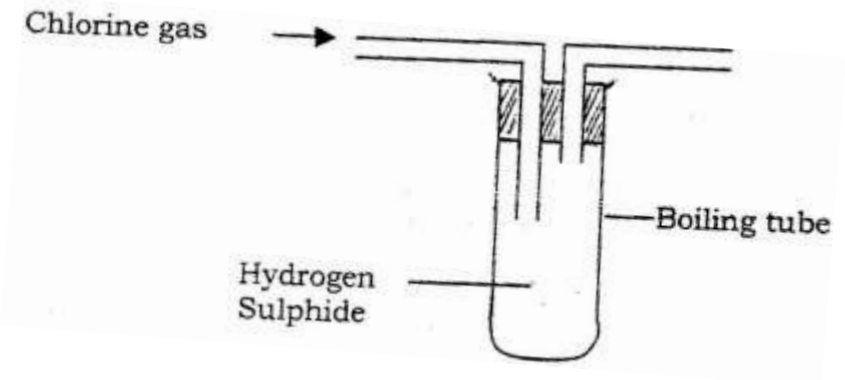
13. In an experiment, chlorine gas was passed into moist hydrogen sulphide contained in a boiling tube as shown in the diagram



a) What observation was made in the boiling tube? (1mark)

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

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c) What precaution should be taken in carrying out this experiment? Give a reason. (1mark)

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14.Using dots (.)and crosses (x) to represent outermost electrons, draw diagrams to show the bonding in H_3O^+ (Atomic numbers; H = 1.0, O = 8). (2marks)

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15. Diamond and graphite are allotropes of carbon. In terms of structure and bonding explain

the following.

(a) Diamond is used in drilling through hard rocks. (1mark)

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(b) Graphite is used as a lubricant. (1mark)

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16. The table below gives the energy required to remove the outermost electron for some group I elements.

Element	I	II	III	IV
Energy kJmol-1	494	418	519	376

a) Arrange the elements in order of their reactivity starting with the most reactive. (1mark)

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……

b) suggest possible identity of element IV. (1mark)

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17. X gm of potassium hydroxide were dissolved in distilled water to make 100cm^3 of solution. 50cm^3 of the solution- required 50cm^3 of 2 M nitric acid for complete neutralization. Calculate the mass X, of potassium hydroxide. (Relative formula mass of KOH = 56). (3marks)

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18. State and explain how the rate of reaction between zinc granules and steam can be

increased holding temperature constant. (2marks)

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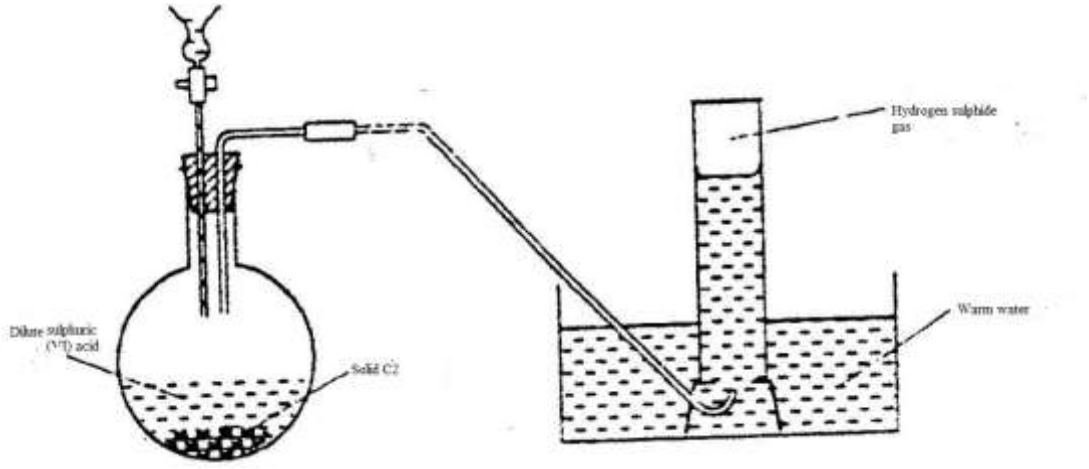
19. The apparatus shown below was set to prepare and collect hydrogen sulphide



a) Name solid C2. (1mark)

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b) Give a reason why warm water is used. (1mark)

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(c)What observation would be made if hydrogen sulphide gas was bubbled into a solution of lead (II) nitrate? (1mark)

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20. Concentrated nitric (V) acid was added to iron (II) sulphate acidified with sulphuric (VI) acid and the mixture heated. The solution turned from pale green to yellow with evolution of brown gas. Explain these observations. (3marks)

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21. Describe how a solid sample of Zinc (II) carbonate can be prepared in the laboratory starting with zinc oxide. (3marks)

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22. But -2- ene undergoes addition hydrogenation when reacted with hydrogen gas.

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

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b) Name the conditions necessary for hydrogenation process. (1mark)

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c)State one industrial use of hydrogenation. (1mark)

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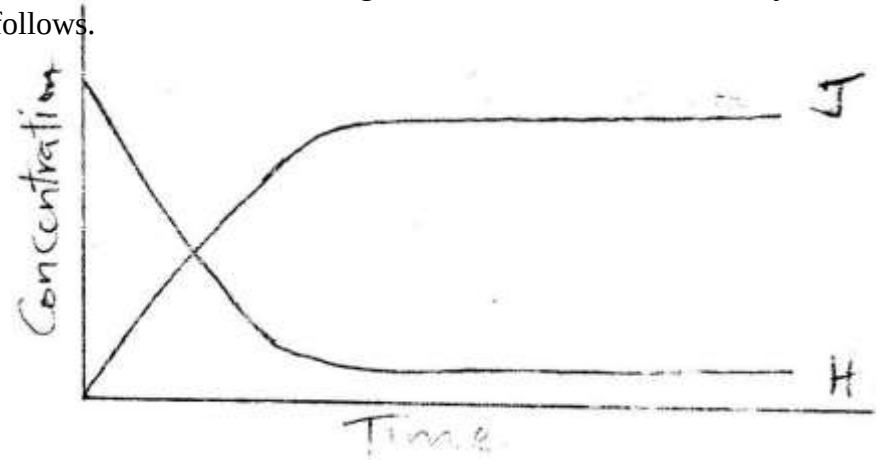
23. The sketch below shows substance H being converted to substance J. study it and answer the question that follows.



Why do the two curves become horizontal after sometime? (2marks)

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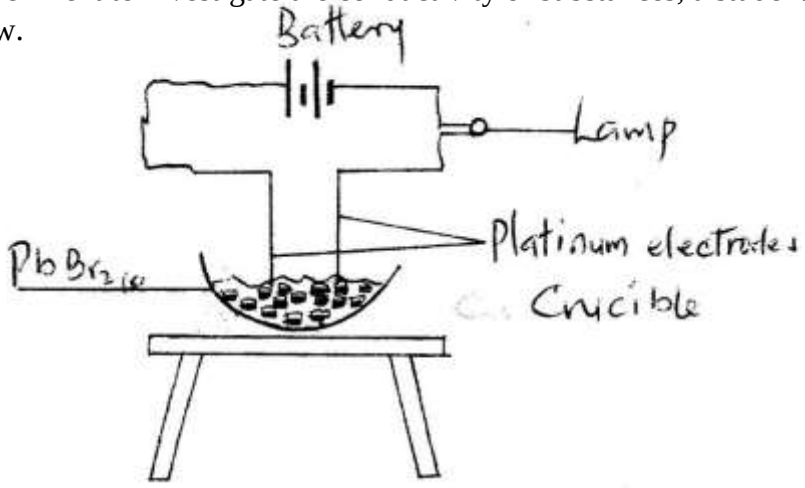
24. In an experiment to investigate the conductivity of substances, a student used the set – up shown below.



The Student noted that the bulb did not light

(a) What had been omitted in the set- up? (1mark)

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(b) Explain why the bulb lights when the omission is corrected. (2marks)

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25. a) State the Graham's law diffusion. (1mark)

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

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26.When solid B_1 was heated, a gas which formed a white precipitate when passed through lime water was produced. The residue was dissolved in dilute nitric (V) acid to form a colourless solution B_2. when dilute hydrochloric acid was added to solution B_2 a white precipitate which dissolved on warning was formed.

a) Write the formula of the;

I Cation in solid B_1 (1mark)

……

……

II anion in solid B_1 (1mark)

……

……

b) Write an ionic equation for the reaction between the residue and dilute nitric (V) acid (1mark)

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27. Hardness of water may be removed by either boiling or addition of chemicals.

a) write an equation to show how boiling removes hardness of water. (1 mark)

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……

b) Name two chemicals that are used to remove hardness of water. (2 marks)

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28. Study the information in the table below and answer the questions below the table.

Bond	Bond energy (kJmol-1)
C-H	414
Cl-Cl	244
C-Cl	326
H-Cl	431

Calculate the enthalpy change of the reaction: (3marks)

$CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(g) + HCl(g)$

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29.Distinguished between dilute acid and a weak acid. Give an example in each. (3marks)

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NAME……**ADM**……

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233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

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Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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Question	Maximum score	Candidate's score
1-29	80	

Turn Over

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

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

(i) Copper metal. (1mark)

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

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

……

……

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

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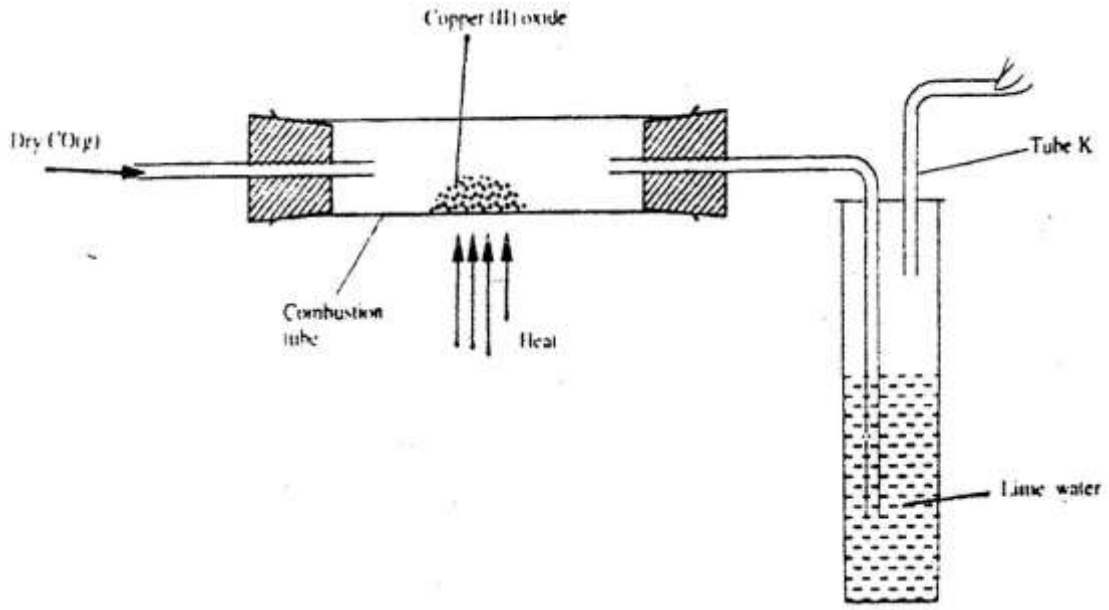
4. Draw two positional isomers of the third member of alkyne series. (3marks)

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



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

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

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

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.....

6.Give a reason why

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

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

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

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

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

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

……

……..

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

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……

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

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

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

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

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

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

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

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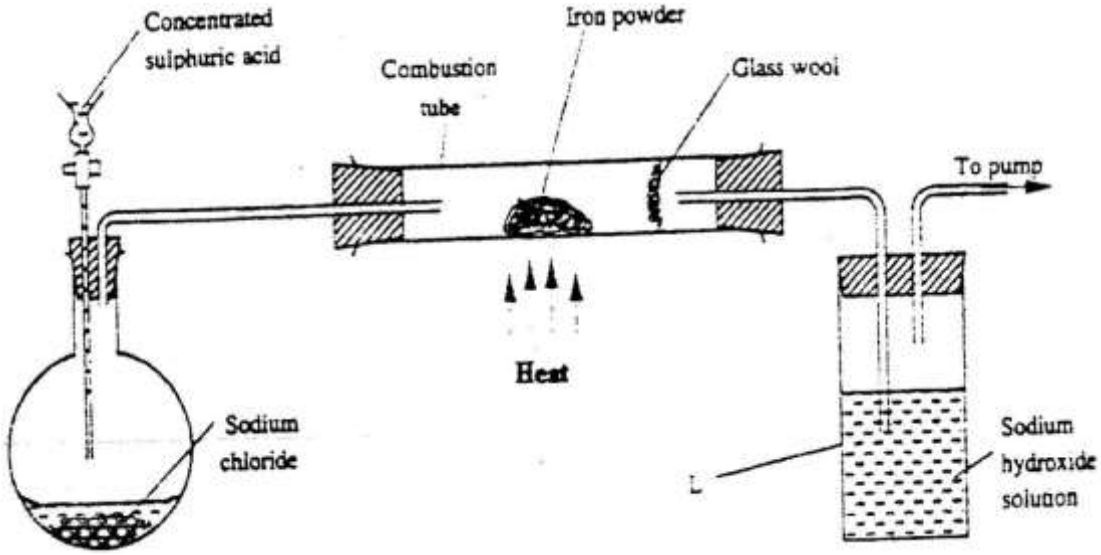
11. The set – up below was used to prepare hydrogen chloride gas and react it with iron powder. Study it and answer the questions that follow.



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

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

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

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12. Below is part of the Thorium decay series.

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

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

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

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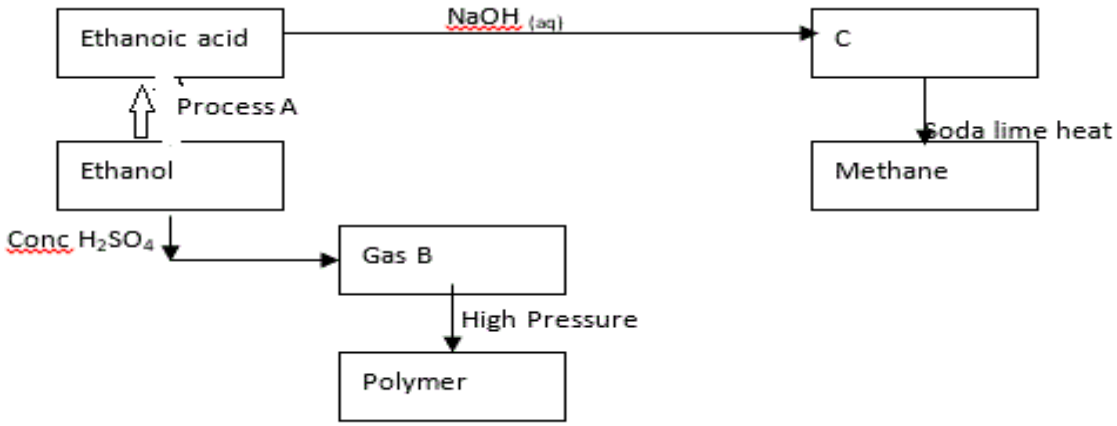
13. The flow chart below shows a series of reactions starting with ethanol , Study it and answer the questions that follow.



i) Name:

I. Process A…… (1mark)

II. Substances B and C

B..... (½mark)

C…… (½mark)

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

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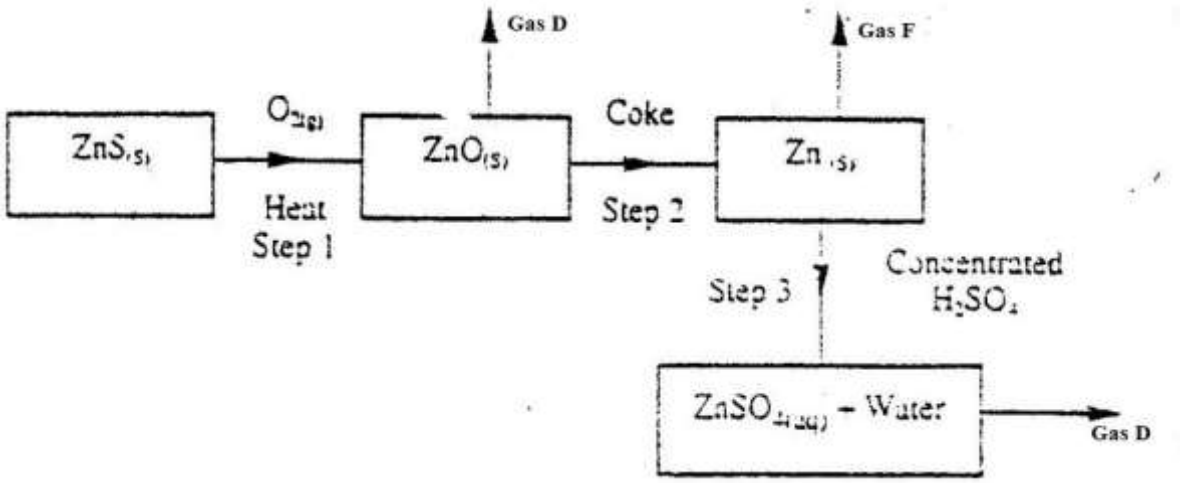
14. Study the flow chart below and answer the questions that follow.



a) State the condition necessary for the reaction in step 2 to occur (1mark)

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b) Name gases D and F: (1mark)

i) Gas D……

Gas F ……..

ii) State one use of zinc metal. (1mark)

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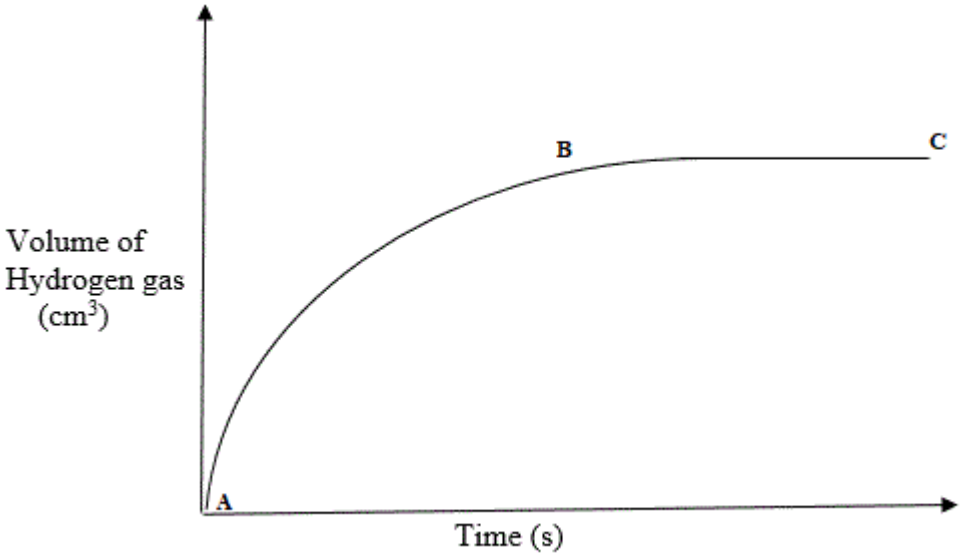
15. The reaction between a piece of magnesium ribbon with excess 2M hydrochloric acid was investigated at 25^{o}C by measuring the volume of hydrogen gas produced as the reaction progressed. The sketch below represents the graph that was obtained.



a) Explain the shape of the curve between B and C. (1mark)

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b) Suggest another parameter that can be used to determine the rate of the above reaction (1mark)

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c) On the same diagram, sketch the curve that would be obtained if the experiment is repeated using powdered magnesium metal. (1mark)

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16. Zinc oxide reacts with acids and alkalis.

a) Write the equation for the reaction between zinc oxide and:

i) Dilute sulphuric acid (1mark)

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ii) Sodium hydroxide solution (1 mark)

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b) What property of zinc oxide is shown by the reactions in (a) above? (1 mark)

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17. **0.84 g** of aluminum reacted completely with chlorine gas. Calculate the volume of chlorine gas used (Molar gas volume is $24dm^3$, al = 27). (3 marks)

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18. Proper use of soaps in washing hands has proven to control the spread of corona novel virus.

a) Write the formula of the grey insoluble substance left in the washing basin when one uses soap with tap water given that the formula of the soap is $C_{17}H_{35}COONa$. (1mark)

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b) State two advantages of Soapy detergents over soapless detergents. (2marks)

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19. a) Use the information given below to draw a labeled diagram of an electrochemical cell that can be constructed to measure the electromotive force between G and J.

$G2+(aq) + 2e \rightarrow G(s)$; $E^{\theta} = - 0.74$ V
$J2+(aq)+ 2e \rightarrow J(s)$; $E^{\theta} = -0.14$ V (2marks)

b) Calculate the E^{θ} value for the cell constructed in (a) above. (1mark)

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……

20. a) Sate Le' Chetelier's principle. (1mark)

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b) Study the following equilibrium reaction and answer the questions that follow: -

$$\underbrace{HL_{(aq)} + H_2O_{(l)}}_{\text{Red}} \rightleftharpoons \underbrace{H_3O^+(aq)\ L^-(aq)}_{\text{Blue}}$$

Given that in an acid solution, $H_3O^+_{(aq)}$ act in place of hydrogen ions, H^+, according to the equation.

$$H_3O^+_{(aq)} + OH^-_{(aq)} \longrightarrow 2H_2O_{(l)}$$

Explain what would be observed when potassium hydroxide solution is added to the above equilibrium mixture. (2marks)

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21. The table below gives information on four elements K, L, M and N. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	Electron arrangement	Atomic radius (nm)	Ionic radius(nm)
K	2, 8, 2	0.136	0.065
L	2, 8, 7	0.099	0.181
M	2, 8, 8, 1	0.203	0.133
N	2, 8, 8, 2	0.174	0.099

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

……

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……

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

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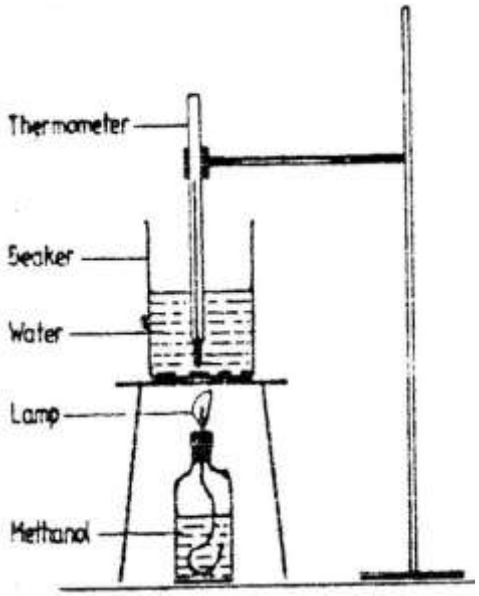
22.In an experiment to determine the heat of combustion of methanol, a student used the set-up below.



Volume of water = 500cm^3
Final temperature of water= 27.0^{0}C
Initial temperature of water = 20.0^{0}C
Final mass of lamp + methanol = 22.11g
Initial mass of lamp+ methanol= 22.98g
Density of water = 1.0g/cm^3
Specific heat capacity = 4.2kJ/g/k

Calculate:
(i)The number of moles of methanol used in this experiment given that the R.F.M is 32. (1mark)
……
……

(ii) The heat of combustion per mole of methanol. (2mark)

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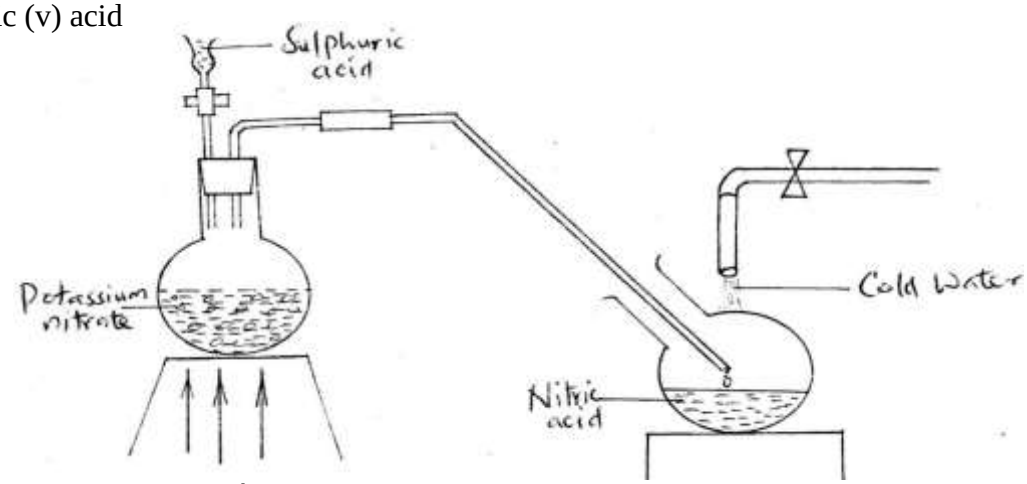
23. Using dots (.) and crosses (x) to represent outermost electrons, draw diagrams to show the bonding in, CO_2 and H_3O^+. (Atomic numbers; H = 1.0,C= 14.0, O = 8)

i) CO_2. (1mark)

ii) H_3O^+ (2marks)

24. The diagram below shows a set- up that was used to prepare and collect a sample of nitric (v) acid



a)Give a reason why it is possible to generate nitric (v) acid from sulphuric(vi) acid in the set – up. (1mark)

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……..……..

b) Name another substance that can be used instead of potassium nitrate. (1mark)

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……

c) Give two use of nitric (v) acid. (1mark)

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25. When a hydrocarbon was completely burnt in oxygen, 4.2g of carbon (IV) oxide and 1.71 g of water were formed. Determine the empirical formula of the hydrocarbon
(H= 1.0 ; C=12.0 ; 0 = 16.0). (3marks)

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

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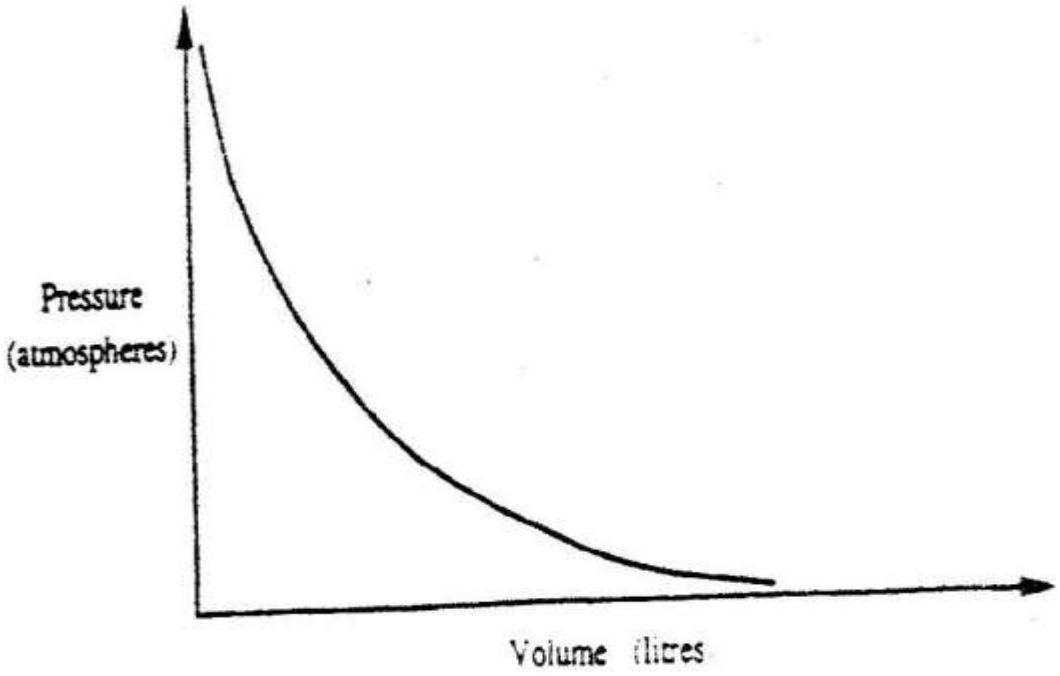
27. The graph below shows the behavior of a fixed mass of a gas at constant temperature.



a) What is the relationship between the volume and the pressure of the gas? (1mark)

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b) Three litres of oxygen gas at one atmosphere pressure were compressed to two

Atmospheres at a constant temperature calculate the volume occupied by the oxygen gas (2marks)

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28. Explain the following observations

i) Very little amount of hydrogen gas is collected when dilute sulphuric acid react with calcium metal. (1mark)

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ii) When hydrogen chloride gas is dissolved in water, the solution turns blue litmus paper to red, while when hydrogen chloride gas is dissolved in methyl benzene; the resulting solution has no effect on the blue litmus paper. (2marks)

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NAME……**ADM**……

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233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

SERIES 4 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) This paper consists of **10 printed pages***

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

(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

Turn Over

1. List three differences between a conductor and an electrolyte (3mks)

CONDUCTOR	ELECTROLYTE

2. Describe how you can prepare ethane starting with calcium carbide and water (3mks)

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3. Define the following terms

i. covalent bond (1mk)

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ii. Coordinate bond (1mk)

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iii. Draw a dot(o) and cross(x) diagram of ammonium chloride (N=14, H=1, Cl=17) (2mks)

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4. State two functions of a school laboratory (2mks)

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5. Identify substances with the following properties (1mk)

i. it is an ionic compound, an electrolyte and can be used as a food additive (1mk)

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ii. Relights a glowing splint, has a slight smell, slightly less dense than air, and fairly soluble in cold water (1mk)

……..……

……..…

iii. Has a density of 1.84 g/cm^3, an oily liquid, changes blue hydrated copper (ii) sulphate to white (1mk)

……

……..…..

6. a) Define the term fermentation (1mk)

……

……

b) Name the compounds formed when potassium metal reacts with (2mks)

i. ethanol

……

……

iii. ethanoic acid

……

……

7. A hydrated salt of copper has the formula $CuSO_4.nH_2O$. About 25g of the salt was heated until all the water evaporated. If the mass of the anhydrous salt is 16.0g, find the value of n. (Cu = 64.0, S = 32.0, O = 16.0, H = 1)

(3 mks)

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8. When 100 cm^3 of 0.5 M sulphuric acid solution, H_2SO_4, react with 100 cm^3 of 1 M sodium hydroxide solution, NaOH, the temperature rises by 6.85 Kelvins. (Density = 1.0g/cm^3, specific heat capacity = 4.2kJ$kg^{-1}K^{-1}$). Calculate the molar heat of neutralization described by the equation:

$H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$ (3 mks)

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9. Name the catalysts used in the following (3mks)

i. Esterification

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……

ii. Ostwald process

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iv. Preparation of hydrogen in the laboratory

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10. a) State Gay Lussac's law (1mk)

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b) 15.0cm^3 of ethene were mixed with 50.0cm^3 of oxygen and the mixture was sparked to complete the reaction. If all volumes were measured at a pressure of one atmosphere and 25°C, calculate the volume of the resulting gaseous mixture. (2mks)

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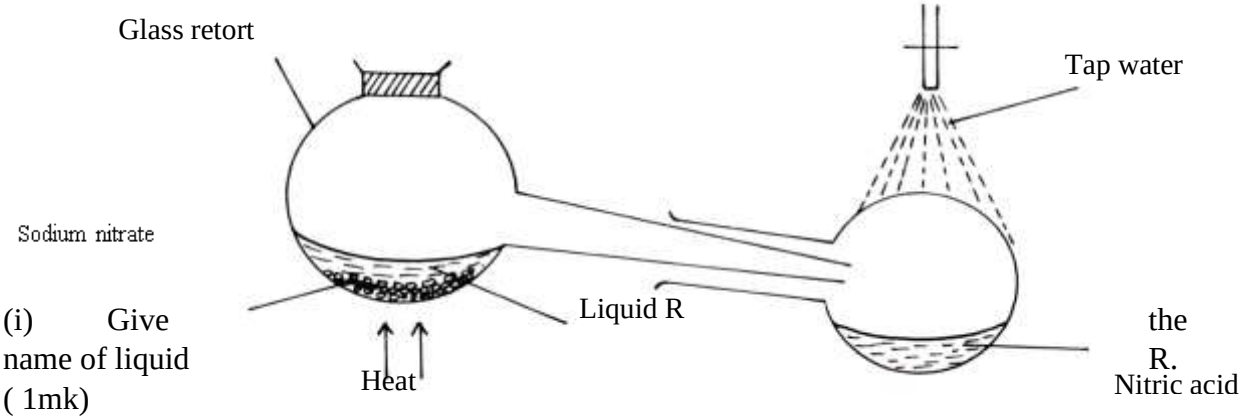
11. The set-up below was used to prepare Nitric(V)acid.



(i) Give the name of liquid R. (1mk)

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(ii) Write an equation for the reaction which takes place in the retort flask (1mk)

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……

(iii) State the role of tap water. (1mk)

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

Bond	Bond energy (KJ mol)
C-H	413
Br-Br	193
C-Br	280
H-Br	365

(a) Calculate the Enthalpy changes for the reaction below (2mks)

$$CH_4\,(g) + Br_2\,(g) \longrightarrow CH_3Br\,(g) + HBr\,(g)$$

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(b) State whether the reaction is exothermic or endothermic. Explain (1mk)

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13. Differentiate between hydrolysis and saponification (2mks)

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14. a) Zeolites (Na_2X) is a complex compound used to soften hard water in the ion-exchange methods according to the equation below.

$$Ca^{2+}(aq) + Na_2X(aq) \longrightarrow CaX_{(s)} + 2Na^{+}_{(aq)}$$

After sometimes the Zeolites get exhausted and cease to soften water. Write an equation to show how Zeolite is regenarated. (1mk)

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b) Name two other method used in softening hard water (2mks)

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……

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15. The table below gives information about some reactions of metals A,B, C and D and their rates.

METAL	**Reaction with acid**	**Reaction with water**	**Action of heat on its nitrate**
A	Hydrogen evolved	No reaction	Oxide formed
B	NO reaction	No reaction	Metal formed
C	Hydrogen evolved	Hydrogen evolved	Oxide formed
D	NO reaction	NO reaction	Oxide formed

Arrange the metals in order of decreasing activity (3mks)

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16. Elements X, Y and Z have atomic numbers 9, 11 and 18 respectively.

(a) Which element can be used in electric light bulbs? (1mark)

……..……

……..……

(b) Which two elements react to form an ionic compound? (1 Mark)

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……

(c) Write an equation for the reaction between element B and water? (1mark)

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17. (a) What is a universal indicator? (1mark)

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(b) State **one** advantage of universal indicator over other commercial indicators. (1mark)

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18. Explain how solid calcium sulphate can be prepared from solid samples of calcium carbonate and sodium sulphate. All other reagents and apparatus are provided. (3 marks)

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19. 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)

P

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U

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S

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V

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T

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W

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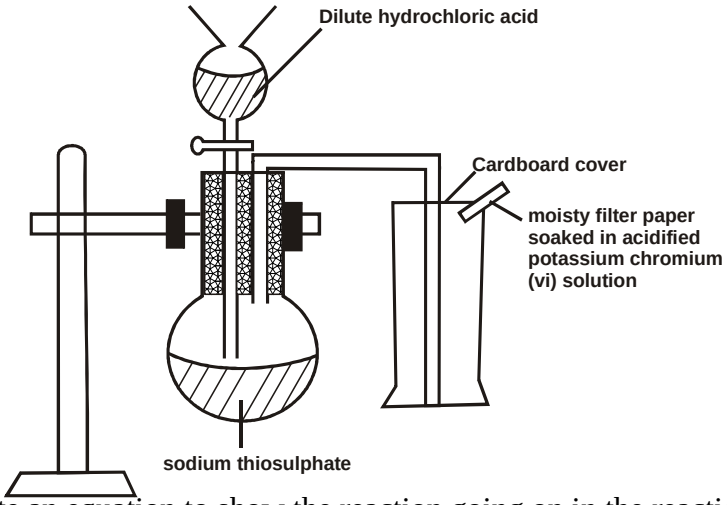
20. Sodium thiosulphate was reacted with dilute hydrochloric acid in a round bottomed flask as shown below. The gas evolved was collected by downward delivery in a gas jar.



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

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

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

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22. State one use of each of the following apparatus in the laboratory

i) Conical flask (1mk)

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ii) Desiccator (1mk)

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iii) Crucible (1mk)

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22 i. Define Vulcanisation (1mk)

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ii. What is the importance of the above defined process (2mks)

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23. Two gas jar containing hydrogen chloride gas and ammonia gas were close to each other as shown below

i. State and explain the observation made (2mks)

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ii) State the significance of the above experiment (1mk)

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24. Unknown substances had PH values as shown in the table below.

Substance	PH values
A	6.0
B	2.0
C	8.0

State which substance is likely to be;

i. Lemon juice (1mk)

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……

ii. **Identify** a substance that would be a better electrolyte? Explain (2mk)

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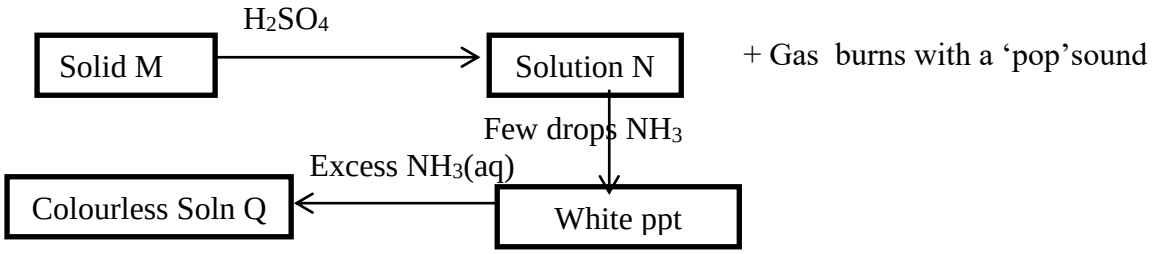
25. The scheme below shows some reaction sequence starting with solid M.



i. Name solid **M** (1mk)

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ii. Write the formula of a complex ion present in solution **Q** (1mk)

……

……

ii. Write an ionic equation of the reaction between lead (ii) nitrate and solution **N** (1mk)

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26. Describe how you can separate a mixture of water and hexane (3mks)

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27. A solid p was suspected to be a sulphate of sodium, describe the tests that would be carried out to determine whether the sold was actually sodium sulphate (3mks)

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……

28. Define the term chemistry (1mk)

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233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

SERIES 5 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) This paper consists of **10 printed pages***

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

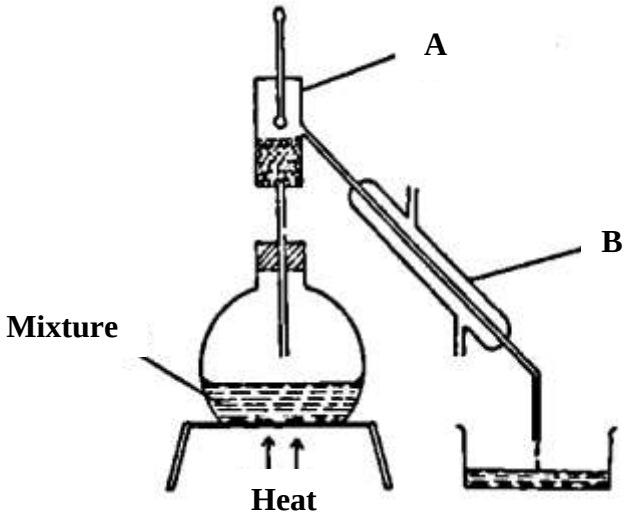
(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

Turn Over

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



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

A-

B-

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

.....

.....

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

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

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

.....

.....

.....

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

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

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

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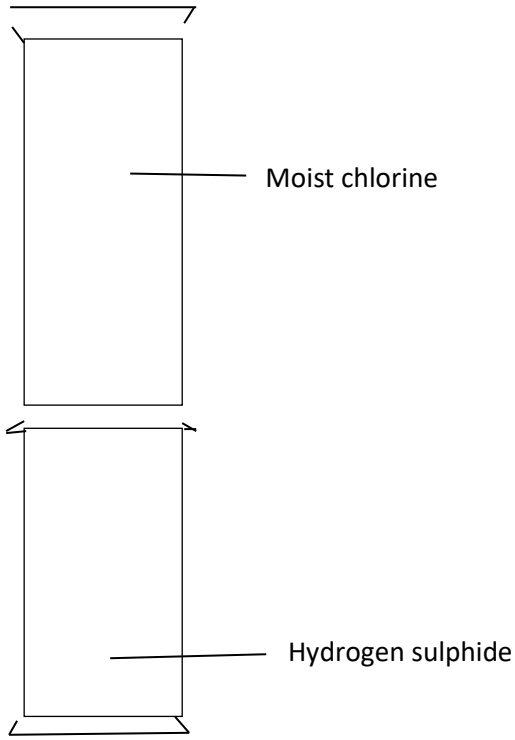
4. A jar full of moist chlorine was inverted over a jar of hydrogen sulphide as shown below.



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

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

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

(i) Explain the observation. (1mark)

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

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

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

Reagent

Observation (2 marks)

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

Reagent

Observation (2marks)

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

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

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

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

P^{2-}	2:8:8
Q^{2+}	2:8
R^{+}	2:8
S	2:8:8

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

……

……

……

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

……

……

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

Density 1.134gm and percentage purity 37%

Determine the molarity of the solution. (4 marks)

……

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……

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

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

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

……

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……

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

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……

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

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

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

.....

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.....

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

13. (a) Using an equation explain the observation made when sodium hydroxide is added to aluminum oxide dropwise until in excess. (2 marks)

.....

.....

.....

(b) Name the product of the reaction (1mark)

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.....

14. (a) Cynogen is a gaseous compound of carbon and Nitrogen only. 250cm^3 Cynogen.

On

complete combustion in oxygen. 750cm^3 of nitrogen (iv) Oxide and 1000cm^3 of the rest of product. Determine the formula of cynogen. (3 marks)

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

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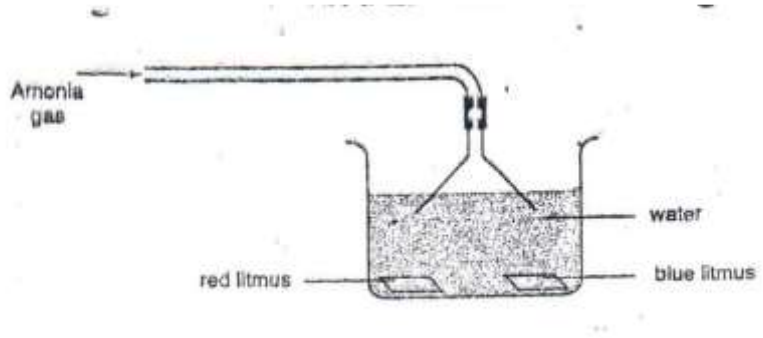
15. A stream of Ammonia was bubbled in water containing litmus papers.



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

.....

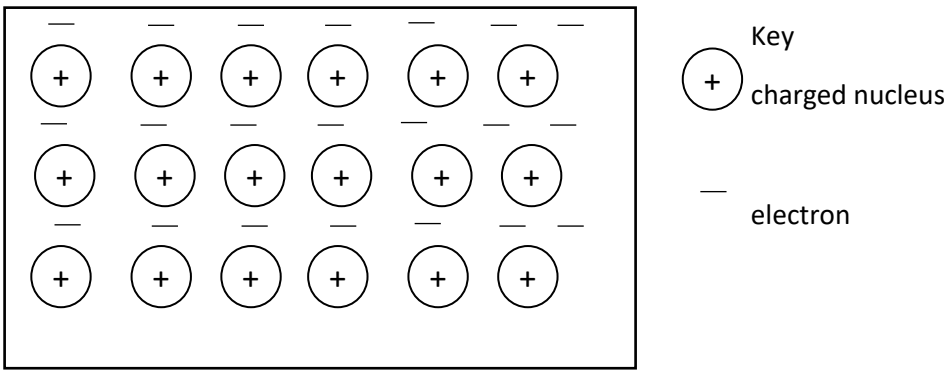
.....

b) Explain the observation made during the experiment. (1mark)

.....

.....

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



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

……

……

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

……

……

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

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

……

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……

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……

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

$C_2H_4 \longrightarrow$

c) State type of reaction and calculate the value of n given the molecular mass of polymer is 33600. (4 marks)

.....

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.....

18. Below is a chemical reaction

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

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

.....

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……

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

.....

……..

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

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19. Study the test below and answer the questions.

(i)

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

(ii)

Chlorine gas was bubbled through an aqueous of P	Solution turn from green to yellow

a) Identify P……

R……1mark)

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

……

……

……

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

.....

.....

.....

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

a) Iron

.....

.....

b) Copper

.....

.....

c) Sodium

.....

.....

d) Aluminium

.....

.....

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

.....

.....

……

……

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

.....

.....

.....

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

.....

.....

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

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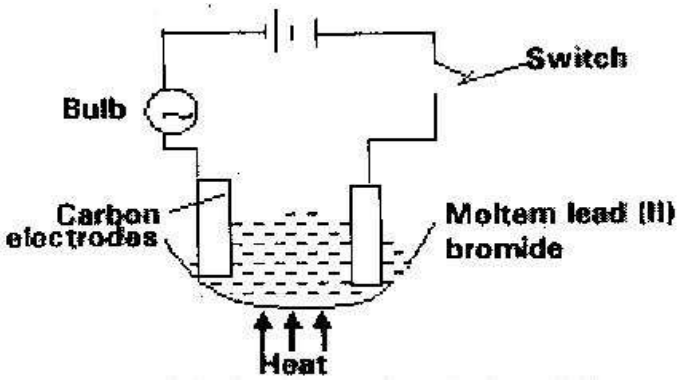
.....

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



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

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……

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

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

i. Temporary hardness (1mk)

……..……..

……..…….

ii. Permanent hardness (1mk)

……..……..

……..…..…….

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

……..……..

……..……

c. State **one** disadvantage of using hard water in boilers. (1mk)

……..……..

……..……

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

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

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

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

a. Define '**enthalpy** of formation' (1mk)

……..……..

……..……

……..……

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

……..……..

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NAME……**ADM**……

SCHOOL……**INDEX**……

DATE……**SIGN**……**TARGET**……

233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

SERIES 6 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) This paper consists of **10 printed pages***

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

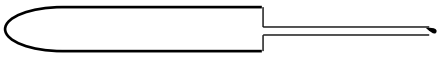
(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

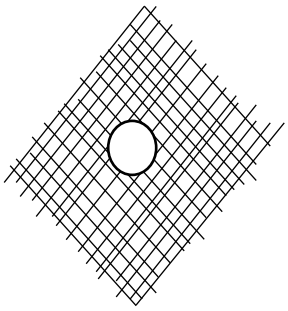
Turn Over

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)

$H_2N\ CH_2\ COOH + H_2N\ CH_2CH_2C\cancel{OOH}$

.....

.....

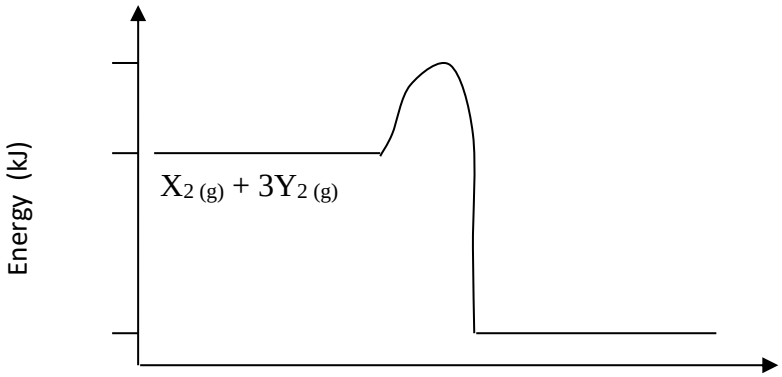
b) Name the type of polymerization shown above. (1 mark)

.....

.....

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)

.....

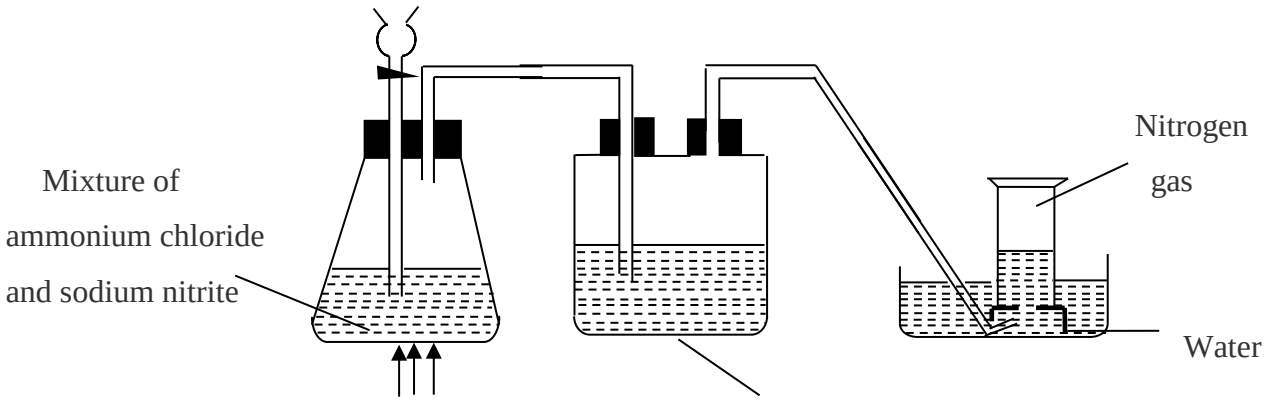
.....

.....

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.

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

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

$$Al_2Cl_6 \underset{\text{Process P}}{\overset{\text{Process Q}}{\rightleftharpoons}} 2AlCl_3\ (s)$$

(g)

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)

.....

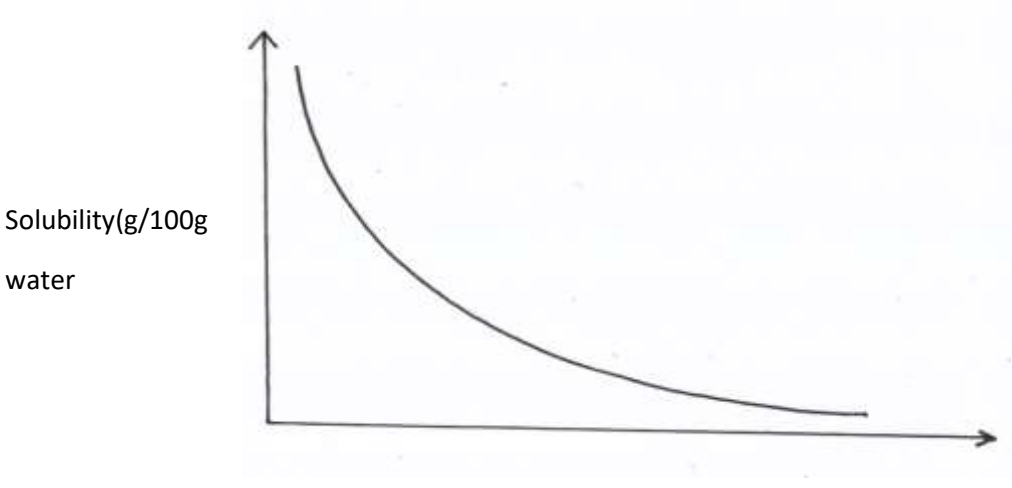
.....

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.

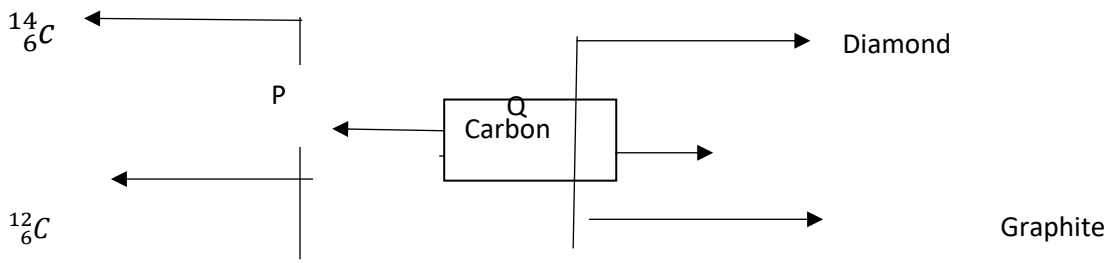
Salt	**Solubility (g 1 100 g H_2 O**	
	At 60^0 C	At 40 ^oC
Cu SO4	40	28
Pb $(N0_3)_2$	99	79

Calculate the mass of copper (II) sulphate that will crystalize if 40g of a saturated solution is cooled from 60 ^oC to 40 ^oC. (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)

.....

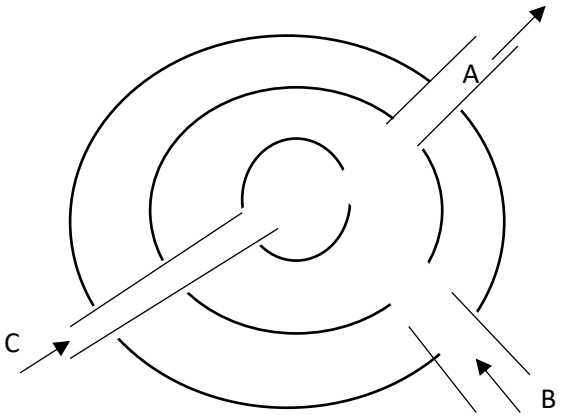
b) Give one use of $^{14}_{6}c$ (1 mark)

.....

.....

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

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

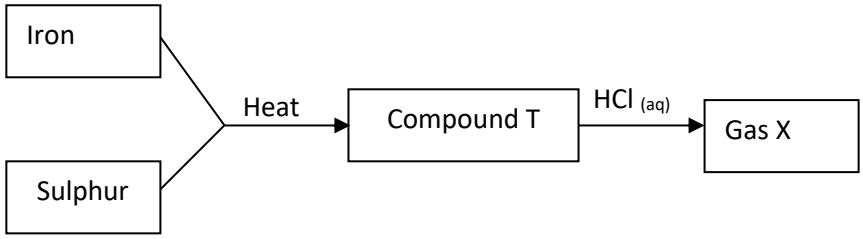


Name the substances that pass through A and C.

A……..(1 mark)

C…….. (1 mark)

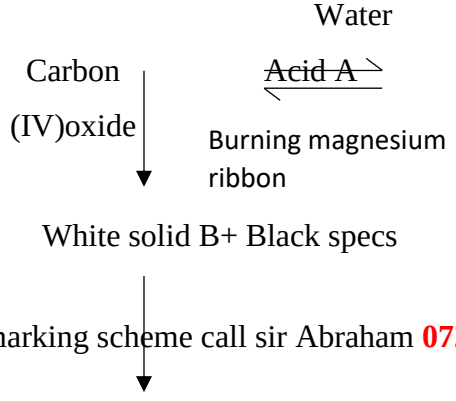
b)Study the flow chart below and answer the questions that follow.



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.



+ water

Alkaline solution C

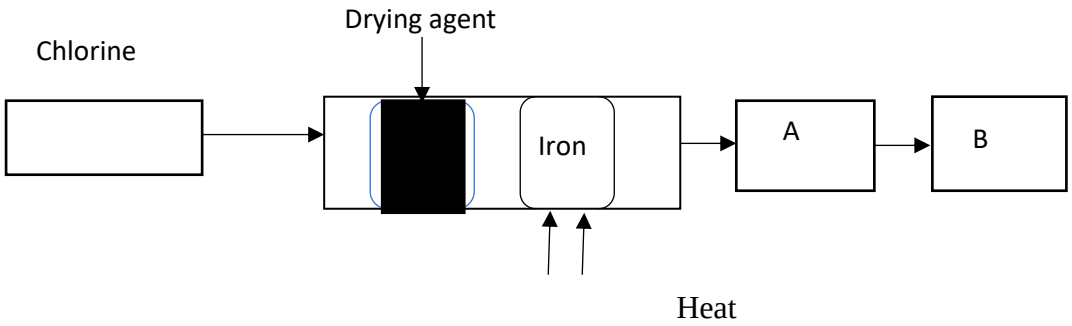
Write the formula of substances A, B and C (3 marks)

A……

B……

C……

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)

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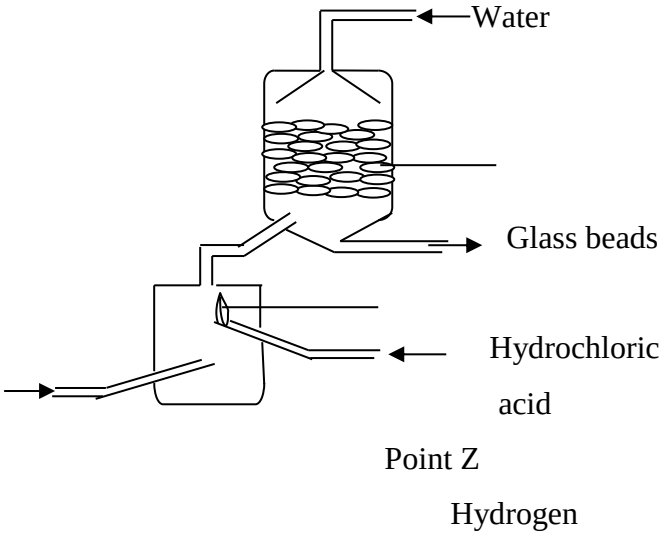
21. The diagram below represents the industrial manufacture of hydrochloric acid, study it and answer the questions that follow.



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)

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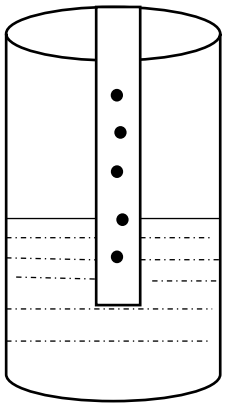
.....

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)

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

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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)

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.....

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

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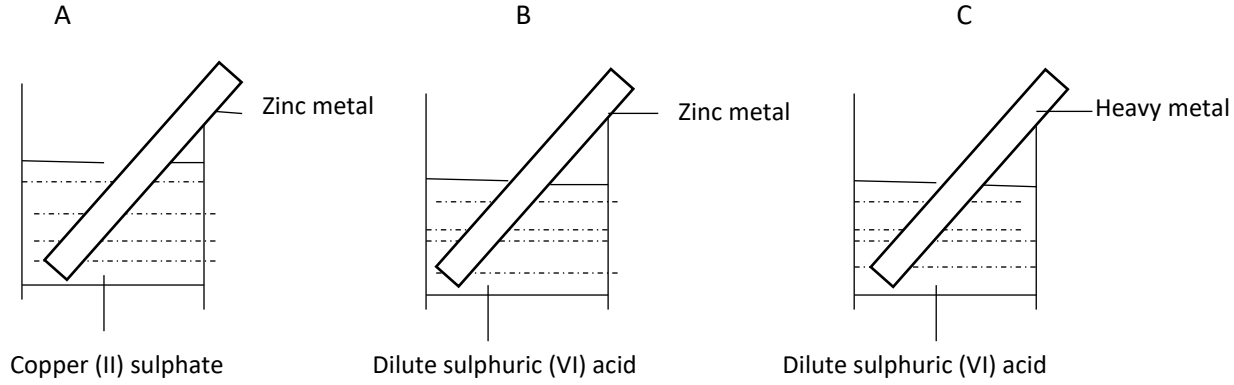
26 a) A student set up experiments as illustrated by the diagrams below. Before introducing each metal into the solution it was cleaned.



i)Why is it necessary to

clean the metal pieces before introducing them into their respective beakers 1. a) Name and provide the function of the following pieces of apparatus.

(1 mark)

.....

.....

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

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NAME……**ADM**……

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233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

SERIES 7 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) This paper consists of **10 printed pages***

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

(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

Turn Over

1. Using reagents provided only, explain how you could prepare a salt of Zinc carbonate solid. Dilute nitric(v) acid, zinc, sodium carbonate (3mks)

……

……

……

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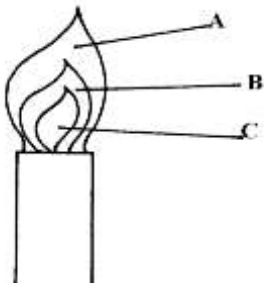
……

2. The diagram below shows a Bunsen burner when in use



Describe an experiment that would confirm that region labeled C is unsuitable for heating. (2mk

……

……

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……

3. a) On the grid provided sketch a graph of pressure against volume for fixed mass of a gas at constant temperature (1mk)

b) A fixed mass of a gas has a volume of 250cm^3 at 27^{o}C and 750mmHg pressure.

Calculate the gas volume that the gas would occupy at 41^{o}C and 750mmHg pressure. (0^o = 273k) 2mks

……

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4. 22.2cm^3 of sodium hydroxide solution containing 4.0g per litre sodium hydroxide were required for complete neutralisation of 0.1g of a dibasic acid. Calculate the relative formula mass of the dibasic acid. (Na = 23, O=16, H=1) (3mks)

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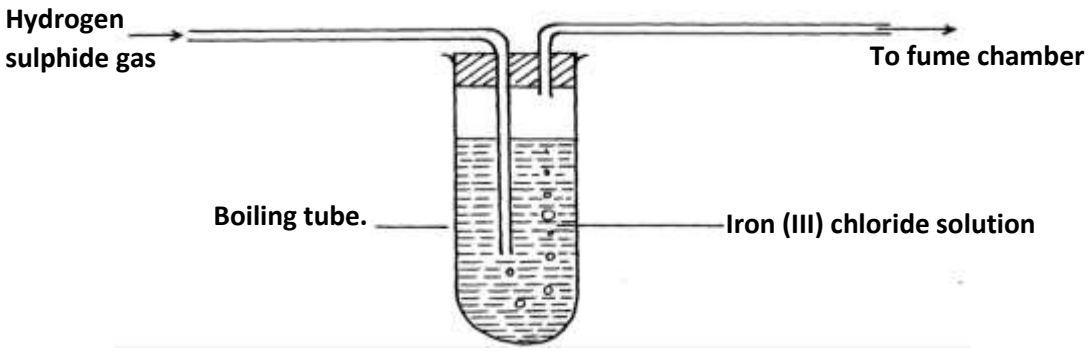
5. The diagram below represents a laboratory experiment to investigate the reaction between hydrogen - sulphide gas and an aqueous iron (III) chloride.



a) Write chemical equation for the reaction which takes place in the boiling tube. (1mk)

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……

……

b) What adjustment need to be made in the above set-up if the laboratory does not have a fume chamber. (1mk)

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c) Describe a laboratory chemical test for a sample of hydrogen sulphide gas. (1mk)

……

……

……

6. A group of compounds called chlorofluorocarbons have a wide range of uses but they have harmful effects on the environment. State and explain one harmful effect of chlorofluorocarbons on the environment. (2mks)

……

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7. X grams of a radioactive isotope takes 120 days to decay to 3.5 grams. The half-life period of the isotope is 20 days.

   a) Calculate the initial mass of the isotope (2mks)

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   b) State the application of radioactivity in agriculture. (1mk)

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8. Sulphur and sodium belong to the same period on the periodic table. State and explain the difference in M.P of the oxide of sulphur and the oxide of sodium. (3mks)

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9. a)Water is an example of a polar solvent. What is a polar solvent? (1mk)

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b) Explain the following observations HCl gas dissolves in water to form an electrolyte, while the same chloride dissolves in methylbenzene to form a non-electrolyte (1mk)

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10. a)Define the term deposition (1mk)

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b) Describe how you can obtain copper powder from a mixture containing copper and zinc powder. (2mks)

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11. a) Name the main ore from which iron is extracted. (1mk)

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b) Name two substances that convert iron (III) oxide to iron in the blast furnace. (2mks)

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12. a)Write an equation showing how boiling can remove temporary water hardness.(1mk)

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b) Name one method that can be used to remove both temporally and permanent water hardness. (1mk)

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c) Other than wastage of soap during cleaning, state one other disadvantage of hard water.(1mk)

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13. a)Name two pure allotropes of carbon. (1mk)

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b)State and explain using relevant equations the observation made when carbon(IV) oxide is bubbled through calcium hydroxide solution for a long time. (2mks)

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14. When $Na_2CO_3.xH_2O$ is strongly heated it loses 63.2% of its mass. Determine the value of x in the compound(Na = 23, O = 16, H = 1) (3mks)

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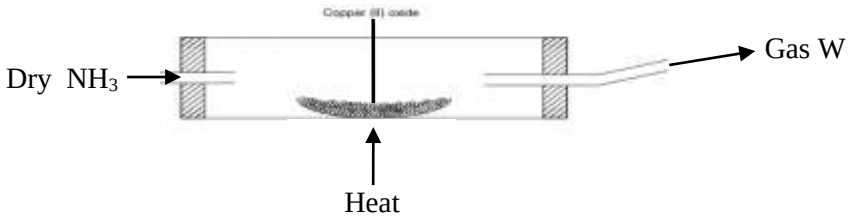
15. Dry ammonia was passed over a heated lead(II) oxide in a combustion tube as shown

Lead (II) oxide



a) What observations would be made in the combustion tube (1mk)

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b) Write a chemical equation for the reaction in the combustion tube (1mk)

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c) State one industrial use of ammonia (1mk)

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16. An ion of P^{2+} has a configuration of 2.8

a) Name the family to which P belong (1mk)

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b) Compare the atomic and ionic radius of P. Explain (2mks)

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17. a)Explain why alkanes are used as fuel (1mk)

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b) Draw the structure of the following compounds (2mks)

i) 3-methylbut – 1 yne

ii) But – 2 –ene

18. a)Define solubility (1mk)

b) Study the information in the table and answer the questions below

Salt	Solubility (g) 100g water	
	At 40^0C	At 60^0C
$CUSO_4$	28	38
$Pb(NO_3)_2$	79	98

i)Calculate the mass of $CuSO_4$ that would saturate 200g of water at 60^0C (1mk)

ii)A solution containing 80g of $Pb(NO_3)_2$ in 100g of water at 60^0C was cooled to 40^0C. Calculate the mass of $Pb(NO_3)_2$ that crystallized (1mk)

19. Dilute hydrochloric acid was added to a compound Z of copper. The solid reacted with the acid to form a colourless gas which formed a white precipitate when bubbled through lime water.

a) Name solid Z (1mk)

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b) State the observation that would be made if a similar compound of lead is used. Explain. (2mks)

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20. a)Explain why the reactivity of group(VII) elements decrease down the group (2mks)

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b) Moist blue litmus and dry blue litmus paper were introduced into gas jars of dry chlorine. State the observations that would be made. 1mk)

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21. a)Name the reagents that are commonly used in the preparation of hydrogen (1mk)

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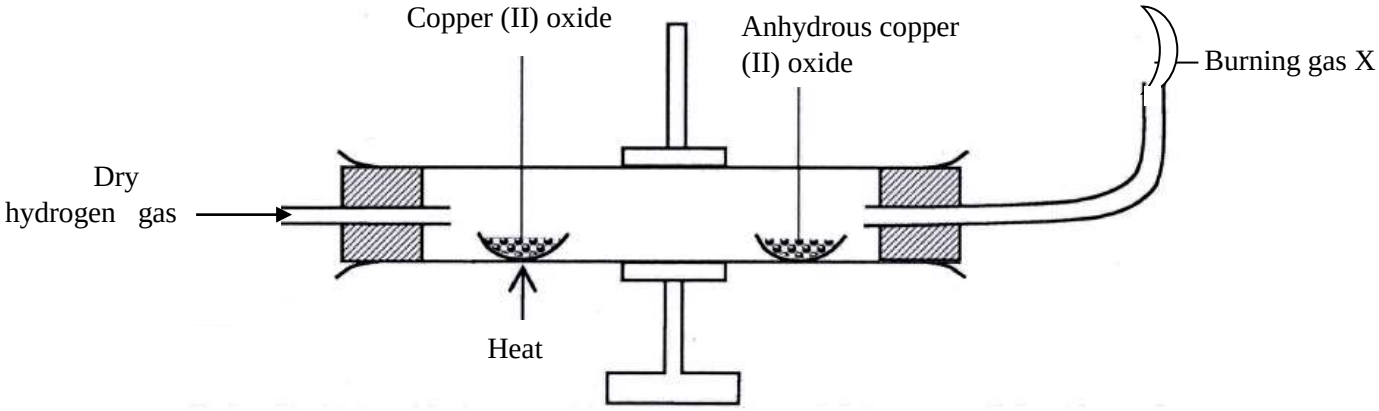
b) Study the diagram below and answer the questions that follow



i) Name gas x (1mk)

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ii) State and explain the observation made in the anhydrous copper(II) sulphate after sometime (1mk)

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22. a) State two physical properties of sulphur (IV) oxide (1mk)

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b) Explain why when sulphur (IV) oxide is bubbled into acidified potassium dichromate (VI) the solution changes colour from orange to green. Explain the observation (1mk)

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c) In the contact process of manufacture of sulphuric(VI) acid, explain how pollution by SO_2 is reduced. (1mk)

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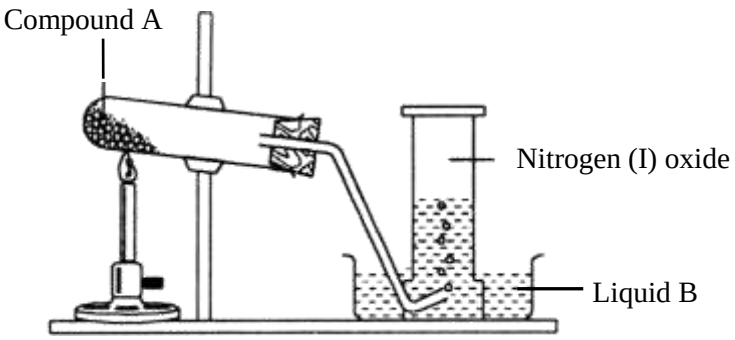
23. Study the setup below and answer questions that follow



a) Name (1mk)

i) Compound A

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ii) Liquid B

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b) Why is the boiling tube tilted downwards (1mk)

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24. Explain why

a) Aluminium is commonly used for making cooking pots and pans. (1mk)

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b) Silicon(IV) oxide is a poor conductor of heat and electricity (1mk)

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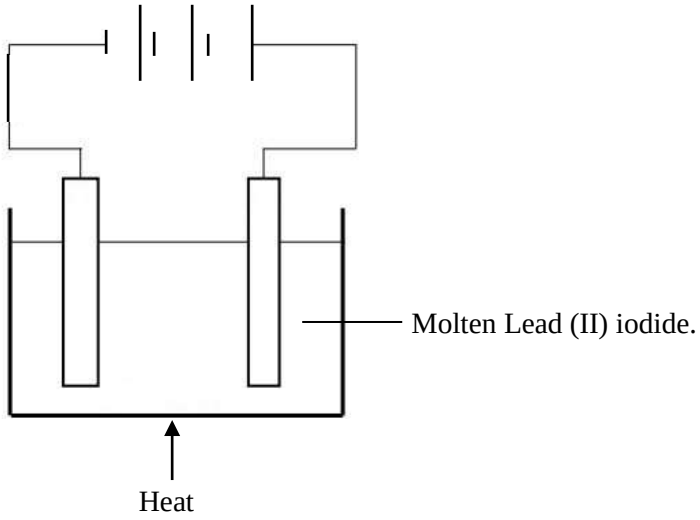
25. The set up below was used to show electrolysis in molten lead(II) iodide



i) On the diagram label the cathode (1mk)

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ii) State the observation that was made at the anode during the electrolysis. Give a reason for your answer (2mks)

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26. 100cm^3 of carbon (II) oxide gas was reacted with 100cm^3 of oxygen. (All volume were measured under the same conditions of temple and pressure.

a) Determine

i) Volume of the product formed (1mk)

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ii) The gas which was in excess and by what volume (2mks)

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27. a) Using a dot(.) and cross(x) diagram of carbon(II) oxide, differentiate between a covalent and a co-ordinate bond (1mk)

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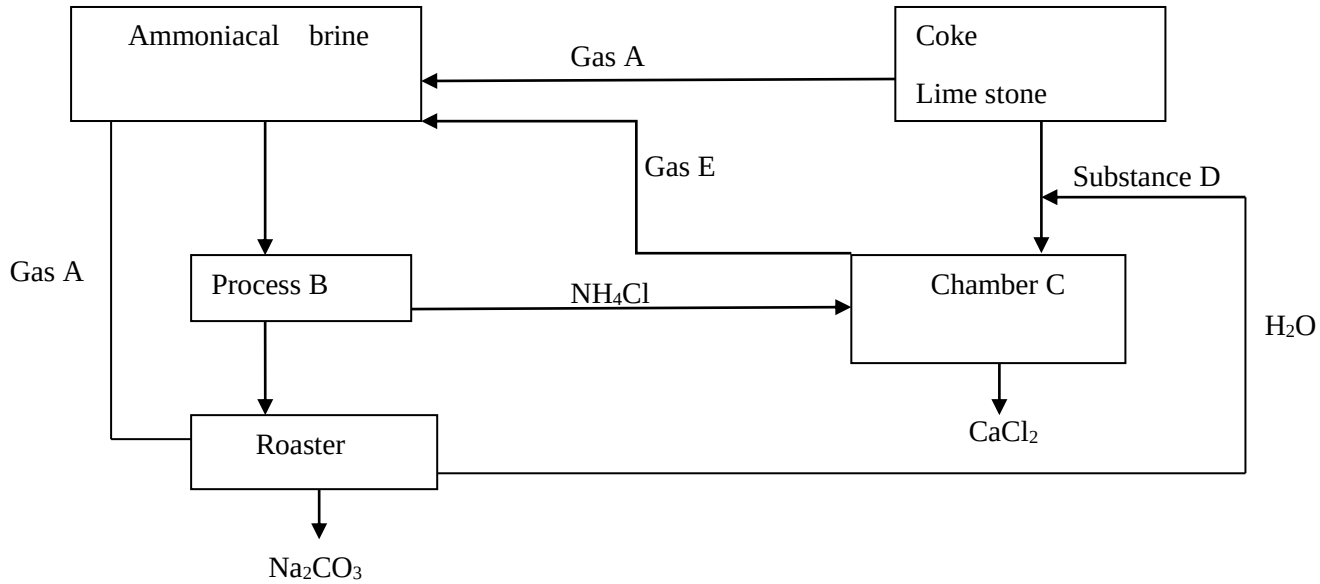
b) Use dot (.) and cross(x) diagrams to show bonding in between the elements represented by the following symbols. (2mks)

i) $^{24}_{12}X$ and $^{19}_{9}Y$

28. Study the flow diagram below



a) Name

i) Gas A (½ mk)

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ii) Process B (½ mk)

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iii) Substance D (½ mk)

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iv) Gas E (½ mk)

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b) Write the equation for the reaction in chamber C (1mk)

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NAME……**ADM**……

SCHOOL……**INDEX**……

DATE……**SIGN**……**TARGET**……

233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

SERIES 8 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) This paper consists of **10 printed pages***

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

(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

Turn Over

1 (a) What is a universal indicator? (1mark)

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(b) State **one** advantage of universal indicator over other commercial indicators. (1mark)

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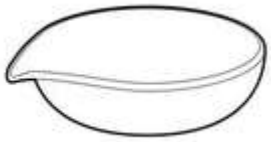
2. Complete the diagram below on identification and uses of some laboratory apparatus.

Diagram		
Name	(a) (½ mark)	(c) (½ mark)
Purpose	(b) (1mark)	(d) (1mark)

3 (a) In an experiment, sulphur was heated in a deflagrating spoon until it begins to burn then lowered into a gas jar. Explain the observations made. (2 marks)

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(b) Explain the role of oxygen in steel making. (2 marks)

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

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(b) At what temperature, in K, assuming constant pressure, is the volume of a fixed mass of gas at 127^{o}C doubled? (2 marks)

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5 (a) Distinguish between a temporary physical change and temporary chemical change. (2 marks)

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(b) In an experiment, the following substances were heated in separate test tubes. Complete the table to state the observations and classifying the type of change that occurs. (3 marks)

Solid	**Observations on heating**	**Type of change**
$CuSO_4.5H_2O$		
$KMnO_4$		

6. Explain how you would distinguish between ethane and ethyne. (2 marks)

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7. Explain how solid calcium sulphate can be prepared from solid samples of calcium carbonate and sodium sulphate. All other reagents and apparatus are provided. (3 marks)

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8 (a) A metal reacts with dilute hydrochloric acid to produce a gas. Explain how to identify the gas.

(1mark)

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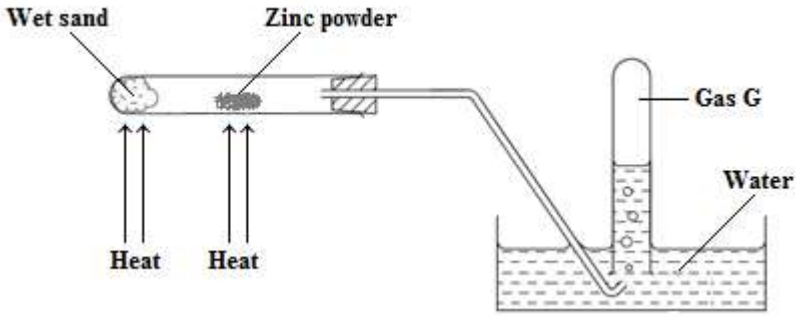
(b) The diagram below shows the set up used for the reaction between magnesium and steam.



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

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(ii) Explain why the wet sand must be heated first before the zinc powder is heated. (1mark)

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9 (a) Distinguish between covalent bond and co-ordinate bond. (2 marks)

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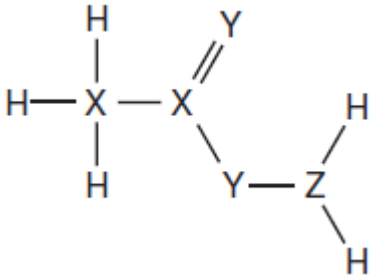
(b) The diagram below shows the structure of a covalent compound containing the element hydrogen, H, and the unknown elements X, Y and Z.



To which groups of the Periodic Table do these three elements, X, Y and Z, belong? (1½ ma

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10. In an experiment silicon (IV) chloride is dissolved in water in a boiling tube.
(a) Write an equation for the reaction that occurs. (1mark)

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(b) Explain the observations that were made during the experiment. (3 marks)

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11. A standard solution of potassium hydroxide (KOH) is prepared in a 250 cm^3 volumetric flask. During a titration, 12.5 cm^3 of this solution neutralizes 25 cm^3 of a 0.16 $moldm^{-3}$ ethanoic acid solution.
The balanced equation for the reaction is: $CH_3COOH_{(aq)} + KOH_{(aq)} \rightarrow CH_3COOK_{(aq)} + H_2O_{(l)}$
Calculate the mass of potassium hydroxide used to prepare the solution above in the 250 cm^3 volumetric flask.
(K = 39, O = 16.0, H = 1.) (3 marks)

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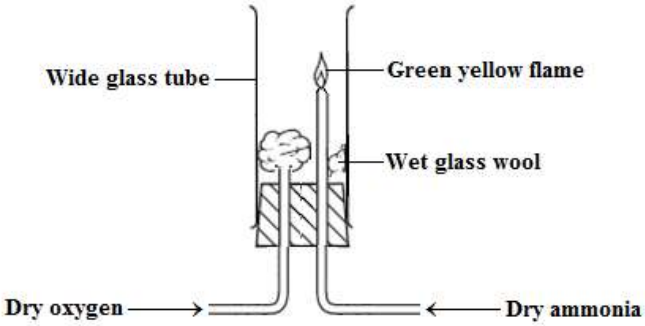
12. Ammonia gas was burnt in oxygen as shown in the diagram below.



(a) State the role of the glass wool. (1mark)

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(b) State the observations made during the experiment. (1mark)

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(c) Write an equation for the reaction that occurs. (1mark)

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13. Study the following reaction at equilibrium at a certain temperature.

$2SO_{3(g)} \rightleftharpoons O_{2(g)} + 2SO_{2(g)}$ $\Delta H > 0$

(a) State **two** optimum conditions for this reaction. (1mark)

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(b) State **two** ways of increasing the yield of $SO_{3(g)}$. (2 marks)

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14 (a) Write the equation for the reaction between chlorine and cold dilute sodium hydroxide.(1mark)

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(b) When chlorine gas reacts with hot concentrated calcium hydroxide, one of the products formed is calcium hypochlorite ($CaOCl_2$). This commonly referred to as bleaching powder.
Explain the bleaching action of calcium hypochlorite. (2 marks)

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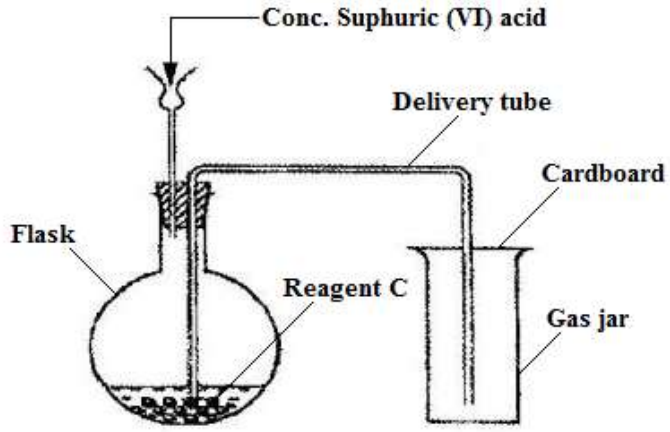
15. The diagram below shows an apparatus for the laboratory preparation of carbon (II) oxide.



(a) Identify **two** mistakes in the set up. (2 marks)

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(b) Write an equation for the reaction between concentrated sulphuric (VI) acid and reagent C.(1mark)

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

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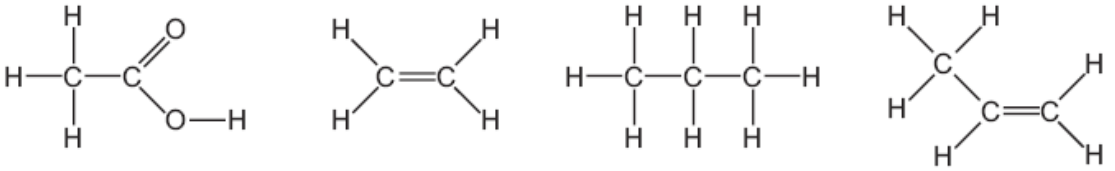
16. The structures of four organic compounds are shown.

1 2 3 4



(a) Which compounds decolourize bromine water? (1mark)

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(b) Explain **one** chemical test that can be used to distinguish between compounds 1 and 2. (2 marks)

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17. How does the number of carbon, hydrogen and oxygen atoms in an ester differ from the total number of carbon, hydrogen and oxygen atoms in the alcohol and carboxylic acid from which the compound was derived?

(1½ marks)

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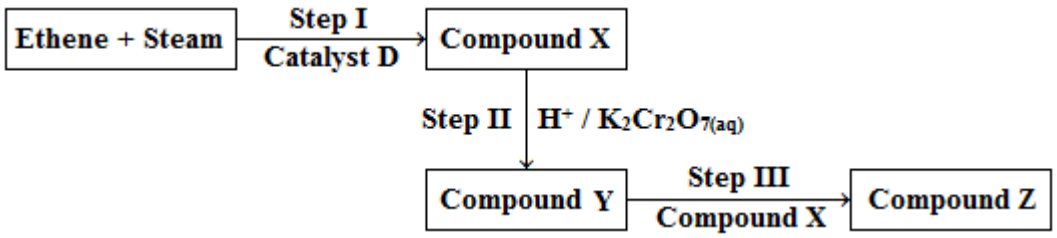
18. The diagram shows a reaction scheme.



(a) Name:
(i) Catalyst D
(ii) Reaction II
(iii) Reaction III
(iv) Compound Z (4 marks)

(b) State the observations made in step II. (1mark)

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(c) Write an equation for the reaction that occurs in step III. (1mark)

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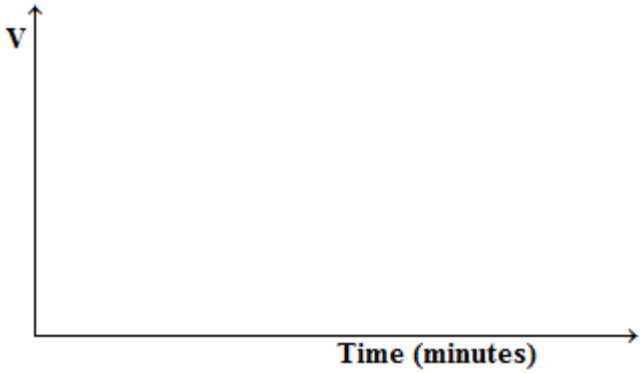
19. A student performs two reactions.

- reaction 1: 10 g of magnesium ribbon with excess 2.0 mol / dm^3 dilute hydrochloric acid
- reaction 2: 5 g of magnesium powder with excess 2.0 mol / dm^3 dilute hydrochloric acid

In both experiments, the volume of hydrogen produced, V, is measured against time, t, and the results plotted graphically.

(a) On the grid below, sketch a graph that would be obtained is volume of hydrogen produced is plotted against time for both reactions1 and 2. (2 marks)



(b) Explain your answers. (2 marks)

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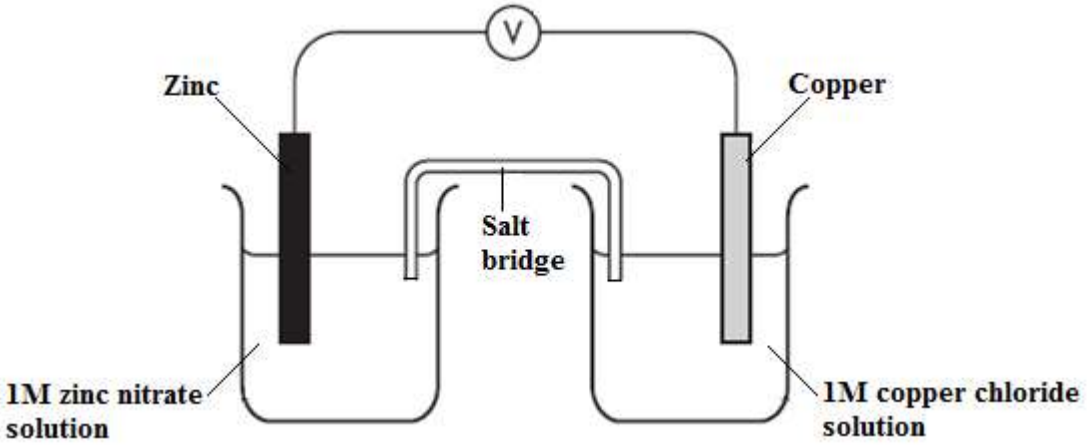
20. A copper – zinc electrochemical cell is set up as shown below.



Lead (II) nitrate is used as an electrolyte in the salt bridge.

(a) Initially the cell did not work. Explain. (2 marks)

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(b) Once the mistake identified in (a) above was corrected:

(i) Write the equation for the reaction at the anode. (1mark)

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(ii) Determine the E.m.f of the cell given that: (2 marks)

$Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2e; E^{\Theta} + 0.76V$
$Cu_{(s)} \rightarrow Cu^{2+}_{(aq)} + 2e; E^{\Theta} - 0.34V$

21. When a solution containing silver ions is added to a solution containing iron (II) ions, an equilibrium is set up.

$2Ag^{+}_{(aq)} + Fe^{2+}_{(aq)} \rightleftharpoons 2Ag_{(s)} + Fe^{3+}_{(aq)}$
(Green) (Yellow)

Explain the effect of addition of silver nitrate to the equilibrium mixture. (2 marks)

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22 (a) One of the ores of sodium is saltpetre. Give the formula of saltpetre. (1mark)

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(b) In the Down's cell, the anode is made of carbon while the cathode is made of steel. Steel is a reactive electrode and would make the electrolytic process faster. Explain why it is not used at the anode despite this advantage.

(1mark)

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(c) Write **two** equations that occur at the anode during the electrolysis process. (2 marks)

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23 (a) What is half life as used in radioactivity? (1mark)

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(b) A certain nuclide has a half-life of 1.5 seconds.
(i) What is a nuclide? (1mark)

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(ii) What percentage of a given mass of the nuclide will be left after 7.5 hours? (2 marks)

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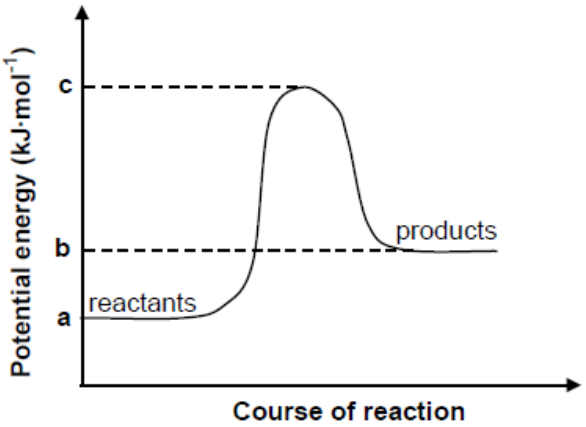
24. The potential energy graph for a hypothetical chemical reaction is shown below.



(a) What type of reaction is taking place? (1mark)

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(b) What are the correct methods to calculate ΔH and E_a? (2 marks)

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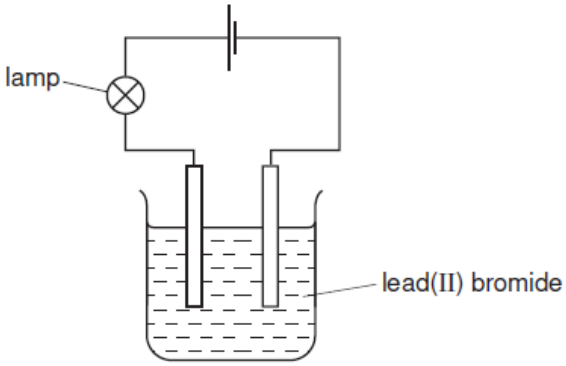
25. The diagram shows the apparatus used to electrolyse lead (II) bromide using inert electrodes.



Why does the lamp light up only when the lead (II) bromide is melted? (2 marks)

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NAME……**ADM**……

SCHOOL……**INDEX**……

DATE……**SIGN**……**TARGET**……

233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

SERIES 9 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) This paper consists of **10 printed pages***

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

(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

Turn Over9

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

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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)

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

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

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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)

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

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4. State and explain the observation that would be made when zinc powder is heated with

copper (II) oxide. (2 marks)

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

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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)

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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)

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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)

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

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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)

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

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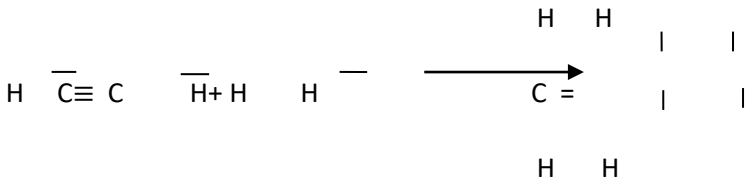
11. Ethyne reacts with hydrogen as shown below



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

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

(1 mark)

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

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13. Given the equation below

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

Identify the species that acts as;

i) A base. Explain (1 mark)

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ii) An acid. (½ mark)

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

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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)

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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)

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16. The production of ammonia is given by the equation

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

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

(2 marks)

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

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

The above equation show a redox reaction

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

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

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

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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)

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20. 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)

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21. 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)

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

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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)

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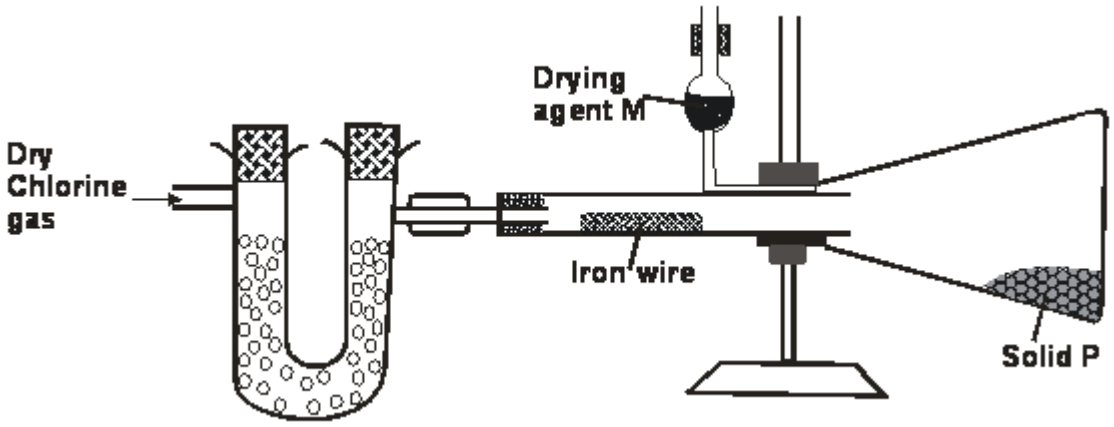
22. The apparatus set up below was used to prepare an anhydrous solid P



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

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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)

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23. 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)

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

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

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

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24. 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)

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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)

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25. 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)

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

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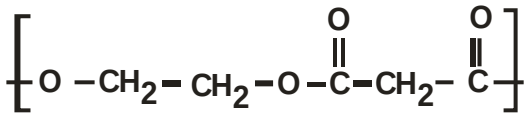
26. The following is structural formula of polyester.



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)

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27. 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)

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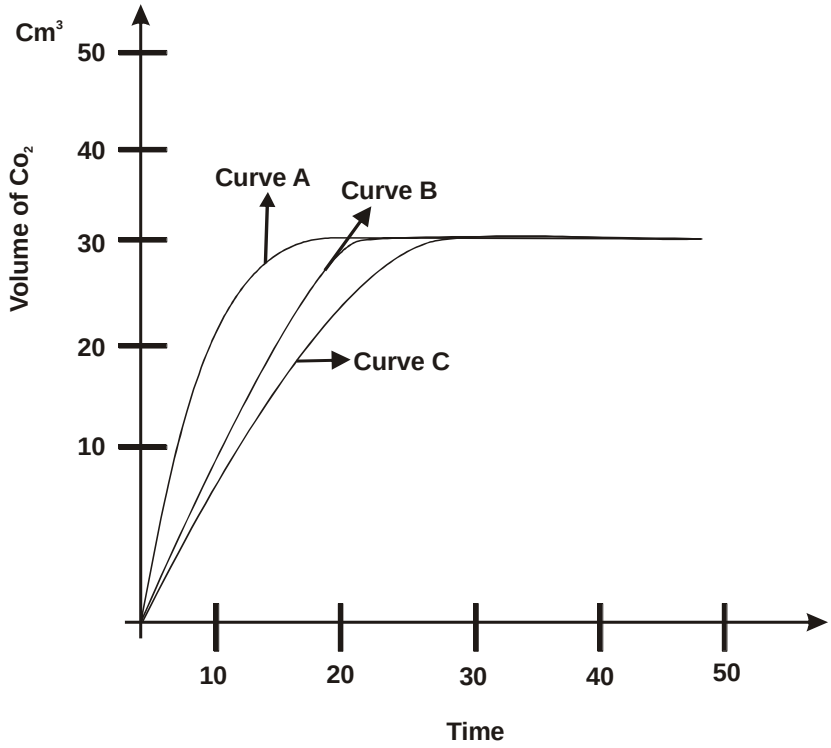
28. The graphs below were drawn when 15g of marble chips in different physical states were reacted with 50cm^3 of 2M Hydrochloric acid. They are drawn by measuring the volume of carbon (iv) oxide produced with time.



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)

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(ii) Large sized calcium carbonate (½ mark)

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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)

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

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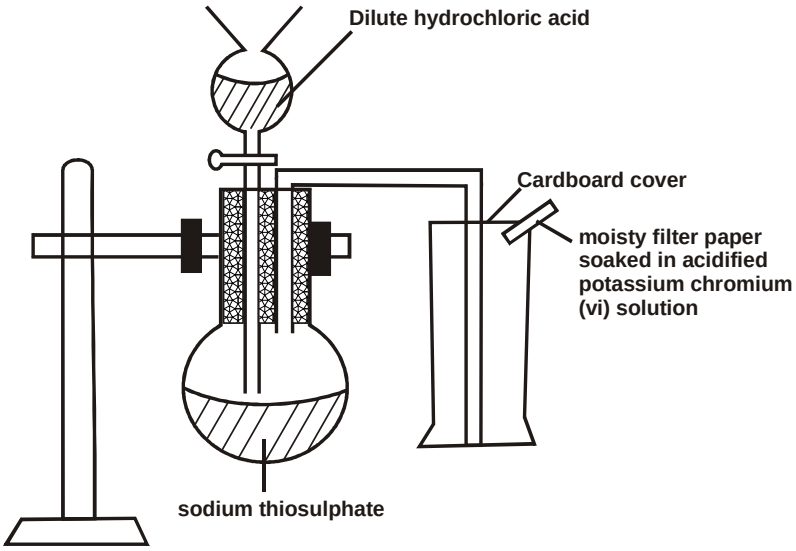
29. Sodium thiosulphate was reacted with dilute hydrochloric acid in a round bottomed flask as shown below. The gas evolved was collected by downward delivery in a gas jar.



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

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

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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)

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NAME……**ADM**……

SCHOOL……**INDEX**……

DATE……**SIGN**……**TARGET**……

233/1

CHEMISTRY Theory Paper 1

Time: 2 Hours

SERIES 10 2024 KCSE PREDICTION MOCK

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

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

(c) KNEC Mathematical tables and electronic calculators may be used for calculations

*(d) All working **MUST** be clearly shown where necessary*

*(e) This paper consists of **10 printed pages***

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

(g) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

Turn Over

1 (a) What is a universal indicator? (1mark)

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(b) State **one** advantage of universal indicator over other commercial indicators. (1mark)

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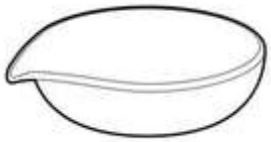
2. Complete the diagram below on identification and uses of some laboratory apparatus.

Diagram		
Name	(a) (½ mark)	(c) (½ mark)
Purpose	(b) (1mark)	(d) (1mark)

3 (a) In an experiment, sulphur was heated in a deflagrating spoon until it begins to burn then lowered into a gas jar. Explain the observations made. (2 marks)

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(b) Explain the role of oxygen in steel making. (2 marks)

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

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(b) At what temperature, in K, assuming constant pressure, is the volume of a fixed mass of gas at 127^oC doubled? (2 marks)

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5 (a) Distinguish between a temporary physical change and temporary chemical change. (2 marks)

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(b) In an experiment, the following substances were heated in separate test tubes. Complete the table to state the observations and classifying the type of change that occurs. (3 marks)

Solid	**Observations on heating**	**Type of change**
$CuSO_4.5H_2O$		
$KMnO_4$		

6. Explain how you would distinguish between ethane and ethyne. (2 marks)

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7. Explain how solid calcium sulphate can be prepared from solid samples of calcium carbonate and sodium sulphate. All other reagents and apparatus are provided. (3 marks)

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8 (a) A metal reacts with dilute hydrochloric acid to produce a gas. Explain how to identify the gas.

(1mark)

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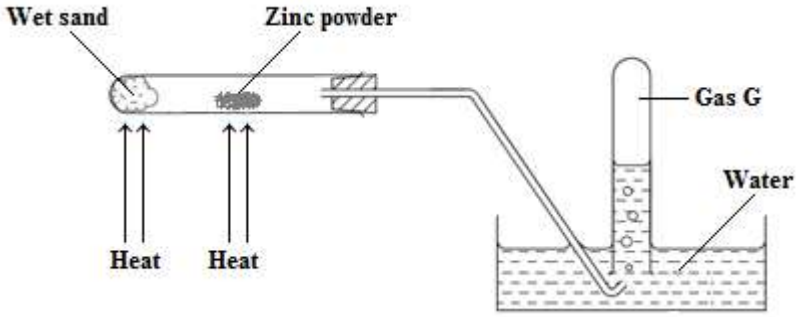
(b) The diagram below shows the set up used for the reaction between magnesium and steam.



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

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(ii) Explain why the wet sand must be heated first before the zinc powder is heated. (1mark)

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9 (a) Distinguish between covalent bond and co-ordinate bond. (2 marks)

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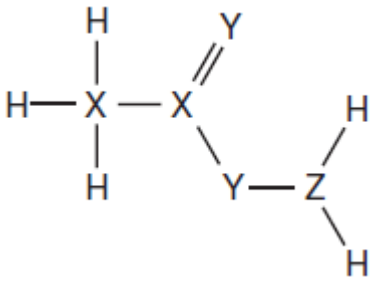
(b) The diagram below shows the structure of a covalent compound containing the element hydrogen, H, and the unknown elements X, Y and Z.



To which groups of the Periodic Table do these three elements, X, Y and Z, belong? (1½ marks)

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10. In an experiment silicon (IV) chloride is dissolved in water in a boiling tube.
(a) Write an equation for the reaction that occurs. (1mark)

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(b) Explain the observations that were made during the experiment. (3 marks)

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11. A standard solution of potassium hydroxide (KOH) is prepared in a 250 cm^3 volumetric flask. During a titration, 12.5 cm^3 of this solution neutralizes 25 cm^3 of a 0.16 $moldm^{-3}$ ethanoic acid solution.
The balanced equation for the reaction is: $CH_3COOH_{(aq)} + KOH_{(aq)} \rightarrow CH_3COOK_{(aq)} + H_2O_{(l)}$
Calculate the mass of potassium hydroxide used to prepare the solution above in the 250 cm^3 volumetric flask.
(K = 39, O = 16.0, H = 1.) (3 marks)

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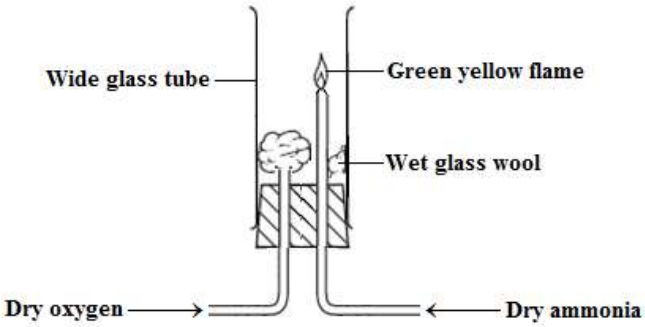
12. Ammonia gas was burnt in oxygen as shown in the diagram below.



(a) State the role of the glass wool. (1mark)

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(b) State the observations made during the experiment. (1mark)

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(c) Write an equation for the reaction that occurs. (1mark)

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13. Study the following reaction at equilibrium at a certain temperature.

$2SO_{3(g)} \rightleftharpoons O_{2(g)} + 2SO_{2(g)}$ $\Delta H > 0$

(a) State **two** optimum conditions for this reaction. (1mark)

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(b) State **two** ways of increasing the yield of $SO_{3(g)}$. (2 marks)

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14 (a) Write the equation for the reaction between chlorine and cold dilute sodium hydroxide.(1mark)

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(b) When chlorine gas reacts with hot concentrated calcium hydroxide, one of the products formed is calcium hypochlorite ($CaOCl_2$). This commonly referred to as bleaching powder.
Explain the bleaching action of calcium hypochlorite. (2 marks)

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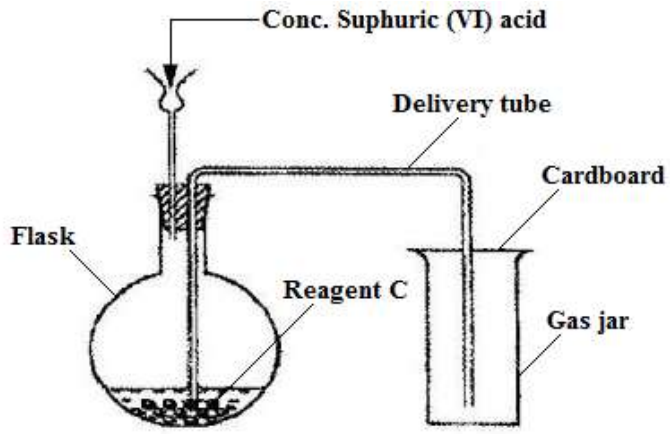
15. The diagram below shows an apparatus for the laboratory preparation of carbon (II) oxide.



(a) Identify **two** mistakes in the set up. (2 marks)

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(b) Write an equation for the reaction between concentrated sulphuric (VI) acid and reagent C.(1mark)

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

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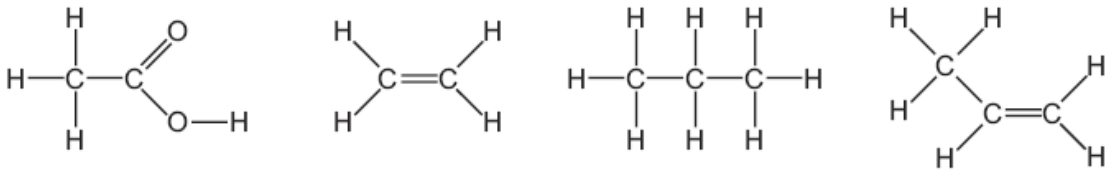
16. The structures of four organic compounds are shown.

1 2 3 4



(a) Which compounds decolourize bromine water? (1mark)

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(b) Explain **one** chemical test that can be used to distinguish between compounds 1 and 2.(2 marks)

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17. How does the number of carbon, hydrogen and oxygen atoms in an ester differ from the total number of carbon, hydrogen and oxygen atoms in the alcohol and carboxylic acid from which the compound was derived?

(1½ marks)

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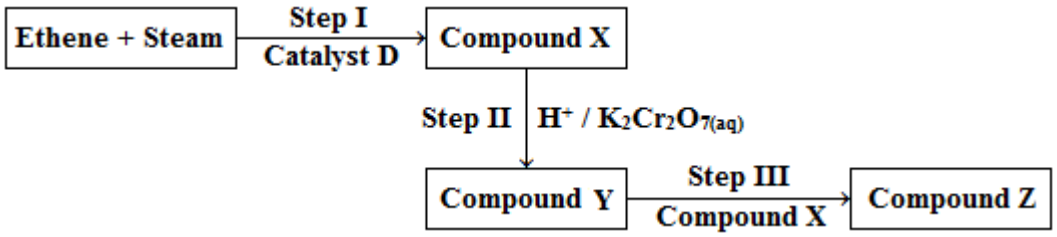
18. The diagram shows a reaction scheme.



(a) Name:
(i) Catalyst D
(ii) Reaction II
(iii) Reaction III
(iv) Compound Z (4 marks)

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(b) State the observations made in step II. (1mark)

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(c) Write an equation for the reaction that occurs in step III. (1mark)

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19. A student performs two reactions.

- reaction 1: 10 g of magnesium ribbon with excess 2.0 mol / dm^3 dilute hydrochloric acid
- reaction 2: 5 g of magnesium powder with excess 2.0 mol / dm^3 dilute hydrochloric acid

In both experiments, the volume of hydrogen produced, V, is measured against time, t, and the results plotted graphically.

(a) On the grid below, sketch a graph that would be obtained is volume of hydrogen produced is plotted against time for both reactions1 and 2. (2 marks)

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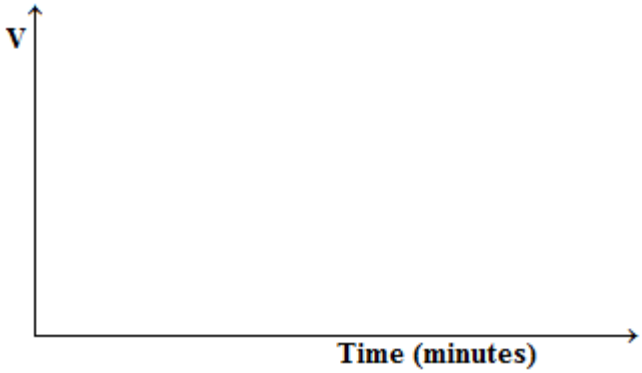

(b) Explain your answers. (2 marks)

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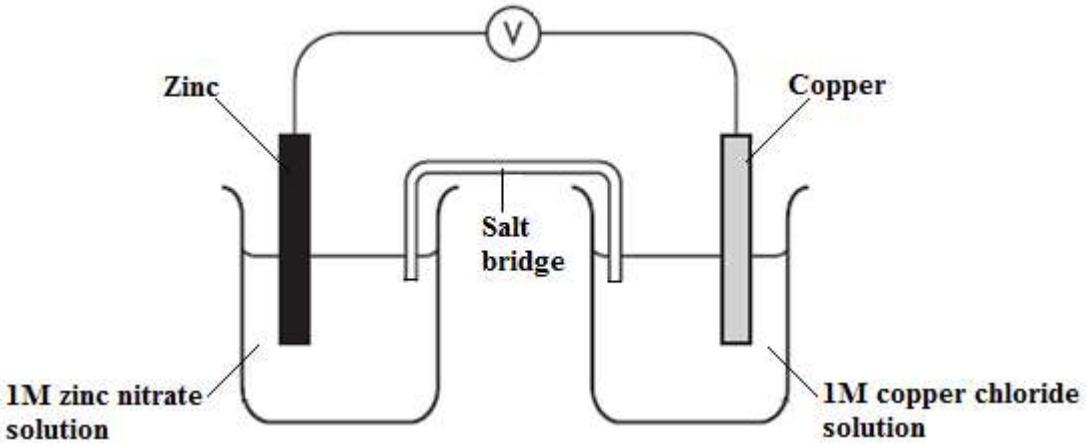
20. A copper – zinc electrochemical cell is set up as shown below.



Lead (II) nitrate is used as an electrolyte in the salt bridge.

(a) Initially the cell did not work. Explain. (2 marks)

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(b) Once the mistake identified in (a) above was corrected:

(i) Write the equation for the reaction at the anode. (1mark)

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(ii) Determine the E.m.f of the cell given that: (2 marks)

$Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2e$; $E^{\Theta} + 0.76V$

$Cu_{(s)} \rightarrow Cu^{2+}_{(aq)} + 2e$; $E^{\Theta} - 0.34V$

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21. When a solution containing silver ions is added to a solution containing iron (II) ions, an equilibrium is set up.

$2Ag^{+}_{(aq)} + Fe^{2+}_{(aq)} \rightleftharpoons 2Ag_{(s)} + Fe^{3+}_{(aq)}$

(Green) (Yellow)

Explain the effect of addition of silver nitrate to the equilibrium mixture. (2 marks)

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22 (a) One of the ores of sodium is saltpetre. Give the formula of saltpetre. (1mark)

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(b) In the Down's cell, the anode is made of carbon while the cathode is made of steel. Steel is a reactive electrode and would make the electrolytic process faster. Explain why it is not used at the anode despite this advantage.

(1mark)

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(c) Write **two** equations that occur at the anode during the electrolysis process. (2 marks)

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23 (a) What is half life as used in radioactivity? (1mark)

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(b) A certain nuclide has a half-life of 1.5 seconds.
(i) What is a nuclide? (1mark)

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(ii) What percentage of a given mass of the nuclide will be left after 7.5 hours? (2 marks)

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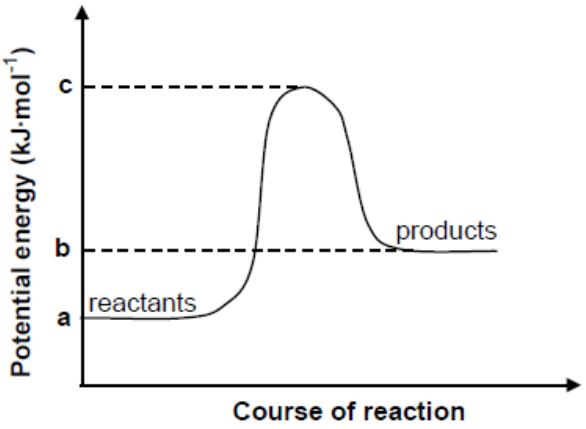
24. The potential energy graph for a hypothetical chemical reaction is shown below.



(a) What type of reaction is taking place? (1mark)

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(b) What are the correct methods to calculate ΔH and E_a? (2 marks)

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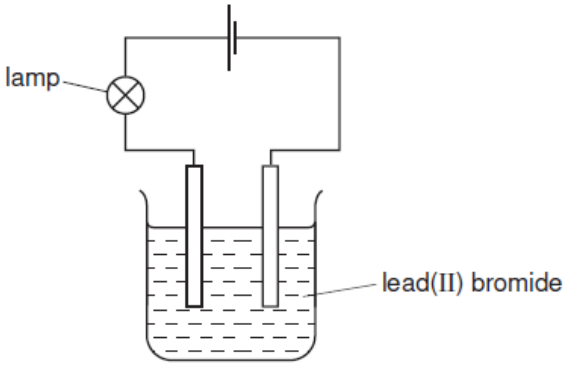
25. The diagram shows the apparatus used to electrolyse lead (II) bromide using inert electrodes.



Why does the lamp light up only when the lead (II) bromide is melted? (2 marks)

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