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KCSE NATIONAL SCHOOLS TRIALS AND JOINT SERIES 2025

CHEMISTRY PAPER 1

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These exams have been compiled from recently done national schools' trials and joint series

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GOLDLITE ONLINE SUPPLIES

Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name …… **Admission number** ……

Candidate's Signature……**Date**……

233/1
CHEMISTRY
Paper 1
Time: 2 hours

KABARAK HIGH SCHOOL E X A M I N A T I O N - 2025

Kenya Certificate to Secondary Education

CHEMISTRY PAPER 1

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

- *Write your name, admission number, date and school in the spaces provided.*
- *Answer all the questions in the spaces provided.*
- *All working must be clearly shown where necessary.*
- *Scientific calculators may be used.*

FOR EXAMINERS' USE ONLY

Questions	Maximum Score	Candidate's Score
1 – 29	80	

This paper consists of **11** printed pages. Candidates are advised to check and to make sure all pages are as indicated and no question is missing.

1. a.State two examples of commercial indicators used in a high school laboratory **(2 marks)**

……

……

b. Define the term Neutralisation reaction [1mark]

……

2. (a) Give **one** reason some of the laboratory apparatus are made of Glass **(1 mark)**

……

……

(b) Name **two** apparatus that can be used to measure approximately 100cm^3 of dilute Hydrochloric acid. **(2 marks)**

……

……

3. Draw awell labeled set-up that can be used to separate a mixture of iodine and sodium chloride. **(3 marks)**

4. The table below shows pH values of solutions ABC and D

Solution	A	B	C	D
pH value	1	7	10	13

a) Give solution that is;

i) Acidic (1mk)

……

ii) Weak base (1mk)

……

iii) Neutral (1mk)

……

b) Give the test of the gas formed when solution A react with a carbonate salt (1mk)

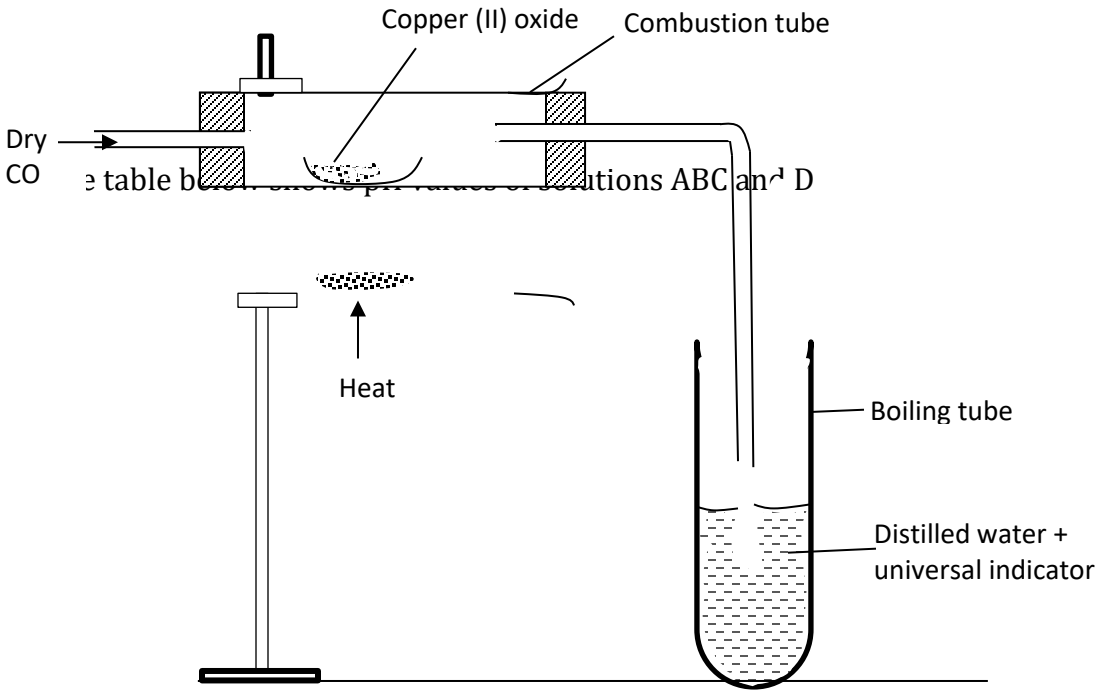
……

c.Define Amphoteric oxides and give an example . [2marks]

……

……

5.



The above set-up was used to determine the chemical properties of carbon (II) oxide.

(a) Write the chemical equation for the reaction taking place in the combustion tube. **(1 mark)**

……

(b) State and explain the PH of the solution in boiling Tube **(2 marks)**

……

……

6. A student placed some hydrogen peroxide in a test tube then added a small amount of manganese (IV) oxide. A glowing splint was then brought near the mouth of the tube.

(a) State the observation made on the glowing splint. **(1 mark)**

……

(b) What is the role of the manganese (IV) oxide? **(1 mark)**

……

(c) Give **one** use of the gas produced. **(1 mark)**

……

……

7.aDefine Isomerism

……

……

b .An organic compound with formular C_4H_8 , has isomers. Draw and name two possible structural isomers of the compound. **(3 marks)**

8. Explain how the compound C_4H_8 and C_4H_{10} can be distinguished using burning **(2 marks)**

……

……

……

……

9. (a) Chlorine can be prepared in the laboratory by using the following reagents and chemicals.
Concentrated sulphuric (VI) acid, water, manganese (IV) oxide, concentrated hydrochloric acid.

(i) State the role of concentrated sulphuric (VI) acid. **(1 mark)**

……

(ii) Write the equation for formation of chlorine. **(1 mark)**

……

(iii) What is the role of manganese (IV) oxide? **(1 mark)**

……

10. (a) State Boyle's law. **(1 mark)**

……

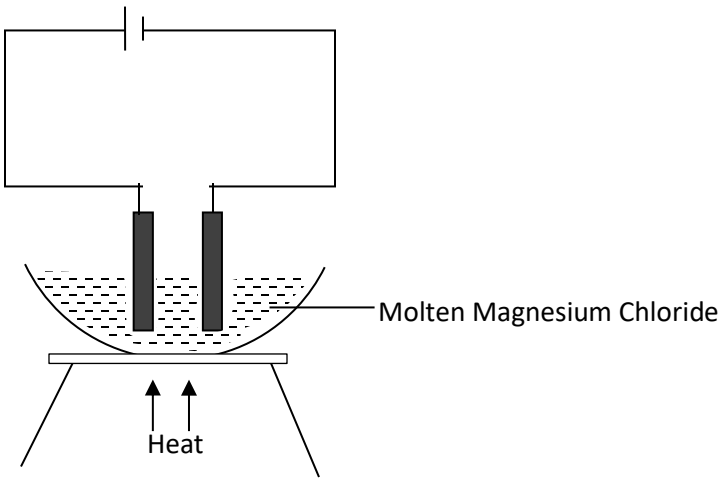
……

……

(b) A gas occupies 270cm^3 at a pressure of 660mmHg at 37^{0}C. What is the new volume if pressure is changed to 810 mmHg at 63^0 C? **(3 marks)**

11. An organic compound contains 24.24% carbon, 4.04% hydrogen and the rest chlorine. If its relative molecular mass is 99, what is its molecular formula? **(3 marks)**
(C = 12, H = 1, Cl = 35.5)

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



(a) Define electrolysis. **(1 mark)r**

……

……

(b) On the diagram, label the Anode and Cathode. **(1mark)**

(c) Write the equation at the anode. **(1 mark)**

……

13. In order to find the proportion by volume of gases in air, a sample of air was passed through two wash bottles, the first containing sodium hydroxide solution and the second containing concentrated sulphuric (VI) acid. The remaining gas was then collected in a syringe.

(a) Why was the air passed through;

(i) sodium hydroxide solution? **(1 mark)**

……

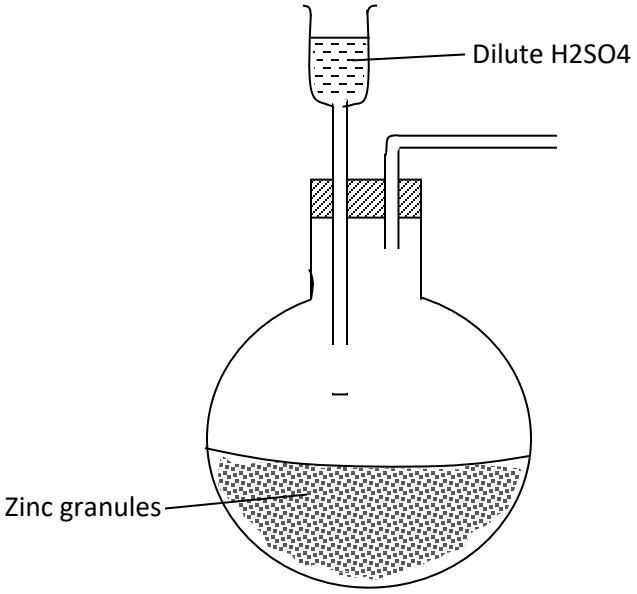
(ii) concentrated sulphuric (VI) acid? **(1 mark)**

……

(b) Name the major gas collected in the syringe. **(1 mark)**

……

14. (a) Complete the diagram below to show how dry sample of hydrogen gas is prepared in the laboratory using 0.5M Sulphuric vi Acid.
(2 marks)



(b) Name the catalyst which could be used to increase the reaction rate of production of hydrogen gas in the set up drawn above. **(1 mark)**

……

c.apart from the catalyst,state two other ways of increasing the above reaction [2marks]

15. An element consists of two isotopes with atomic masses 59 and 61 in the ratio of 3 : 2 respectively.

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

……

……

……

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

16. An element: $^{39}_{19}Q$

(a) To which chemical family does it belong? **(1 mark)**

……

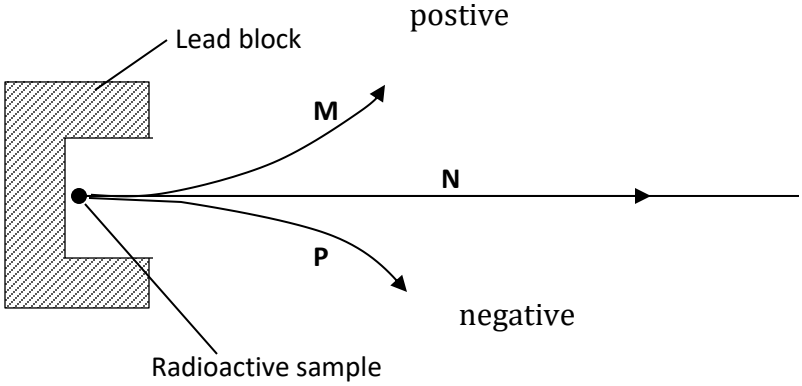
(b) Write the electron arrangement of the atom. **(1 mark)**

……

(c) Draw the structure of its ion. **(1 mark)**

17. A given mass of sodium nitrate was heated completely and 320 cm^3 of the gas was produced at s.t.p. Determine the mass of the sodium nitrate heated.
(Na = 23. N = 14, O = 16, molar gas volume = 22.4L) **(3 marks)**

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



Name the radiations; **(3 marks)**

P - ……

M - ……

N - ……

19. Calculate the enthalpy of formation of ethanol given the enthalpies of;
combustion of ethanol = -1369 kJ/mole
combustion of carbon = -394kJ/mole
combustion of hydrogen = -286kJ/mole

(3 marks

……

……

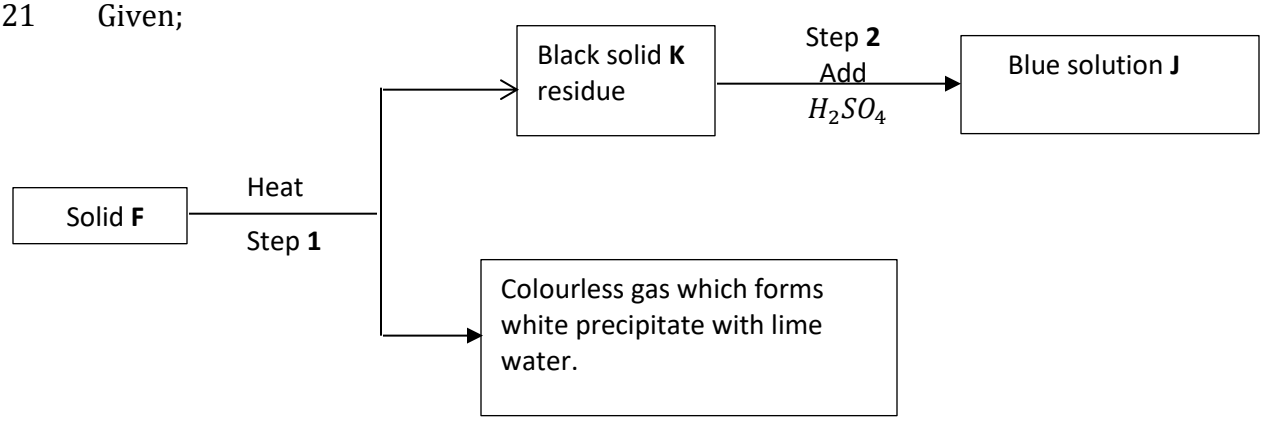
20. (a) State what is observed when sodium hydroxide pellets are left in air overnight.
(1 mark)

……

(b) What name is given the process shown by the salt in (a) above? **(1 mark)**

……

21 Given;



(a) Identify the cation and anion in Solid **F** **- 2marks**
Cation ……

Anion ……

(b) Write equation for step **1**. **(1 mark)**

……

22. [a] Name two allotropes of sulphur [2mks]

……

……

[b] In an experiment to investigate a certain property of sulphur, Wanjare added few drops of conc HNO_3 to sulphur in a test tube and warmed the mixture

[i]State one observation made [1mk]

……

……

[ii]Write a chemical equation of the reaction that occurred [2 mk]

……

……

23. Use dot (•) and cross (**X**) to show the bonding in Sodium Chloride **(2 marks)**

29. a.Excess magnesium ribbon was burnt in air to form a white solid mixture. Write two equations to show the formation of the white solid mixture.
(2 marks)

b]Give two effects of continued exposure of nitrogen 1V oxide in the atmosphere[.2marks]

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KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name ……**Admission number** ……
Candidate's Signature……**Date**……

STAREHE GIRLS CENTER SCHOOL TRIAL SERIES

233/1
CHEMISTRY
PAPER 1
TIME: 2 hours

Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *Answer **ALL** questions in spaces provided in the question paper.*
d) ***ALL** working must be shown clearly where necessary.*
e) *Mathematical tables and silent non-programmable calculators may be used.*

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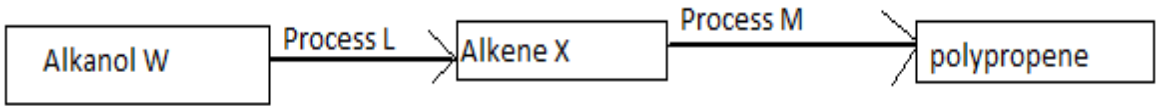
Question	Maximum score	Candidate's score
1 – 27	80	

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



(a) Name (i) Alkanol W

(ii) Process L (1mark)

(b) Write an equation for the reaction that converts alkene X to polypropene. (1mark)

(c) Name the reagent and give the conditions required in process L. (1mark)

2) The two different flames produced by a Bunsen burner were separately used to heat 100cm^3 of water in 250cm^3 beaker. The water heated using flame **A** took 13 minutes to boil while the water heated using flame **B** took 9minutes and 25 seconds to boil.

Identify flame **A** and draw a labeled diagram of the flame, showing all its regions. (3marks)

3) Name (i) the most abundant gas found in air; (1mark)

(ii) Two gases found in air that causes iron to rust. (1mark)

(iii) The most abundant noble gas found in air. (1mark)

4) Sodium nitrate crystals were mixed with lead (II) chloride salt. Explain briefly how you can separate the crystals of sodium nitrate from this mixture. (3marks)

5) Element **A** burns with a blue flame in air forming a colourless gas **B**. The gas formed turns wet blue litmus red and after sometime, the litmus turns white.

(i) Name element **A** and gas **B.** (1mark)

(ii) Give the nature of gas **B.** (1mark)

(iii) Write an equation for the reaction that caused red litmus to turn white**.** (1mark)

6) What colour would blue cobalt (II) chloride paper turn on exposure to air for some time. Explain.

(2marks)

7) Below is a table of some particles (not their actual chemical symbols) showing the number of protons, neutron and electrons.

Particle	Protons	Neutrons	Electrons
K	**12**	**12**	**10**
L	**17**	**18**	**17**
M	**7**	**7**	**10**
N	**17**	**20**	**18**
Q	**10**	**10**	**10**

a) Choose;

(i) A cation. (½mark)

(ii) Neutral atom of a non metal. (½mark)

(iii) A pair of isotopes. (½mark)

b) Using crosses(x) and dots (.) draw the structure of particle **M**. (1½ mark)

8) Argon has three isotopes which are argon-36, argon-38 and argon-40. Determine the percentage composition of argon-40 given that the relative atomic mass of argon is 39.9852 and argon-36 has percentage abundance of 0.34%. (3marks)

9) Elements **X** and **Y** are in period 3 of the periodic table. The chemical formula of their chlorides is $\mathbf{XCl_2}$ and $\mathbf{YCl_4}$ respectively. The chloride of **X** dissolve in water producing a solution with a pH of 7 while the chloride of **Y** dissolve in water producing a solution with a pH of 3.

a) Determine the type of bond and structure of the chlorides of **X** and **Y**. (X and Y are not chemical symbols of an element. Chlorine is a halogen).

(2marks)

b) Draw a cross(x) dot (.) diagram of the chloride of **Y**. (1mark)

10) A molten oxide of metal **M** (not the actual chemical symbol of the element) was electrolyzed using graphite. The chemical formula of the metal oxide is M_2O_3.

(i) The solid metal oxide does not conduct electricity but only conduct in liquid state. Explain.

(1mark)

(ii) Write half equations for the reactions that took place at the;

(a) Anode. (1mark)

(b) Cathode. (1mark)

11) A pellet of sodium hydroxide left exposed to air underwent the following changes:

(i) Changed into a colourless liquid, then
(ii) Formed colourless transparent crystals, and finally
(iii) The crystals formed a white powder.

(a) Use **one** word to describe each of the changes in **(i)** and **(iii)**.

(i) **(1mark)**

(iii) **(1mark)**

(b) Write an equation for change **(ii).** **(1mark)**

12) When a current of 0.5 amperes was passed through the fused chloride of metal **Z (ZCl$_2$)** for 20 minutes and 20 seconds, 0.278 g of **Z** were deposited at the cathode. Determine the relative atomic mass of **Z**. (1 Faraday =96500C). (3 marks)

13) (i)What is meant by the term **cracking** of alkanes. (1mark)

(ii) Cracking of heptane gives propene and another hydrocarbon **Y** as the only products. Draw and name two isomers of **Y.** (2marks)

14) Aluminium hydroxide reacts with acid and alkalis.

a) Write an equation for the reaction between aluminium hydroxide and:

(i) Dilute hydrochloric acid. (1mark)

(ii) Potassium hydroxide. (1mark)

b) What property of aluminium hydroxide is shown by the reactions in (a) above.

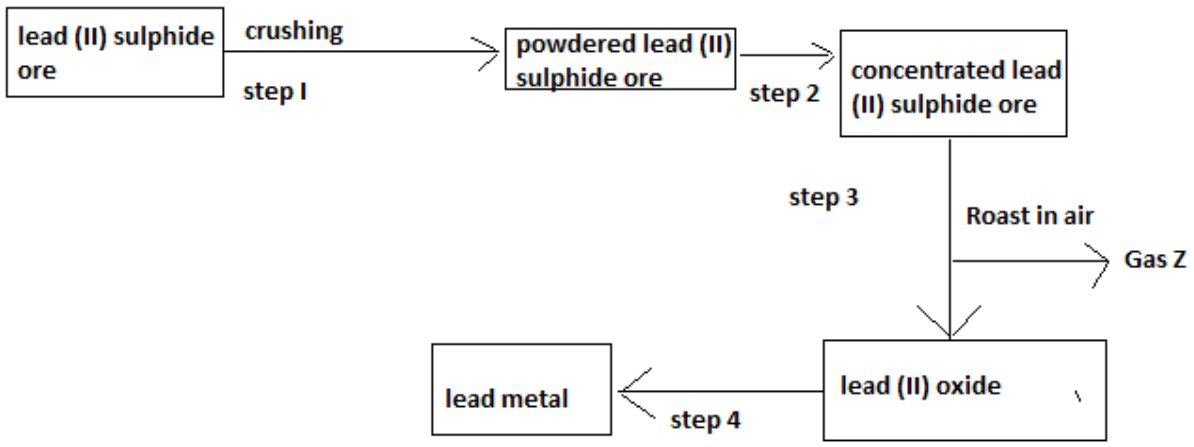
(1mark)

15) (a) Write the chemical formula of the compounds that causes temporary water hardness.

(1marks)

(b) Write equations for reaction that take place when temporary hardness is removed by addition of ammonia solution. (2marks)

16) The flow chart used below shows steps used in the extraction of lead from its ore.



(a) Name the process that is used in step 2 to concentrate the ore. (1mark)

(b) Name gas Z and write an equation that leads to its formation in this process. (2marks)

17) (i) What is a 0.5molar nitric (V) acid solution? (1mark)

(ii) Calculate the volume of water that must be added to 20cm^3 of 4M nitric (V) acid solution to make a 0.5M solution. (2marks)

18) Study the table below showing solubility of a salt at various temperatures.

Temperature (^{0}C)	Solubility (g/100g water)
0	30
30	24
70	19
100	14

325g of saturated solution at 0^{0}C was heated to a temperature of 100^0 C. calculate the mass of salt crystallized out. (3marks)

19) Study the equation for the cell reaction below.

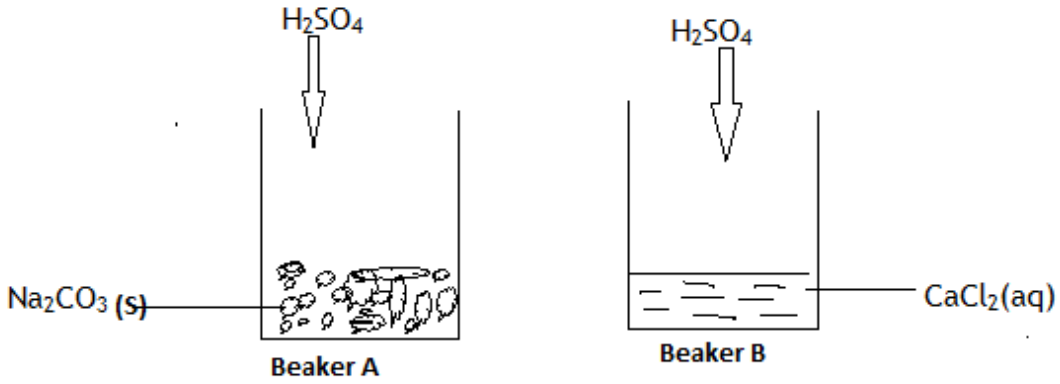
$2X(s) + 3Zn^{2+}(aq) \longrightarrow 2X^{3+}(aq) + 3Zn(s)$

(a) Write the cell representation. (1mark)

(b) If the overall potential of the cell is +0.30V. Calculate the standard electrode potential for $X^{3+}(aq)/X(s)$ given that the E^{θ} for

$Zn^{2+}_{(aq)} / Zn_{(s)} = -0.76$ V . (2marks)

20) Dilute sulphuric (VI) acid was added to each of the following beakers containing the substances shown below.



(a) State and explain the observations that are made in each of the beakers above. (2marks

(b) Write an ionic equation for the reaction that took place in beaker B above.

(1mark)

21) Silver nitrate solution was electrolyzed using graphite cathode and silver anode for some time.

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

(b) Explain the effect of this electrolysis on the P^{H} of the solution. (1mark)

(c) Write an equation for the reaction that took place at the anode.(1mark)

22) (a)What is half life of a radioactive element? (1mark)

(b)224 grams of a radioactive element **W** disintegrate to 7grams in 100days. Determine the half life of the element **W.** (2marks)

23) State three properties of carbon (IV) oxide that makes it suitable for use in fire extinguishers. (3marks)

24) Study the equilibrium reaction below and answer the questions that follow.

$$2NO(g) + O_{2\,(}g) \rightleftharpoons 2NO_2(g).$$

The forward reaction is exothermic. How would the following affect the position of the equilibrium?

(a) The temperature of the system is lowered. Explain. (1½ mark)

(c) The pressure of the system is lowered. Explain. (1½ mark)

25) The molar heat of combustion of methane is -890kJ/mole. Calculate the mass of methane that is burnt to cause the temperature of 500cm^3 of water to rise from 21.0^{0}C to 36.0^{0}C.(Take the specific heat capacity of water to be 4.2kJ kg^{-1} K^{-1}, density of water is 1g/$cm^3$and C=12,H=1)
(3marks)

26) When potassium manganate(VII) is heated strongly, the solid changes its colour from purple to form a residue of green and black solids and a colourless gas **Y**.

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

(b) Describe the test for gas **Y.** (1mark)

(c) Gas **Y** is collected over water. Explain. (1mark)

27) Draw a labeled diagram of set up of apparatus that can be used to prepare a dry sample of hydrogen gas when hydrochloric acid is reacted with zinc metal. (3marks)

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Name ……**Admission number** ……

Candidate's Signature……**Date**……

FRIENDS SCHOOL KAMUSINGA TRIAL SERIES

233/1

CHEMISTRY

PAPER 1

TIME: 2 hours

Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*

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

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

d) ***ALL** working must be shown clearly where necessary.*

e) *Mathematical tables and silent non-programmable calculators may be used.*

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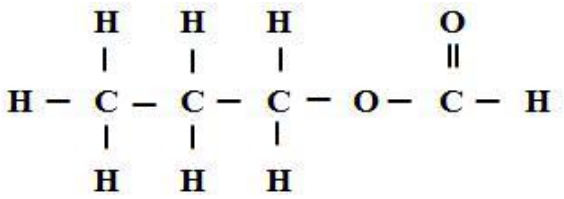
Question	Maximum score	Candidate's score
1 – 29	80	

1. At 60^0C, 38 grams of lead (II) nitrate saturate $56cm^3$ of water. Determine the solubility of lead (II) nitrate at this temperature [2mks]

2. A compound can be represented as



[a] What name is given to the above class of compounds [1mk]

[b] Name two reagents that can be reacted together to generate the above compound [2mks]

[c] State two conditions necessary for the reaction leading to formation of the above compound to occur [2mks]

3. Using dots and crosses, show bonding in carbon (II) oxide [2mks]

4. When 20g of a compound containing carbon, hydrogen and oxygen was burnt in the air, 29.3g of carbon (IV) oxide and 11.7g of water were produced. Determine its empirical formulae. (C=12, H=1, O=16) [3mks]

5. Few drops of hydrochloric acid were added into a test tube containing lead {II} Nitrate solution

(a) State one observation made [1mk]

(b) Write an ionic equation of the reaction that occurred in the test tube [1mk]

6. Two bottles of liquid have lost their labels. The liquids are known to be: Aqueous potassium hydroxide, pure water, Outline test you would do to identify and distinguish the liquid in each bottle. (4mks)

Liquid	Test	Observation
KOH (aq)		
Pure water		

7. Using kinetic theory explain the difference between a solid and liquid. (2marks)

8. The table below shows the pH values of solution J to N.

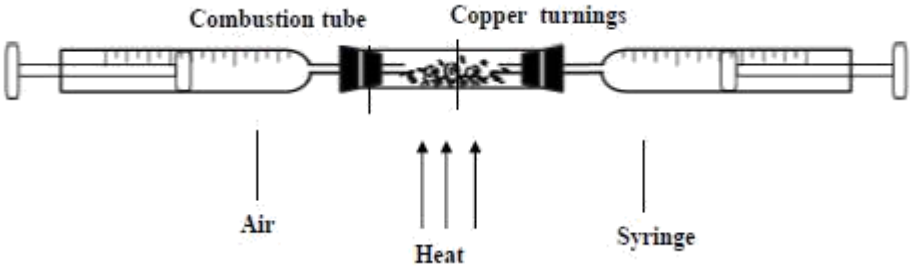
Solution	J	K	L	M	N
pH	5	13	2	10	7

i. Which solution contains largest concentration of hydroxyl ions? Explain. (1mk)

ii. Which solution is likely to be a solution of ethanoic acid? Explain. (1mk)

9. When a candle was burnt completely, the total mass of products was found to be greater than the original mass of the candle. (2 marks)

10. The apparatus below shows the setup used to determine the percentage of oxygen in air.



The air was slowly and repeatedly passed through the copper turnings until a constant volume was obtained.

(i) Explain why air was passed slowly and repeatedly. (1 mark)

(ii) State the observation made at the end of the experiment. (1 mark)

(iii) Is it advisable to use potassium in this experiment? Give a reason. (1 mark)

11. The atomic numbers of the first four noble gases are 2, 10, 18 and 36. Use this information to deduce the group and the period of the elements whose atomic numbers are 15 and 37. (2 marks)

Atomic No.	Group	Period
15		
37		

12. An element has isotopic species A and B each with a mass number 39 and 40 respectively. The percentage of A is 60% and B is 40% for an isotopic element X. Calculate the relative atomics mass of X. (2 marks)

13. 50cm3 of Oxygen gas diffused through a porous plug in 80secs .How long will it take 100cm3 of sulphur (IV) oxide to diffuse through the same plug? (S=32 O=16) (3 marks)

14. A patient suffering from intestinal ulcer released 30 cm3 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)

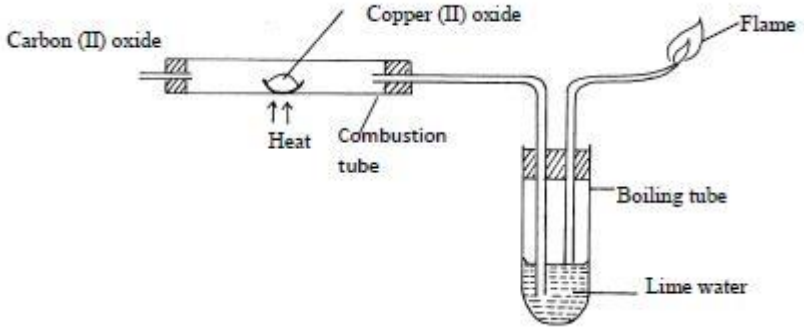
    c) Calculate the percentage impurity of calcium carbonate (chalk) used. (1 mark)

15. Graphite is an allotrope of carbon. Distinguish between allotropes and isotopes. (1mk)

16. Nitric acid reacts with copper metal though it is below hydrogen in the reactivity series. Name the chemical property of nitric acid which is exhibited in these case. (1mark)

17. Describe how you would prepare a dry sample of lead II chloride starting with lead II carbonate. (3 marks)

18. Study the experimental set up of apparatus shown below.



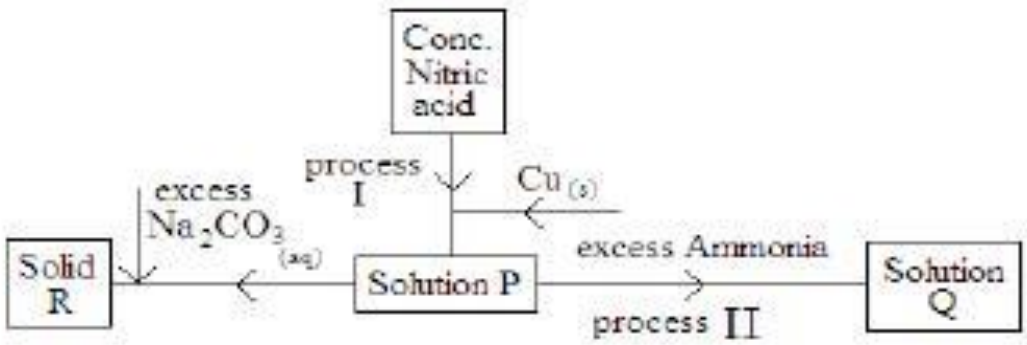
a. State two observations made in the set up as the experiment progressed. (2 marks)

b. Using an equation; Explain the change that occurred in the boiling tube after along time. (2 marks)

c. Why was the gas burned in the flame? (1 mark)

19. When calcium carbonate was added to a solution of dry hydrogen chloride in methyl benzene there was no observable reaction explain. (2mks)

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



i. Identify solution P (1 mark)

ii. Write a chemical equation to show how solid R is formed. (1mark)

iii. Write the observation made in process (II). (1mark)

21. The following elements belong to the same group of periodic table. (letters do not represent the actual symbols)

Element	Atomic radius (nm)	Ionic radius (nm)	First ionization energy (KJ mol $^{-1}$)
P	0.137	0.066	736
Q	0.089	0.031	900
R	0.174	0.099	590

i. State whether the elements are metals or non-metals. Explain your answer. (2 marks)

ii. Which element is the most reactive? Explain (2 marks)

22. A gaseous compound consists of 86% carbon and 14% hydrogen by mass. At s.t.p. 3.2dm3 of the compound has a mass of 6g. (C=12, H=1, molar gas volume at s.t.p.= 22.4dm^3) a) Calculate its empirical formula. (2 marks)

b) Calculate its molecular formula. (2 marks)

23. If 25.0cm3 0.1M H_2SO_4 solution neutralized a solution containing 1.06g of sodium carbonate in 250cm3 of solution, calculate the molarity and volume of sodium carbonate solution (Na=23 O=16 C=12) (3 marks)

24. When 0.7g of element D were completely burnt in oxygen and all the heat evolved used to heat 500cm3 of water, the temperature rose from 23oC to 320C. Work out the relative atomic mass of element D given that the specific heat capacity of water is 4.2KJkg-1, density of water = 1.0g/cm3 and molar heat of combustion of D is 380kjmol-1. (3 marks)

25. The following are tests that were carried out on solid M and observations recorded as below. i. ***Solid M is a Green solid.***

ii. When solid M was heated strongly, colourless liquid formed on the cooler parts the test tube and a colourless odourless gas N that formed a white ppt with calcium hydroxide was given off, a black residue remained in the test-tube.

iii. When dilute hydrochloric acid was added to the black residue, it dissolved to form a green solution.

iv. When aqueous ammonia was added to a portion of green solution in step (iii) above, a blue precipitate which dissolves in excess ammonia to form a deep blue solution was formed.

v. When zinc metal powder was added to a portion of the green solution and the resulting mixture was filtered, a brown residue was obtained and a colourless filtrate.

a. Identify the colourless N and white precipitate formed in step (i). (2mks)

b. Write the formula of the cation and anion in solid M. (1mk)

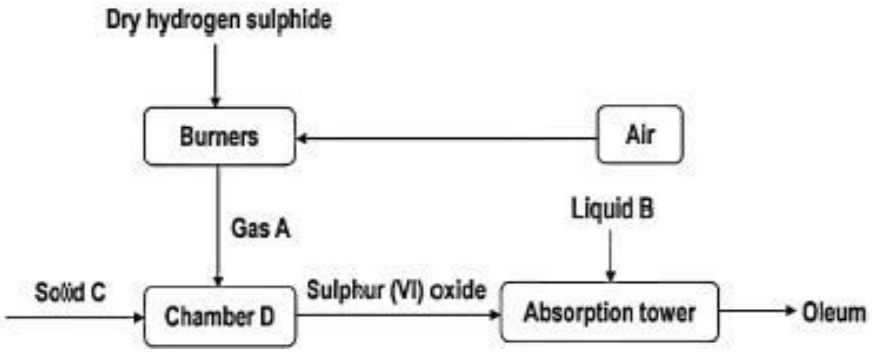
c. Write the formula of the complex ion in the deep blue solution. (1mk)

d. Write ionic equation for the formation of the blue precipitate and deep blue solution in the experiment above. (2mks)

e. Give the chemical names for the residue and filtrate in step (v). (2mks)

f. State the type of reaction that takes place in step (v). (1mk)

26. Sulphuric (VI) acid can be prepared using hydrogen sulphide as shown in flowchart below. Study it and answer the questions that follow.



a. Identify gas A and liquid B. (1mk)

b. What is the function of solid C in chamber D. (1mk)

c. Write an ionic equation for the confirmatory test of hydrogen sulphide gas. (1mk)

d. Write a chemical equation to the formation of concentrated sulphuric (VI) from oleum. (1mk)

e. Why is SO_3 gas not directly dissolved in water to make concentrated sulphuric (VI) acid? (1mk)

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Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name …… **Admission number** ……
Candidate's Signature……**Date**……

MOI GIRLS ELDORET TRIAL SERIES

233/1
CHEMISTRY
PAPER 1
TIME: 2 hours

Instructions to candidates;

(a) Answer all the questions in the spaces provided.
(b) Non-programmable silent calculators and mathematical sets may be used.
(c) All working must be shown clearly where necessary.
(d) Ensure the paper has all the questions.

For examiners only

Question	Maximum Score	Candidate's Score
1 – 26	80	

Q1.An ion of element P has 18 electrons, 16 neutrons and 15 protons.

(a) Write the electron arrangements of an atom of element P (1mk)

(b) What is the mass number of element P (1mk)

(c) State the period and group of the periodic table does element P is found.

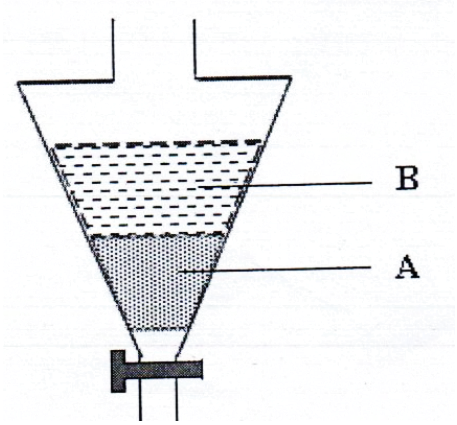
Period: …….

Group: ……. (1mk)

Q2. (a) State Charles's Law (1mk)

(b) The volume of a certain gas was measured at 21°C is 15.9cm^3. At what temperature will the volume be doubled if pressure remains constant (2mks)

Q3.The figure below shows an apparatus used to separate a mixture of water and octane



(a) Name the apparatus above (1mk)

(b) State the principle by which the mixture of the two liquids is separated (1mk)

(c) Identify the liquids A and B if the density of Octane is 0.66g/cm^3 (1mk)

A ……..

B ……..

Q4..A mixture of Iron filings and sulphur were placed in a crucible and heated strongly.

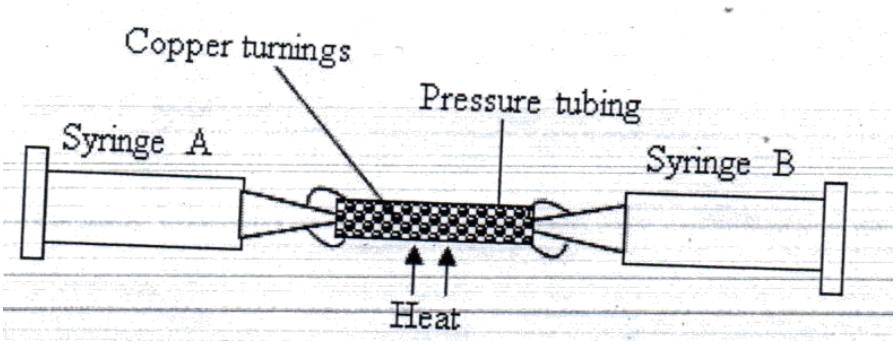
(a) Explain the following observations:

(i) The mixture continued to glow red even when heating was stopped (1mk)

(ii) The black solid produced was not attracted by a magnet. (1mk)

(b) Write an equation for the reaction which took place (1mk)

Q5. The following set-up was used by Form Two students to determine the percentage of Oxygen in air. About 200cm^3 of air was passed repeatedly from syringe A to syringe B and back. After sometime the volume of air was found to be 160cm^3.

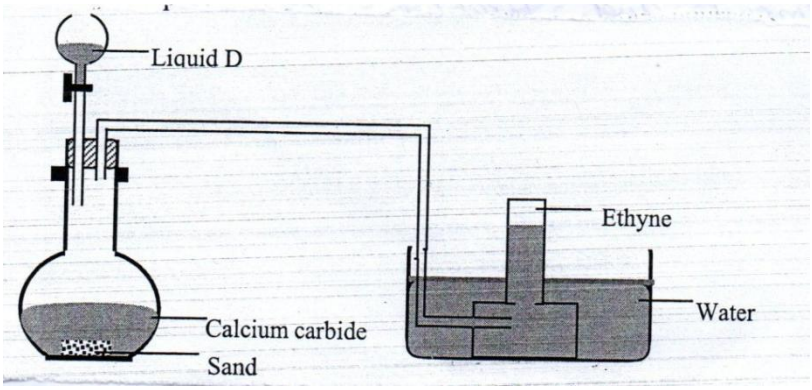


(a) Calculate the percentage of Oxygen in the initial sample of air (1mk)

(b) Write the equation for the reaction that took place (1mk)

(c) Why would Magnesium metal not be used in the experiment to replace the Copper metal? (1mk)

Q6. The following set-up was used to prepare ethyne gas



(a) Identify liquid D (1mk)

(b) Write an equation for the reaction in the flask (1mk)

(c) State one precaution to be taken when performing the experiment (1mk)

Q7. (a) State the Graham's Law of diffusion in gases (1mk)

(b) If it takes 44 seconds for Nitrogen (IV) Oxide to diffuse through a porous pot. Calculate how long it will take an equal volume of chlorine gas to diffuse through the same porous pot under the same conditions. (N=14, O=16, Cl = 35.5) (2mks)

Q8.(a) Diamond and Graphite are allotropes of Carbon. What is meant by the term allotrope? (1mk)

(b) Explain why Graphite can be used as a lubricant while diamond cannot (2mks)

Q9.Given the following substances; sodium Chloride, Lemon Juice and Wood-ash

(a) Name one commercial indicator that can be used to show whether wood ash. Lemmon juice and Sodium Chloride are basic, acidic or neutral. (1mk)

(b) Classify the substances in 9(a) above as acids, bases or neutral. (2mks)

Neutral	**Acid**	**Bases**

Q10. (a) Define the standard heat of formation (1mk)

(b) Given that $\Delta Hc(C) = -393$ kJ/mole, $\Delta Hc(H_2) = -286$kJ/mole and ΔHc $(C_2H_5OH) = -1368$kJ/mole. Calculate the enthalpy of formation of C_2H_5OH.

(2mks)

Q11. When Z cm^3 of 0.5M Zinc Nitrate solution was reacted with excess Ammonium Carbonate solution, the mass of Zinc Carbonate formed was 12.5g.

(a) Write the ionic equation for the reaction that took place. (1mk)

(b) Calculate the value of W. (C=12, Zn = 65, O = 16) (2mks)

Q12. The following is an extract of r periodic table. Study it and answer the questions that follows. The letters do not represent the actual symbols of the elements.

A								
	B						**C**	
D			**E**	**F**			**G**	**H**
I	**J**						**K**	

(a) State the name given to the groups the following elements belong

(i) H (1mk)

(ii) C, G and K (1mk)

(b) Compare the following

(i) The atomic and ionic radius of element B (1mk)

(ii) The melting points of elements G and H (1mk)

Q13. Chlorine gas is prepared in the laboratory by reacting concentrated Hydrochloric Acid with an oxidizing agent like Potassium Manganate (VII).

(i) State another oxidizing agent that can be used in place of $KMnO_4$ (1mk)

(ii) Freshly cut blue flowers petals were placed in a gas jar containing oxygen and another containing Chlorine gas. Explain the differences in the observations

(2mks)

(iii) State one use of Hydrochloric acid (1mk)

Q14. (a) State any two adaptations of the burrette to perform its functions (2mks)

(b) Under what conditions does the Burnsen burner produces luminous flame and state two reasons that makes it not suitable for heating. (2mks)

Condition :

Reason :

Q15. Which type of Sulphur is formed under the following conditions (3mks)

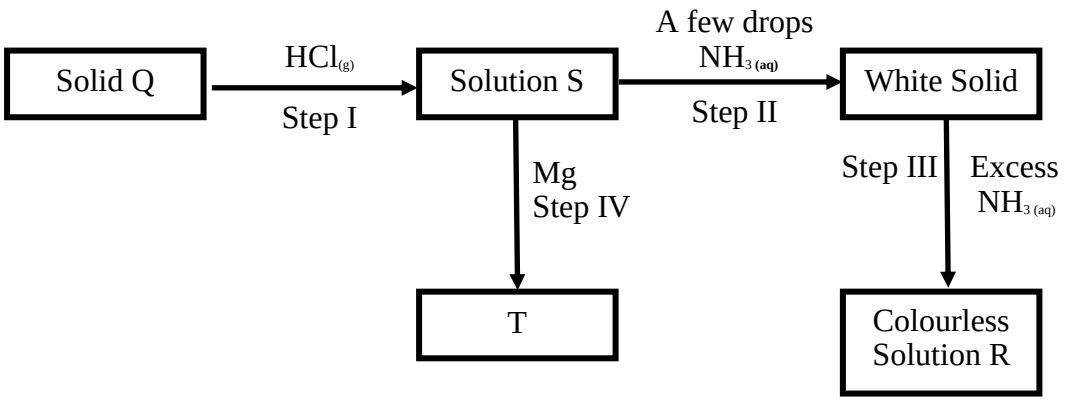
Conditions	**Type of Sulphur**
(i) Temperature above 96°C	
(ii) Rapid cooling of Sulphur vapour	
(iii) Pouring boiling Sulphur in cold water	

Q16. Use dots (•) and cross (x) diagram to show bordering diagram of the following compounds.

(a) Phosphine Molecule (PH_3) (1mk)

(b) Nitrosyl Chloride (NOCl) (1mk)

Q17. The scheme below shows some reaction sequence starting with solid Q. Study it and answer the questions that follow



(a) Write the formula of the complex ion in solution R (1mk)

(b) Write an equation for the reaction in step IV (1mk)

(c) Write an equation for the reaction in step I (1mk)

Q18. (a) Define the term solubility. (1mk)

(b) The solubility of Sodium Nitrate at 60°C is 34g per 100g of water. Determine the mass of solute and solvent in 100g of saturated solution at 60°C. (2mks)

Q19. When a hydrated sample of Calcium Sulphate $CaSO_4.nH_2O$ was heated until all the water was lost, the following data was recorded
Mass of crucible = 30.296g
Mass of crucible + hydrous salt = 33.111g
Mass of crucible + anhydrous salt = 32.781g
Determine the empirical formula of the hydrated salt (Ca=40, S=32, O=16, H=1)
(3mks)

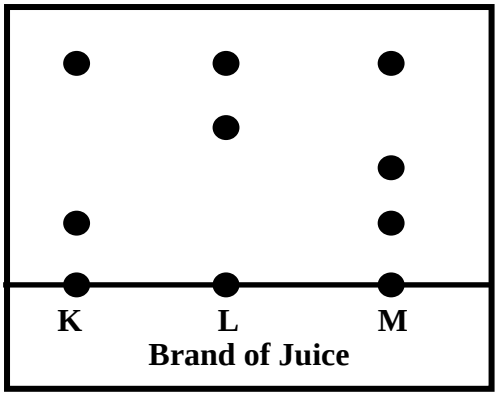
Q20. (a) Nitrogen is freely found in the atmosphere. What percentage of air does it occupy?
(1mk)

(b) Students prepared Ammonia gas, dried it using concentrated Sulphuric (VI) acid then collected it over water.

(i) Identify two mistakes the students made (2mks)

(ii) Write the equation from the preparation of Ammonia gas (1mk)

Q21. The diagram below represents a paper chromatogram for three brands of juices suspected to contain banned food colorings.



The results showed the presence of banned food colorings in L and M only. On the same diagram.

(a) Circle the spots which show the banned food colorings. (2mks)

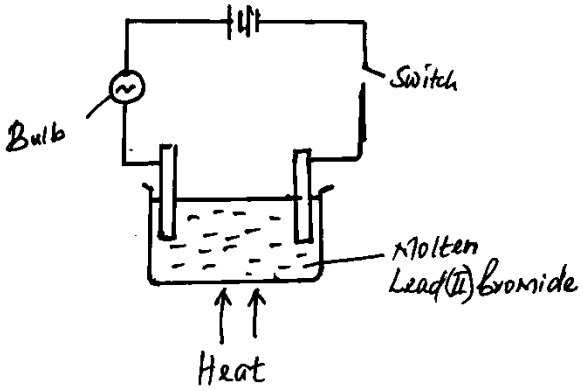
(b) Show solvent front (1mk)

Q22. (a) Define the term fuel. (1mk)

(b) Give two reasons why wood and charcoal are chosen for domestic heating (2mks)

Q23. Starting with $40cm^3$ of 2.8M Sodium Hydroxide describe how a sample of Sodium Sulphate crystals can be prepared in the laboratory. (3mks)

Q24. The diagram below shows the set-up which was used by a student to investigate the effect of electricity on molten Lead (II) Chloride.

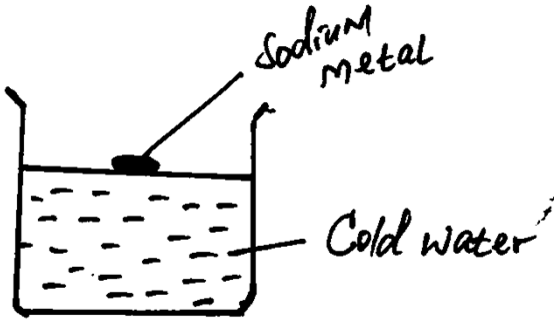


(a) Define the term electrolysis (1mk)

(b) Indicate on the diagram the electrode which is anode (1mk)

(c) Write the reaction at the cathode (1mk)

Q25. Study the diagram below and answer the questions that follow



(a) State two observations made in the above experiment when Sodium is gently placed on water. (2mks)

(b) Write a chemical equation that takes place (1mk)

Q26. Distinguish between the following

(a) Strong and concentrated acid (1mk)

(b) Endothermic and Exothermic reactions (1mk)

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Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name ……**Admission number** ……
Candidate's Signature……**Date**……

NAIROBI SCHOOL TRIAL SERIES

233/1
CHEMISTRY
PAPER 1
TIME: 2 hours

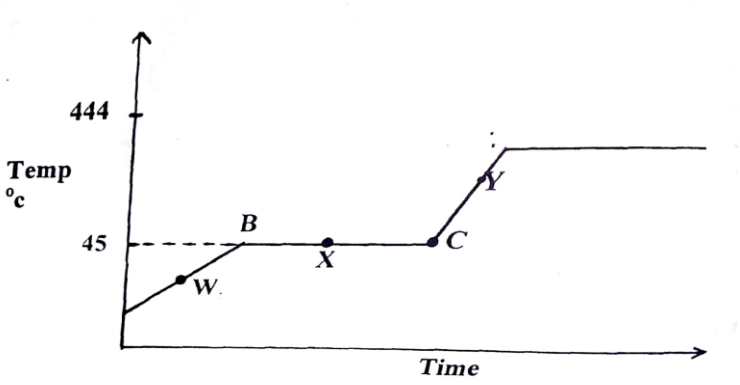
Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *Answer **ALL** questions in spaces provided in the question paper.*
d) ***ALL** working must be shown clearly where necessary.*
e) *Mathematical tables and silent non-programmable calculators may be used.*

FOR OFFICIAL USE ONLY

Question	Maximum score	Candidate's score
1 – 26	80	

1. The diagram below shows the heating curve of a pure substance. Study it and answer the questions that follow.



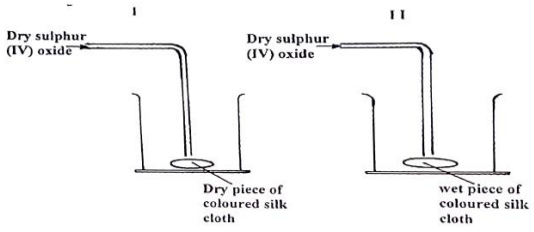
a) What are the physical states of the substances at point W and Y. (2mks)

b) Explain why the temperature remains constant between point B and C. (2mks)

2. Consider the reaction below.
$Cr_2O_7(aq) \rightleftharpoons CrO^{2-}{}_4(aq) + 2H^+(aq)$

Using oxidation numbers explain whether the above reaction is a redox reaction or not.
(3mks)

3. Dry sulphur (IV) oxide was passed through two pieces of coloured silk both in a gas jar as shown in the diagram.



a) State the observation in the gas jars. (2mks)

b) Write equations to explain your observations in flask II. (2mks)

4. The equations show some reactions. Use the equations to answer the following questions.

$CH_3CH_2OH \xrightarrow{\text{Step I}} CH_2=CH_2 \xrightarrow{\text{Step II}} CH_3CH_3$

a) Name the type of reaction in step I and II. (2mks)

b) Explain why ethane burns with a more smoky flame than ethane. (2mks)

5. The third number of the alkenes is converted to its corresponding saturated hydrocarbon by hydrogenation. Using the bond energy values given below, answer the questions that follow.

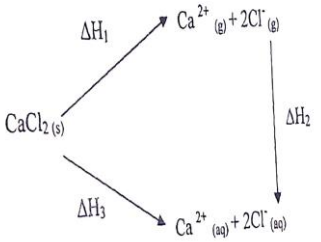
Bond	**Bond energy kJ/mol**
H-H	432
C=C	610
C-C	346
C-H	413

Determine the enthalphy change for the conversion of the third member of the alkenes to its corresponding saturated hydrocarbon by hydrogenation. (3mks)

6. a) Graphite is a non metal most commonly used as an electrode. State two properties that make it suitable for use as an electrode. (2mks)

b) Graphite is an allotrope of carbon. Distinguish between allotropes and isotopes. (2mks)

7. Use the information in the energy cycle below to answer the questions that follow.



i. What is the name given to the energy changes? (3mks)

ΔH_1-

ΔH_2-

ΔH_3-

ii. Given H_1= 2237KJ/Mol and ΔH_2= -2378KJ/Mol, calculate the value of ΔH_3. (1mk)

8. The 1st 2nd and 3rd ionization energies in KJ/Mol of element G and R are given below.

Element	**1st I.E**	**2nd I.E**	**3rd I.E**
G	520	7,300	9,500
R	420	3,100	4,800

i. Define the term 1st ionization energy. (1mk)

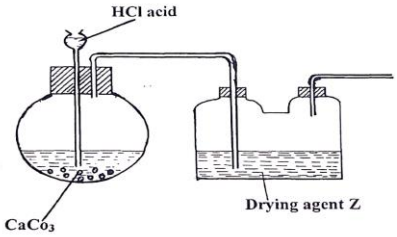
ii. Apart from the decrease in energy levels, explain the big difference between the 1st and 2nd ionization energies. (1mk)

iii. Calculate the amount of energy for the process. (1mk)

$R(g) \longrightarrow R(g) + 3e$

9. When solid Zinc carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no observable change. On addition of some water to the mixture to the mixture there was effervescence. Explain theses observation. (2mks)

10. a) The diagram below represents an incomplete set-up of apparatus that can be used to prepare dry carbon (iv) oxide gas. Complete the diagram and answer the questions that follow.

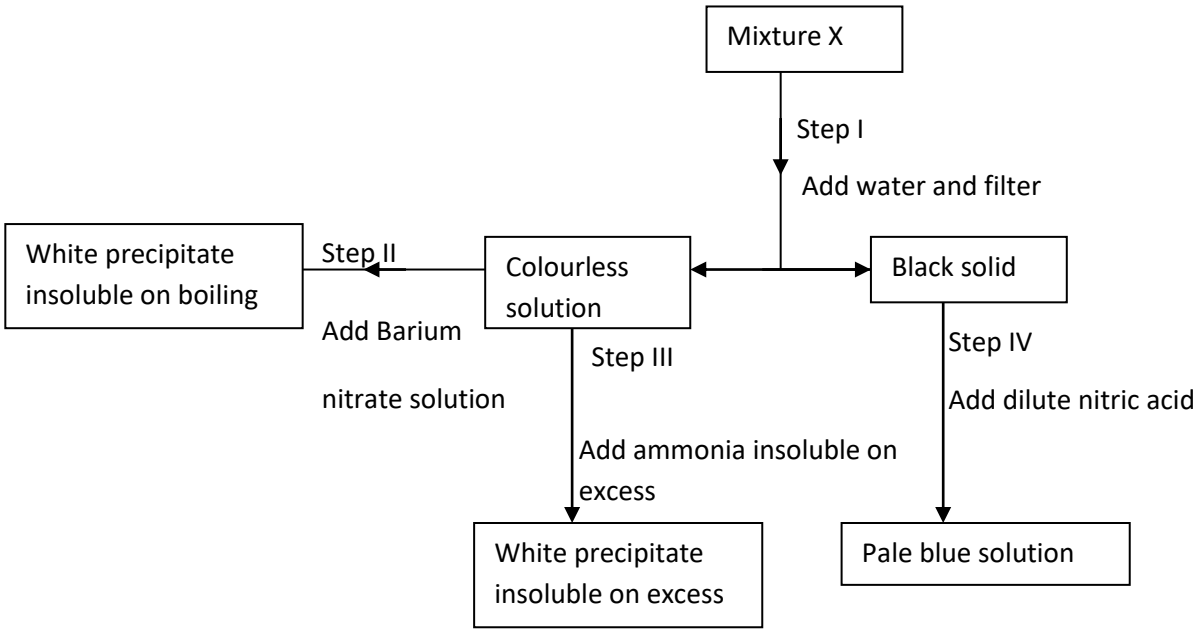


i. Write an equation for the reaction that takes place. (1mk)

ii. Name liquid Z. (1mk)

iii. State two advantages of using 'dry ice' over ordinary ice as a refrigerant. (2mks)

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



a) Name:

i. Cations present in mixture X. (1mk)

ii. Anions present in the solution. (1mk)

b) Write an equation to show how the white precipitate in step III dissolves. (1mk)

c) Name the process outlined in step IV above. (1mk)

12. i) A student intending to prepare lead (II) sulphate reacted lead metal with dilute sulphuric acid. However, he was not successful. Explain why he was not successful.
(1mk)

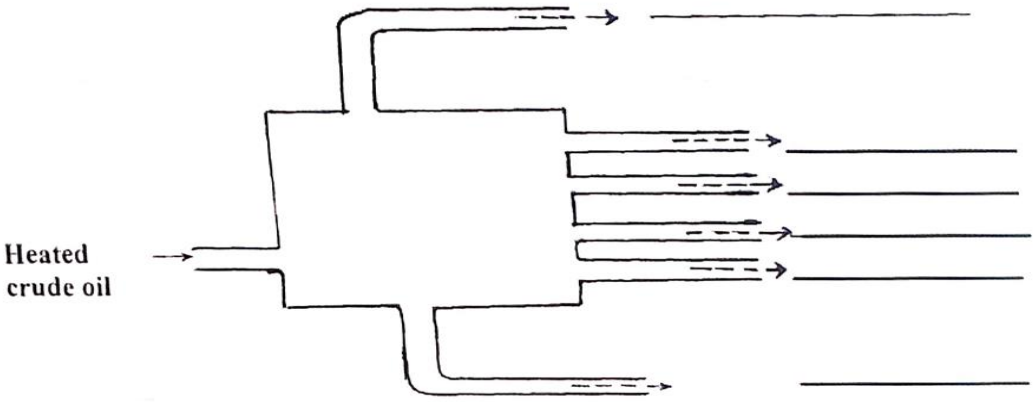
ii) Suggest a method the student could have used to prepare lead (II) sulphate. (2mks)

iii) Write an ionic equation that would take place in (ii) above. (1mk)

13. In an experiment, ammonium chloride was heated in a test-tube. A moist red litmus paper placed at the mouth of the test-tube first changed blue then red. Explain these observations.
(2mks)

14. An element X has two naturally occurring isotopes X-22 and X-20. If its relative atomic mass is 21.8, calculate the percentage abundance of the more stable isotope. (2mks)

15. Fractional distillation of crude oil used to produce the following fractions; petrol, diesel, petroleum gases, kerosene, naphtha and bitumen. Below is a simplified diagram of a fractionating column used during the refining of crude oil.
i. On the diagram, write the names of theses fractions in their correct positions.
(3mks)



ii. Which fraction is used as a jet fuel? (1mk)

iii. What process is used to convert higher fractions to lower fractions? (1mk)

16. Carbon (iv) oxide and silicon (iv) oxide are both covalent oxides but carbon is a gas whereas silicon (iv) oxide is a solid with high melting point. Explain. (2mks)

17. The ability of hard water to conduct electricity falls when water is boiled but is not much affected when the water hardness is removed by addition of washing soda (sodium carbonate). Explain. (2mks)

18. When sulphur is heated in a boiling tube in absence of air, the yellow crystals melts into golden yellow mobile liquid at 113^{o}C. The liquid changes at 180^{o}C into a dark brown very viscous liquid. More heating to about 400^{o}C, produces a brown less viscous liquid.

a) Draw the molecular structure of sulphur in the yellow crystals. (1mk)

b) Explain why the molten liquid becomes viscous. (1mk)

c) If the brown liquid at 400^{o}C is cooled rapidly by pouring it into cold water, which form of sulphur is produced? (1mk)

d) State the observation made when sulphur is heated in a deflagrating spoon. (1mk)

19. The table below gives some information about certain chemical substances. The letters used are not the actual chemical symbols or formulae.

Substance	Melting point (°C)	Boiling point (°C)	Electrical conductivity		
			Of solid	Of liquid	In water
A	1540	3000	Good	good	Insoluble
B	-114	-85	Poor	poor	good
C	712	1418	Poor	good	good
D	-39	357	Good	good	insoluble
E	2045	3000	Poor	good	insoluble
f	1700	2776	Poor	good	insoluble

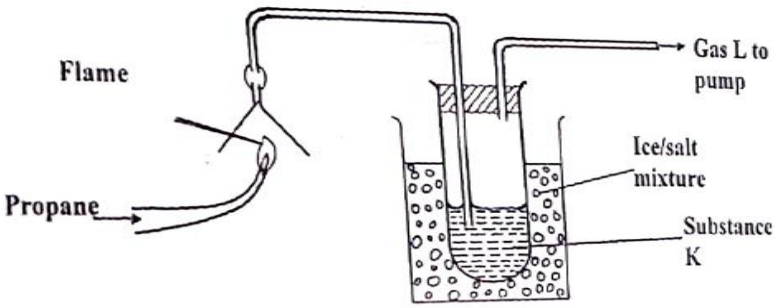
a) From the table, select;

i. Two substances that cannot be elements. (1mk)

ii. A substance that is likely to have giant atomic structure. (1mk)

iii. A substance that is likely to consist of molecules and which produce ions when added to water. (1mk)

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



i. Write the equation for the combustion of propane. (1mk)

ii. The pH of substance K was found to be less than 7. Explain this observation. (1mk)

21. Explain how you would separate a mixture of nitrogen and oxygen gases given that their boiling points are -196°C and -183°C respectively. (2mks)

22. Dry carbon (iv) oxide gas reacts with heated lead (ii) oxide as shown in the equation below.

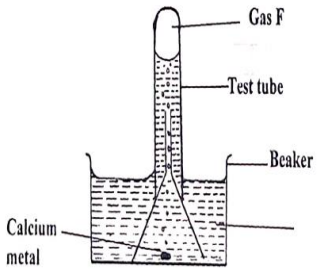
$PbO(s) + CO(g) \longrightarrow Pb(s) + CO_2(g)$

a) Name the process undergone by the lead (ii) oxide. (1mk)

b) Give a reason for your answer in (a) above. (1mk)

c) Name another gas that can be used to perform the same function as carbon(IV) oxide gas in the above reaction. (1mk)

23. The set-up below was used to collect gas F, provided by the reaction between water and calcium metal.



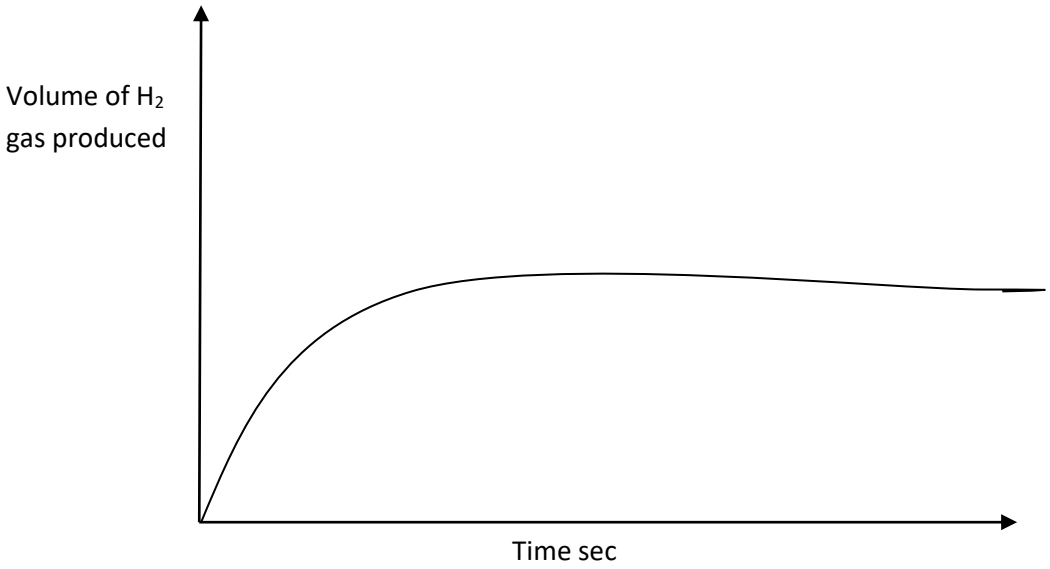
a) Name gas F. (1mk)

b) At the end of the experiment the solution was found to be a weak base. Explain why the solution is a weak base. (2mks)

c) Give one laboratory use of the solution formed in the beaker. (1mk)

24. In terms of structure and bonding, explain why graphite is used as a lubricant. (2mks)

25. 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) Name one piece of apparatus that may be used to measure the volume of hydrogen gas produced. (1mk)

b) On the same diagram the curve that would be obtained if the experiment was repeated at 35°C. (1mk)

26. Methane reacts with oxygen according to the equation given below;
$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g)\ 2H_2O(g)\ \ \triangle H = -890KJMol^{-1}$
Calculate the volume of methane whoch would produce 11.25KJ when completely burnt at r.t.p (molar volume of a gas at r.t.p = 24litre) (2mks)

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Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name ……**Admission number** ……
Candidate's Signature……**Date**……

BAHATI GIRLS

233/1
CHEMISTRY
PAPER 1
TIME: 2 hours

Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *Answer **ALL** questions in spaces provided in the question paper.*
d) ***ALL** working must be shown clearly where necessary.*
e) *Mathematical tables and silent non-programmable calculators may be used.*

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Question	Maximum score	Candidate's score
1 – 27	80	

1. Complete the following table to distinguish the types of flame by stating the conditions under which they are produced, their uses and characteristics. (3 marks)

Type of flame	Luminous	Non-luminous
Condition		
Use		
Characteristic		

2. (a) What is an acid? (1 mark)

……

(b) Consider the following reactions of acids in water.

$HA(aq) \rightleftharpoons H^+(aq) + A^-(aq)$

$HB(aq) \longrightarrow H^+(aq) + B^-(aq)$

$HC(aq) \rightleftharpoons H^+(aq) + C^-(aq)$

Identify with a reason:

i) A strong acid (1 mark)

ii) A weak acid (1 mark)

3. (a) Give the systematic names of the following compounds. (1½ mark)

i) C_2H_2

……

ii) $CH_3(CH_2)_3CHCH_2$

……

iii) $CH_3CH_2CH_3$

……

(b) Describe how the presence of alkenes in a liquid can be tested using acidified potassium manganate(VII) solution. (1½ marks)

……

……

……

4. Briefly explain the following:
(a) Alkaline earth metals are generally less reactive than-alkali metals. (2 marks)

……

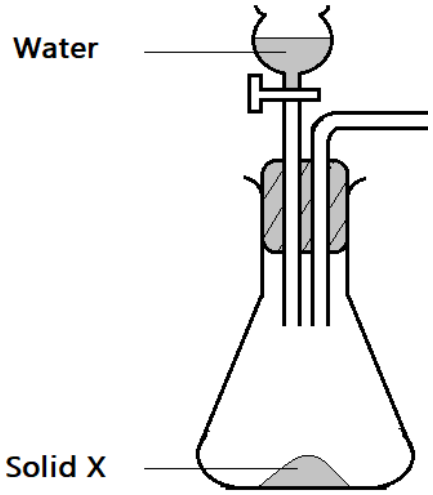
……...…….

(b) Though sodium and aluminum are in the same period and are both metals, aluminium is a better conductor of electricity. (1 mark)

……...…….

……...…….

5. The set up below was used to prepare a sample of oxygen gas. Complete the diagram to show how dry oxygen is collected. (3 marks)



6. (a) Other than solid carbon (IV) oxide, name two substances that sublime when heated. (2 marks)

……...…….

……...…….

(b) Why is solid carbon (IV) oxide preferred to be used in cold boxes by ice cream vendor over ordinary ice. (1 mark)

……...…….

……...…….

7. Use the information given below to answer the questions that follows:

Solution	G	H	I	J	K
pH	1.5	6.5	13.0	7.0	8.0

(a) Solution **K** can be used to relieve heartburn and indigestion. Explain. (1 mark)

……...…….

……...…….

(b) Which solution is likely to be;

i) Dilute sulphuric(VI) acid (1 mark)

……...…….

ii) Sodium hydroxide solution (1 mark)

……...…….

8. (a) The electronic arrangement of the ion of element **Y** is **2.8.** If the Formula of the ion is $\mathbf{Y^{3+}}$, state the group and period to which **Y** belongs,

Group: …… (½ mark)

Period: …… (½mark)

(b) Helium, neon and argon belong to group 8 of the periodic table. Give:

i) The general name of these elements; (1 mark)

……...…….

ii) One use of these elements (1 mark)

……...…….

9. 0.05 mole of sodium hydroxide liberates 2.1 kJ of heat when it is dissolved in distilled water.

(a) Determine the molar heat solution of sodium hydroxide. (1 mark)

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(b) Write the thermochemical equation for the reaction that occurs. (1 mark)

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(c) Sketch an energy level diagram for the reaction. (1 mark)

10. The conductivity of some substances was investigated. The observations made were recorded as shown in the table. Use it to answer the questions that follow.

Substance	Conductivity in solid state	Conductivity in molten or aqueous state
J	Does not conduct	Does not conduct
K	Conducts	Conducts
L	Does not conduct	Conducts

(a) Identify a substance that is a metal. Give a reason. (1 marks)

……...…….

(b) Substance L does not conduct electricity in solid state but conducts in molten or aqueous state. Explain. (2 marks)

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11. A white crystalline sodium salt C when heated with concentrated sulphuric acid evolves a gas D which turns moist blue litmus paper red. When manganese(IV) oxide is added to the reaction and the mixture warmed, gas E was given off.

a) Name: (1½ marks)

i) Solid C. …….

ii) Gas D. …….

iii) Gas E. …….

b) State the role of manganese(IV) oxide in the experiment. (1 mark)

……...…….

c) What is the confirmatory test for gas D? (½ mark)

……...…….

12. An atom of element L has mass number 27 and 13 protons.

(a) Write the electron arrangement of the atom. (1 mark)

……

(b) State the period and group to which element L belongs

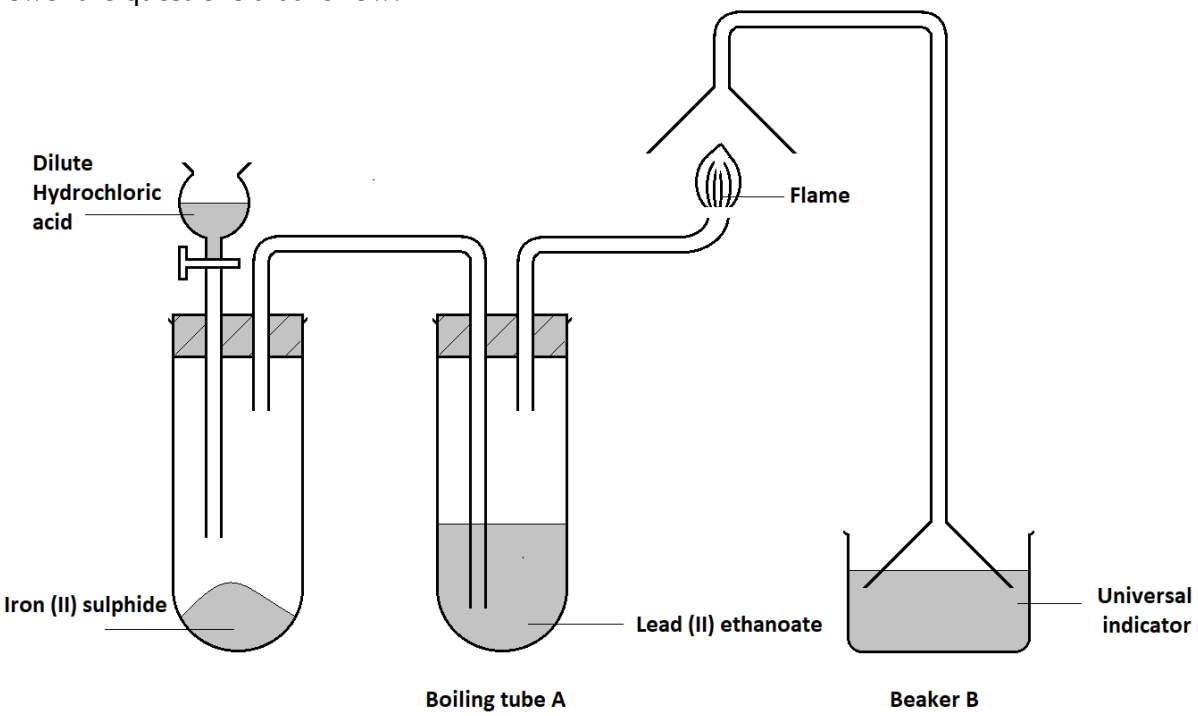
Group …..……. (½ mark)

Period …..……. (½ mark)

(c) State whether the element is a metal or a non-metal. (1 mark)

……

13. The set up below was used to prepare a gas and study some of its properties. Study it and answer the questions that follow:



(a) State and explain the observations made in the.

i) Boiling tube labelled A; (1 mark)

……

……

ii) Beaker B. (1 mark)

……

……

(b) State and explain **one** precaution that should be taken when carrying out this experiment. (1 mark)

……...…….

……...…….

14. (a) Describe how carbon (IV) oxide can be distinguished from Carbon (II) Oxide. (2 marks)

……...…….

……...…….

……...…….

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(b) State one use of carbon(II) oxide? (1 mark)

……...…….

15. A certain mass of gas occupies 300 cm^3 at 740 mmHg. Calculate its volume if the pressure changes to 800 mmHg. (2 marks)

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16. A mixture contains sodium sulphate, zinc carbonate and lead(II) chloride. Describe how a pure sample of each salt can be obtained. (3 marks)

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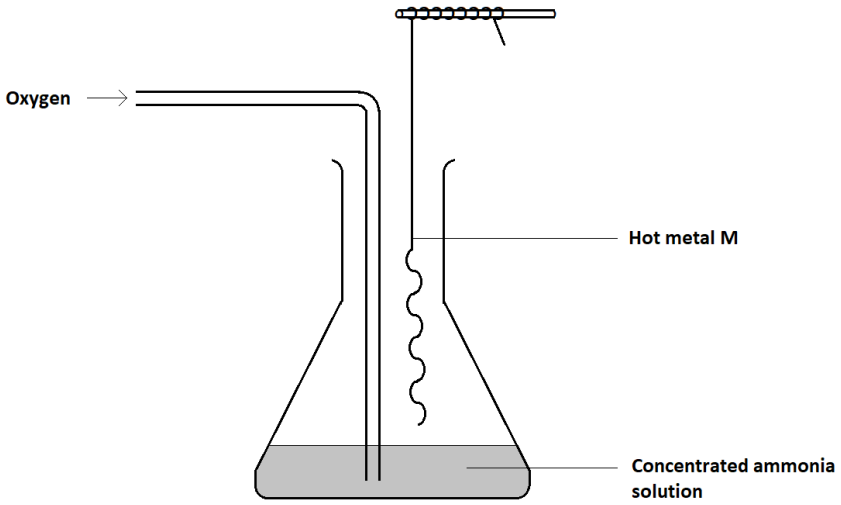
17. The set-up in the figure below can be used in an experiment to investigate some properties of ammonia. Study it and answer the questions that follow.



(a) Name a suitable element which can be used as metal **M**. (1 mark)

……

(b) State one observation made in during the reaction of ammonia with oxygen in the presence of metal M. (1 mark)

……

(c) Write a chemical equation for the reaction that occurs in (b) above. (1 mark)

……

18. 20.0 cm^3 of aqueous sodium hydroxide containing 6.0 g per litre of sodium hydroxide were completely neutralized by 0.147 g of a dibasic acid. Determine the relative formula mass of the dibasic acid. (Na = 23.0; O = 16.0; H 1.0) (3 marks)

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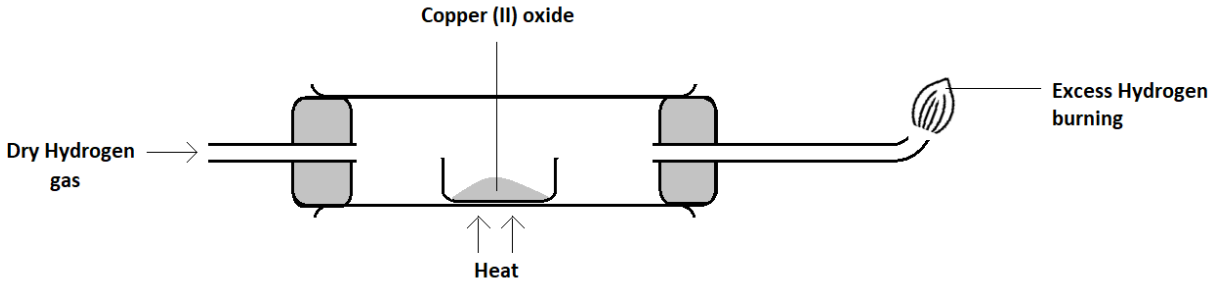
19. In an experiment, dry hydrogen gas was passed over heated copper (II) oxide as shown in the diagram below.



(a) State and explain one observation made in the combustion tube. (1 mark)

……

……

(b) Identify one mistake made in the set-up above. Give a reason for your answer. (2 marks)

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20. The table below gives the number of electrons, protons and neutrons in particles A, B, C, and D.

Particle	**A**	**B**	**C**	**D**
Electrons	10	6	8	18
Neutrons	14	6	8	18
Protons	13	6	8	17

(i) Write the formula of the compound formed when A combines with C. (1 mark)

……

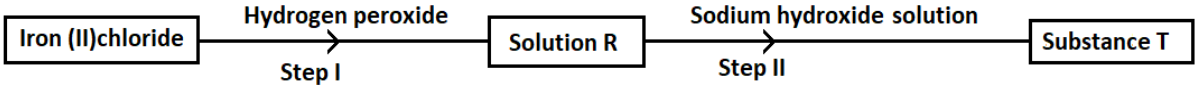
……

(ii) Name the type of bond formed in (i) above (1 mark)

……

(iii)Draw a dot (●) and cross (x) diagram for the compound formed between B and D. (1 mark)

21. Use the flow chart below to answer the questions that follow.



(a) State the observation made in:

i) Step **I** (1 mark)

……

ii) Step **II** (1 mark)

……

(b) Write an ionic equation for the reaction that occurs in step **II**. (1 mark)

……

22. Describe how the mass of zinc in **hydrated zinc nitrate** can be determined.(3 marks)

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23. a) What are allotropes (1 mark)

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b) Name two allotropes of carbon. (1 mark)

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c) which allotrope of carbon has a higher melting point? Explain (1 mark)

……

24. a) State the Gay Lussac's law. (1 mark)

……

……

b) A volume of 15 cm^3 of ethane gas (C_2H_4) was exploded with 50 cm^3 of oxygen. If both volumes were measured at the same temperature, calculate the volume of the resulting gaseous mixture. (2 marks)

……...…….

……...…….

……...…….

25. a) Complete the following table by filling the catalysts used in various industrial process. (2 marks)

Industrial process	**Chemical equation**	**Catalyst used**
Haber process	$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	
Contact process	$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$	

b) Name the gaseous pollutant produced during large scale manufacture of nitric(V) acid (1 mark)

……...…….

26. Sate three differences between a proton and an electron. (3 marks)

……...…….

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……...…….

27. a) Describe how the ion exchange resin removes water hardness. (2 marks)

……...…….

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……...…….

b) The efficiency of the resin to remove water hardness reduces with time. How is it restored? (1 mark)

……...…….

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Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name ……**Admission number** ……
Candidate's Signature……**Date**……

ALLIANCE BOYS HIGH SCHOOL

233/1
CHEMISTRY
PAPER 1
TIME: 2 hours

Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *Answer **ALL** questions in spaces provided in the question paper.*
d) ***ALL** working must be shown clearly where necessary.*
e) *Mathematical tables and silent non-programmable calculators may be used.*

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Question	Maximum score	Candidate's score
1 – 29	80	

1. The electron arrangement of ions X^{+}, Y^{2+} and W^{3-} are 2.8, 2.8 and 2.8.8 respectively.
   a) Write the electron arrangement of their atoms. (1½ marks)

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   b) Arrange the atoms in the order of increasing atomic radius starting with the smallest. Give a reason for the order. (1½ marks)

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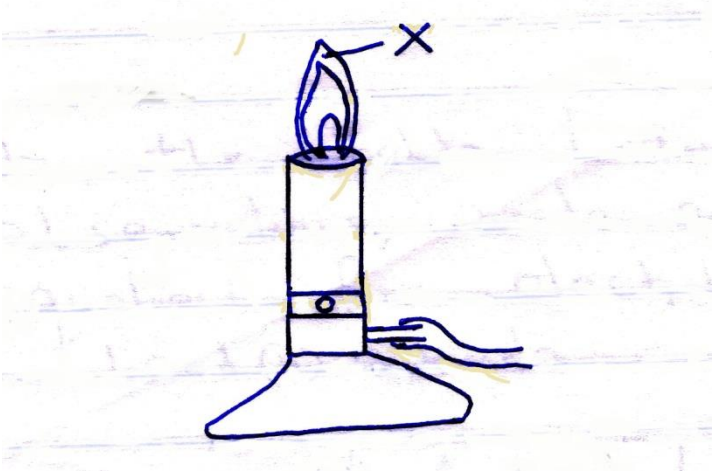
2. The diagram below shows a Bunsen burner when in use.



   a) State the condition under which the Bunsen burner produces the flame shown in the diagram above. (1 mark)

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.....

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   b) Describe an experiment that can be carried out to confirm that the region labeled X is the hottest. (2 marks)

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3. (a) Chlorides of Sodium and aluminium are given in the table below. Complete the table by writing the properties of the chlorides. (2 marks)

Property	NaCl	$AlCl_3$
Bonding		
Structure		

(b) Sodium carbonate powder were added to aqueous solution of aluminium chloride. State and explain the observation made. (1 mark)

……

……

4. (a) Explain why molten Magnesium Chloride conducts electric current while sugar solution do not. (1 mark)

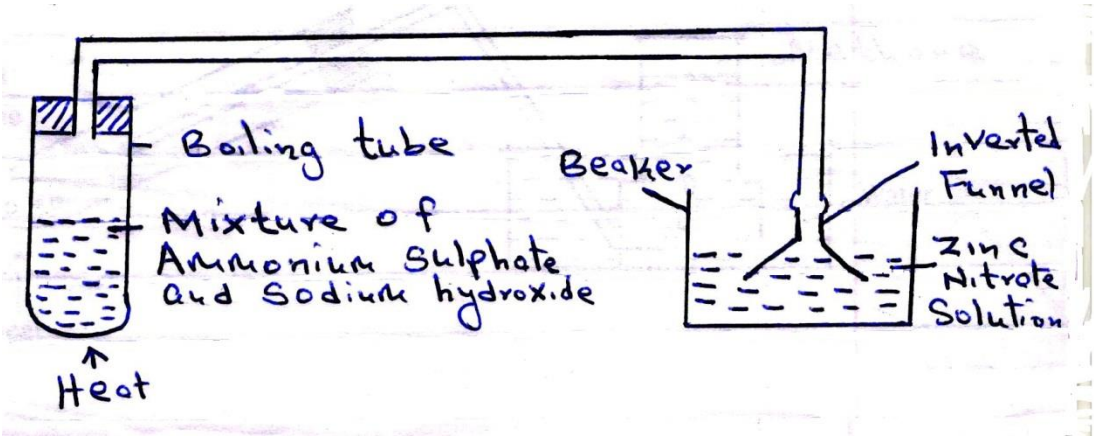
……

……

b) Complete the table below by writing the observations, anode and cathode half-equations for electrolysis of molten Lead (II) Chloride. (2 marks)

	Anode	Cathode
Observations		
Half-equations		

5. The set-up below was used during a class experiment. Study it and answer the questions that follow.



a) Identify the gas produced in the boiling tube. (1 mark)

……

b) State and explain the observation made in the beaker. (2 marks)

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.....

6. The following data refers to element X.

Isotope	**X_1**	**X_2**	**X_3**
Mass of isotope	54	56	57
% abundance	6	92	2

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

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7. (a) State the Charles' Law (1 mark)

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(b) Using Kinetic Theory, explain why the pressure of a fixed mass of a gas decreases with increase in volume at a constant temperature. (2 marks)

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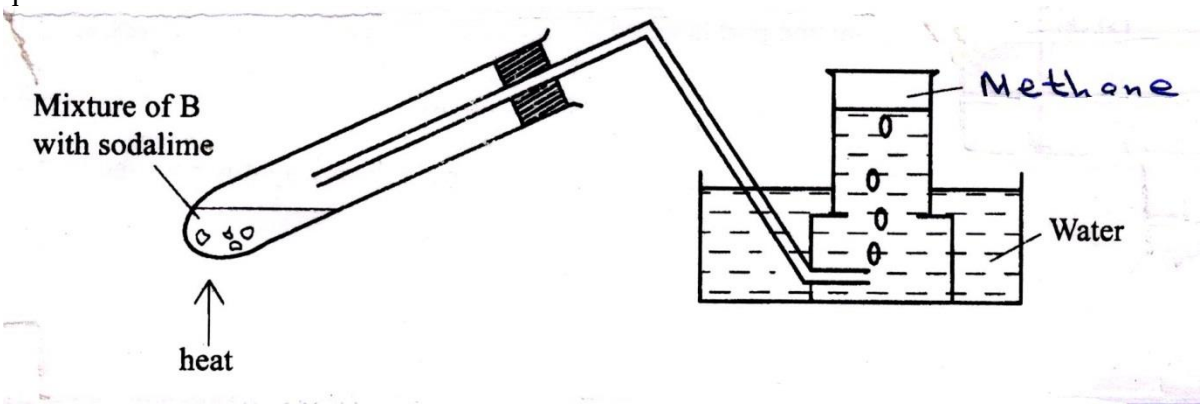
8. The set up below was used to prepare a sample of methane gas. Study it and answer the questions that follow.



a) Identify substance B (1 mark)

.....

b) (i) Give one condition that is necessary for methane to react with chlorine gas. (1 mark)

.....

(ii) Write an equation for the reaction that occurs when methane react with excess chlorine gas. (1 mark)

……

……..

9. Chemical tests were carried out on separate samples of water from the same river. The observations made were recorded as shown in the table below.

	Test	Observation
(i)	Addition of few drops of barium chloride	White precipitate formed
(ii)	Addition of sodium hydroxide dropwise until in excess	White precipitate dissolves
(iii)	Addition of aqueous ammonia until in excess	White precipitate insoluble
(iv)	Addition of acidified barium chloride	White precipitate

a) State the inference in;

Test (i) ……. (1 mark)

Test (ii) …… (1 mark)

b) Identify the cation and anion present in the sample of water. (1 mark)

.....

.....

10. 2M potassium hydroxide has higher pH value as compared to 2M ammonia solution. Explain. (2 marks)

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11. (a) Name two reagents used to prepare hydrogen sulphide gas. (1 mark)

……

……

(b) Hydrogen Sulphide and Sulphur (IV) oxide were separately bubbled into acidified potassium manganite (VII) solution. State and explain the observation made in each case. (2 marks)

Hydrogen sulphide

.....

.....……

Sulphur (IV) oxide

……

……

12. An organic compound Y was analysed and found to contain carbon, hydrogen and oxygen only. 2.58g of Y on complete combustion produced 5.28g of carbon (IV) oxide and 1.62g of water. Determine the empirical formula of Y. (C = 12.0 H = 1.0 O = 16.0) (3 marks)

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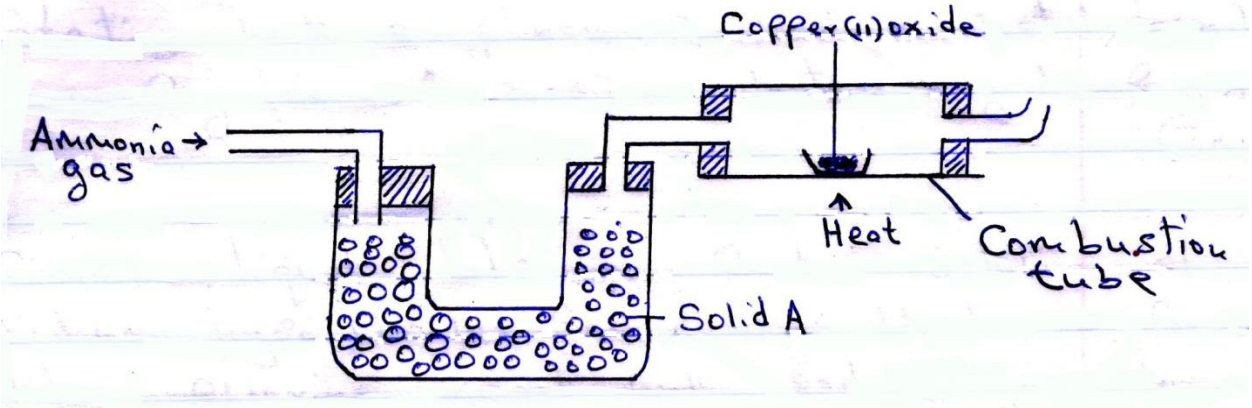
13. The set-up below was used to investigate the properties of ammonia gas.



(a) Identify solid A. (1 mark)

……

(b) State

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

……

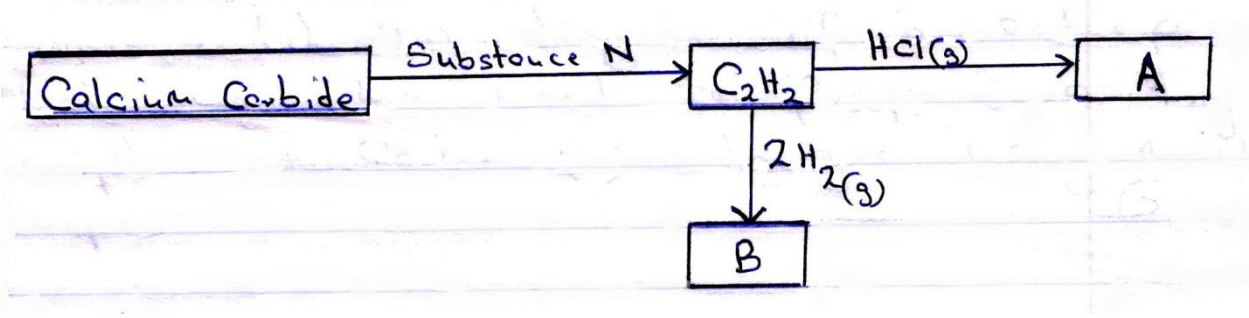
……

(ii) Property of ammonia gas shown in this experiment. (1 mark)

……

……

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



a) Identify substance N (1 mark)

.....

.....

b) Name substance B (1 mark)

.....

.....

c) (i) Draw the structural formula of substance A. (½ mark)

.....

.....

(ii) Draw one repeat unit of polymer formed by substance A. (½ mark)

15. Starting with a piece of sodium metal, describe how crystals of sodium nitrate may be prepared. (3 marks)

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16. (a) Common liquid bleaches contain solution of sodium hypochlorite is formed when chlorine react with sodium hydroxide solution.

(i) Give two conditions under which sodium hypochlorite is formed. (1 mark)

.....

.....

(ii) Explain how sodium hypochlorite works as a bleaching agent. (1 mark)

……

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……

(b) Describe a test for hydrogen chloride gas. (1 mark)

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……

17. Draw a well labeled diagram of a set-up that can be used to prepare a dry sample of carbon (IV) oxide gas using marble chips. (3 marks)

18. 6.84g of aluminium sulphate were dissolved in 400cm^3 of water. Determine the number of sulphate ions in the solution.

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19. Burning magnesium and a burning splint were separately introduced into a gas jar full of carbon (IV) oxide. State and explain the observations made.
Burning Magnesium (2 marks)

……

……

Burning splint. (1 mark)

……

……

20. Using dot (•) and cross (X) diagram, show bonding in the following substances.

a) Water molecule (1 mark)

b) Hydroxonium ion (H_3O^+) (1 mark)

c) Give a reason why water molecule can combine with hydrogen ion. (1 mark)

21. Describe how you can obtain zinc sulphate crystals from zinc sulphate solutions. (1 mark)

.....

.....

22. $120cm^3$ of ethane were mixed with $40cm^3$ of oxygen and the mixture exploded to complete reaction. Calculate the volumes of the resulting gaseous mixture when measured at room temperature and pressure. (3 maarks)

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23. In an experiment to study properties of carbon, a mixture of concentrated nitric (IV) acid and wood charcoal was heated in a boiling tube. State and explain the observation made. (2 marks)

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24. (a) Write formulas of two substances that causes temporary hardness in water. (1 mark)

.....

.....

(b) Give one advantage of hard water in brewing industry. (1 mark)

.....

……

(c) Write an equation to show how boiling removes hardness of water. (1 mark)

.....

.....

25. Clean magnesium ribbon was dropped into a solution of hydrogen chloride gas in methylbenzene.

(i) State and explain the observations made. (1 mark)

.....

.....

(ii) The experiment was repeated using solution of hydrogen chloride in water. State and explain the observation made. (1 mark)

.....

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26. (a) Define molar heat of solution. (1 mark)

.....

.....

(b) 1.0g of zinc powder was added to $50cm^3$ of 0.2m copper (II) sulphate solution and the mixture stirred gently. The temperature of the mixture rose from 20^0C to 27^0C. Calculate the molar heat of displacement of copper (specific heat capacity = 4.2KJ/Kg/K, density of solution = 1g cm^{-3}) (2 marks)

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27. The following equation represents the reaction that occurs during contact process.

$$2SO_{2(g)} + O_{2\,(g)} \leftrightarrow 2SO_{3(g)}$$

a) Name the catalyst used in this reaction (1 mark)

.....

b) The sulphur (VI) oxide is normally absorbed in concentrated sulphuric (VI) acid and not in water. Explain. (1 mark)

.....

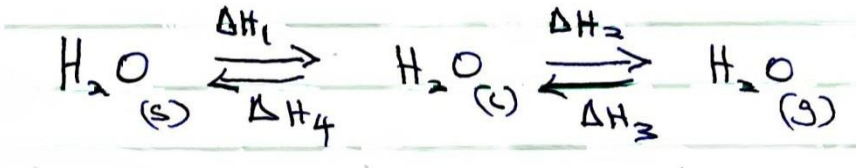
.....

28. (a) When ice is heated, temperature remains constant at 0^0C until all the ice has melted. Explain this explanation. (1 mark)

.....

.....

(b) The scheme below shows the energy changes that are involved between ice, water and steam. Study it and answer the questions that follow.



(i) What name is given to the energy change ΔH_2 (1 mark)

.....

(ii) What is the sign of ΔH_4 (1 mark)

.....

29. The following results were obtained during an experiment to determine the solubility of potassium chlorate (V) in water at 30^0C.

Mass of evaporating dish = 15.86g.
Mass of evaporating dish + saturated solution at 30^0C = 26.8g.
Mass of evaporating dish + solid potassium chlorate (V) after evaporating to dryness = 16.86g.

Calculate the mass of the saturated solution containing 60.0g of water at 30^0C.
(3 marks)

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Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name …… **Admission number** ……

Candidate's Signature……**Date**……

ALLIANCE GIRLS' HIGH SCHOOL

233/1

CHEMISTRY

PAPER 1

TIME: 2 hours

Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*

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

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

d) ***ALL** working must be shown clearly where necessary.*

e) *Mathematical tables and silent non-programmable calculators may be used.*

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Question	Maximum score	Candidate's score
1 – 28	80	

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)

……

……

……

……

……

3. Define the following terms

i. covalent bond (1mk)

……

……

ii. Coordinate bond (1mk)

……

……

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)

……

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 ……

ii. 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)

……

……

……

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

i. Esterification…….

ii. Ostwald process……

iii. Preparation of hydrogen in the laboratory……..

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

……

……

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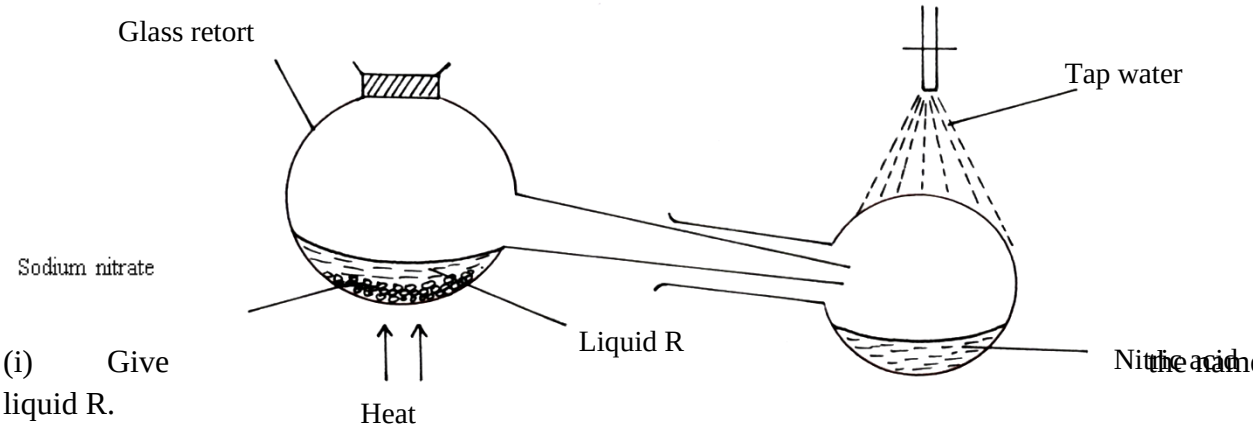
11. The set-up below was used to prepare Nitric(V)acid.



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

……..

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

……

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

…….

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)

……

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)

.....

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

……

……

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)

……

……

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)

……

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

……

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

……
……
……

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

……

……

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.

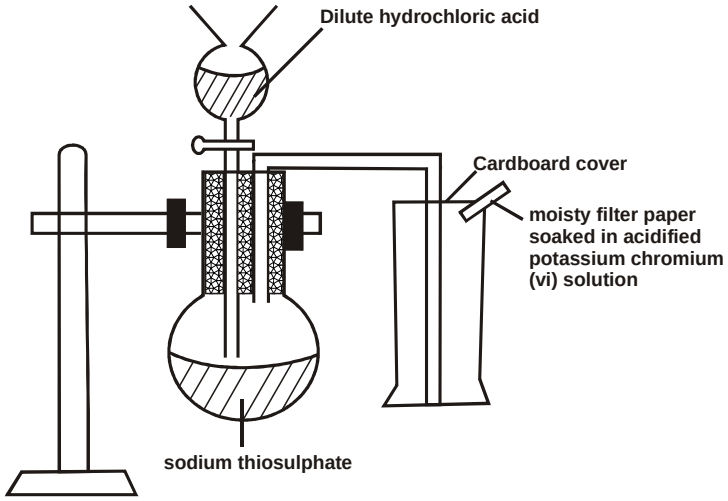
i. Identify the substances P, S, T, U, V, W. (3 marks)

P …… U ……..

S …….. V ……

T …… W …….

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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……..……....

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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……

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

i) Conical flask (1mk)

……

ii) Desiccator (1mk)

……

iii) Crucible (1mk)

……

22 i. Define Vulcanisation (1mk)

……

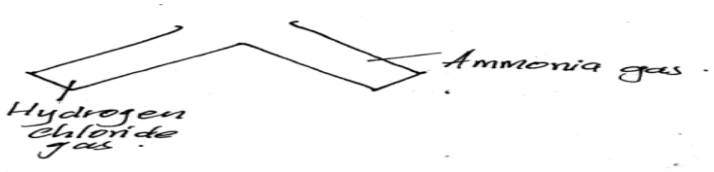
……

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

……

……

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)

……

……

……

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

……

……

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)

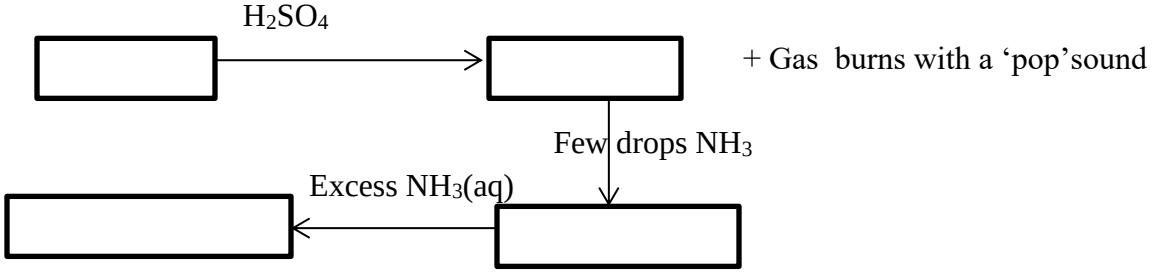
……

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

……

……

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



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

.....

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

……

……

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

……

……

……

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

……

……

……

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)

……

……

……

28. Define the term chemistry (1mk)

……

……

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Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name …… **Admission number** ……

Candidate's Date……

ASUMBI GIRLS TRIAL 1

233/1

CHEMISTRY

PAPER 1

TIME: 2 hours

Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*

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

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

d) ***ALL** working must be shown clearly where necessary.*

e) *Mathematical tables and silent non-programmable calculators may be used.*

FOR OFFICIAL USE ONLY

Question	Maximum score	Candidate's score
1 – 27	80	

1. a) State Charles' law: (1mk)

b) A gas R at 27°C and 750mmHg was found to occupy 36cm3. calculate the temperature at which the same mass of R will occupy twice the volume at a pressure of 1000mmHg (2mks)

2. Element **A** and **B** with atomic numbers 12 and 17 respectively react together.

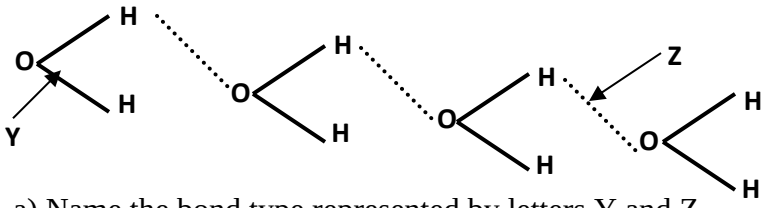
a) Write the electronic configurations of each (1mks)

A-

B -

b)Write the formula of the compound formed between **A** and **B** (1mk)

3.The structure of water molecule can be represented as shown below.



a) Name the bond type represented by letters Y and Z

Y: (1mk)

Z: (1mk)

b) Methane and water are molecular substances with almost similar molecular masses however; the boiling point of water is 100^0C while that of methane is – 161^0C. Explain (1mk)

4.The table below shows elements in the same group of the periodic table. Study it and answer the questions that follow.

Element	Atomic size
B_1	0.18

B_2	0.24
B_3	0.16

Which element has the highest ionization energy? Give a reason (3 Marks)

5.The first step in the industrial manufacture of Nitric (V) acid is the catalytic oxidation of ammonia gas.

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

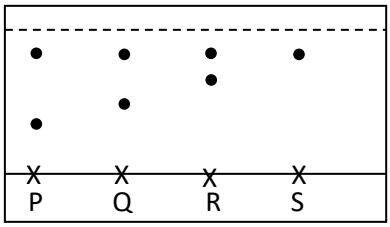
(b) Write the equation for the catalytic oxidation of ammonia gas. (1 Mark)

(c) Nitric (V) acid is used to make ammonium nitrate, state two uses of ammonium nitrate (1 Mark)

6.(a) State the Graham's law of diffusion. (1 Mark)

(b)The molar masses of gases X and Y are 16.0 and 44.0 respectively. If the rate of diffusion of X through a porous material is $12cm^3S^-$. Calculate the rate of diffusion of Y through the same material. (2 Marks)

7. The paper chromatography below represents blood samples of four athletes P, Q, R and S suspected to contain prohibited drugs. The results showed that the prohibited drugs were in P, Qand R.

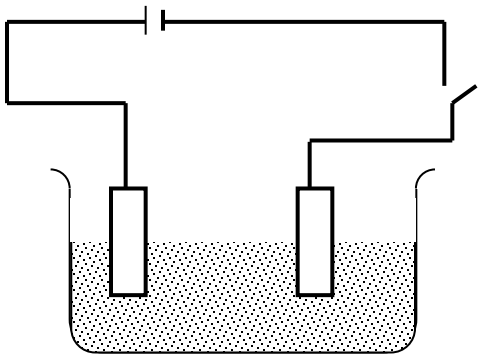


(a) On the diagram, identify the solvent front. (1 Mark)

(b) Circle the spots which show the prohibited drugs. (1 Mark)

(c) State two solvents that can be used in paper chromatography. (1 Mark)

8. The diagram below shows a set-up which was used by a student to investigate the effect of electricity on molten Lead (II) Iodide.



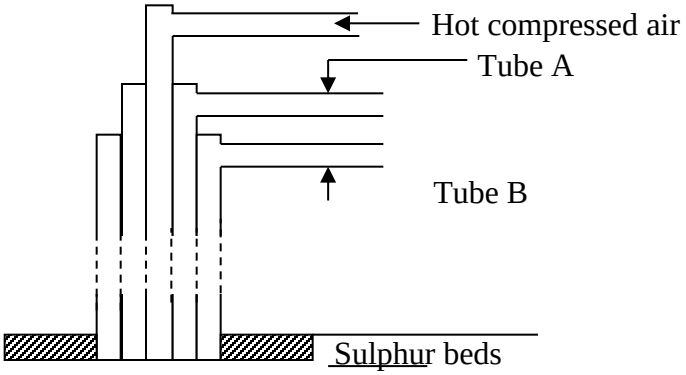
Molten Lead (II) Iodide

(i) Define the term electrolysis (1 Mark)

(ii) Indicate the anode and the cathode. (1 Mark)

(iii) Write the anode reaction (1 Mark)

9.The diagram below represents the extraction of Sulphur by Frasch process.



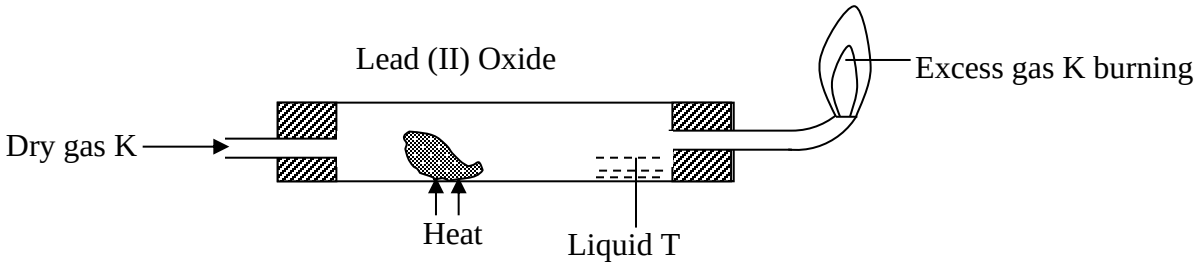
(a) Name the substances that passes through tube: - (2mks)

A

B

(b) What is the purpose of hot compressed air in the process? (1 Mark)

10.A gas K, that burns with a blue flame and a pop sound, was passed over heated Lead (II) Oxide as shown in the diagram below.



(a) Identify:-

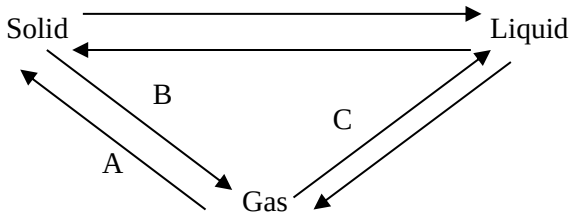
(i) Gas K (½ Mark)

(ii) Liquid T (½ Mark)

(b)Write an equation for the reaction between gas K and Lead (II) Oxide. (1 Mark)

(c)Why is gas K passed through the combustion tube before heating starts. (1 Mark)

11. The diagram below shows changes that take place between states of matter. Use it to answer the questions that follow.



(i) Name process: (2mks)

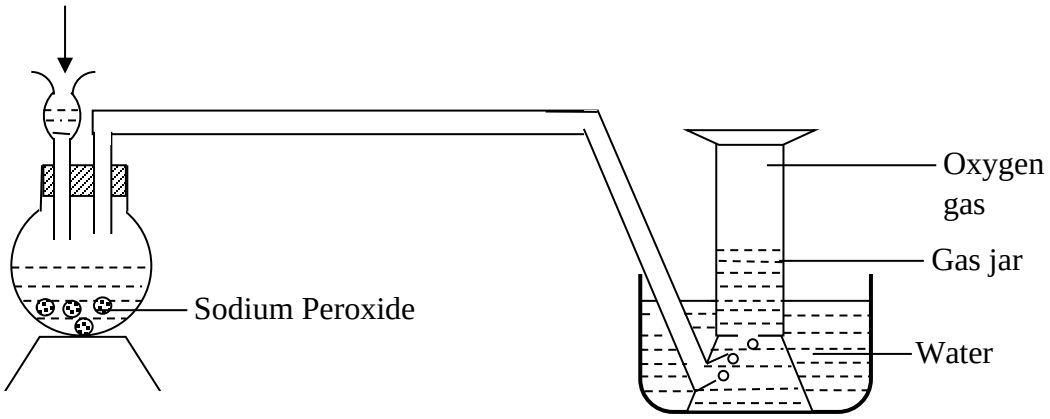
A

C

(ii) Ammonium chloride and Iodine can undergo the same process. Identify the process.

(1 Mark)

12.The set-up below can be used to prepare oxygen gas. Study it and answer the questions that follow. Y



(a) Identity Y (1 Mark)

(b)What property of oxygen makes it possible to be collected as shown in the above set-up?

(1 Mark)

(c) State one use of oxygen apart from patients with breathing problems. (1 Mark)

13. The table below gives some properties of gases X and Y.

Gas	Density	Effects of $H_2SO_{4(aq)}$	Effects of $NaOH_{(aq)}$
X	Lighter than air	Reacts to form a salt	Dissolves without reacting
Y	Heavier than air	Not affected	Not affected

(a) Describe how you obtain a sample of Y from a mixture of gases X and Y. (2 Marks)

(b) Suggest a possible identity of gas X. Give a reason for your answer. (1 Mark)

14. The table below shows the pH values of the solutions I, II, III and IV

Solution	**I**	**II**	**III**	**IV**
pH	2	7	11	14

a) Which solution is likely to be that of calcium hydroxide? (½ mark)

b) Select the solution in which a sample of aluminum oxide is likely to dissolve. Give a reason for your answer. **(2 marks)**

c)Select a pair of solutions that would likely give a pH of 7 when equal volumes are reacted with each other. **(1 mark)**

15.Study the information in the table below and answer the questions 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 following reaction

$CH_{4\,(g)} + Cl_{2\,(g)} \xrightarrow{\text{U.V. light}} CH_3Cl_{(g)} + HCl_{\,(g)}$

(3 marks)

16.A pupil analyzed a commercial vinegar solution by titration and found that 24.5cm^3 of 0.09 M sodium hydroxide solution was required for titration of 1cm^3 of vinegar. Calculate the molarity of ethanoic acid CH_3COOH in vinegar. **(3 marks)**

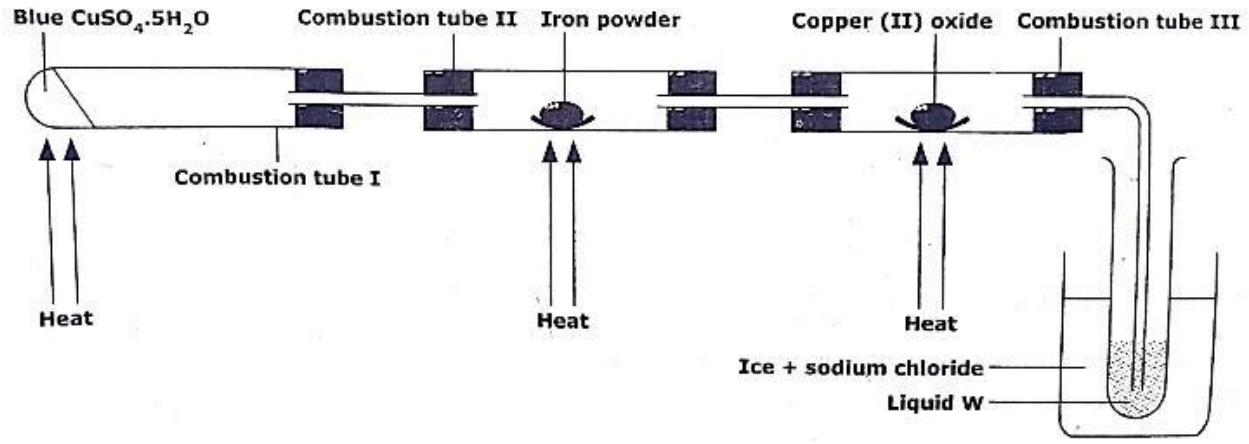
17. In an experiment, soap solution was added to three samples of water. The results below shows the volume of soap solution required to lather with 500cm^3 of each water sample before and after boiling.

	Sample 1	Sample 2	Sample 3
Volume of soap used before water boiled	26.0	14.0	4.0
Volume of soap after water boiled	26.0	4.0	4.0

(i) Which water samples are likely to be soft. (1mark)

(ii) Explain the change in volume of soap solution used in sample 2 (1mark)

18.The diagram below shows the apparatus for the preparation of gas A and investigates its properties. Study the diagram and answer the questions that follow.



a) Identify

(i) gas A (1 mark)

(ii) liquid W (1 mark)

b) Suggest the property of gas A under investigation. (½ mark)

c) Write an equation for reaction that took place in combustion tube II. (1 mark)

19. You are provided with Lead (II) oxide powder, dilute nitric (V) acid, solid potassium carbonate and distilled water. Explain how a solid sample of Lead (II) carbonate can be prepared. (3 marks)

20. Use the information below to calculate the enthalpy of formation of calcium hydroxide. (3 marks)

I : H2(g) + ½ O2(g) → H2O(l); Δ H = -286.78kJ/mol

II: CaO(s) + H2O(l) → Ca(OH)2(s); Δ H = -64.26kJ/mol

III. Ca(s) + ½ O2(g) → CaO(s;) Δ H = -637.56kJ/mol

21.Name the processes taking place in I, II and III below. (3 marks)

I. $NaOH(s) \rightarrow NaOH(aq)$

II. $Na2CO3.10H2O(s) \rightarrow Na2CO3.H2O(s) + 9H2O(l)$)

III. $CuSO4(s) + 5\ H2O(l) \rightarrow CuSO4.5H2O(s)$

22. In a titration experiments, 25.0cm3 of sodium hydroxide containing 8g per litre was required for complete neutralization of 0.245g of a dibasic acid. Calculate the relative molecular mass of the acid. (Na=23, O=16, H=1) (3 marks)

23.The table below shows the ions of element W, X, Y, Z and their electronic configurations.

Ion	**Electronic Configuration**
W^-	2, 8, 8
X^{2+}	2, 8, 8
Y^{3+}	2, 8
Z^{2-}	2, 8

a) Which two elements belong to the same period? (1 mark)

b) Draw the atomic structure of element Z. (2 marks)

24. Chlorine can be prepared in the laboratory by using the following reagents and chemicals. Concentrated sulphuric (VI) acid, water, manganese (IV) oxide, concentrated hydrochloric acid.
(i) State the role of concentrated sulphuric (VI) acid. (1 mark)

(ii) Write the equation for formation of chlorine. (1 mark)

(iii) What is the role of manganese (IV) oxide? (1 mark)

25. The molecular formula of a hydrocarbon is C8H18. The hydrocarbon can be converted into 2 other hydrocarbons as shown in the equation below.

$C_8H_{18} \longrightarrow C_3H_8 + M$

i) Name and draw the possible structural formula of M. (1 marks)

ii) A few drops of bromine water were added to a sample of M. State and explain the observations made. (2 marks)

26. Using sodium hydroxide solution, describe a chemical test that can be used to distinguish between copper (II) ions and iron (II) ions. (3 marks)

27. 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. Calculate the molar heat of neutralization described by the equation:

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

(density of the solution= 1g/cm3, specific heat capacity of water= 4.2J/g/k) **(3 marks)**

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Name …… **Admission number** ……

Candidate's Signature……**Date**……

KENYA HIGH SCHOOL TRIAL 1

233/1

CHEMISTRY

PAPER 1

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

*(a) Write your **name** and **index number** in the spaces provided above.*
(b) Sign and write the date of the examination in the spaces provided above.
(c) Answer all the questions in the spaces provided in the question paper.
*(d) **Non-programmable** silent electronic calculators and **KNEC** mathematical tables may be used.*
(e) All working must be clearly shown where necessary.
*(f) This paper consists of **14 printed pages**.*
(g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
(h) Candidates should answer the questions in English.

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-27	80	

1. (a) What is the meaning of the term homologous series? (1 mark)

……..……

(b) Describe the procedure of preparing a soapless detergent from dodecene (4 marks)

……

……

……

2. State three factors that affect the rate of a chemical reaction. (3 marks)

……

……

……

3. In an industrial process, ammonia is produced by reacting nitrogen gas and hydrogen gas in the presence of a catalyst.

(a) Sate Le Chatelier's principle. (1 mark)

……

……

(b) Write the equation for the formation of ammonia gas. (1 mark)

……

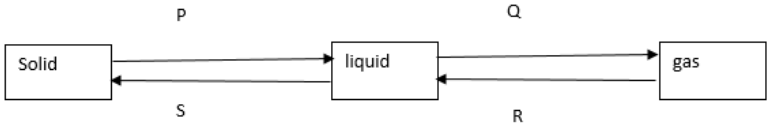
……

(c) State how an increase in temperature affects the position of equilibrium. (1 mark)

……

……

4. The diagram below shows the relationship between the physical states of matter. Study it and answer the questions that follow.



(a) Identify energy changes represented by the letters:

P ……and Q …… (2 marks)

(b) Explain why there is no change in temperature during each of the processes shown in the diagram. (2 marks)

……

……

5. State two methods that can be used to determine the purity of a substance. (2 marks)

……

……

6. The volume of a fixed mass of a gas at a pressure of 550mmHg and 45^{o}C is 220 cm^{3}. What would be the volume of the gas if the pressure and temperature are raised to 700mmHg and 40^{o}C respectively? (3 marks)

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

bond	Bond energy kJ/mol
H-H	435
C-H	413
C-C	346
C=C	611
C≡ C	835

(i) Calculate the energy released during the hydrogenation of prop-1-ene to propane. (3 marks)

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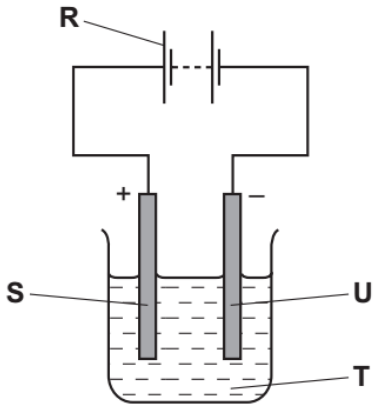
8. The diagram below shows the apparatus used for the electrolysis of molten sodium bromide.



(a) Which letter **R, S, T** or **U** on the diagram represents the cathode? (1 mark)

……

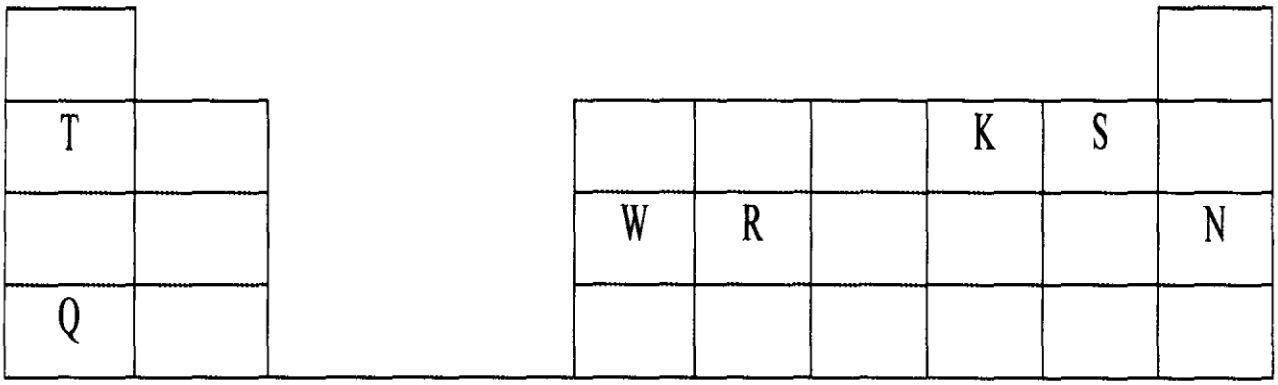
(b) State and explain the observation made at the anode. (2 marks)

……

……

(c) Which **condition** is missing in the set-up? ……(1 mark)

9. The grid below is part of the periodic table. The elements are not represented by their actual symbols. Use the information to answer the questions that follow.



a) (i) Which is the most reactive non — metal? Explain. (2marks)

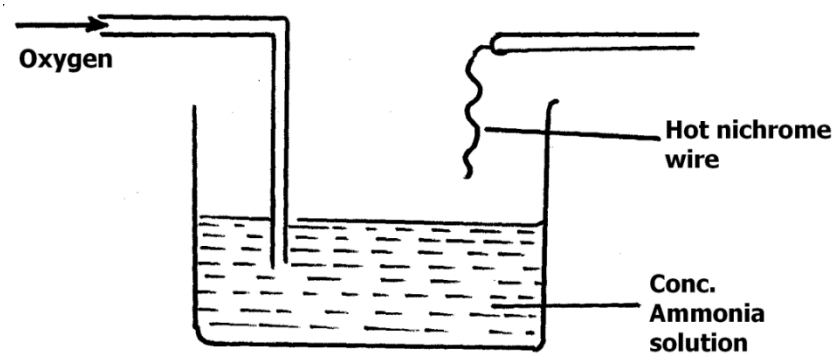
……

……

(ii) Write an equation for the reaction between elements Q and K (1 mark)

……

10. The apparatus below was set – up to show the catalytic oxidation of ammonia. Study the diagram and answer the questions that follow.



a) State what would be observed in the experiment above. Explain. (2 marks)

……

……

b) Write the equation for the reaction that takes place during oxidation of ammonia. (1mark)

……

……

11. A heavy metal **X** was dissolved in dilute nitric acid to form a solution of compound **X(**$NO_3)_2$.

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 X, S, T, U, V, W (3 marks)

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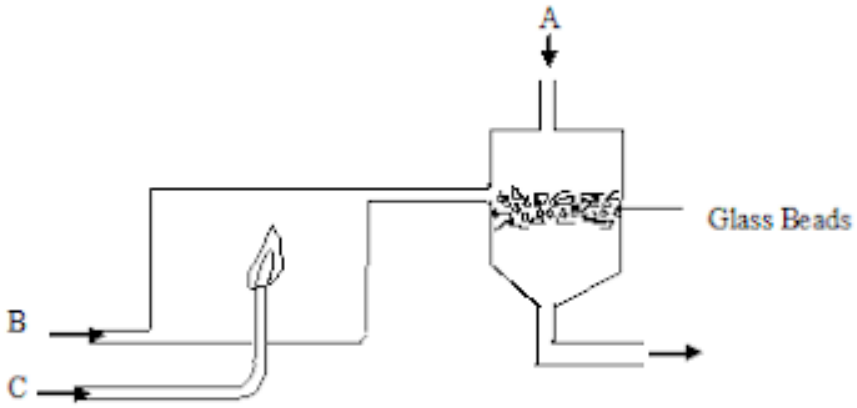
.....

ii. Write an ionic equation of the reaction that occurs in part (iii) (1 mark)

……

……

12. The diagram below shows industrial manufacture of hydrochloric acid.



a) Name the substance: (3 marks)

A.....

B.....

C……

b) State the function of the glass beads in the above process. (1 mark)

……..

13. (a) What do you understand by the term recycling? (1 mark)

……

……

(b) Describe how a mixture of iron filings and sulphur. (2 marks)

……

……

14. An organic compound **P** contains 68.9% carbon, 13.5% hydrogen and 21.6% oxygen. The relative formula mass of **P** is 74. Determine its molecular formula (C=12, H=1, O=16). (3 marks)

……

……

……

……

15. Calculate the molarity of phosphoric (V) acid (H_3PO_4) that is obtained by dissolving 13g of phosphoric (V) acid in 250 cm^3 of solution. (H=1, P=31, O=16).

(2 marks)

……

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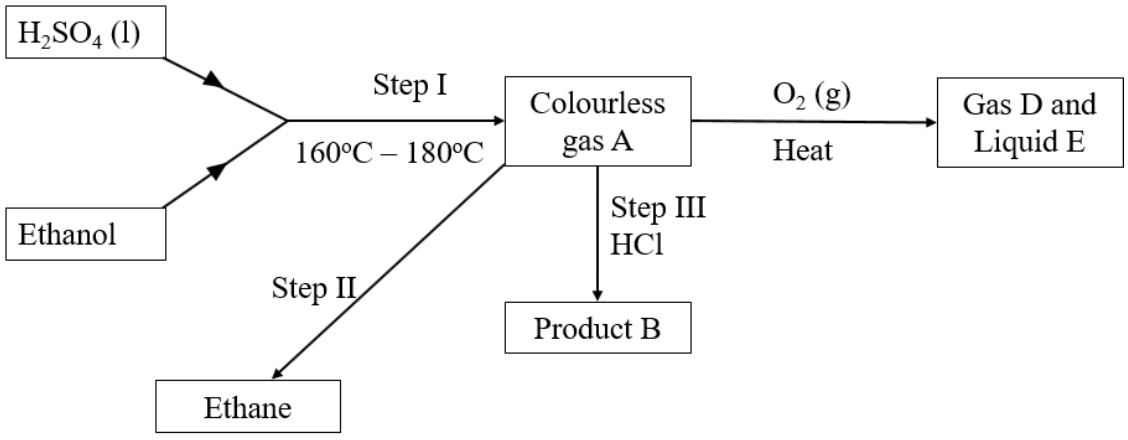
16. Study the reaction scheme below and answer the following questions:



(a) Write the equation for step I. (1 mark)

……

(b) What is the name of gas D and Liquid E? (1 mark)

Gas D……..

Liquid E…….

(c) Name the process taking place in step II. (1 mark)

……

17. State the type of bonding in the following substances: (2 marks)

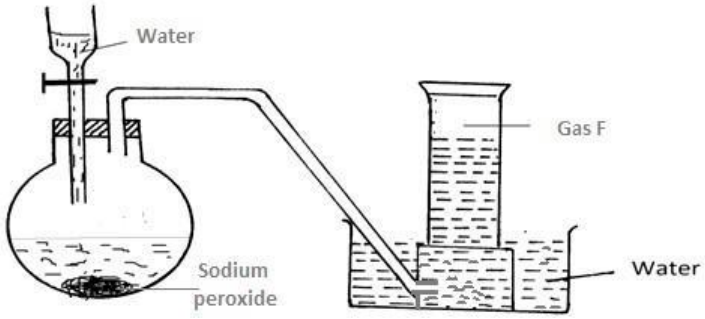
(a) Diamond

……

(b) Copper (I) oxide

……

18. The set-up below was used to collect gas **F** produced by the reaction between sodium peroxide and water



(i) Name gas **F** (1 mark)

…….

(ii) At the end of the experiment, the solution in the round-bottomed flask was found to be a strong base. Explain why this was a strong base. (1 mark)

……

……

(iii) Which property of gas **F** makes it be collected by the method used in the set-up? (1 mark)

……..

(iv) Write the equation for the reaction taking place in the flask. (1 mark)

……

……

19. (a) Using an equation, explain the observation made when concentrated sulphuric (IV) acid is added to sugar crystals. (2 marks)

……

……

……

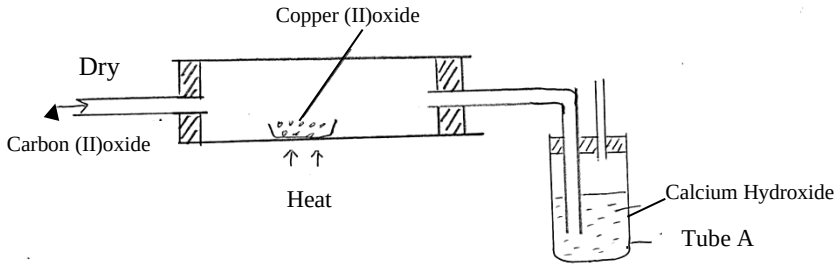
……

(b) What property is displayed by the acid in (a) above. (1mark)

……

……

20. Carbon (II) oxide was passed over heated copper (II) oxide in a combustion tube as shown in the diagram below.



(a) State and explain the observation made in tube A. (2 marks)

……

……

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

……

……

21. (a) What is isomerism ? (1 mark)

……

……

(b) Draw and name any **two** isomers of $C_4 H_8$ (2 marks)

22. Liquids **A** and **R** are immiscible. (Density of A – 1.6gcm^{-3} and density of R = 1.9gcm^{-3}).

(a) Draw a diagram to illustrate the most suitable method of separation that would be used to separate the two liquids. (3 mark)

23. Chlorine gas was passed over heated iron wire. On cooling the set-up, a solid X was formed. All the solid X was dissolved in water to form solution X. Sodium hydroxide solution was added to about 2 ml of solution X, little by little until in excess.

(a) Write the equation for the reaction of chlorine and iron. (1 mark)

……..

(b) Calculate the number of volume of chlorine that reacted with 1.4g of iron. (Fe = 56, Cl = 35.5, Molar gas volume = 24dm^3). (3 marks)

(c) State the observation that was made when sodium hydroxide was added to solution X drop by drop until in excess. (1 mark)

……

24. Draw a well-labelled diagram to show how nitrogen (I) oxide can be prepared and collected in the laboratory. (3 marks)

25. Name the two types of bonds within a molecule of ammonia. (2 marks)

……

……

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KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name …… **Admission number** ……

Candidate's Signature……**Date**……

LENANA SCHOOL TRIAL SERIES

233/1

CHEMISTRY

PAPER 1

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

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

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

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

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

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

*(f) This paper consists of **14 printed pages**.*

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

(h) Candidates should answer the questions in English.

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

1. **(a)** What is the role of the following parts during fractional distillation of a mixture of water and ethanol.

(i) Fractionating column (1 mark)

……

……

(ii) Class beads in the fractionating column (1 mark)

……

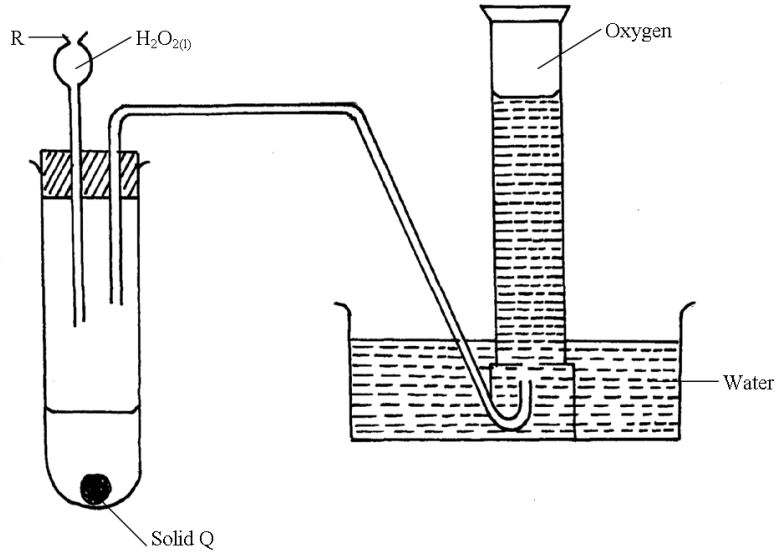
……

(b) State any one application of fractional distillation process (1 mark)

……

……

2. Below is a set up used to prepare oxygen in a laboratory?



(a) Identify

(i) Solid Q (½ mark)

……

(ii) Apparatus R (½ mark)

……

(b) Write a balanced equation for reaction in which oxygen is produced in the above set up.

……

……

(1 mark)

(c) State and explain observation which is made when white phosphorus is introduced into a gas jar full of oxygen. (1mark)

……

……

3. (a) State one way in which the strength of an acid or a base can be determined in the laboratory

……

……

(1mark)

(b) Give the basicity of the following acids.

(i) Sulphuric acid (½ mark)

……

……

(ii) Phosphoric acid (½ mark)

……

……

4. Name the process which takes place when:

(i) Iodine changes directly from solid to gas (1 mark)

……

……

(ii) $Fe^{2+}_{(aq)}$ changes to form $Fe^{3+}_{(aq)}$ (1 mark)

……

……

(iii) White sugar changes to black solid when mixed with excess concentrated Sulphuric (vi) acid (1 mark)

……

……

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

P			Q	R			N	
								V
S	X					M		
							T	

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

……

……

(b) Give a reason why the ionic radii of S are smaller than that of M. (1mark)

……

……

(c) Give the formulae of the compound formed between X and N (1mark)

……

……

6. State two properties of carbon (iv) oxide that makes it suitable for extinguishing fire. (2 marks)

……

……

7. Use the information in the table below to answer the questions that follow

Element	Sodium	Magnesium	Phosphorus	Chlorine
Electric conductivity	Good	Good	Poor	Poor
M.P (^oC)	98	660	44/115	-173

(a) Explain why both Sodium and Magnesium conducts electricity while phosphorus and chlorine do not. (1mark)

……

……

(b) Suggest a reason why phosphorus has been assigned two melting point values. (1mark)

……

……

(c) Explain why atomic radii of elements in period 3 decreases generally from left to right in the periodic table (1mark)

……

……

8. (a) Define half-life of radioisotopes (1mark)

……

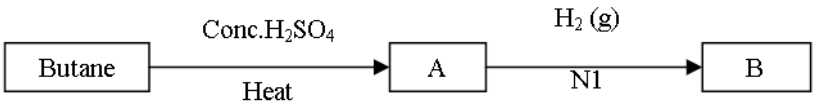
……

(b) X grams of a radioactive isotope takes 100 days to decay to 20gms. If half-life of the element is 25 days. Calculate the initial mass of X of the radio-isotope. (2marks)

9. When a hydrocarbon was completely burnt in Oxygen 4.2g of CO_2 gas and 1.71g H_2O of water were formed. (Determine the empirical formulae of the hydrocarbon) (2 marks)
(C=120, H=1.0, O=16.0)

……
……
……
……

10. Use the information in the scheme diagram below to answer the questions that



follow.

(a) Draw two structures of isomers of compound A. Name each isomer. (2marks)

……
……
……
……

(b) Name two products produced when B is burnt in excess oxygen. (1 mark)

……
……

11. (a) State Charles's law (1mark)

……
……

(b) The volume of a sample of nitrogen gas at a temperature of 298k and 600minHg pressure was 4.8×10^{-2} m^3. Calculate the temperature at which the volume of the gas would be 3.2×10^{-2} m^3 if pressure is constant. (2 marks)

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12. Aluminium is extracted from its ore by the process of electrolysis

(a) Name the ore from which aluminium is normally extracted. (1mark)

……
……

(b) Aluminium Ore in (a) above has a very high melting point (2015^0C) through it is electrolyzed at a lower temperature of about 900^0C. Explain how the low temperature is achieved. (1mark)

……
……

(c) Graphite electrodes are used in the above process. Give the advantage of using graphite electrodes in the above process (1mark)

……
……

13. (a) Name a suitable drying agent to be used to dry chlorine gas. (1mark)

……
……

(b) Chlorine reacts with red hot Iron powder to give iron (iii) chloride but not Iron (ii) chloride. Explain (1mark)

……
……

(c) Sodium hydroxide reacts with chlorine to form bleaching powder. Write a balanced equation for the reaction. (1mark)

……

……

14. The table below gives some bond energies of some bonds.

Bond	Bond energy ($lgmol^{-1}$)
H-H	435
Cl-Cl	243
H-Cl	431

Calculate the enthalpy change of the reaction below.

$H_{2\,(g)} + Cl_{2\,(g)} \rightarrow 2HCl_{\,(g)}$ (2 marks)

15. When a mixture of iron filings and Sulphur was heated, a red glow spreads through the mixture and a dark grey solid was formed.

(a) Identify the dark grey solid formed. (1mark)

……

……

(b) Write a chemical equation in which the dark grey solid is formed during healing. (1mark)

……

……

(c) What observations can be made when the dark grey solid reacts with dilute Hydrochloric acid. (1mark)

……

……

16. Study the reversible reaction below

$2CrO_4^{-}{}_{(aq)} + 2H^{+}{}_{(aq)} \rightleftharpoons Cr_2O_7{}^{2}{}_{(aq)} + H_2O_{\,(l)}$

(Yellow) (Orange)

(a) State the colour change if few drops of sodium hydroxide was added to the mixture. (1mark)

……

……

(b) Explain the observation in (a) above (1mark)

……

……

17. Nitric (V) acid rarely give hydrogen with metals e.g. Zn.

(a) Give reasons for this. (1mark)

……

……

(b) Give a condition under which nitric (v) avid can produce hydrogen with the metal (1mark)

……

……

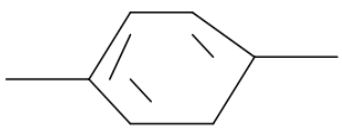
(c) State one use of hydrogen gas. (1mark)

……

……

18. The structure shown below represents two cleansing agents, A and B

R ——— $COO^{(-)}\,Na^{(+)}$ (A)

R  $OSO_3{}^{(-)}\,Na^{+}$

(B)

(a) Which cleansing agent would be more suitable for the washing in water containing calcium sulphate? (1mark)

……

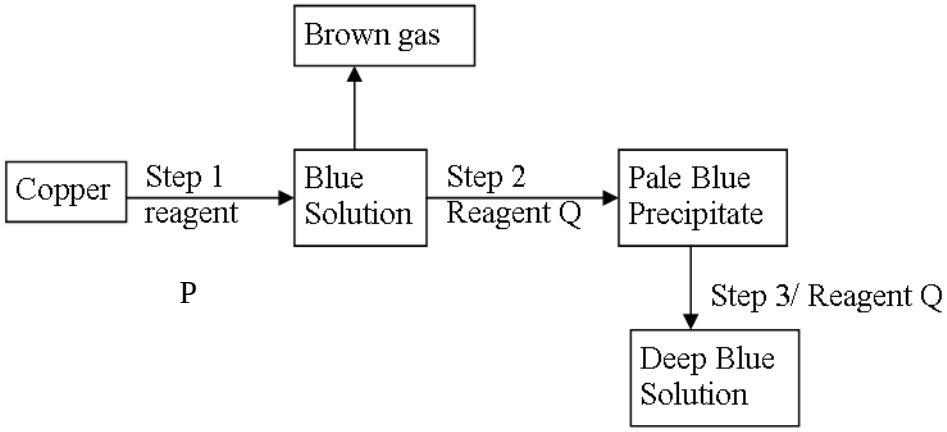
……

(b) Give one advantage of B over A (1mark)

……

……

19. Study the flow chart below and answer the following questions.



(a) Name reagents P and Q (2marks)

……

……

……

……

(b) Write the formulae of the complex ions present in the deep blue solution (1mark)

……

……

20. In an experiment to determine the solubility of potassium nitrate at 30^0c, a saturated solution was heated in an evaporation dish until there was no further change in mass. The following date was obtained.

Mass of dish + Solution	=	128.9g
Mass of dish + Dry salt	=	103.9g
Mass of empty dish	=	94.3g

Determine the solubility of Potassium nitrate at 30^0c (2marks)

……

……

……

……

21. You are given the following half equations

$I_2(s) + 2e^- \rightleftharpoons 2I^-_{(aq)}$ $\quad E^\theta = +0.54V$

$Br_2(I) + 2e^- \rightleftharpoons 2Br^-_{(aq)}$ $\quad E^\theta = +1.09V$

(a)Write an overall equation of the cell reaction (1mark)

……
……

(b) Calculate the E^{θ} value of the cell (1mark)

(c) Name the Oxidizing agent (1mark)

……
……

22. Describe how a solid sample of calcium sulphate can be prepared using the following reagents, dilute nitric acid, dilute sulphuric acid and calcium carbonate. (1mark)

……
……

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

Formulae of Ion	Electronic configuration of Ion
U^{2+}	2
V^{-}	2.8
W^{2-}	2.8.8
X^{3+}	2.8
Y^{2+}	2.8

(a) Select the elements in

(i) Same group (½ mark)

……
……

(ii) Period II (½ mark)

……
……...

(b) Write the electronic configuration of elements

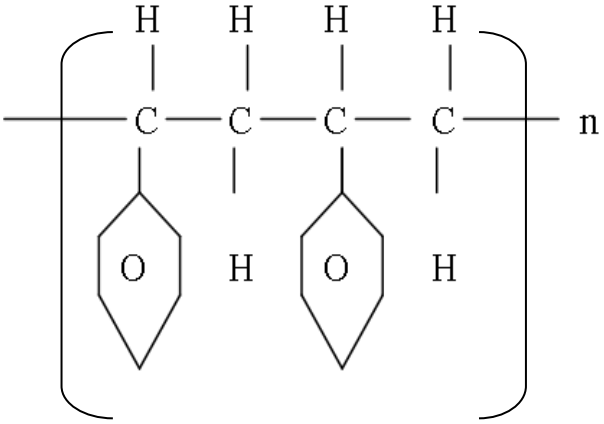
(i) W (½ mark)

……
……

(ii) X (½ mark)

……
……

24. The formula given below represents a potion of polymer



a) Give the name of the polymer. (1mark)

……

……

(b) Draw the structure of the monomer used to manufacture the polymer (1mark)

……

……

25. In an experiment 3.36g of iron fillings were added to excess of copper (ii) Sulphate. Calculate the mass of copper that was deposited. (Cu=63.5, Fe=56.0) (3marks)

……

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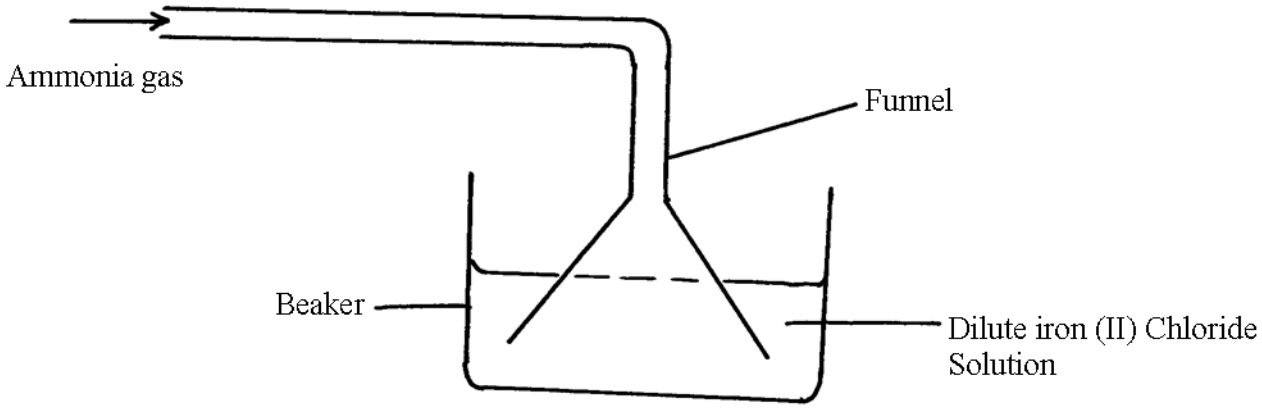
……

……

26. Below is a set up of apparatus used to react ammonia gas with Iron (ii) Chloride.



(a) State observation made in the beaker (1mark)

……

……

(b) Give reason of using a funnel to deliver the ammonia to the beaker. (1mark)

……

……

27. Using dots (.) and crosses(x) to represent -electrons show the bonding between oxygen and carbon to form carbon (ii) oxide. (2marks)

……

……

28. An atom of hydrogen can form two ions. Write two equations to show how a neutral atom of hydrogen can form the two ions. In each case show the sign of the energy change involved. (2marks)

……

……

29. Elements X and Y reacted forming a compound Z. The compound has the following properties.

(i) It does not conduct electricity in solid.

(ii) It has low melting and boiling points.

(a) What type of elements are X and Y? (1mark)

……

……

(b) What type of structure is compound Z has (1mark)

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Name …… **Admission number** ……
Candidate's Signature……**Date**……

MANG'U SSCHOOL INTERNAL MOCK

233/1
CHEMISTRY
PAPER 1
TIME: 2 hours

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)

……

……

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

……

……

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

……

……

……

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)

……

……

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

……

……

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)

……

……

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

……

……

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

……

……

……

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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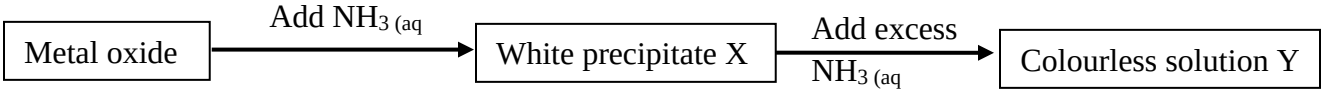
……

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



a) Identify the metal oxide. (1mk)

……

……

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

……

……

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

……

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

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

State the meaning of this hazard symbol. (1mk

.....

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

……

(c) Hydrogen sulphide gas is highly poisonous. Sate one safety precaution that should be taken when handling hydrogen sulphide. (1mk)

……

……

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

Isotope	$^{69}_{31}R_1$	$^{71}_{31}R_2$
Relative abundance %	61.3	38.7

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

……

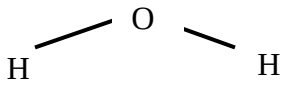
(b) Calculate the relative atomic mass of element **R**. (2mks)

……

……

……

8. a) Identify the type of bond formed compound below. (1mk)



b) Using dots (•) 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) $KNO_{3(s)} \xrightarrow{\text{Heat}}$

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

10. Explain why when one is stung by a bee application of a little solution of sodium

hydrogen carbonate helps to relieve the pain. (2 marks)

……

……

……

11. The following table gives the melting point of oxides of the third period elements.

Study it and answer the questions that follow.

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)

……

……

……

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

(i) NaOH (1 mark)

……

……

(ii) HCl (1 mark)

……

……

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

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

……

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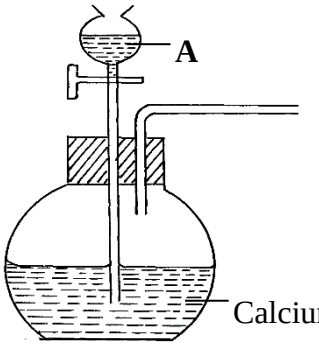
14. The set-up below was used to prepare a carbon (IV) oxide gas.



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

……

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

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

……

15. Calculate the mass of sulphur which on complete combustion would yield $7dm^3$ of sulphur (IV) oxide measured at 182^oc and 722 mm Hg pressure. (0=16, S=32, molar gas volume = $24dm^3$ at r.t.p). (3 mks)

……

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……

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

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)

……

……

ii) Metal (s)

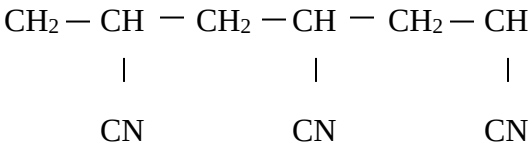
……

……

iii) Insoluble in water.

……

17. A polymer has the following structure



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

……

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

(i) Cathode ……(½mk)

(ii) Anode …… (½mk)

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

Anode……...

Cathode……

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

……

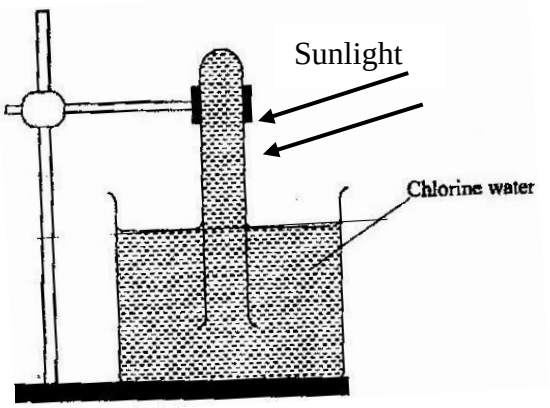
……

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

……

……

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



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

……

……

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

i) State the observations made. (1mk)

……

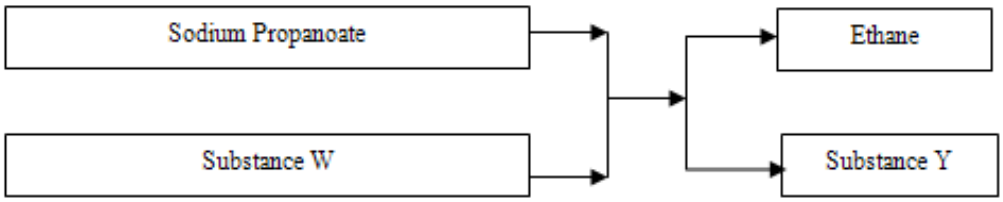
……

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

……

……

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



a) Name substances

W ……..….(½ mark)

Y ……..…..(½ mark)

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

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

(3 marks)

……

……

……

……

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)

……

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

……

(c) Likely to be graphite. (½ mark)

……

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

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

……

(b) i) State the observation that were made on addition on sulphur (IV) oxide into the bromine water. (1mk)

……

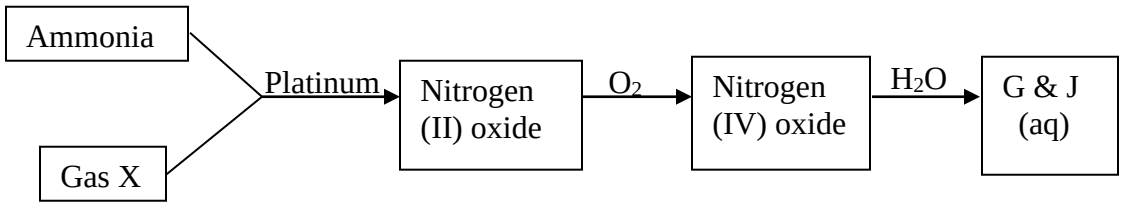
……

ii) Explain the observation. (1mk)

……

……

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



a) Identify gas X (1mk)

……

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

……

……

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

……

……

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

……

……

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

(i) A Particle (½ mark)

……

(ii) Gaseous (½ mark)

……

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

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

……

……

……

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

……

…… ……

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KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name …… **Admission number** ……

Candidate's Signature……**Date**……

MARANDA SCHOOL TRIAL 1

233/1

CHEMISTRY

PAPER 1

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

*(a) Write your **name** and **index number** in the spaces provided above.*
(b) Sign and write the date of the examination in the spaces provided above.
(c) Answer all the questions in the spaces provided in the question paper.
*(d) **Non-programmable** silent electronic calculators and **KNEC** mathematical tables may be used.*
(e) All working must be clearly shown where necessary.
*(f) This paper consists of **14 printed pages**.*
(g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
(h) Candidates should answer the questions in English.

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

1. The table below shows the pH values of some solutions.

Solutions	J	K	L	M	N
pH	6	13	2	10	7

a) Which solution is likely to be:

i) Potassium hydroxide. (1 mark)

_____

ii) Lemon juice. (1 mark)

_____

b) Explain why a solution of hydrogen chloride gas in methylbenzene was identified as N. (1 mark)

_____

_____

c) Compare the electrical conductivity of solution J and L. (1 mark)

_____

_____

_____

2. Name the process that takes place when:

i) Sulphur is heated with natural rubber. (1 mark)

_____

ii) Fats or oils are hydrolysed using an alkali. (1 mark)

_____

3. a) Oxygen is obtained by fractional distillation of liquid air.

Name **two** other gases which are obtained from this process during distillation. (1 mark)

_____

_____

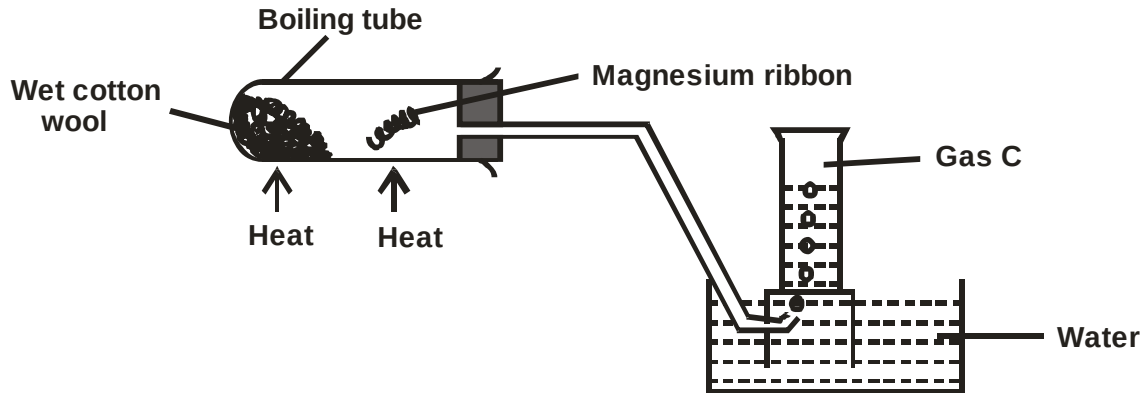
b) Give **two** industrial uses of oxygen gas. (2 marks)

_____

_____

_____

4. The diagram below represents the apparatus used to react steam with magnesium.



a) State an observation made in the boiling tube. (1 mark)

_____

_____

b) Write an equation for the reaction that takes place in the boiling tube. (1 mark)

_____

c) State and explain **one** precaution required before the heating is stopped. (2 marks)

_____

_____

_____

5. State and explain how an increase in pressure will affect the equilibrium position in the following reactions.

a) $2SO_{2\,(g)} + O_{2\,(g)} \rightleftharpoons 2SO_{3\,(g)}$ (1 mark)

_____

_____

b) $H_{2\,(g)} + Cl_{2\,(g)} \rightleftharpoons 2HCl_{\,(g)}$ (1 mark)

_____

_____

6. Given a mixture of sodium chloride, silver chloride and ammonium chloride, describe how each component can be obtained. (2 marks)

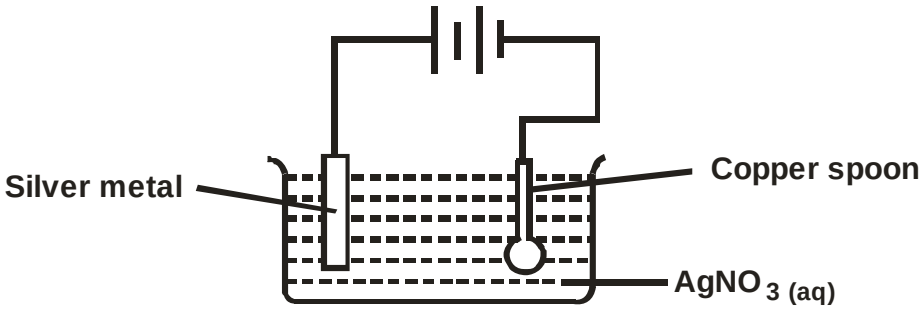
_____

_____

_____

_____

7. A copper spoon was coated with silver metal as shown below.



i) Write an equation for the reaction that occurs at the copper spoon (cathode). (1 mark)

_____

_____

ii) How many grams of silver would be deposited on the spoon in two hours using steady current of 0.03A? (IF = 96500C, Ag = 108.0) (3 marks)

_____

_____

_____

_____

_____

_____

_____

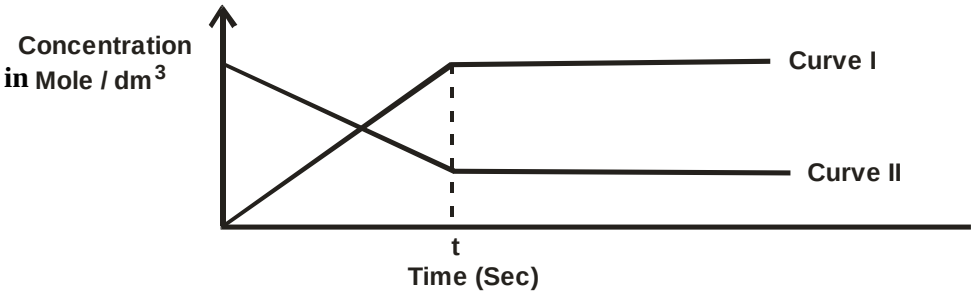
8. Using dost (•) and crosses (**X**) to represent electrons, show bonding in

a) Ammonia molecule. (1 mark)

b) Calcium oxide. (1 mark)

9. The curve below represents the changes in the concentration of substances E and F with time in the equation.

$E_{(g)} \rightleftharpoons F_{(g)}$



a) Which curve represents the changes in the concentration of substance F? Give a reason. (2 marks)

_____

_____

_____

b) Give a reason for the shapes of the curves after time (t) seconds. (1 mark)

_____

_____

_____

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

a) A piece of blue flower was dropped into the first test-tube. Explain why the flower bleached. (2 marks)

_____

_____

_____

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. (1 mark)

_____

11. State any **two** differences between a luminous and a non-luminous flame. (2 marks)

_____

_____

_____

_____

_____

12. Potassium hydroxide of mass Yg was dissolved in distilled water to make 200cm^3 of solution. 100cm^3 of the solution required 100cm^3 of 2M nitric acid for complete neutralization. Calculate the value of Y. (K = 39, O = 16, H = 1) (3 marks)

13. Explain how electrical conductivity may be used to distinguish between magnesium oxide and silicon (IV) oxide. (3 marks)

14. In the nuclear reaction below:

$$^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{90}_{42}Sr + {}^{x}_{y}Xe + 3\,{}^{1}_{0}n + \text{Energy}$$

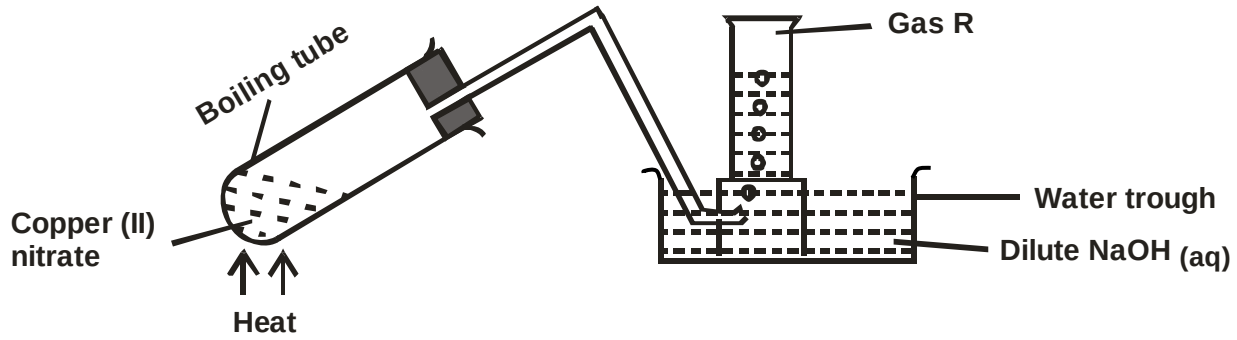
a) Identify the value of x and y.

x (½ mark)

y (½ mark)

b) State **two** applications for radioisotopes. (1 mark)

15. The diagram below shows the effect of heat on copper (II) nitrate.



a) State **two** observations made in the boiling tube. (1 mark)

_____

_____

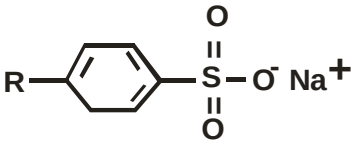
b) Write the equation for the reaction that takes place in the water trough. (1 mark)

_____

c) How would you confirm the identity of gas R? (1 mark)

_____

16. The structure below represents a cleaning agent which is said to have both an advantage and a disadvantage.



a) Which type of cleaning agent does the structure above represent? (1 mark)

_____

b) State:

i) **one** advantage (1 mark)

_____

ii) **one** disadvantage (1 mark)

_____

17. a) State and explain Boyle's law on the behavior of gases. (2 marks)

_____

_____

_____

b) State **two** conditions under which gases are likely to behave as ideal. (1 mark)

_____

_____

18. Both diamond and graphite have giant atomic structures.

Explain why diamond is hard while graphite is soft. (2 marks)

19. a) What is meant by the terms

i) Element (1 mark)

ii) Atomic number (1 mark)

b) The formula for a chloride of Titanium is $TiCl_3$. What is the formula for its sulphate? (1 mark)

20. A student investigated the effect of an electric current by passing it through some substances.

The student used inert electrodes and connected a bulb to the circuit.

The table below shows the substances used and their states.

Experiment	**Substance**	**State**
1	Potassium carbonate	Solid
2	Copper (II) Sulphate	Solution
3	Sugar	Solution
4	Lead (II) Iodide	Molten

a) In which experiment did the bulb not light? (1 mark)

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

21. a) Name **one** natural polymer. (1 mark)

_____

b) Give **one** advantage of synthetic fibres over natural fibres. (1 mark)

_____

_____

22. The table below gives the atomic numbers of elements, W, X, Y and Z. the letters do not represent the actual symbols of the elements.

Element	W	X	Y	Z
Atomic number	9	10	11	12

a) Which one of the elements is least reactive? Explain. (1 mark)

_____

_____

b) i) Which **two** elements would react most vigorously with each other? (1 mark)

_____

_____

ii) Give formula of the compound formed when the elements in b (i) react. (1 mark)

_____

23. a) Name **two** ores from which copper is extracted? (1 mark)

_____

_____

b) During extraction of copper metal, the ore is subjected to froth flotation.
Give a reason why this process is necessary. (1 mark)

_____

_____

c) Name **one** alloy of copper and state its use. (1 mark)

_____

_____

24. The table below is part of the periodic table. The letters do not represent the actual symbols of the elements. Study it and answer the questions that follow.

					C	D	E	F
G	H						I	

a) Select an element which is stored in paraffin in the laboratory. (1 mark)

_____

b) How do the Ionic radii of E and I compare? Explain. (2 marks)

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

Equation	Enthalpy of formation
$H_{2\,(g)} + \frac{1}{2}O_{2\,(g)} \rightarrow H_2O_{(l)}$	$\Delta H_1 = -286\ KJmol^{-1}$
$C_{(s)} + O_{2\,(g)} \rightarrow CO_{2\,(g)}$	$\Delta H_2 = -394\ KJmol^{-1}$
$2C_{(s)} + 3H_{2\,(g)} + \frac{1}{2}O_{2\,(g)} \rightarrow C_2H_5OH_{(l)}$	$\Delta H_3 = -277\ KJmol^{-1}$

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

b) Calculate the molar enthalpy of combustion ΔH_4 of ethanol.

$C_2H_5OH_{(l)} + 3O_{2\,(g)} \rightarrow 2CO_{2\,(g)} + 3H_2O_{(l)}$ (2 marks)

26. Nitrogen forms many compounds in which its oxidation state varies.

a) What is meant by oxidation state? (1 mark)

b) What is the oxidation state of nitrogen in Mg_3N_2? (1 mark)

c) Explain why high temperature is required for nitrogen to react with oxygen. (1 mark)

27. Draw and name the isomers of pentane. (3 marks)

28. When a student was stung by a nettle plant a teacher applied an aqueous solution of ammonia to the affected area of the skin and the student was relieved of pain. Explain. (2 marks)

_____

_____

_____

29. Distinguish between ionization energy and electron affinity of an element. (2 marks)

_____

_____

_____

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Name …… **Admission number** ……

Candidate's Signature……**Date**……

MASENO SCHOOL

233/1

CHEMISTRY

PAPER 1

TIME: 2 hours

INSTRUCTIONS TO CANDIDATES

*(a) Write your **name** and **index number** in the spaces provided above.*
(b) Sign and write the date of the examination in the spaces provided above.
(c) Answer all the questions in the spaces provided in the question paper.
*(d) **Non-programmable** silent electronic calculators and **KNEC** mathematical tables may be used.*
(e) All working must be clearly shown where necessary.
*(f) This paper consists of **14 printed pages**.*
(g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
(h) Candidates should answer the questions in English.

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1-29	80	

1. In the industrial preparation of oxygen, state:

(a) How dust particles are removed from air. **(1 mark)**

……

(b) Why carbon (IV) oxide is removed before the mixture is cooled to -25^0C **(1 mark)**

……

……

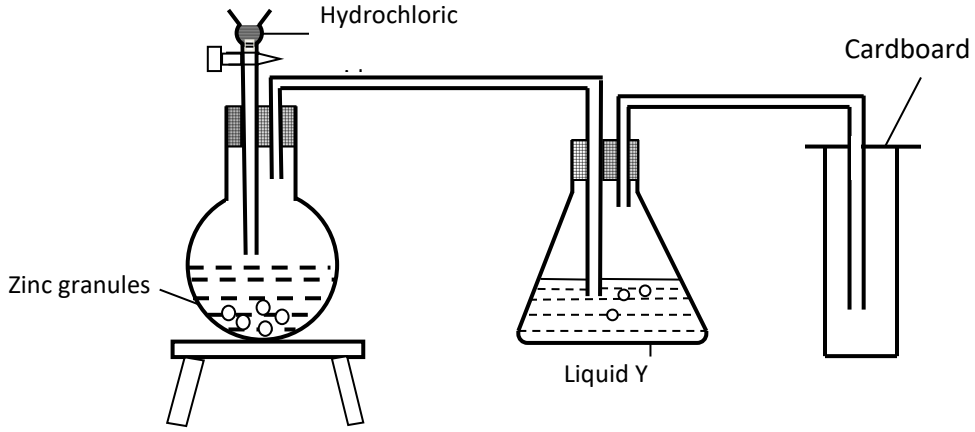
2. A form four student accidentally mixed Sodium Carbonate and Calcium Carbonate. Describe how he would obtain a dry sample of Sodium Carbonate from the mixture. **(3 marks)**

……

……

……

3. The set up below was used to prepare dry hydrogen gas. Study it and answer the questions that follow.



(i) Identify a mistake in the set up **(1 mark)**

……

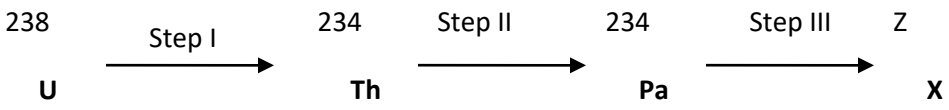
(ii) Write an equation for the reaction for the reaction that produces hydrogen gas **(1 mark)**

……

(iii) State the chemical test for hydrogen **(1 mark)**

……..

4. The following is a part of Uranium decay series



(i) Which particles are emitted in **step I** and **II** **(1 mark)**

……

(ii) If a beta particle is emitted in **step III,** find **Z a**nd **A** **(1 mark)**

……

(iii) State one environmental effect of radioisotopes. **(1 mark)**

……

5. The standard electrode potentials for the elements chlorine and magnesium

$Cl_{2(aq)} + 2\bar{e} \longrightarrow 2Cl^-_{(aq)}, \quad E\ \theta = +1.36V$

$Mg^{2+}_{aq} + 2\bar{e} \longrightarrow Mg_{(s)}, \quad E\ \theta = -2.36V$

i) Which one of the two elements will act as an oxidizing agent?Explain your choice**(2 marks)**

……

……

(ii). Calculate the electromotive force of a cell whose overall reaction is

$Cl_{2(aq)} + Mg_{(g)} \longrightarrow Mg\ Cl_{2(aq)}$ **(1 mark)**

……

……

6. 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)**

……

……

……

7. 50cm^3 of Carbon (IV) Oxide diffuses through a porous plate in 15 seconds. Calculate the time taken by 75cm^3 of Nitrogen (IV) Oxide to diffuse through the same plate under similar conditions. (C = 12, 0 = 16, N = 14) **(2 marks)**

……

……

……

8.(a). Carbon (IV) oxide is bubbled through Calcium hydroxide until there is no further change. Explain using equations the changes observed. **(2 marks)**

……

(b) Explain why diamond is used in cutting of glass and drilling. **(1 mark)**

……

9. Using an energy cycle diagram, calculate the enthalpy change of formation of carbon disulphide. **(3 marks)**

$S_{(s)} + O_{2\,(g)} \longrightarrow SO_{2\,(g)} \quad \Delta H = -294\ kJmol^{-1}$

$CS_{2(g)} + 3O_{2\,(g)} \longrightarrow CO_{2\,(g)} + 2SO_{2\,(g)} \quad \Delta H = -1072\ kJmol^{-1}$

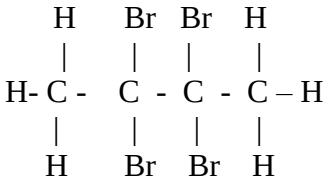
$C_{(s)} + O_{2\,(g)} \longrightarrow CO_{2\,(g)} \quad \Delta H = -393\ kJmol^{-1}$

……

……

……

10.A compound G reacts with 2 moles of bromine to form another compound whose structural formula is.



i) What is the formula and name of compound **G** **(2 marks)**

……

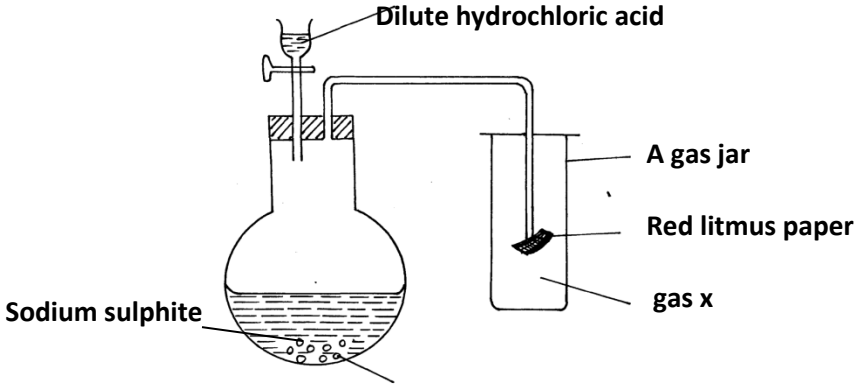
……

ii) State the observations made when acidified potassium chromate (VI) is added to compound G

(1 mark)

……

11. Study the set-up below and answer the questions that follow



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

……

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

……

(c) What is the effect of the gas **x** above on the red-litums paper **(1 mark)**

……...

……

12. The grid below is part of the periodic table. Use it to answer the questions that follow. (The letters do not represent the actual symbols of elements.)

						R	**S**	
N	**Q**						**T**	**U**
P								

(a) Indicate in the grid the position of an element represented by letter V, whose atomic number is 14. **(1 mark)**

(b) Select a letter which represents a monoatomic gas. **(1 mark)**

……

(c) Write an equation for the reaction between Q and T **(1 mark)**

……

13. The table below shows the solubility of a substance at various temperatures. Study it and answer the questions that follow.

Temperature (^{0}C)	Solubility in g/100g of water
0	36
40	30
80	25
110	20

(a) What is the meaning of solubility? **(1 mark)**

……

(b) What is the physical state of the substance? **(1 mark)**

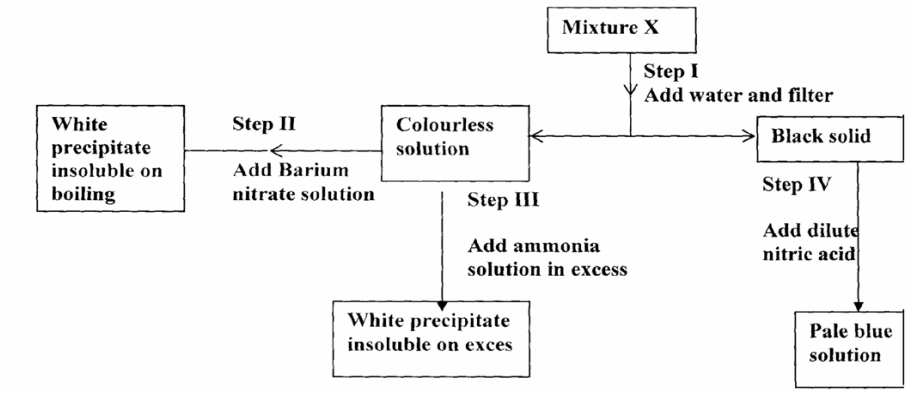
……

(c) State and explain what would happen if a sample of a saturated solution of the substance at 40^0C was heated to 110^0C. **(1 mark)**

……

……

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



(a) Name:

(i) Cations present in mixture X. **(1 mark)**

……

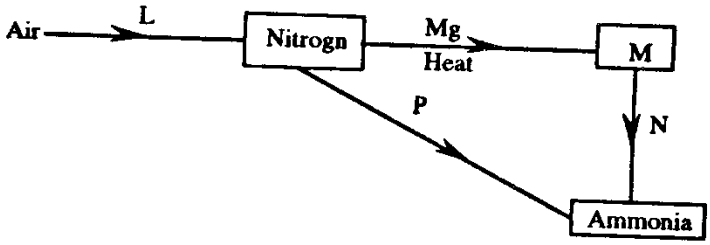
(ii) Anions present in the solution. **(1 mark)**

……

(b) Write an equation to show how the white precipitate in step III is formed. **(1 mark)**

……

15. Study the diagram below and answer the questions



(i) What is the process involved in step L **(1 mark)**

……

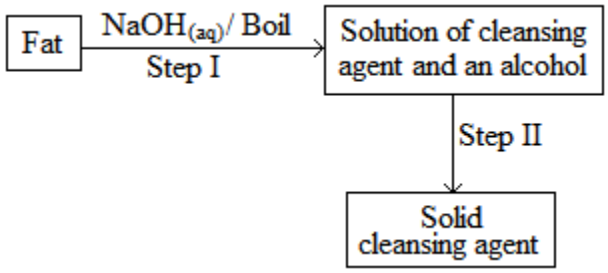
(ii) Explain how process N and P can be affected **(2 marks)**

N……

……

P……

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



(d) Given to the type of cleansing agent prepared by the method above? **(1 mark)**

……..

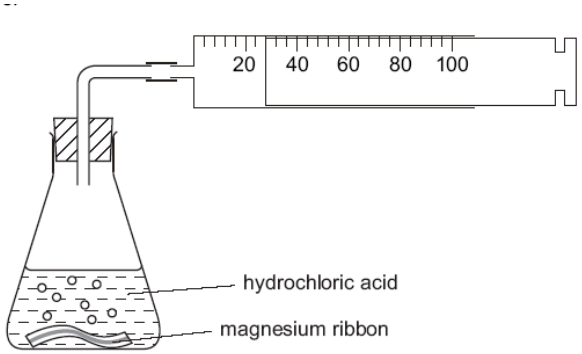
(ii) Name one chemical substance added in step II **(1 mark)**

……

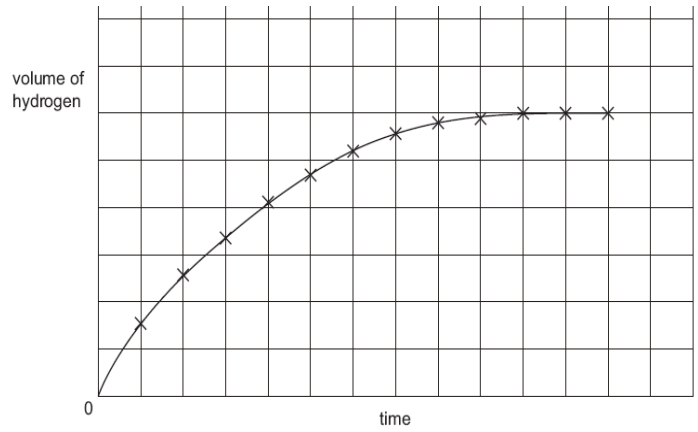
(iii) What is the purpose of adding the chemical substance named in c (ii) above? **(1 mark)**

……

17. The rate of a reaction depends on concentration of reactants, temperature and possibly a catalyst. Apiece of magnesium ribbon was added to 100cm^3 of 1M HCl. The hydrogen evolved was collected in a gas syringe and its volume measured every 30 seconds



The results were plotted to give a graph shown below



(e) The experiment was repeated. Two pieces of magnesium ribbon were added to $100cm^3$ of 1M HCl . Sketch this graph on the same grid and label it X **(1 mark)**

(ii) The experiment was repeated using one piece of magnesium ribbon and $100cm^3$ of 1.0M ethanoic acid. Describe how the shape of the graph would differ from the one given on the grid. **(2 marks)**

……

……..

18. 6g of potassium nitrate solid were added to $120cm^3$ of water in a plastic beaker. The mixture was stirred gently and the following results were obtained.

Initial temperature = 21.5^0C

Final temperature = 17.0^0C

(a) Calculate the enthalpy change for the reaction (density = $1g/cm^3$, C = $4.2jg^{-1}K^{-1}$) **(2 marks)**

……

……..

……..

b) Calculate the molar enthalpy change for the dissolution of potassium nitrate. **(2 marks)**

(K = 39, N = 14, O = 16)

……

……

……

19. In the redox reaction below:

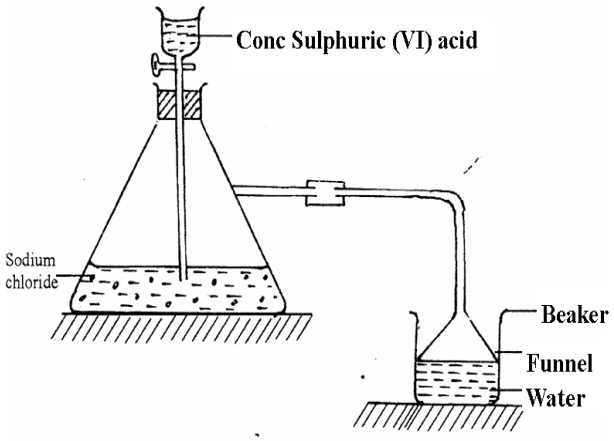
$$2H^{+}_{(aq)} + Cr_2O_7^{2-}{}_{(aq)} + 3SO_{2\,(aq)} \longrightarrow Cr^{3+}_{(aq)} + 3SO_4^{2-} + H_2O_{(l)}$$

Identify the reducing agent, explain your answer**.** **(2 marks)**

……

……

20. Study the set-up below and answer questions that follow.



i) Name the gas that is produced when concentrated sulphuric (VI) acid reacts with the sodium chloride **(1 mark)**

……

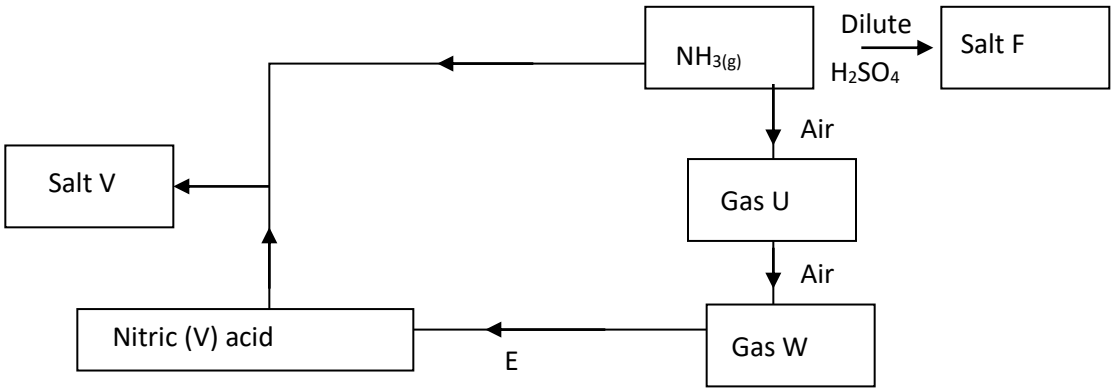
ii) Why is it necessary to use a funnel in the beaker? **(1 mark)**

……

iii) How does the gas affect the P^H of the water in the beaker? **(1 mark)**

……

21. The flow chart/diagram below outlines a method of preparing a fertilizer



i) Identify U and W

U ……. **(½ mark)**

W …… **(½ mark)**

ii) Give the names of salt F and V

F ……. **(½ mark)**

V ……. **(½ mark)**

iii) Write a balanced equation for the formation of salt F **(1 mark)**

……

22. (a) Draw a dot (•) and a cross (**x**) diagram to show bonding in Cl_2O. **(1 mark)**

b) Explain why the compound Cl_2O has a very low melting and boiling point. **(1 mark)**

……

……

23. Ethene reacts with oxygen according to the equation.

$$C_2H_{4\,(g)} + 3O_{2\,(g)} \longrightarrow 2\,C0_{2\,(g)} + 2H_2O_{\,(g)}$$

15.0 cm^3 of ethene were mixed with 50cm^3 of oxygen and mixture was sparked to complete the reaction. If all the volumes were measured at a pressure of one atmosphere and 25^0C**. Calculate** the volume of resulting gaseous mixture. **(3 marks)**

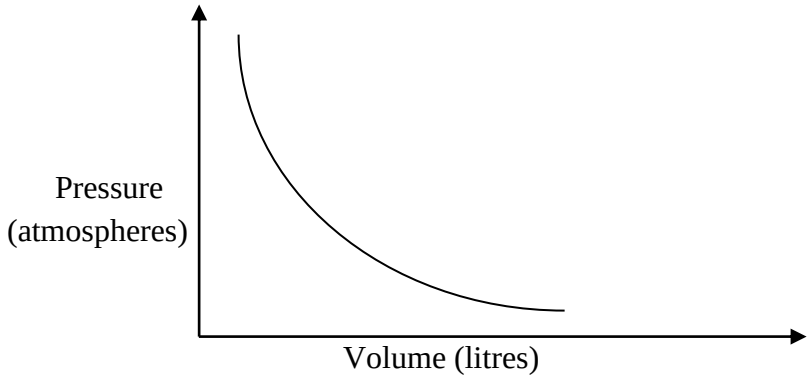
……

……

……

……

24. 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? **(1 mark)**

……

(b) 3 litres of oxygen gas at 1atm atmosphere pressure were compressed to 2atm at constant temperature. Calculate the volume occupied by the oxygen gas. **(2 marks)**

……

……

……

25. Temporary water hardness can be removed by boiling

(a) What is hard water. **(1 mark)**

……....

(b) Write a chemical equation to show how temporary hardness is removed by boiling. **(1 mark)**

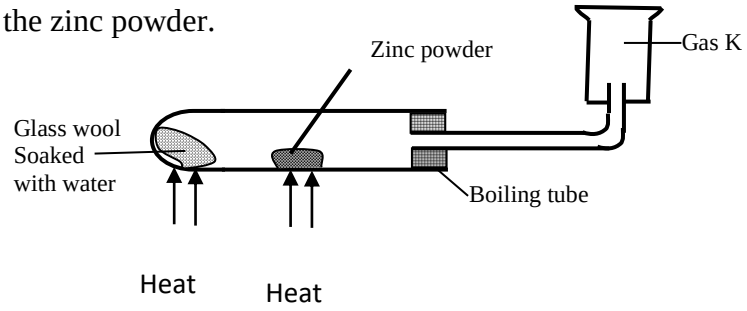
……....

……...

(c) State **one** advantage of hard water. **(1 mark)**

……..

26. A student set-up the experiment below to collect gas K. The glass wool was heated before heating the zinc powder.



(a) Why was it necessary to heat the moist glass wool before heating the zinc powder?

(1 mark)

……

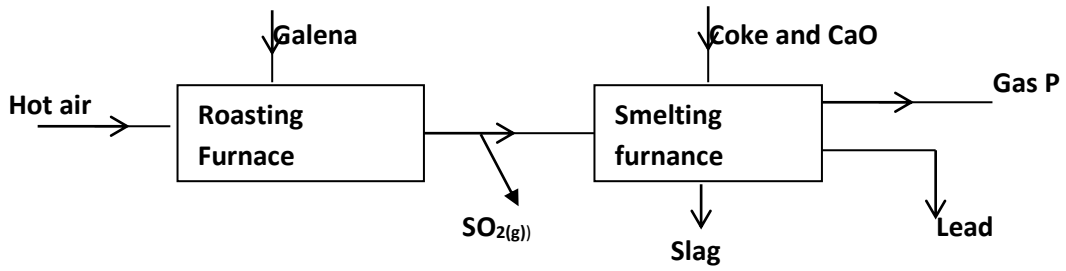
……

(b) What observation was made in the boiling tube. **(1 mark)**

……

……

27. During the extraction of lead from its ores one of the main ore used is Galena



(i) Write an equation for the reaction in roasting furnace. **(1 mark)**

……

(ii) Name gas **P** **(1 mark)**

……

(iii) State **one** use of lead metal. **(1 mark)**

……...

28. The empirical formula of a compound is CH_2 and it has a molecular mass of 42.

(a) What is the molecular formula of this compound? **(1 mark)**

.....

.....

(b) Write the general formula of the homologous series to which the compound belongs.

(1 mark)

.....

(c) Draw the structural formula of the third member of this series and give its IUPAC name.

(1 mark)

……

……

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Kenya Certificate of Secondary Education

KCSE TOP NATIONAL SCHOOLS TRIAL SERIES 2025

Name ……**Admission number** ……
Candidate's Signature……**Date**……

PANGANI GIRLS SCHOOL

233/1
CHEMISTRY
PAPER 1
TIME: 2 hours

Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *Answer **ALL** questions in spaces provided in the question paper.*
d) ***ALL** working must be shown clearly where necessary.*
e) *Mathematical tables and silent non-programmable calculators may be used.*

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Question	Maximum score	Candidate's score
1 – 27	80	

1. Paper chromatography is a method of separating colours or dyes.
What two properties should the components of a mixture have that would make the separation possible. **(2 marks)**

2. (a)Distinguish between a strong acid and a concentrated acid. **(1 mark)**

(b)Giving a reason in each case, identity an acid and a base in the equation.

$H_3O^+_{(aq)} + NH_{3(g)} \longrightarrow NH_4^+{}_{(aq)} + H_2O_{(l)}$

Acid: **(1 mark)**

Reason: **(1 mark)**

Base: **(1 mark)**

Reason: **(1 mark)**

3. Study the following information and answer the question that follows.

Heat of hydration of x^{2+} = -1480 kJ/mol
Heat of hydration y^- = -364 kJ/mol
Lattice energy of XY_2 = +2112 kJ/mol
Determine the heat evolved when 31.8g of $XY_{2(s)}$ is dissolved in water to give an infinitely dilute solution.
(RAM of Z = 88, Y = 35.5) **(3 marks)**

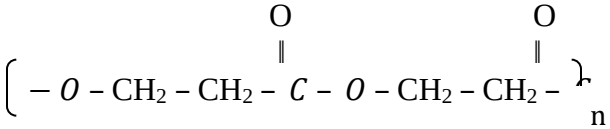
4. On complete combustion of a hydrocarbon gas X, 1.32g of carbon (IV) oxide and 0.54g of water.
Calculate the empirical formula of X (C = 12.0, H = 1, O = 16.0) **(3 marks)**

5. $RCOO^- Na^+$ and $RC_6H_5SO_3^- Na^+$, represent two cleansing agents where R is a long hydrocarbon chain.

(a) Write the formulae of the salts that would be formed when each of these cleansing agents is added to water containing magnesium ions. **(1 mark)**

(b) Explain how the solubilities of the magnesium ions in (a) above affect the cleansing properties of each of the cleansing agents. **(2 marks)**

6. A condensation polymer formed by loss of water molecules has the following structure.



(a) State **two** advantages of using natural polymers over synthenic ones. **(2 marks)**

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

7. Describe how to distinguish between substance I and II below using sodium carbonate.

I. $HOCH_2CH_3$ II. $HOOCCH_2CH_3$ (3marks)

8. Element K has two isotopes ^{20}K and ^{22}K with relative abundance of 90% and 10% relatively.

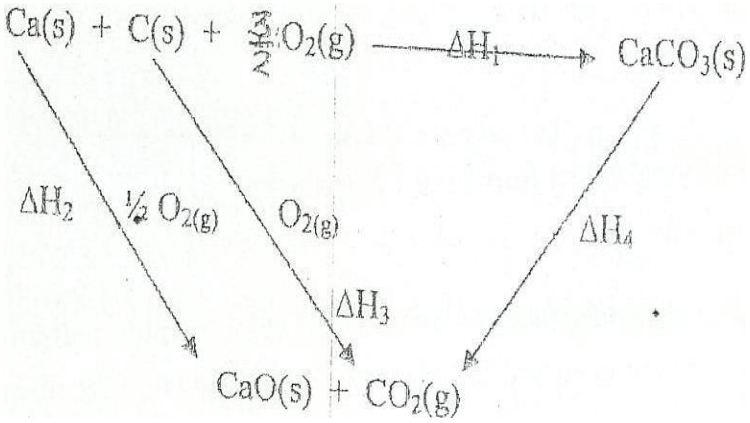
a) What are isotopes? (1mark)

b) Determine the relative atomic mass of element K (2marks)

9. Give one application of calcium oxide (1mark)

10. (a) State Hess's law (1mark)

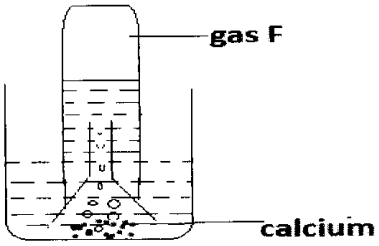
(b) The diagram below shows an energy cycle.



Given: ΔH_1 = -1207 kj/mol, ΔH_2=-635kj/mol, ΔH_3=-394kJ/mol

Determine the volume of ΔH_4 (3mrks)

11. The set – up below was used to collect gas **F** produced by the reaction between water and calcium.

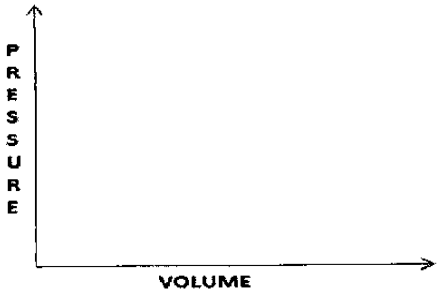


(a) Name gas **F** (1mk)

(b) Give **one** laboratory use of solution formed in the beaker. (1mk)

(c) After some time there was formation of a white precipitate formed at the top of the solution in the beaker. Explain this observation. (1mk)

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

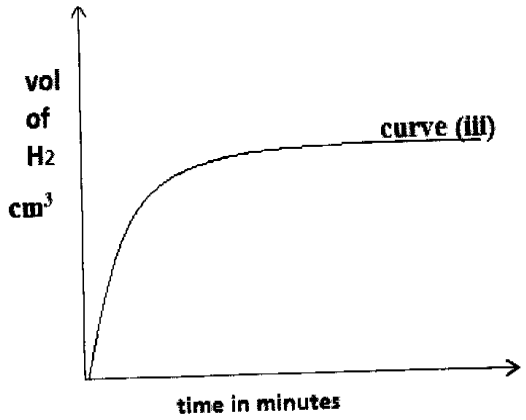


(b) 50dm^3 of a gas at one atmosphere was compressed to four atmospheres at Constant temperature. Calculate the volume occupied by the gas (2mks)

13. The table below gives three experiments on the reaction of excess sulphuric (VI) acid and 0.5g of zinc done under different condition. In each case the volume of gas was recorded at different time internals.

Experiment	**Term of zinc**	**Conclusion of dil. HCL acid**
i)	Granules	0.8M
ii)	Powder	1.0M
iii)	Powder	0.8M

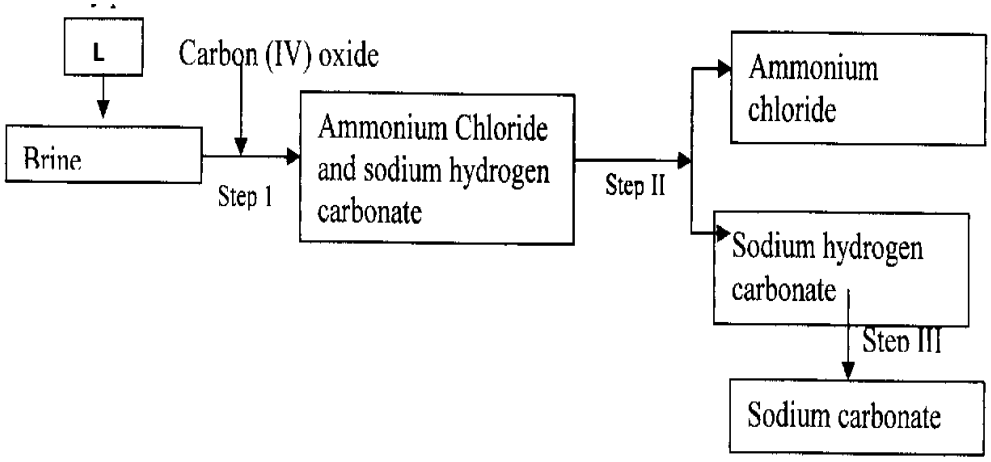
a) On the same axis draw and label the two other curves obtained from such results (2mks)



b) Explain the difference between curve (I) and (II) (1mk)

14. Draw a dot (.) and cross (x) diagram to show bonding in Silane (SiH_4):- (H = 1 Si = 14) (3mks

15. The simplified flow chart shows some of the steps in the manufacturing of the sodium carbonate by the Solvay process.



a) Identify substance **L** (1mk)

b) Name the process taking place in step II (1mk)

c) Write an equation for the reaction which take place in step III (1mk)

16. When hydrated sample of calcium sulphate was heated until all the water was lost. The following data was recorded.

Mass of crucible = 30.296g
Mass of crucible + Hydrated salt = 33.111g
Mass of crucible + Anhydrous salt = 32.781g

Determine the empirical formula of the hydrated salt (RMM of $CuSO_4$ = 136 and that of H_20= 18) (3mks)

17. The structure below represents a sweet smelling compound

$$CH_3 - CH_2 - CH_2 - \underset{\underset{O}{||}}{C} - O - CH_2 - CH_2 - CH_3$$

Give the name of the **two** compounds that can be used to prepare this compound in the laboratory(2mks)

18. Starting with copper metal describe how a sample of crystals of copper (ii) chloride may be prepared in the laboratory (3mks)

19. (a) State the Grahams law of diffusion (1mk)

(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 $12cm^3\ s^{-1}$. Calculate the rate of diffusion of **X** through the same material. (2mks)

20. (a)When iron and steam are heated in a closed container, a dynamic equilibrium is reached.

$$3Fe(s) + 4H_2O \longrightarrow Fe_3O_4\ (s) + 4H_2\ (g)$$

(b)Define the term dynamic equilibrium? (1mk)

(c)What is the effect on equilibrium if magnesium is added? Explain (2mks)

21. 15 cm^3 of ethanoic acid was dissolved in water to make 500cm^3 of solution.
Calculate the concentration of the solution in moles per litre (C=12, H= 1, O= 16, density of ethanoic acid is 1.05g/ cm^3) (3mks)

22. A compound whose general formula is Y $(OH)_3$ reacts as shown by the equations below.

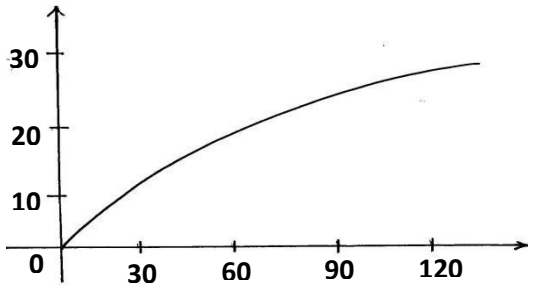
(i) $Y(OH)_{3\ (s)} + OH^-_{(aq)} \longrightarrow [Y(OH)_4]^-_{(aq)}$

(ii) $Y(OH)_{3\,(s)} + 3H^{+}_{(aq)} \longrightarrow Y^{3+}_{(aq)} + 3H_2O_{(l)}$

a) What name is given to compounds which behave like $Y(OH)_3$ in the two reactions? (1mk)

b) Name **two** elements whose hydroxides behave like that of **Y** (2mks)

23. A Certain mass of a metal reacted with excess dilute hydrochloric acid at **25^0C**. The volume was recorded after every 30secs. The results were presented as shown below.



(a) Name **one** piece of apparatus that may be used to measure the volume of the gas liberated. 1mk)

(b)(i) On the same axis, sketch the curve that would be obtained if the experiment was repeated at **35^0C** (1mk)

(ii) Explain the shape of your curve in b(i) above (1mk)

24. A piece of cover slip was weighed before and after a student made a circle on it using a pencil lid of pure graphite. The masses were as shown below;
Mass of cover slip before - 1.804g
Mass after drawing the circle – 1.9053g
Determine the number of carbon atoms used to draw the circle. (C =12, L=6.00×10^{23}) (3mks)

25. State **<u>one</u>** use of each of the following apparatus in the laboratory:

a) Desiccator (1mk)

b) Crucible (1mk)

c) Deflagrating spoon (1mk)

26. Name the particles responsible for the electrical conductivity of:

a) Graphite: (1mk)

b) Magnesium sulphate (1mk)

27. Describe how you can separate a mixture of sand and common salt. (2mks)

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STAREHE BOYS CENTER INTERAL EXAM

233/1
CHEMISTRY
PAPER 1
TIME: 2 hours

Instructions to Candidates:

a) *Write your **Name** and **Index Number** in the spaces provided.*

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

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

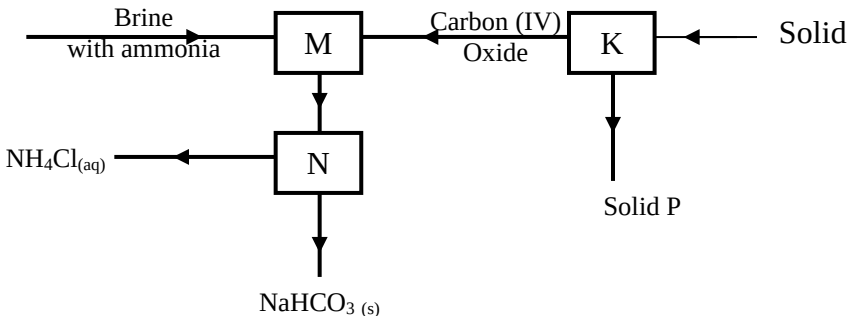
d) ***ALL** working must be shown clearly where necessary.*

e) *Mathematical tables and silent non-programmable calculators may be used.*

FOR OFFICIAL USE ONLY

Question	Maximum score	Candidate's score
1 – 29	80	

1. The diagram below shows part of Solvay process.



(a) Name solid P (1 Mark)

(b) State the process taking place in chamber N. (1mark)

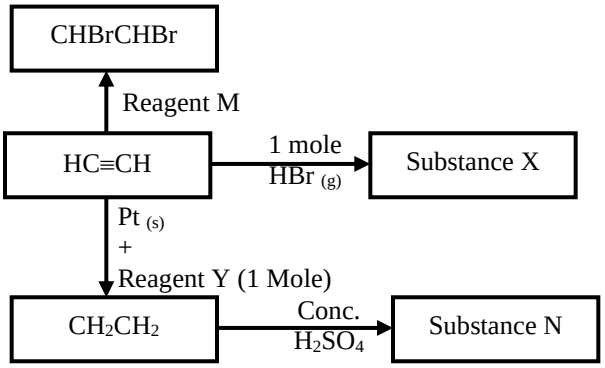
(c) State two uses of calcium chloride which is a by-product in this process.(1 mark)

2. $100cm^3$ of methane gas diffused through a porous partition in 40 seconds. How long would it take $90cm^3$ of ozone gas to diffuse through the same partition? C = 12, H = 1, O = 16 (3marks)

3. Ammonia is produced in large scale by Haber process.
(i) Write an equation for the formation of ammonia gas. (1 mark)

(ii) State **two** optimum conditions for obtaining a high yield of ammonia in the process.
(2 marks)

4. The scheme below shows some reactions starting with ethyne. Study it and answer the questions that follow.



(a) Name substance X and N (1mark)

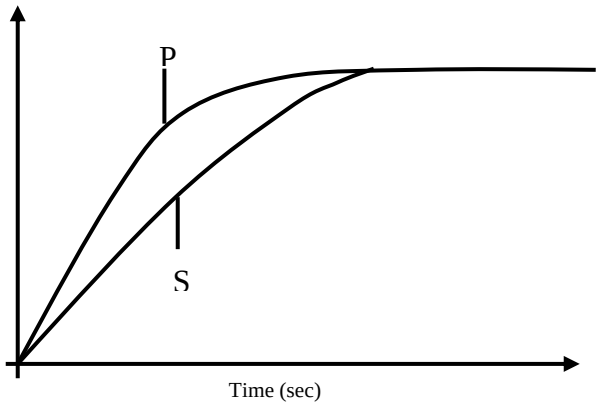
(b) Name reagent M (1 Mark)

(c) Ethene undergoes polymerization to form a polymer. Give an equation for the reaction and name the product.

(i) Equation; (1 mark)

(ii) Name: (1mark)

5. The curves below represent the volume of carbon (IV) oxide gas evolved once 2M(concentrated) hydrochloric acid was reacted with 100g of powdered calcium carbonate and also when 1M concentrated hydrochloric acid was reacted with the same quantity of carbonate.



(i) Which of the two curves represents the reaction of 2M concentrated HCl with powdered calcium carbonate. Give a reason. (2 marks)

(ii) Why do the two curves flatten at the same level of production of CO_2 (1 mark)

6. Study the following equilibrium equation.
$2X_2(g) + Y_{2(g)} \rightleftharpoons 2X_2Y_{(g)}$ $\Delta H = -197Kj/mol$
Suggest two ways of increasing the yield of X_2Y. (1 mark)

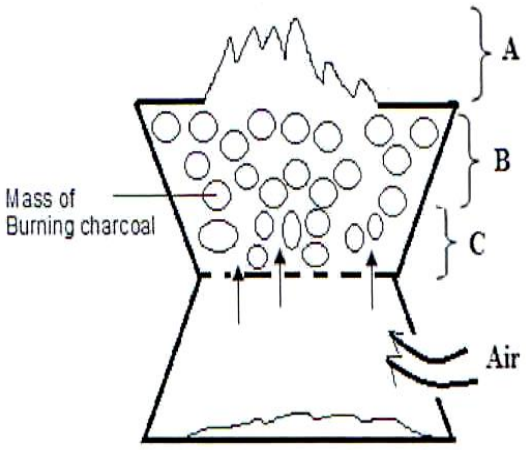
7. The table below gives some elements in the periodic table. Use it to answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	A	B	C	D	E
Atomic number	12	13	14	15	16

Which of the above letters represent:
(a) A metallic element which forms ions with the smallest ionic radius? Explain(2 marks)

(b) A non metallic element with the largest atomic size? Explain. (1mark)

8. The diagram below shows a burning jiko. Study it and answer the questions that follow.

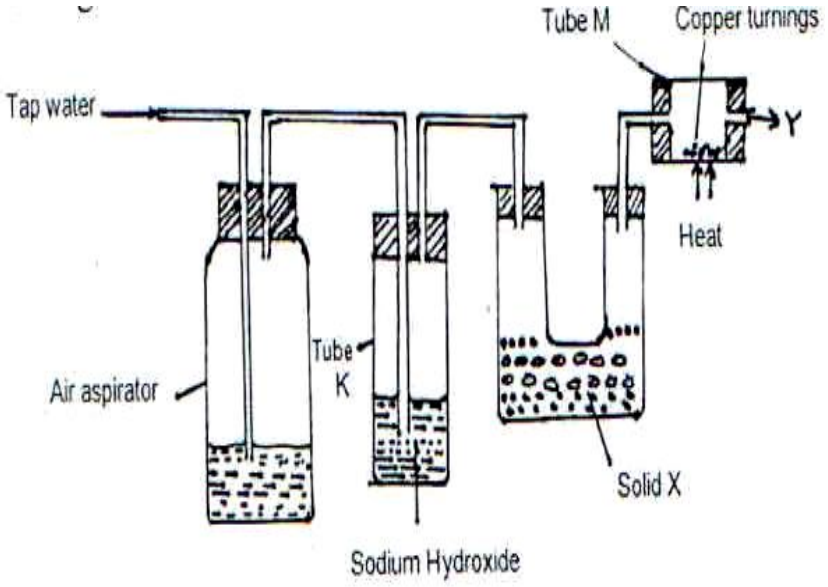


(a) Write the equation for the reaction taking place in region A. (1 Mark)

(b) Name the gas produced at region B. (1 Mark)

(c) State ONE use of the gas named in (b) above. (1 Mark)

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



(i) What is the purpose of passing tap water through the air aspirator? (1 Mark)

(ii) State and explain the observation that would be made in tube M after sometime.(1 Mark)

10. 15g of sodium chloride was dissolved in 120cm^3 of distilled water. Calculate the concentration of the resulting solution in moles per litre. (Na = 23, Cl = 35.5) (3Marks)

11. (a) State Boyle's Law. (1 Mark)

(c) The volume of a gas at 30^0C and 780mmHg is 400cm^3. What will be its volume at 50^0C at 600 mmHg. (3marks)

12. Sulphur exhibits allotropy.
(a) What is allotropy? (1 Mark)

(b) Name the **two** allotropes of sulphur. (2 Marks)

(c) Sulphur powder was placed in a deflagrating spoon and heated on a Bunsen Burner.
(i) State the observation made. (1 Mark)

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

13. 0.318g of an oxide of metal M was completely reduced by hydrogen gas to 0.254g of metal. Calculate empirical formula of the metal oxide. (M = 63.5, O = 16) (3 Marks)

14. Given the following reagents: Solid sodium Carbonate, water, solid Lead (II) nitrate. Describe how a sample of Lead (II) Carbonate can be prepared in the laboratory.(3 Marks)

15. Volume of liquids can be measured using a pipette; measuring cylinder or burette. Explain which one would be best for measuring 29.1cm^3 of liquid. (1 Mark)

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

Substance	Solubility g/100g water
V	126
W	2

Describe how a solid sample of substance **V** could be obtained from a solid mixture of **V** and **W**.(2 Marks)

17. Use the bond energies given below to calculate the heat of reaction for;(3 marks)

$$H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$$

Bond	Energy (Kj/Mol)
H – H	435
Cl – Cl	243
H – Cl	431

18.The PH of a soil sample was found to be 5.7. An agricultural officer recommended addition of lime.

(a) State **two** functions of the lime. (2 Marks)

(b) Give the name of the process applied in (a) above. (1mark)

19. The electronic configuration of ions X^{2+} is 2.8 while that of ion Y^{-} is 2.8.8.

(a) Write down the electron arrangement of the atoms of X and Y (2 Marks)

(b) Compare the atomic radii of the two elements. (1 Mark)

(c) Give the name of the chemical family to which element X belongs (1 Mark)

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

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H_1 = -393$ KJ/mol

$H_{2(g)} + ½\ O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta H_2 = -286$ KJ/mol

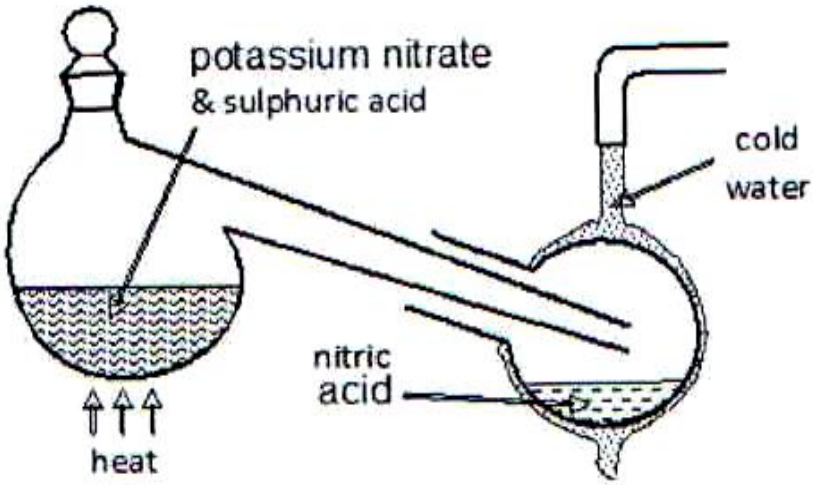
$C_4H_{10} + 6\ ½\ O_{2(g)} \longrightarrow 4CO_{2(g)} + 5H_2O_{(l)}$ $\Delta H_3 = -2877$KJ/mol

(a) Calculate the molar enthalpy of formation of butane (C_4H_{10}) from its elements in their normal states. (3mks)

21. (a) (i) A student found a colourless liquid in the laboratory which he suspected to be water. Describe a chemical test the could have performed to confirm that the liquid is water.(2 Marks)

(ii) What other test could he have done to prove that the liquid is pure water?(1 Mark)

22.The diagram below shows that the set-up that was used to prepare and collect a sample of nitric acid

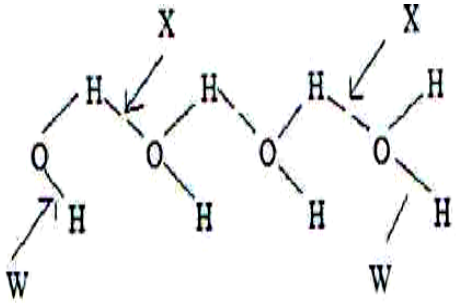


(a) Give a reason why it is possible to separate nitric acid from sulphuric acid in the set-up. (1 Mark)

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

(c) Give one use of nitric acid.(1mark)

23.The structure of water molecules can be represented as shown below.



(i) Name the bond type represented by letter X and W. (1 Mark)

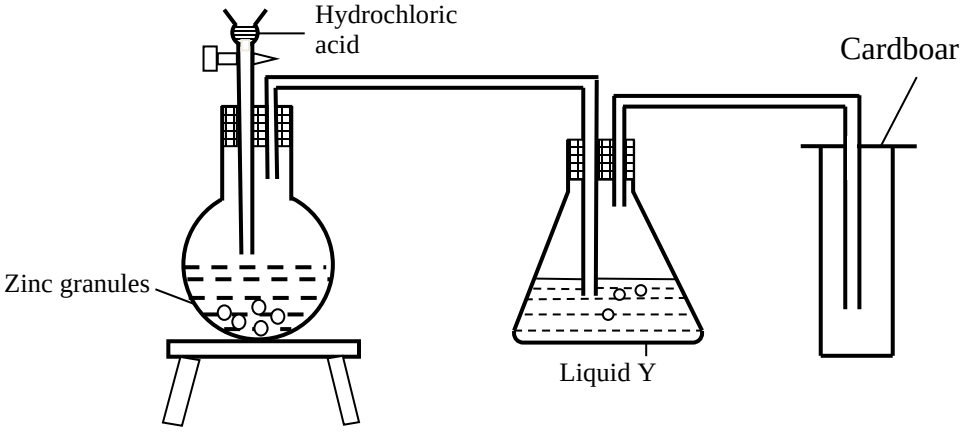
(ii) Relative molecular mass of methane and water are almost similar, however the boiling of water is 100^0C while that of methane is -161^0C. Explain. (1 Mark)

24.Diamond and graphite are allotropes of carbon. In terms of structure and bonding, explain why?

(i) Diamond is used in drilling of hard rocks. (1 Mark)

(ii) Graphite is a lubricant. (1Mark)

25.The set up was used to prepare dry hydrogen gas. Study it and answer the questions that follow.



(i) Is set-up used to prepare the gas correct? Give reason. (1 Mark)

(ii) What would be liquid Y?(1mark)

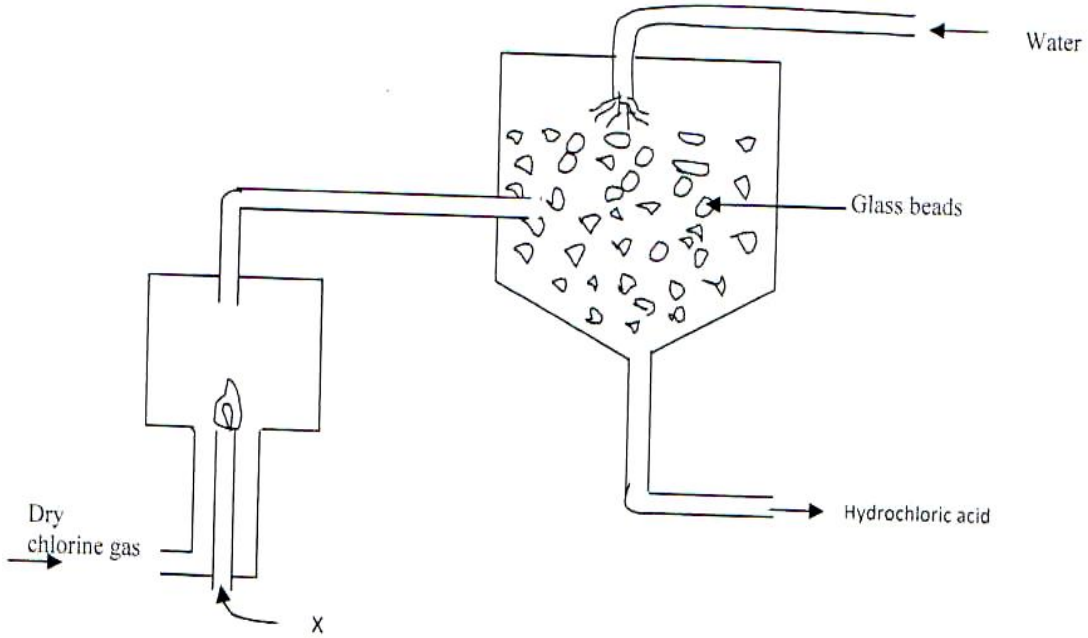
(iii) Give two physical properties of hydrogen gas (1 Mark)

26. Given element W has atomic number 14 and consists of isotopes as shown below.

Isotope	A	B	C
Isotope mass	28	29	30
Percentage abundance	92.2	4.7	3.1

Determine the relative atomic mass of W (2 Marks)

27.The diagram below represents a set up used for the large scale manufacture of hydrochloric acid.



(a) Name substance X (1Mark)

(b) What is the purpose of the glass beads? (1 Mark)

(c) Give one use of hydrochloric acid (1Mark)

28. A mixture contains Iron (III) Chloride, calcium chloride and iron filings. Describe how one can separate and recover the substances in the mixture.(3marks)

29. The structure below represents two cleansing agents A and B. Which cleansing agent would be suitable for washing in water containing calcium chloride? Give a reason.(2marks)

A

$R-COO^-Na^+$

B