SIAYA CHEMISTRY

NAME:..... SCHEME .....ADM NO:..... FORM III

SCHOOL: .....SIGN:.....

02ND JULY 2024

CHEMISTRY PAPER1

FORM THREE.

TIME: 2 HOURS

INSTRUCTION TO CANDIDATES

- Answer all the questions in the spaces provided.
- Answer all questions
- Mathematical tables and electronic calculators may be used.
- All working must be clearly shown where necessary

For Examiner's Use Only

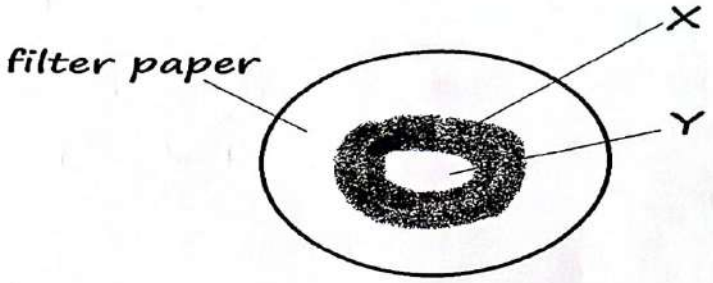
Question	Maximum Score	Candidates Score
1 – 27	80	

This paper consists of 12 printed pages.

Students should check the question paper to ensure that all pages are printed as indicated

and no questions are missing.

1. The diagram below represents a filter paper that was placed in a certain part of a Bunsen burner flame. Study it and use it to answer the questions that follow.



a) Which flame was most likely being investigated? (1 mark)

Non-Luminous ✓1

b) State the likely zones that resulted in the regions marked **X** and **Y**, stating the reason for your answer in each case (2marks)

X Pale blue zone ✓½ is the hottest part ✓½

Y Almost Colourless ✓1 Consist of unburnt gases ✓1

1.

2. Rusting is a process that causes massive destruction of iron structures

[a] State **two** condition that accelerates rusting (2marks)

High temperature ✓1

Acidity ✓1 Any two

Salinity ✓1

[b] State one advantage of rusting (1mark)

Prevent the metal underneath from further damage ✓1

3. State one use each of the following apparatus in the laboratory (3marks)

i. Desiccator

Keep substances away from moisture. ✓1

ii. Crucible

Heating solid substance that require strong heating ✓1

iii. Deflagrating spoon

Holding substances being burnt.

4. (a) What is valency (1mark)

Combining Power of an Element // No. of electrons an atom gains or loses to form a stable ion.

(b) The valency of X is 3, what is the formula of its;

(i) Hydroxide. (1mark)

$X(OH)_3$ ✓1

(ii) Sulphate. (1mark)

$X_2(SO_4)_3$ ✓1

5. Describe how a solid sample of lead(II) chloride can be prepared using the following reagents : dilute nitric acid, dilute hydrochloric acid and lead carbonate (3marks)

Add excess $PbCO_3$ to a beaker Containing dilute HNO_3 to obtain $Pb(NO_3)_{2(aq)}$: ✓½
Filter excess $PbCO_{3(s)}$ ✓½
Add dilute HCl to $Pb(NO_3)_{2(aq)}$ to precipitate insoluble $PbCl_{2(s)}$ ✓½ ✓½
Filter out solid $PbCl_{2(s)}$ ✓
Rinse with chilled water and dry between filter paper ✓½ ✓½

6. The electron configuration of elements A, B, C, D and E are as given below

Element	Electron configuration
A	2, 8, 1
B	2, 8
C	2, 7
D	2, 8, 6
E	2, 8, 3

{a} Which element has the highest electrical conductivity (1mark)

E ✓1

{b} Which letter represents the most reactive metal (1mark)

A ✓1

{c} Which letter represents the most reactive non-metal (1mark)

C ✓1

7. A volume of 50cm^3 ammonia gas diffuses through a small orifice in 20 seconds. How long will it take a 100 cm^3 volume of propane (C_3H_8) to diffuse through the same orifice under the same conditions of temperature and pressure? (C=12.0, H =1.0, N=14.0) (3marks)

Time for 100cm^3 of NH_3 $\frac{100 \times 20}{50} = 40$ sec

$\frac{40}{T C_3H_8} = \sqrt{\frac{17}{46}}$ ✓1

Rmm of $NH_3 = 17$g

Rmm of $C_3H_8 = 46$g ✓1

$T C_3H_8 = 65.8$s ✓1

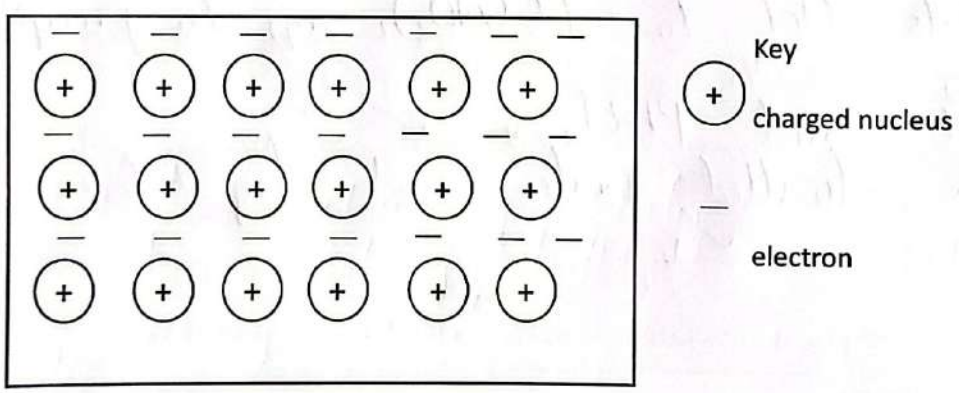
Accept Alternative Methods

Rmm ✓1 mole

Working ✓1

Answer ✓1

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



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

Metallic ✓1

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

Group I ✓1 · One delocalised electron per each atom ✓1

11. Emission of carbon (IV) oxide into the atmosphere has become one of the world's major concerns.

(a) State one disadvantage of releasing carbon (IV) oxide into the atmosphere. (1mark)

Global Warming ✓1

(b) What causes the level of carbon (IV) oxide in the atmosphere to increase? (1mark)

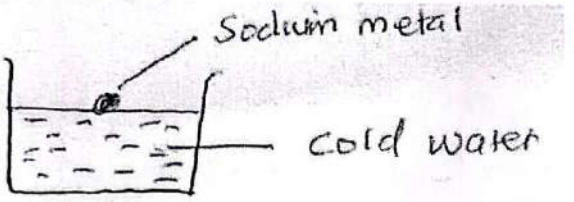
Burning fossil fuels ✓1

(c) How can the amount of carbon (IV) oxide in the atmosphere be reduced other than avoiding the causes in (b) above? (1mark)?

Planting trees ✓1
Using refrigerator and Conditioning // Open area ✓1

Any one

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



a) State two observations made in the above experiment when sodium react with water (2marks)

Darts on the surface of water ✓1
Melts into a silvery ball ✓1
Hissing / fizzing sound ✓1

Any two

b) Write a chemical equation for the reaction that takes place (1mark)

$2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH + H_{2(g)}$

13. Define the term simple acid base-indicator (1mark)

Substance that determine whether a solution is an acid or base based on change in their characteristic Colour or Odour. etc

ii. State **one** disadvantages of using simple acid-base indicators (1mark)

Give Inconclusive Does not show the strength of the acid or base in the solution ✓1

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

✓ It is a Good Conductor ✓1

✓ Its Inert neture ✓1

b) Graphite is an allotrope of carbon. Distinguish between allotropes and isotopes. (1mark)

Allotropes are different forms of an element in the same Physical state while Isotopes are Atoms of the same element with the same atomic No. but different Mass No // No. of Neutrons

15. 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 (1mark)

Minmum energy required to remove the 1st electron from the outermost energy level of an atom in gaseous ✓1 state.

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

Increase in effective Partive Nuclear Charge ✓1

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

$R(g) \longrightarrow R(g) + 3e$ ✓½

420 + 3100 + 4800 = 8320 kJ/mol ✓½

16. An element X is represented as $^{40}_{18}X$ (x = is not the actual symbol of the element)

a. What is the composition of the nucleus for this element? (2marks)

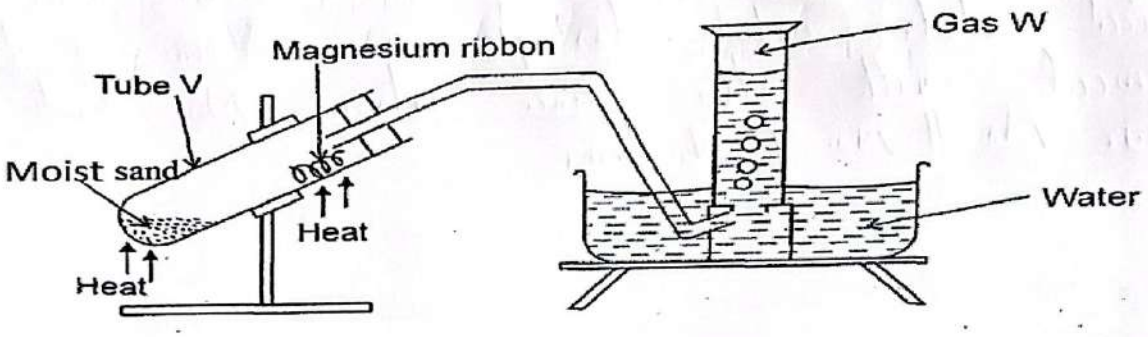
Protons = 18 ✓ 1

Neutron = 22 ✓ 1

b. Give the electronic arrangement of the element. (1mark)

2.8.8. ✓ 1

17. Study the set-up of apparatus below and answer the questions that follow.



a) Write the equation for the reaction that occurs in tube V (1mark)

$Mg_{(s)} + H_2O_{(g)} \rightarrow MgO_{(s)} + H_{2(g)}$

b) State one industrial use of gas W (1mark)

Manufacture of HCl ✓ Manufacture of hydrazine

Manufacture of NH_3 used as rocket fuels

c) Name another metal that can be used in tube V instead of magnesium. (1mark)

Zinc // Zn Iron // Fe

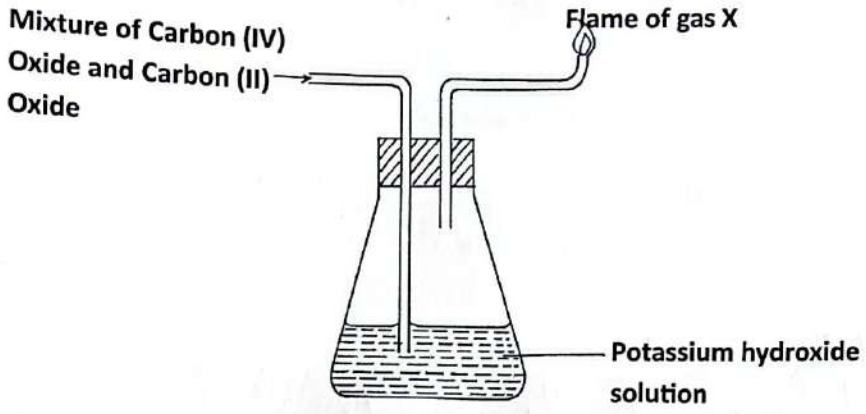
Lead // Pb

18. 3.78g of a hydrated salt of iron (II) sulphate, $FeSO_4.nH_2O$ were heated until all the water of crystallization was driven off. The anhydrous salt left had a mass of 1.52g. Determine the formula of the hydrated salt. (Fe = 56, S = 32, H = 1, O = 16) (3marks)

	$FeSO_4$	H_2O
Mass	1.52	2.26 ✓½
Mm	152	18 ✓½
Mol	$\frac{1.52}{152} = 0.01$	$\frac{2.26}{18} = 0.126$ ✓½
Mole ratio	$\frac{0.01}{0.01}$	$\frac{0.126}{0.01}$
	= 1	13 ✓½

$FeSO_4 \cdot 13H_2O$ ✓1 mark

19. A mixture of carbon (IV) Oxide and carbon (II) oxide is passed through potassium hydroxide solution as shown in the following set up.



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

$CO_{(g)}$ // Carbon (II) oxide

(ii) Why should gas **X** be burned? (1mark)

It is Poisonous

(iii) Write a well-balanced chemical equation for the reaction that takes place in the conical flask in the first few seconds. (1mark) ✓

$2KOH_{(aq)} + CO_{2(g)} \longrightarrow K_2CO_{3(aq)} + H_2O_{(l)}$

balanced ✓1
wrong state symbols ✓½

20. (a) The relative atomic masses of some elements are not whole numbers. Explain. (1mark)

Exist as Isotopes having different Mass Numbers

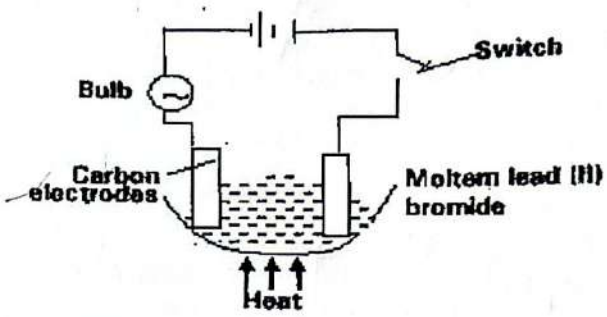
(b) An elements Gallium has relative atomic mass 69.8. In 100 atoms of Gallium 60 atoms are Gallium 69 and 40 atoms are Gallium X.
Determine the value of X. (2marks)

GAM $69.8 = \frac{(69 \times 60) + (40 \times x)}{100}$ ✓1

$6980 = 4140 + 40x$

$x = 71$ ✓1

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



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

The bulb lights ✓1
Brown vapour / fumes at the anode ✓1
Grey deposit / solid at the cathode ✓1

22. Element M has an electronic configuration of 2.8.1. Element N forms ions by gaining two electrons and react with metals to form oxides. Element P has an atomic number of 17 and reacts with water forming acidic solutions. Element Q reacts with P forming a white solid of formula QP. When a gas P is bubbled into colourless solution of MR, the solution turns reddish brown. When a gas R is bubbled into a solution of MS a dark solid is formed.

i) What is the valency of element P (1mark)

1

ii) What is the change of ion of element N.? (1mark)

N^{2-}

iii) Write down the formula of the compound formed between M and N (1mark)

M_2N

23. If 25.0cm^3 of 0.1M H2SO4 solution neutralized a solution containing 1.06g of anhydrous sodium carbonate in 250cm^3 of solution, calculate

a. The molarity of sodium carbonate (Na=23, O=16, C=12) (1 ½ marks)

1.06g — 250
— 1000

$\frac{1000 \times 1.06}{250}$ ½

= 4.24g/l ✓

$Mm = 23\times2 + 12 + 16\times3$ ½
$= 46$

Molarity = $\frac{4.24}{46} = 0.04M$ ½

OR $\frac{1.06}{106} = 0.01$ moles ✓ ½

Molarity = $\frac{0.01 \times 1000}{250}$ ✓ ½

= 0.04M ✓ ½

b. Volume of sodium carbonate solution used (1 ½ marks)

$Na_2CO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + CO_2 + H_2O$

1 (aq) 1 (aq)

moles of H_2SO_4 in 25cm³

$\frac{25 \times 0.1}{1000}$

$= 0.0025$ moles ✓ ½

moles of Na_2CO_3 ✓ ½

1 : 1 $= 1 \times 0.0025 = 0.0025$ mol

Volume $= \frac{0.0025 \times 1000}{0.04}$

$= 62.5 cm^3$ ✓ ½

24. The table below shows the atomic numbers, mass numbers and numbers of electrons in atoms/ions P,Q,R and S. The letters are not actual symbols of the elements.

Atom/Ion	P	Q	R	S
Atomic number	12	14	12	13
Mass number	24	25	26	27
Number of electrons	12	13	13	13

(a) Which two elements are isotopes? Explain your answer. (1mark)

P and R ✓ ½ – Same atomic No. but different Mass No. ✓ ½

(b) Which is an anion from the table? Give a reason for your answer? (1mark)

R. ✓ ½ – more electrons than Protons // gained electron ✓ ½

(c) How many neutrons does an atom of S, have? (1mark)

$27 - 13 = 14$ ✓

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

(a) Identify gas C (1mark)

Oxygen.

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

Thermal decomposition // dessociation

c) Write a balanced chemical equation for the reaction that takes place. (1mark)

$2KNO_3(s) \xrightarrow{heat} 2KNO_2(s) + O_2(g)$

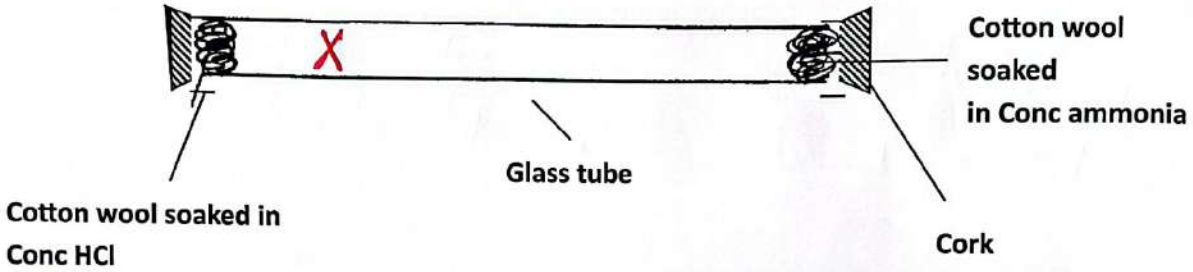
26. (a) Give two products formed when a candle burns. (2marks)

Carbon (IV) oxide ✓1
steam // water ✓1

(b) From the above products; which elements make up a candle? (1mark)

Carbon ✓½ and Hydrogen ✓½

27. Study the set up below and answer the questions that follow



(a) What observation would be made in the tube (1mark)

White fumes close to Cotton wool soaked in Conc HCl

Accept white solid // deposit

(b) Indicate with a cross (x) on the diagram the likely position where the observation stated in (a) above would be made (1mark)

(c) Give an explanation for your answer in (b) above (1mark)

NH_3 (g) is lighter diffuser faster travelling longer distance than HCl which is heavier.