Name: ....

Class: ....   Adm.No. ....

233/1
CHEMISTRY
Paper 1
AUGUST 2022
Time: 2 hours

M\S

M O K A S A E X A M I N A T I O N TERM II 2022

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

1	2	3	4	5	6	7	8	9	10

11	12	13	14	15	16	17	18	19	20

21	22	23	24	25	26	27	TOTAL 80	

This paper consists of **13** printed pages. Candidates are advised to check and to make sure all pages are as indicated and no question is missing.

1 a) Explain the term 'strike back' as applied to a Bunsen burner (1mk)

— Phenomenon where the flame goes down the chimney and goes off. It happens when the gas is being burnt faster than can be supplied

b) Give the name and state the function of the apparatus labeled N in the diagram shown below

(2mks)
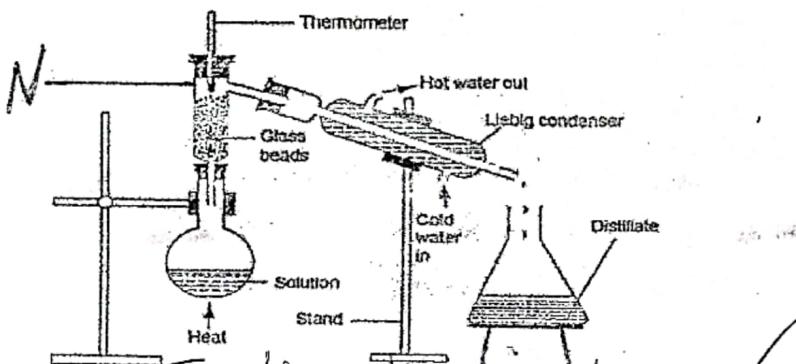
Name ... Fractionating column ✓ 1

Function
— Condenses vapour of a liquid with higher boiling point back to flask before attaining its boiling point. ✓ 1

2. 1.6g of Ammonium nitrate were dissolved in 100cm³ of water at room temperature of 21°C and The mixture was stirred with a thermometer. The molar heat of solution obtained in the experiment was +126kJ/mol, Calculate the final temperature of solution.
C=4.2kJ/Kg/K, Density of solution 1g/cm³, N=14, H=1, O=16   (3mks)

Moles.g. NH_4NO_3 used

$\dfrac{1.6}{80} = 0.02$ moles

$2.52 = \dfrac{100 \times 4.2 \times \Delta T}{1000}$

$\Delta T = 6.6°C$

final Temp = 21 - 6
= 15.6 °C

$\Delta H = \dfrac{1 \text{ mole} \rightarrow 126}{0.02 \text{ moles}} = 2.52 kJ$

3. Describe how constant mass of copper can be determined in copper II carbonate
(3mks) — Weigh the mass of the crucible and $CuCO_3$ ✓ 1
  — Heat $CuCO_3$ in a crucible strongly to form CuO as residue.
  — Pass dry hydrogen over heated CuO to form Cu metal.
  — Determine (weigh) the mass of the residue.
  — Subtract the mass of crucible from the mass of residue and crucible

4. a) Define the term Homologous series   (1mk)
... Sequence of compounds with the same chemical properties, chemical formula and functional group and they exhibit gradual change in physical properties. ✓ 1

b) Hydrocarbon A with 3 carbon atoms decolorizes bromine water in the presence of light but does not decolorize acidified Potassium Manganate VII

i) Name the homologous series to which hydrocarbon A belongs   (1mk)

....

......Alkane..................... ✓ 1

....

ii) Write the chemical equation to show how the Hydrocarbon A is prepared in the laboratory ✓
(1mk)..........$C_3H_7COONa_{(s)} + NaOH_{(s)} \longrightarrow C_3H_{8(g)} + Na_2CO_{3(s)}$ ✓

5. a) The diagram below shows two allotropes of Carbon. Study them and answer questions that follows
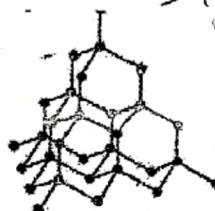
Ignore state symbols off ommitted d otherwize penalize wrong states

Allotrope X   Allotrope Y

State: (2mks)

i)   One use of allotrope X
   ..Dry lubricant , positive terminal in dry cell, pencils ✓ 1

ii)   Why allotrope Y is very hard
   - Strong covalent bonds between Carbon atoms that are uniformly distributed..........
   - Close packaging of the Carbon atoms ✓ 2

b) Set up below was used to prepare gas W

Dilute sulphuric (VI) acid

Gas W

Liquid J

Iron (II) sulphide
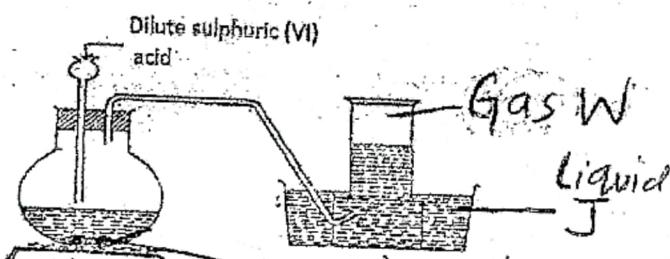
i)   Identify gas W and liquid J
   Gas W...... hydrogen sulphide / H_2S ✓2   (1mk)
   Liquid J........ warm water ✓2

ii)   Sate the observation made when gas W is bubbled in lead (II) nitrate solution   (1mk)
   Black precipitate. ✓ 1

3

....

....

6. A form two student in an attempt to stop rusting placed copper and zinc metals in contact with iron separately as shown below:
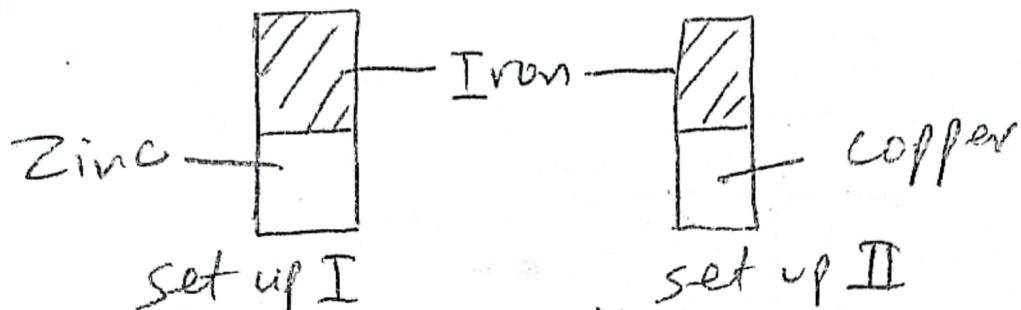
set up I   set up II

a) State the observation made set up I and II ✓2   (1mk)

Set I......Iron remains grey........✓2

Set II......A brown coating is formed on iron ✓2

b) Explain your answer in (a) above   (1mk)

In set up I, Iron did not rust since zinc offers ²sacrificial protection

In set up II, Iron rusted since copper is less reactive and offered no protection. ✓2

c) Name the method of preventing rusting illustrated above   (1mk)

..Sacrificial protection...✓1

7. a) State Graham's law of diffusion.   (1mk)

..Under similar conditions of temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density.. ✓1

b) $100cm^3$ of Carbon (IV) oxide gas diffused through a porous partition in 30 seconds, How long would it take $150cm^3$ of Nitrogen IV oxide to diffuse through the same partition under similar conditions C=12,N=14,O=16   (2mks)

$100cm^3$ of $CO_2 \rightarrow 30$

$150 \rightarrow ?$

$\dfrac{150 \times 30}{100} \rightarrow 45$ ✓2

$\dfrac{T_{CO_2}}{T_{NO_2}} = \dfrac{\sqrt{M_{CO_2}}}{\sqrt{M_{NO_2}}}$

$\dfrac{45}{T_{NO_2}} = \dfrac{\sqrt{44}}{\sqrt{46}}$ ✓1

$T_{NO_2} = 46.011$ seconds ✓2 $\dfrac{2}{2}$

8. An element M has 19 neutrons and a mass number of 39

i) Write the electron arrangement of its stable ion   (1mk)

......2.8.8..........✓1

ii) Which period does M belong to   (1mk)

.........Period 4........✓1

iii) Draw the structure of its ion   2†(1mk)

— composition ✓2
   of nucleus

— Distribution ✓2
   of electrons

4

9. The flow chart below shows stages in extraction of copper, use it to answer questions that follow.
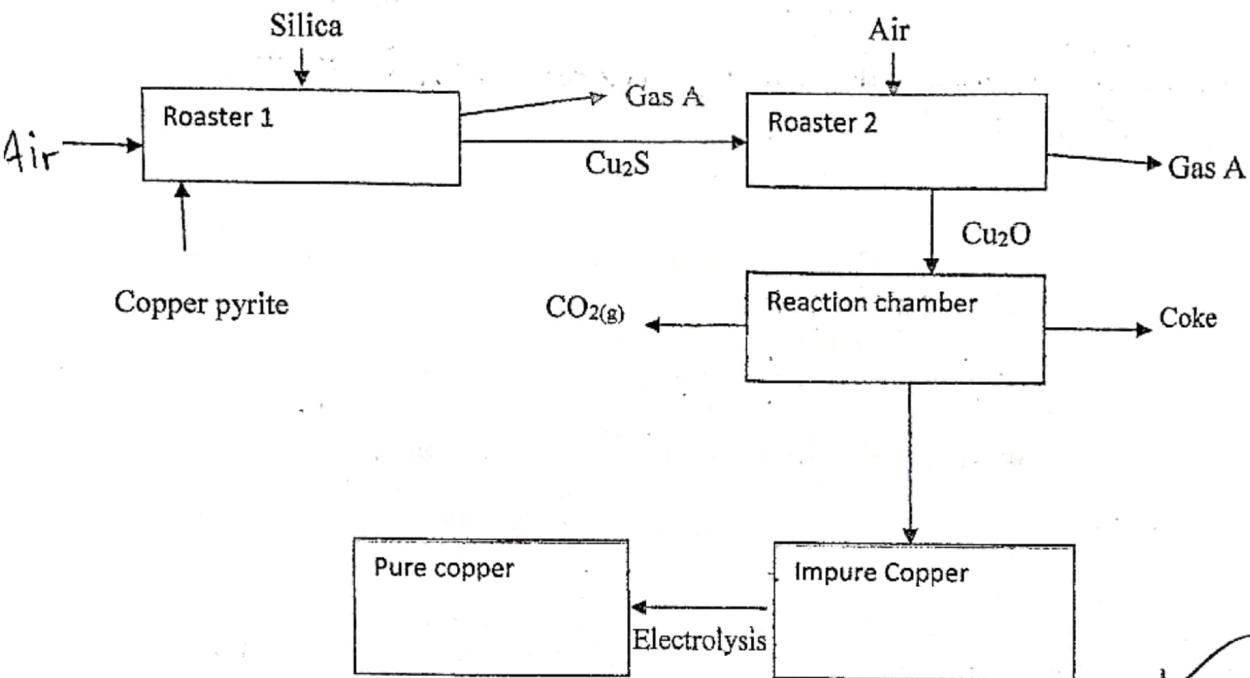
a) Write the equation for the reaction that occurs in the roaster 1 (1mk)

$$2CuFeS_{2(s)} + 4O_{2(g)} \rightarrow Cu_2S_{(s)} + 2FeO_{(s)} + 3SO_{2(g)}$$

b) Name Gas A (1mk)

Sulphur(IV) oxide

c) What is the importance of adding silica in roaster 1 (1mk)

Reacts with iron (II) oxide to form iron (II) silicate (slag)

10. a) Using Dots(.) and Crosses (x) to represent electrons draw the structure of aluminum chloride dimer. (1mk)


Accept correct drawings.
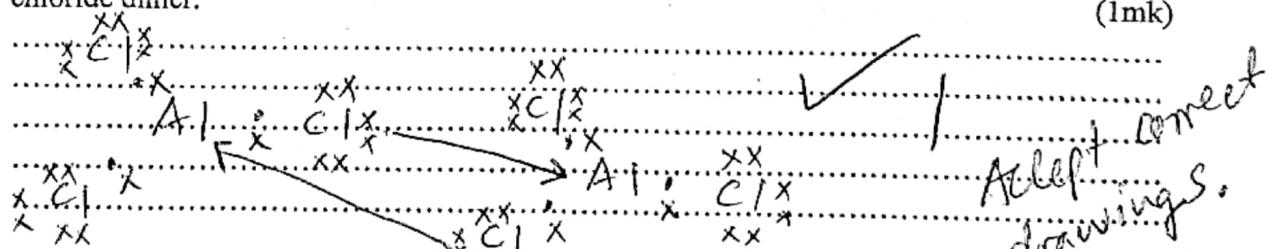
b) Explain why aluminum carbonate does not exist (1mk)

Aluminium salts hydrolyzes in water to form hydrogen ions which reacts with carbonate to form CO_2 gas.

c.) Melting point of Lithium chloride is higher than Sodium chloride. Give reason. (1mk)

LiCl has a stronger ionic bond than NaCl since Li forms smaller ionic radius than Na.

11. The diagram below is a cross section of the dry cell. Study it and answer questions that follow.
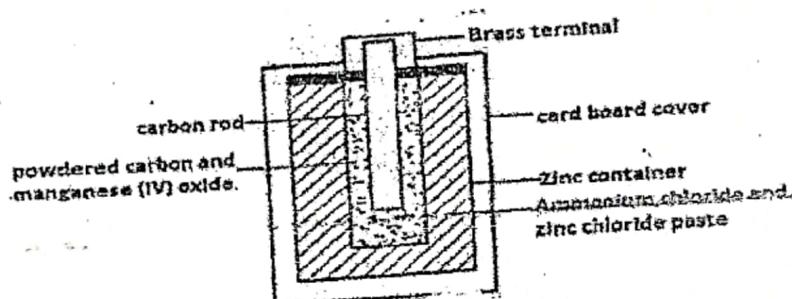
i) Write the overall equation to represent the reaction that takes place in the cell (1mk)

$$Zn_{(s)} + 2NH_4^+{}_{(aq)} \longrightarrow Zn^{2+}{}_{(aq)} + 2NH_{3(g)} + H_{2(g)}$$
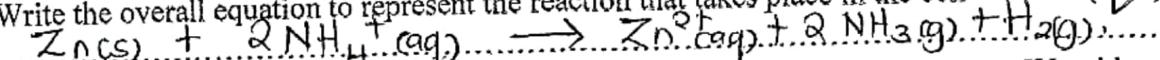
ii) The carbon rod is surrounded with a mixture of powdered carbon and manganese IV oxide. What is the function of Manganese IV oxide. (1mk)

Depolarizer / oxidizes hydrogen gas to water preventing accumulation of bubbles at the positive terminal.

iii) Explain why a brass Cap is suitable over copper cap in the above cell (1mk)

Brass is resistant to corrosion than copper / it is highly conductive and perfect for electrical parts.

12. The diagram below shows preparation of Hydrogen gas. Study it and answer questions that follow.
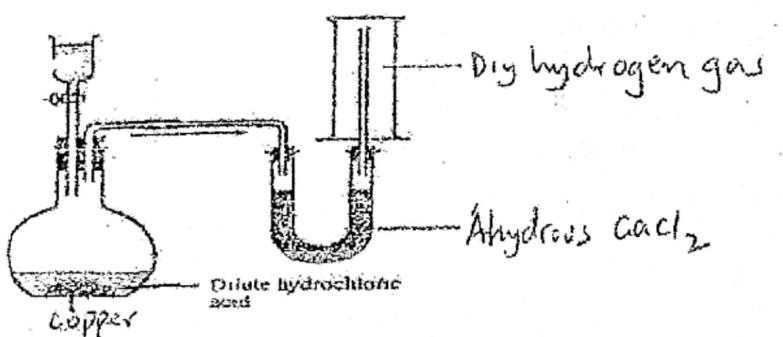
i) Explain why no Hydrogen gas was produced (1mk)

Copper is lower than hydrogen in the reactivity series hence cannot displace hydrogen from the dilute acid.

6

ii) When the mistake is corrected, hydrogen gas is produced name the method used to collect the gas and give reason why it was used (1mk)

Method...... Upward delivery/ downward displacement of air 2

Reason...... hydrogen is less dense than air/ lighter than air

iii) Describe a test that can be done to identify Hydrogen gas in the laboratory (2mk)

...Introduce a burning splint into a gas jar containing hydrogen gas. It extinguishes the burning splint with a 'pop' sound.

13. The equation and the curves below shows decomposition of dinitrogentetraoxide

$$N_2O_{4(l)} \rightleftharpoons 2NO_{2(g)} \qquad \Delta H = +17 \text{ kJ/mol}$$
pale yellow   brown

Concentration (moles/litre)

Curve I

Curve II

Time (minutes)
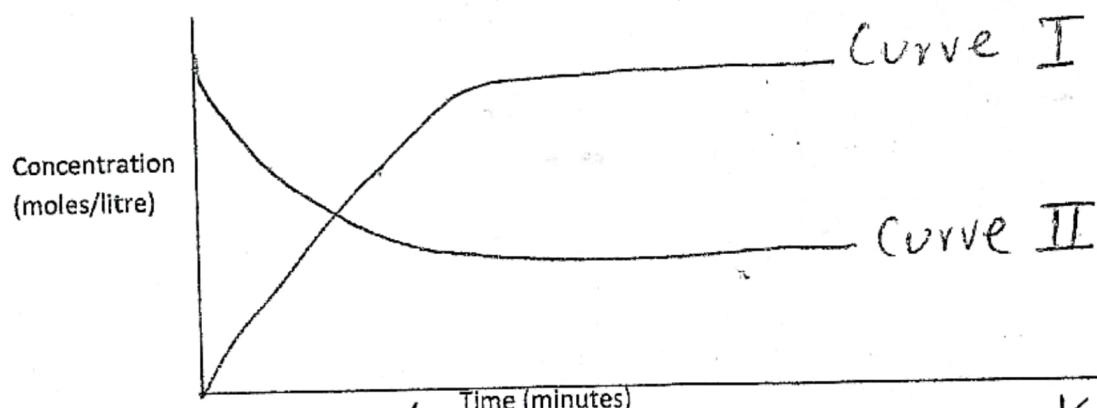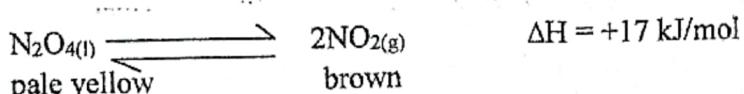
i) Which curve represents change in concentration of Nitrogen (IV) oxide. Explain (1½mks)

...Curve I — Increase in Concentration of NO_2...

ii) State and explain the observation made when the beaker containing the mixture is placed in hot water (1½mks)

Brown Colour Intensifies — Equilibrium shifts forward since Endothermic reaction is favoured by Increase in Temp

14. A student bubbled chlorine gas through a solution of Magnesium bromide in a corked conical flask

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

Solution changes to brown — Cl_2 displaces Br from the solution

ii) Write the ionic equation for the reaction which occurred at the conical flask (1mk)

...$2Br^-_{(aq)} + Cl_{2(g)} \rightarrow 2Cl^-_{(aq)} + Br_{2(l)}$
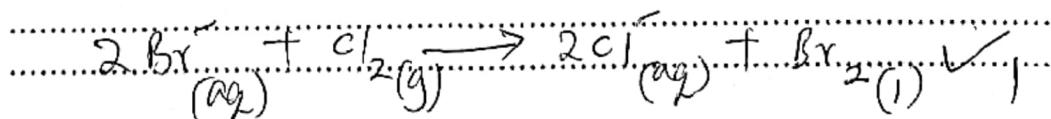
15. a) It is not appropriate to refer to group VIII elements as 'Inert gases' Explain giving an example *Some group VIII Elements are chemically reactive, because of larger atomic radius hence tendency to lose Electrons* (2mks) *E.g Xenon* (1mk)

b) Give one use of Helium
Research baloons / Arch welding (1mk)

16. The diagram below shows burning of Magnesium in air and collecting the products
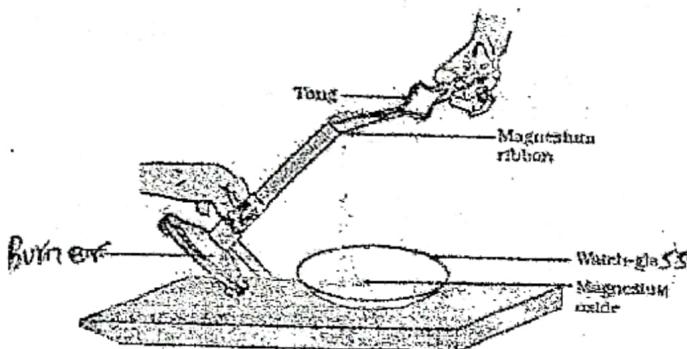
a) Name the observation made during the reaction *brilliant white flame* (1mk)

Water was added to the product formed, a colorless gas with a pungent irritating smell was produced.

i) State the chemical test for the colorless gas
— Introduce glass rod dipped in concentrated HCl, white fumes are formed. (1mk)

ii) Write the equation leading to formation of colorless gas (1mk)

$$Mg_3N_{2(s)} + 6H_2O_{(l)} \longrightarrow 3Mg(OH)_{2(aq)} + 2NH_{3(g)}$$ (1mk)
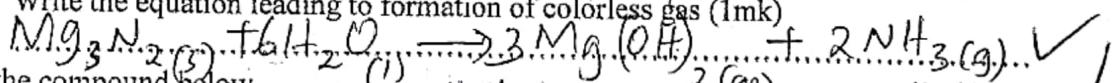
17. a) Name the compound below

$$H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-OH$$
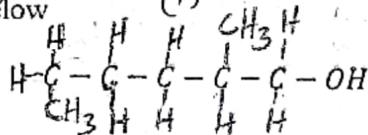
2-methylhexan-1-ol ✓

b.) Compound M reacts with ethanol in the presence of few drops concentrated of Sulphuric (VI) acid to form a fruity smelling compound below

$$H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle O}{||}}{C}-O-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-H$$
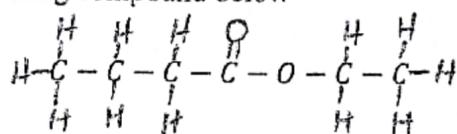
i) Write the molecular formula of compound M (1mk)

$$C_3H_7COOH \quad / \quad C_4H_8O_2$$ ✓
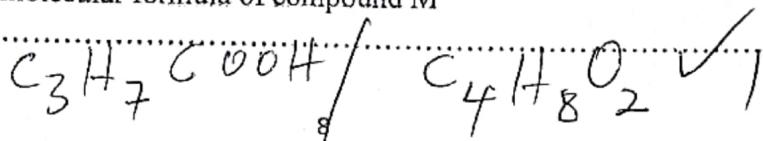
ii)   Give one use of the fruity smelling compound   (1mk)
– freshners .... – cosmetics ....
– perfumes ....

18. 100g of $^{231}_{91}$Th with half life of 12days decayed to a mass of 6.25g on the grid provided below, plot a graph of mass of $^{231}_{91}$Th against time   (3mks)

$100g \longrightarrow 50 \longrightarrow 25 \longrightarrow 12.5 \longrightarrow 6.25g$
$ \quad 12 \qquad 24 \qquad 36 \qquad 48$

Labelling – ½ mrk
Scale – ½ mrk
Plots – 1
Curve – ½
3

Plots
5 plots – 1½ mrk
4
3½

19. a) The following data gives pH values of solution M,N and P
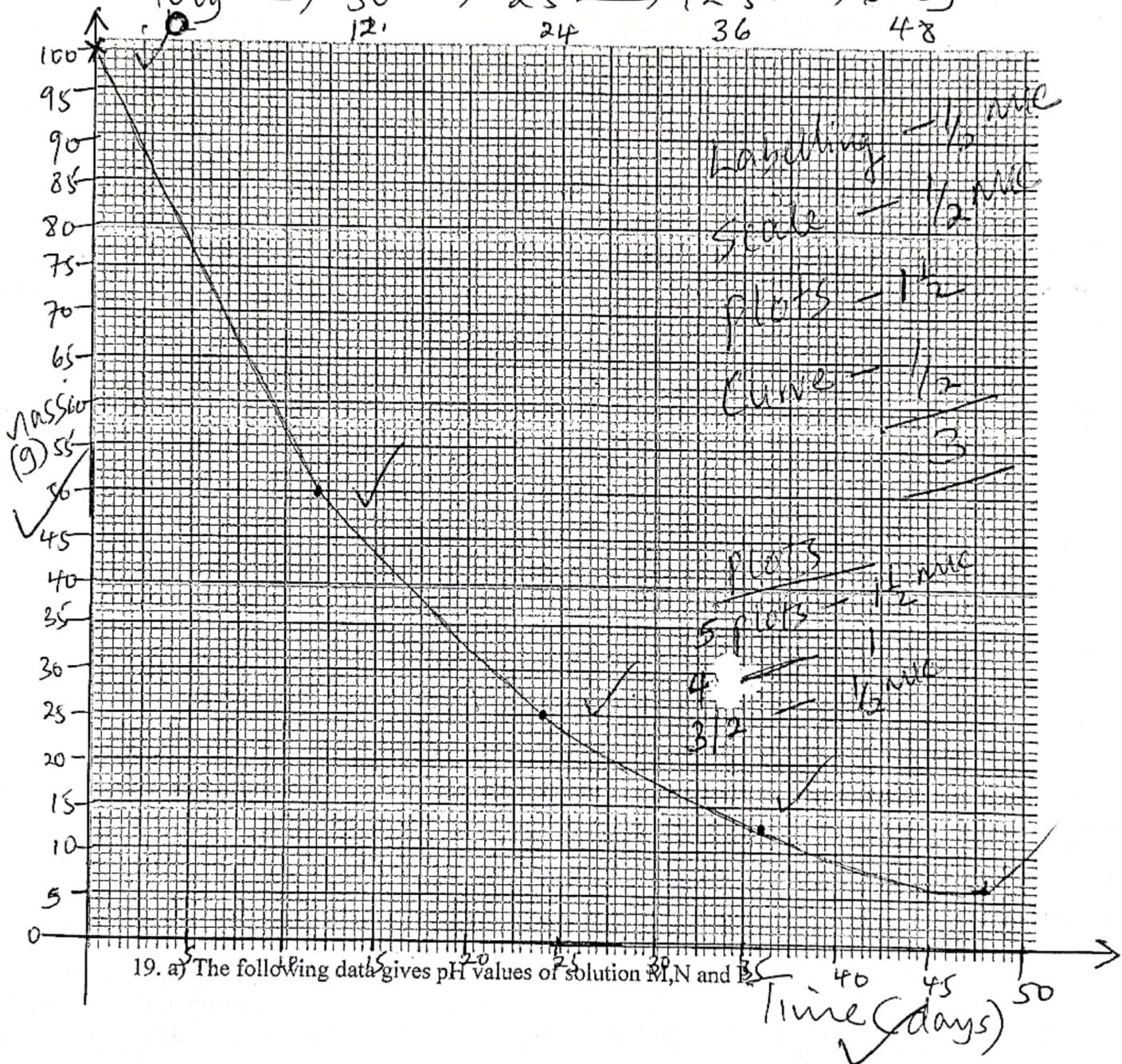
Solution	pH value
M	13.6
N	7.0
P	1.3

i) Which solution will produce carbon iv oxide when reacted with copper (ii) carbonate (1mk)

............................P ✓)..

ii) What would be the colour of solution M after adding a few drops of phenolphthalein (1mk)

............................Pink ✓)..

b.) The graph below shows how the pH value of soil in a farm over a period of time
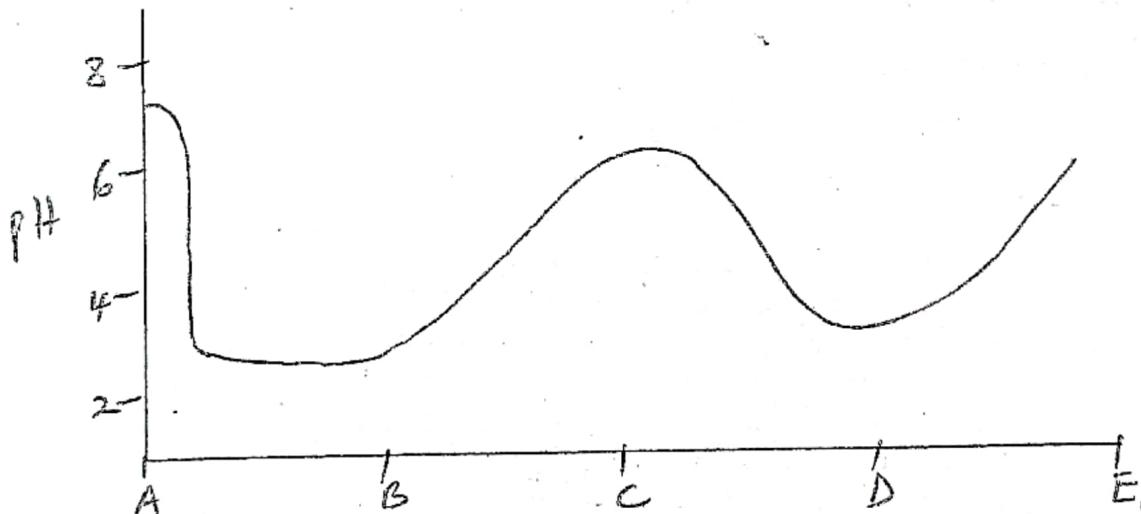
State one factor that may have been responsible for the change in soil pH in the interval AB (1mk)

........Acidic rain / Leaching / water Logging ✓ |

....

20. When 80cm³ of Hydrogen gas were mixed with 60cm³ of chlorine and the mixture exploded in a bright sunlight. Reaction took place according to the equation below:

$H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$
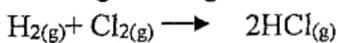
a) Determine the volume of the resulting gas mixture (1mk) ✓½

$$\frac{H_2 : Cl_2 : 2HCl}{1 : 1 : 2}$$

60   60   120
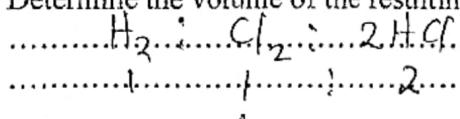
Volume of H_2 used 80 - 60 = 20cm³

Total volume = 20cm³ + 120

= 140cm³ ✓½

b) When the resulting gas mixture was shaken well with water, the volume of the gas was found to be less than the original mixture

  i) Why was the volume reduced (1mk)

  ...... $HCl_{(g)}$ dissolved in H_2O ✓/ ......

  ii) Determine the volume of the residue gas after the reduction (1mk)

  ...... $140cm^3 - 120cm^3 = 20cm^3$ of $H_{2(g)}$. ✓½

21. The diagram below represents the mercury cell used in the industrial manufacture of sodium hydroxide. Study it and answer questions that follow.
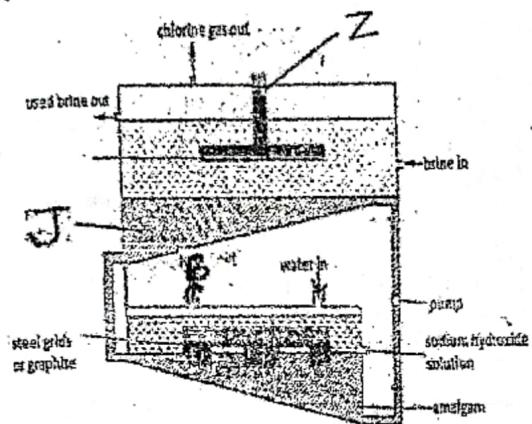
a) Name the substance B (1mk)

  ...... Hydrogen gas ✓/ ......

b) Write the equation for the reaction that takes place at electrode Z (1mk)

  ...... $2Cl^-_{(aq)} \rightarrow Cl_{2(g)} + 2e^-$ ✓/ ......
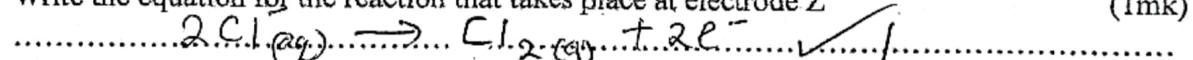
c) Give one reason why electrode J is made up of mercury (1mk) ✓

  ...... Hg prevents/ blocks discharge of $H^+_{(aq)}$ at cathode /

22. Student was required to prepare crystals of Magnesium chloride, starting with 100cm³ of 2M Magnesium Hydroxide. Describe how the student prepared pure dry crystals of magnesium chloride. (3mks)
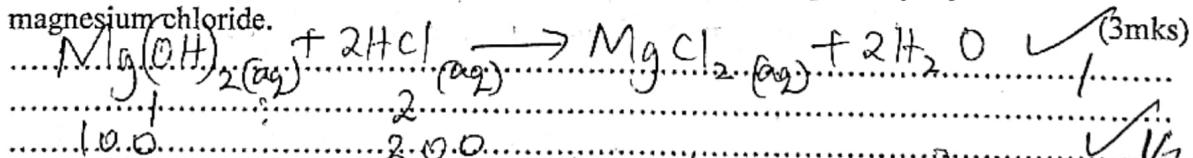
  ...... $Mg(OH)_{2(aq)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + 2H_2O$ ✓/ ......
  ...... 1 : 2 ......
  ...... 10.0 : 20.0 ......
  — Add 200cm³ of 2M HCl to 100cm³ of 2M $Mg(OH)_2$ ✓½
  — Evaporate the resulting solution to saturation
  — Cool the solution & Dry crystals between filter paper ✓½

23. In an experiment to separate a mixture Xanthophyll and Chlorophyll in plant leaf

i) Describe a procedure that was carried out first before separating the two pigments. (2mks)

— Crush the leaves in mortar using pestle ✓1
— Add propanone and continue crushing ✓½
— Decant the solution formed into a beaker ✓½

ii) After sometime it was discovered that Xanthophyll is more soluble than chlorophyll in the solvent. Draw a well-labeled diagram to show the results of this experiment. (1mk)
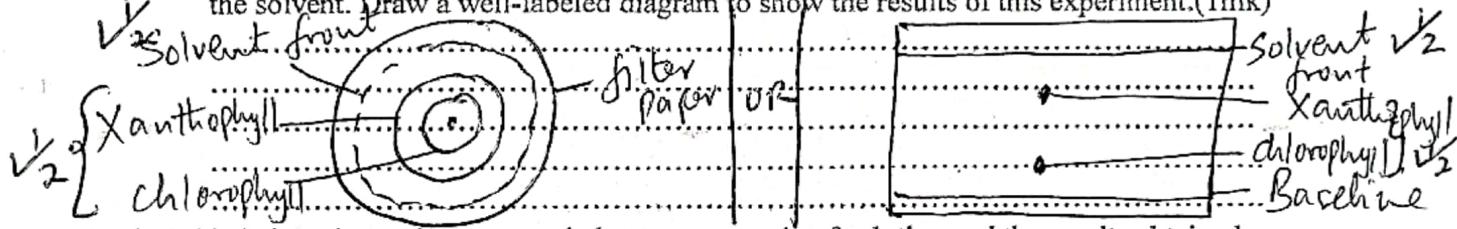

24. The table below shows the tests carried out on a sample of solution and the results obtained as shown on the table below:

|	Tests	Results
I	Addition of excess Sodium Hydroxide	White precipitate soluble in excess
II	Addition of excess aqueous Ammonia solution	White precipitate soluble in excess
III	Addition of acidified Barium Nitrate	White precipitate

a) Identify the Anion present in the solution (1mk)
SO_4^{2-} / Sulphate ion ✓1

b) Write the ionic equation for the reaction in step III (1mk)
$Ba^{2+}_{(aq)} + SO_4^{2-}_{(aq)} \longrightarrow BaSO_{4(s)}$ ✓1

c) Write the formula of the complex ion formed in step II (1mk)
$\left(Zn(NH_3)_4\right)^{2+}_{(aq)}$ ✓1

12
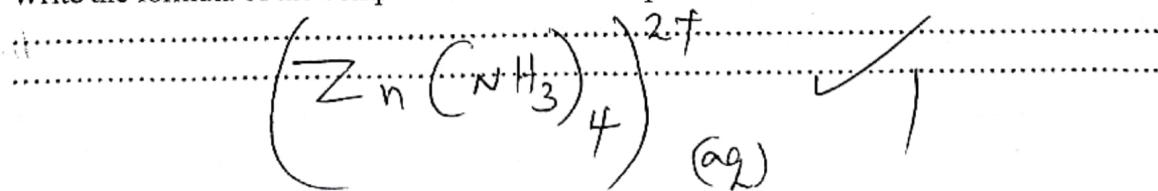
25. In the laboratory Nitric V acid can be prepared using the set up below
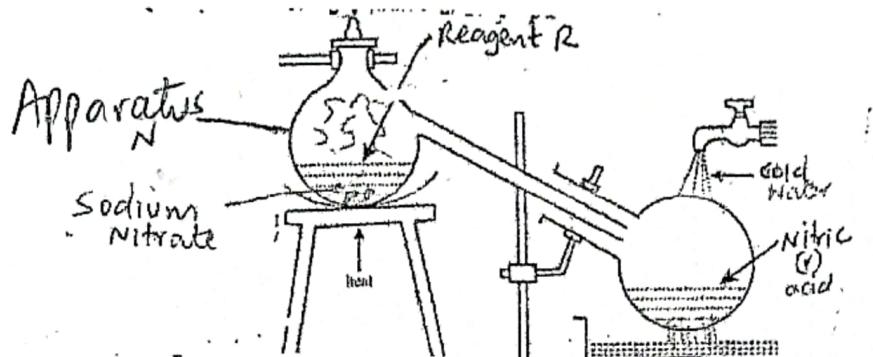
a) Name: (1mk)
    i)   Apparatus N
          ....Retort flask ✓ ½..........

    ii)   Reagent R
          .Concentrated Sulphuric (VI) acid ✓ ½.........

b) Give a reason why sodium nitrate is preferred over other nitrates in the above experiment
                                                                                                 (1mk)
    ......Lacks water of Crystallization ✓.....

c) State one property that makes reagent R suitable for use in this experiment   (1mk)
    ....Less volatile ✓....................

26. Potassium carbonate cannot be manufactured by the Solvay process. Explain   (1mk)
    ...$KHCO_3$ is more soluble than $NaHCO_3$ hence
    ....does not Crystallize ✓......................

27. The set up below was used to collect dry sample of a gas
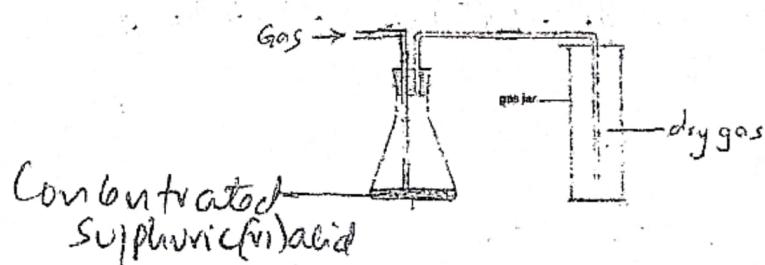
Give two reasons why the set up above is suitable for collecting Carbon IV oxide   (2mks)
    ....— CO_2 does not react with H_2SO_4 ✓.......
    ....— CO_2 is denser than Air ✓..............

XXXXXX LAST PRINTED PAGE XXXXXXXXX