MARANDA HIGH SCHOOL

Kenya Certificate Of Secondary Education

THE 2024 MOCK EXAMINATION

233/1 **CHEMISTRY** **PAPER 1**

June, 2024 **TIME: 2 Hrs**

Name: ..M.I.G.. Admission No: .....

Stream: ..... Signature: .....

233/1 - CHEMISTRY
Monday, 3rd June, 2024
Morning
8.00-10.00 Am

Instructions

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

(b) All answers must be written in the spaces provided in the booklet.

(c) ***This paper consists of 12 printed pages with 27 questions. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing***

(d) Candidate should answer the questions in **English**

(e) All working ***MUST*** be clearly shown where necessary.

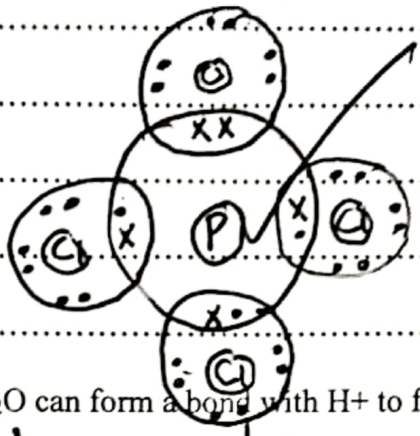
(f) Mathematical tables and silent electronic calculators may be used.

FOR EXAMINERS'USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1-27	80	

1. (a) Using dot(.) and crosses(x) to represent electrons draw the structure of **$POCl_3$** (2 marks)

(P=15,0=8, Cl=17)



2

(b) Explain why a molecule of H_2O can form a bond with H+ to form H_3O^+ (1mark)

H_2O has lone pair of electrons. 1

2.A hydrocarbon contains 80% carbon by mass. Given that 1dm^3 of the compound at **s.t.p** has a mass of 1.34g. Calculate the molecular formula of the compound. (Molar gas volume at s.t.p. = 22.4dm^3, C = 12, H = 1) (3marks)

C	H
moles = $\frac{80}{12}$	$\frac{20}{1}$ ✓½
$\frac{6.6667}{6.6667}$	$\frac{20}{6.6667}$
1	3 ✓½

E.F is CH_3 ✓½

moles of the compound = $\frac{1}{22.4}$

= 0.04 ✓½ moles

Mobr Mass = 1.34/0.0446

= 30.04

$n = \frac{30.04}{15}$ = 2 ✓½ 3

M.F $(CH_3)_2 = C_2H_6$ ✓½

3.Write the chemical equation to show the reaction between Lead (II) oxide and the following substances.

(i) Sodium hydroxide. (1mark)

$PbO(s) + 2NaOH(aq) \longrightarrow Na_2PbO_2(aq) + H_2O(l)$ ✓1 1

(ii) Dilute hydrochloric acid (1mark)

$PbO(s) + 2HCl(aq) \longrightarrow PbCl_2(s) + H_2O(l)$ ✓1 1

(b) State the property of Lead (II) oxide demonstrated above. (1mark)

Amphoteric ✓1 Acc: Amphoterism 1

09

4. Sulphur (IV) oxide reacts with potassium dichromate (VI) according to the equation below.

$$3SO_{2(g)} + Cr_2O_7^{2-}{}_{(aq)} + 2H^+_{(aq)} \rightarrow 3SO_4^{2-}{}_{(aq)} + 2Cr^{3+}_{(aq)} + H_2O_{(l)}$$

(i) What is the oxidation number of chromium ion in $Cr_2O_7^{2-}$. (1mark)

$2Cr + (-2 \times 7) = -2$ ✓

$2Cr = +12$ $\quad Cr = +6$ ✓2 I

(ii) State and explain the observation made in the above reaction (2marks)

Orange acidified potassium dichromate(VI) changes to green due to reduction of $Cr_2O_7^{2-}$ to Cr^{3+} ✓ 2

rej turns to.

5.Nitrogen(I)oxide is a colourless gas with pleasant smell and causes insensitivity when inhaled, but it is not reactive at room temperature. However, it relights a glowing splint

(a) Explain why the gas relights a glowing splint (1mark)

Unstable and supports combustion (Decomposes to give O_2 which supports combustion) ✓1 I

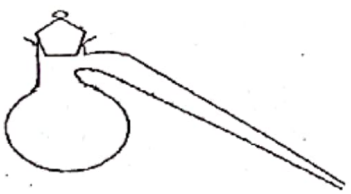
(b) One of the uses of nitric(V) acid is purification of metals such as Gold, explain why Nitric(V) acid is used in purification of metals (1mark)

Dissolves ✓1 away all impurities such as ~~gold~~ Cu and Ag I

(c) To a sample of a salt in a test tube, add $2cm^3$ of freshly prepared Iron (II) sulphate solution. Slant the test tube and slowly add concentrated sulphuric (VI) acid. Which ion does this test aim to confirm? (1 mark)

NO_3^- / Nitrate ion ✓1 I

6. Name the apparatus drawn below and give its use



06

(a) Name (1mark)

Retorts flask ✓1 1

(b) Use (1mark)

Preparation of nitric(v) acid ✓1 1

7. When a current of 0.82A was passed for 5 hours through an aqueous solution of metal Z, 2.65g of the metal was deposited. Determine the charge on the ion of metal Z. (1 Faraday = 96500 coulombs, Relative atomic mass of Z = 52) (3marks)

Mass deposited = $\frac{R.A \cdot M \times Q}{Charge \times 1F}$

$2.65g = \frac{52 \times (0.82 \times 5 \times 60 \times 60)}{Charge \times 96500}$

$2.65 = \frac{52 \times 14760}{Charge \times 96,500}$

$Charge = \frac{52 \times 14760}{2.65 \times 96,500}$

Charge = 3+ ✓ Z^{3+} ✓

rej +3 3

8. The scheme below shows the energy changes that take place between ice, water and steam.

Study it and answer the questions that follow: -

$$H_2O_{(s)} \underset{\Delta H_4}{\overset{\Delta H_1}{\rightleftharpoons}} H_2O_{(l)} \underset{\Delta H_3}{\overset{\Delta H_2}{\rightleftharpoons}} H_2O_{(g)}$$

(a) What name is given to the energy change ΔH_1? (1mark)

Latent heat of fusion ✓1 / Molar heat of fusion. 1

(b) What is the sign ΔH_4, give a reason (2marks)

Negative ✓1 loss of heat (exothermic) 2

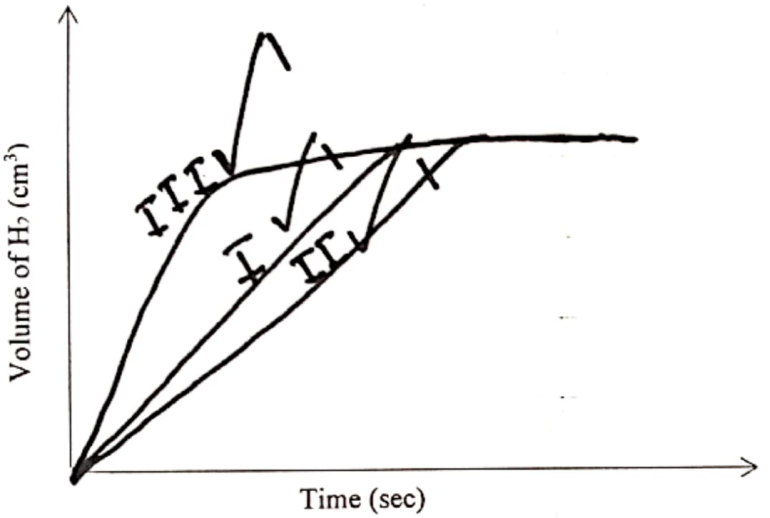
08

9. The table below gives three experiments on the reaction of excess hydrochloric acid and 1.8g of zinc done under different conditions. In each the volume of gas was recorded at different time internals

Experiment	Form of Zinc	Hydrochloric acid solution
I	Powder	1.0M
II	Granules	1.0 M
III	Powder	2.0 M

On the axis below draw and label three curves that could be obtained from such results.

(3 marks)



3

10. The solubility of copper (II)sulphate at 75 ^{0}C is 55g/100g of water and 19g/100g of water at 15^{0}C.

What mass of crystals would be deposited if a saturated solution was made by dissolving X g of Copper (II) sulphate in 150g of water at 75°C then cooled to 15^{0}C (3marks)

At 75°C

If 100g of H_2O ⟶ 55g of salt

150g of H_2O = $\frac{150 \times 55}{100}$ ✓½

= 82·5g ✓½

At 15°C

If 100g of H_2O ⟶ 19g of salt

150g of H_2O = $\frac{150 \times 19}{100}$ ✓½

= 28·5 ✓½

Mass of Crystals = 82·5 − 28·5 ✓½

= 54g ✓½

3

06

11.Potassium is isotopic and has a relative atomic mass (R.A.M) of 39.5, work out the percentage abundance of each isotope. The three isotopes are ^{39}K, ^{40}K and ^{38}K (0.01%) (3marks)

$39.5 = \frac{39x(99.99-y)+(40xy)+(38x0.01)}{100}$ ✓1

$\Rightarrow 3950 = 3899.61 - 39y + 40y + 0.38$

$3950 = 3899.99 + y$

$y = 3950 - 3899.99$

$= 50.01\%$ ✓1

$^{39}K = 49.98\%$ ✓1

$^{40}K = 50.01\%$ ✓1

3

12.A green solid D was heated until there was no further change. The following observations were made.

(i) A colourless liquid condensed on the cooler parts of the test tube

(ii) A colourless gas which changes acidified potassium dichromate (VI) to green was formed

(iii) Brown residue S was left

(a) Give the identity of solid D (1mark)

Hydrated Iron(II) sulphate ✓1 $FeSO_4 \cdot 7H_2O$ / Iron(II) sulphate heptahydrate. I

(b) How can you chemically test the colourless liquid (1mark)

Changes white anhydrous copper(II) sulphate to blue ✓1 hydrated copper(II) sulphate I

Acc. Cobalt(II) chloride (Acc. description).

(c) Name the residue S (1mark)

Iron(III) oxide ✓1 I

13.(i) State the most effective method of preventing rusting? (1mark)

Alloying ✓1 I

(ii) Explain why galvanizing rather than tinning is a better method of prevention of rusting. (1mark)

Zinc is more reactive than tin // Tin protection can be easily scratched. ✓1 I

08

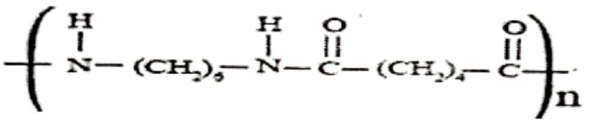
$4Fe(s) + 3O_2(g) + nH_2O \longrightarrow 2Fe_2O_3 \cdot nH_2O$ //

(ii) Write an equation for the formation of rust (1mark)

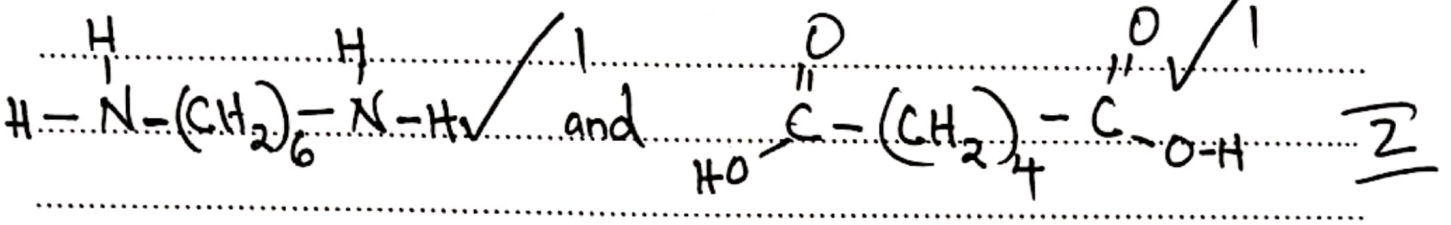
$4Fe(s) + 3O_2(g) + 4H_2O \longrightarrow 2Fe_2O_3 \cdot 2H_2O$ ✓1 I

accept n/x for ② on H_2O

14.Nylon polymer has the structure below.



(i) Determine the structure of the monomers (2marks)



✓1 ✓1 2

(ii) State the type of polymerization. (1mark)

Condensation Polymerization ✓1 (reg Condensation). I

15.(a) State and explain the function of tartaric acid in baking powder. (2marks)

The acid reacts with $NaHCO_3$ in the baking powder to produce CO_2 ✓2 making the dough to rise. ✓2 2

(b) By which process does silica gel protect electronic equipment from damage due to moisture. (1mark)

Hygroscopy ✓1 I

16.A mixture contains Lead (II) chloride, Iron fillings and Silver chloride. Describe how each of the substance can be obtained from the mixture. (3marks)

Spread the mixture on a flat surface and pass a magnet. The magnet attracts iron fillings. Add warm/hot water to the remaining mixture and stir to dissolve lead (II) chloride. Filter ✓2 to obtain lead (II) chloride filtrate and Silver chloride as a residue. Wash the residue with distilled water and dry between filter papers. Allow the filtrate to cool ✓½ to obtain $PbCl_2$. Filter and dry between filter papers 3

10

17.In the industrial extraction of lead metal, the ore is first roasted in a furnace. The solid mixture obtained is then fed into another furnace together with coke, limestone and scrap Iron. State the function of each of the following in this process.

(a) Coke (1 mark)

Reduces CO_2 to CO; main reducing agent ✓1 I

(b) Limestone (1 mark)

Undergoes thermal decomposition to form CaO ✓½ which reacts with SiO_2 ✓½ to form Calcium silicate slag or forms CO_2 ✓½ which is reduced by coke to CO ✓½ I

(c) Scrap Iron (1 mark)

Reduces excess/remaining PbS to lead ✓1 I

18.Complete the table below (3 marks)

Binary electrolyte	Cathode equation	Anode equation	Observation at the anode
Lead (II)Iodide	$Pb^{2+}_{(l)} + 2e^- \longrightarrow Pb_{(s)}$	$2I^-_{(l)} \rightarrow I_{2(g)} + 2e^-$ ✓1	Purple vapour Bubbles
Copper (II)Oxide	$Cu^{2+}_{(l)} + 2e^- \rightarrow Cu_{(s)}$ accept $2Cu^{2+}_{(l)} + 4e^- \rightarrow 2Cu_{(s)}$	$2O^{2-}_{(l)} \longrightarrow O_{2(g)} + 4e^-$ ✓1	Colourless gas which rekindles a glowing splint.

19.The table below shows atomic and ionic radii of some elements represented by letters R, S, T and U. (Not actual symbols). Study it and answer the questions that follow.

Element	Atomic radius (nm)	Ionic radius (nm)
R	0.174	0.099
S	0.203	0.133
T	0.099	0.181
U	0.136	0.065

06

(a) Classify element U as a metal or non-metal. Explain. (1 mark)

Metal ✓½ Ionic radius smaller ✓½ than atomic radius. T

(b) Which of the elements is the strongest reducing agent? (1 mark)

S ✓1

T

(c) Which element forms an anion? (1 mark)

I ✓1

I

20. In an experiment, sulphur (IV) oxide gas was bubbled into water followed by hydrogen peroxide. The resulting colourless solution gave a white precipitate when mixed with barium chloride solution. Explain these observations. (3 marks)

SO_2 dissolves in water to form ✓$H_2SO_3(aq)$ acid. Hydrogen peroxide oxidizes SO_3^{2-} in the acid ✓ to SO_4^{2-} which then reacts with $BaCl_2(aq)$ to form a ✓white precipitate of Barium sulphate. ✓ (Accept the equations) – check on mentioning of acids. 3

21. (a) When an electric current was passed through molten substances P and Q in different containers the observations below were made:

Molten **P** – Conduct electricity and is not decomposed.

Molten **Q** – Conduct electric current and a gas is formed at one of the electrodes.

(a) Suggest the type of bonding present in (1 mark)

(i) Substance P Metallic ✓½ I

(ii) Substance Q Ionic ✓½

(b) The cell convention for an electrochemical cell is shown below.

$Zn_{(s)} / Zn^{2+}_{(aq)} \quad // Pb^{2+}_{(aq)} / Pb_{(s)}$

07

(i) Name one substance that can be used as electrolyte in the above cell. (1 mark)

Zinc nitrate / Lead (II) nitrate. ✓1 or both. I

(ii) Which of the electrodes is the anode? (1mark)

Zinc / Zn(s) / Zinc rod. ✓ I

22. Radioactive polonium (Po)mass number 212 and atomic number 84 was detected in a sample of water. The water had an activity of 1000 counts per second.

(a) If the water is boiled, explain whether the activity would be affected or not. (1 mark)

No effect ✓1 Increase or decrease in temperature doesn't affect nuclear reactions. I

(b) Given that polonium resulted from Bismuth (Bi) following emission of a beta (β) particle, write a nuclear equation for the decay. (1 mark)

$^{212}_{83}Bi \longrightarrow {}^{212}_{84}Po + {}^{0}_{-1}e$ ✓1 I

(c) State one application of radioactivity in the paper industry. (1 mark)

Beta radiation is used to determine thickness of papers. I

23.A mixture of magnesium powder and copper powder was reacted with dilute hydrochloric acid. The solution was the filtered.

Name:

(a)(i) The residue (1mark)

Copper ✓1 I

(ii) The filtrate (1mark)

Magnesium Chloride solution. ✓1 I

07

(b) Write an ionic equation for the reaction that takes place (1mark)

$Mg_{(s)} + 2H^+_{(aq)} \longrightarrow Mg^{2+}_{(aq)} + H_{2(g)}$ ✓1

24.Element A has atomic mass 23 and element B has atomic mass 7 and also have 12 neutrons and 4 neutrons respectively.

(a) Write the electron arrangement of A and B (1mark)

A – 2,8,1 ½

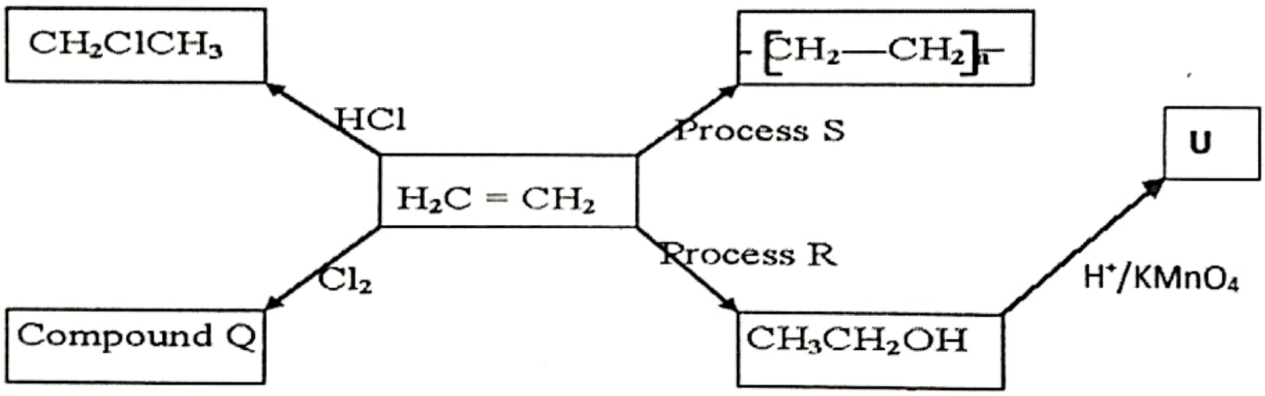
B – 2,1 ½ 1

(b)Which element has higher ionization energy? Explain (2marks)

B ✓ Has smaller/~~lotomic~~ ✓ radius hence stronger nuclear charge 2

Accept actual symbol

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



State;

(i)The conditions for process R (1mark)

- Phosphoric(v)acid
- Pressure of 60 (60-70) Any 2@ ½mk
- temperature of 300°C

Acc. Heat for ½mk
Reg. H_2SO_4 for ½mk 1

(ii)The type of the reaction represented by process S (1mark)

Addition polymerization ✓ Polymerization. 1

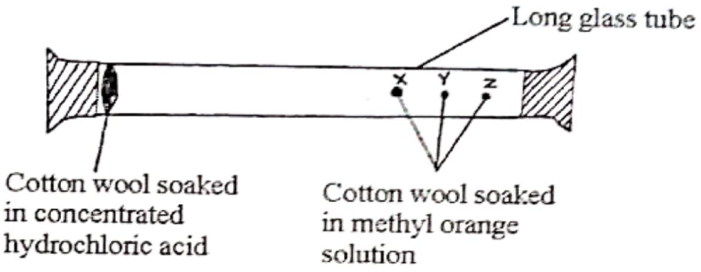
rej addition

(iii) Name of compound U (1mark)

Ethanoic acid ✓1 rej formula 1

07

26.Study the set-up below and answer the questions that follow.



After sometimes, the cotton wools X, Y and Z changed colour in turn.

(a) What were the colour changes? (1mark)

Methyl orange indicator changes to pink/red ✓1 I

(b)Which cotton wool changed colour first? (1 mark)

X ✓1 I

(c) Explain why the cotton wools did not change colour at the same time. (1 mark) fe

HCl diffuses and reaches point X, Z and Y at different times. ✓1 I

27.A sample of unknown compound gas X is shown by analysis to contain Sulphur and oxygen. The gas requires 28.3 seconds to diffuse through a small aperture into a vacuum. An identical number of oxygen molecules pass through the same aperture in 20 seconds. Determine the molecular mass of gas X.

(O =16, S = 32) (3marks)

$\frac{T_X}{T_{O_2}} = \sqrt{\frac{M_X}{M_{O_2}}}$

$\left(\frac{28.3}{20}\right)^2 = \left(\sqrt{\frac{M_X}{32}}\right)^2$ ✓1

$\Rightarrow 2.0022 = \frac{M_X}{32}$ ✓1

$M_X = 64.07$ ✓1 3

THIS IS THE LAST PRINTED PAGE

06