

**MARANDA HIGH SCHOOL**

***Kenya Certificate Of Secondary Education***

 **THE 2024 MOCK EXAMINATION**

**233/2 CHEMISTRY PAPER 2**

 **June, 2024 TIME: 2 Hrs**

**Name**: …………………………………….…….…… Admission No: ……………

**233/2 - CHEMISTRY**

Friday, 7th June, 2024

 Morning

8.00-10.00 Am

**Stream**: ……………………….. **Signature**: ……….........

**Instructions**

1. *Write your* ***name****,* ***admission number, date, stream and signature*** *in the spaces provided above.*
2. *All answers must be written in the spaces provided in the booklet.*
3. ***This paper consists of 9 printed pages with 25 questions. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing***
4. *Candidate should answer the questions in* ***English***

**­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_­**

**FOR EXAMINERS USE ONLY**

|  |  |  |
| --- | --- | --- |
| **Questions** | **Maximum Score** | **Candidate’s Score** |
| **1** | **10** |  |
| **2** | **14** |  |
| **3** | **12** |  |
| **4** | **08** |  |
| **5** | **13** |  |
| **6** | **14** |  |
| **7** | **09** |  |
| **TOTAL** | **80** |  |

1.The table below shows elements with their atomic numbers, mass numbers and their melting

points. Study it and answer the questions that follow. Letters do not represent actual symbols of

the elements

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Element  | B | C | D | E | F | G | H | I | J | K |
| Atomic number  | 7 | 8 | 19 | 15 | 2 | 9 | 6 | 16 | 12 | 11 |
| Atomic mass | 14 | 16 | 39 | 31 | 4 | 19 | 12 | 32 | 24 | 23 |
| Melting point  | - | - | 637 | 44 | -272 | -223 | vary | 113 | 669 | 980 |

(a) Select two elements with oxidation state -2 (1mark)

………………………………………………………………………………………………………………

(b) Which element represents

(i) The most powerful oxidizing agent? (1mark)

………………………………………………………………………………………………………………..

 (ii) The most powerful reducing agent? (1mark)

………………………………………………………………………………………………………………..

(c) Which element has the highest ionization energy? Explain (1mark)

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..(d) Select two elements, when reacted form a compound that conducts electricity in molten and aqueous state (1mark)

………………………………………………………………………………………………………………..

(e) Select two elements when reacted form a compound that dissolves in water to form acidic solution (1mark)

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

(f) Using dot (•) and cross (x) diagram, show the bond between **B** and **J** (2marks)

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

 (g) Explain why the melting point of **K** is higher than that of **D** (2marks)

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

2.(a) State **one** factor that should be considered when choosing a fuel for cooking (1mark)

………………………………………………………………………………………………………………

………………………………………………………………………………………………………………..

(b) The diagram below represents a set-up that was used to determine the molar heat of

combustion of propanol.

 **Thermometer**

**Metallic container**

 **Lamp**

 **Propanol**

 **Water**

During the experiment, the data given below were recorded;

Volume of water = 460cm3

Initial temperature of water = 25oC

Final temperature of water = 47.5oC

Mass of propanol + lamp before burning = 127.5g

Mass of propanol + lamp after burning =123.0g

Calculate the;

(i) Heat evolved during the experiment

(*Density of water = 1g/cm3*) specific heat capacity of water =4.2KJ/Kg/K) (2marks)

……………………….……………………………………………………………………………………….

…………………………….………………………………………………………………………………….

………………………………….…………………………………………………………………………….

(ii) Molar heat of combustion of propanol (2marks)

……….……………………………………………………………………………………………………….

…….………………………………………………………………………………………………………….

(iii) Write the thermo-chemical equation for the combustion of propanol (1mark)

……….……………………………………………………………………………………………………….

(c) On the axis, draw an energy level diagram for the combustion of propanol (2marks)

***Reaction pathway***

***Energy***

(d) Name the heat change represented by ΔH in the process represented below.

 Na(s) Na(g)  ΔH = +ve (1mark)

………………………………………………………………………………………………………………..

(e) (i) Define enthalpy of formation of a substance. (1mark)

………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..(ii) Given that

ΔH(C4 H10(g)) = -125KJmol-1‑

ΔH(CO2(g)) = -395 KJmol-1

ΔH(H2O(l)) = -289 KJmol-1

Calculate the molar heat of combustion of butane (C4H10) (3marks)

………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

……………………………………………………………………………………………………………….………………………………………………………………………………………………………………..

(f) The atomic numbers of Li and K are 3 and 19 respectively.

 Li+(g) + (aq) Li+(aq) ΔH3 = -519

 K+(g) + (aq) K+(aq) ΔH4 = -322

Study the equations above and state why ΔH3 is larger than ΔH4. (1mark)

………………………………………………………………………………………………………………...………………………………………………………………………………………………………………………………………………………………………………………………………………………………..

3.a) The scheme below represents the manufacture of a cleansing agent.

 

i) Draw the structure of **B** and state the type of cleansing agent for which it belongs.

Structure (1mark)

………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..

Type (1mark)

………………………………………………………………………………………………………………..

ii) State one disadvantage of using **B** as a cleansing agent. (1mark)

………………………………………………………………………………………………………………..

b). The list below shows the formulae of some organic compounds. Use letters T1 to T6 to answer the questions that follow.

T1 – CH3CH2CH2CH2CH3 T4 – CH3CH2CH2COOH

T2 – CH3CH2CH2COOC2H5 T5 – CH3CHCHCH3

T3 – CH3CH2CH2CH2CH2OH T6 – CH3CCCH3

I Select two compounds which:

(i) Are not hydrocarbons (1mark)

………………………………………………………………………………………………………………..

(ii) Would decolourise both bromine water and acidified potassium manganate (VII). (1mark)

………………………………………………………………………………………………………………..

(iii) Would produce hydrogen gas when reacted with potassium metal. (1mark)

………………………………………………………………………………………………………………..

II.Select a compound which would produce bubbles of a gas when reacted with sodium carbonate. (1mark)

………………………………………………………………………………………………………………

(c) (i) Identify the compound that is likely to undergo polymerization. Give a reason for answer. using two molecules show how polymerization occurs.

I. Compound (1mark)

………………………………………………………………………………………………………………..

II. Reasons (1mark)

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

III.Polymerization (1mark)

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

(ii) Name the process by which compound **T2** is formed and identify the compounds that were used to form it.

I. Process (1mark)

………………………………………………………………………………………………………………..

II.Compounds (1mark) ………………………………………………………………………………………………………………………………………………………………………………………………………………………………

4.The set up below can be used to prepare a gas without heating. This occurs when substance **M** reacts with solid **N.**

 

a) i) Complete the table below giving the names of substance **M** and solid **N** if the gases generated are hydrogen chloride and Sulphur (IV) oxide. (2 marks)

|  |  |  |
| --- | --- | --- |
|  |  Hydrogen chloride |  Sulphur (IV) oxide |
| Substance M |  |  |
| Solid N |  |  |

ii) Complete the diagram above to show how a dry sample of hydrogen chloride can be collected.

 (3marks)

iii) State and explain the observation that would be made when hydrogen chloride gas is bubbled through a solution of lead (II) nitrate. (2marks) ………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..iv) Concentrated hydrochloric acid is used for removing oxides from metal surfaces (pickling). Explain why concentrated nitric acid cannot be used for the same Purpose (1mark) ………………………………………………………………………………………………………………………………………………………………………………………………………………………………..

5. **I)** Use standard electrode potentials for elements A, B, C, D and F given below to answer the questions that follow.

|  |  |
| --- | --- |
|  | $E^{θ}$(Volts) |
| A2+(aq) + 2e− → A (s)  | −2.90 |
| B2+(aq) + 2e− → B (s)  | −2.38 |
| C+(aq) + e− → ½C2 (g) | 0.0 |
| D2+(aq) + 2e− → D (s) | +0.34 |
| ½F2 (g) + e− → F(aq) | +2.87 |

a) Identify the strongest oxidizing agent. (1 mark) ………………………………………………………………………………………………………………..b) Which **two** half-cells would produce the highest potential difference when combined? (1mark)

……………………………………………………………………………………………………………….c) Draw a labelled diagram of the electrochemical cell that would be obtained when half-cells above (b) is formed. Show the direction of the flow of electrons. (3 marks)

……………………………………………………………………………………………………………….………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

……………………………………………………………………………………………………………….………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

d) Calculate $E^{θ} value $ of the electrochemical constructed above. (2 marks)

………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..

e) Is it advisable to store a solution of a nitrate of D in a container of metal B? Explain. (2marks)

………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..**II)** During the electrolysis of aqueous copper (II) sulphate using copper electrodes, a current of 0.2 amperes was passed through the cell for 5 hours.

i)Write the ionic equation for the reaction that took place at the anode. (1 mark)

………………………………………………………………………………………………………………..ii) Determine the change in mass of the anode which occurred as a result of the electrolysis process.

(Cu = 63.5, 1 Faraday = 96500 Coulombs) (3 marks)

……………………………………………………………………………………………………………….………………………………………………………………………………………………………………............................................................................................................................................................................

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..

6.(a) Define the term solubility (1mark) ………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..

(b) (i) Complete the table below by calculating the solubility of KCl in grams per 100g of water (3marks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mass of KCl(g) | 20 | 20 | 20 | 20 | 20 | 20 |
| Volume of water (cm3) | 40.0 | 45.0 | 50.0 | 55.0 | 60.0 | 65.0 |
| Temperature at which crystals first appear (oC) | 77.0 | 56.0 | 40.0 | 26.0 | 15.0 | 8.0 |
| Solubility in g per 100g of water |  |  |  |  |  |  |

(ii) On the grid provided, Plot the graph of solubility in g/100g of water (y-axis) against temperature

(x-axis) (3marks)



(iii) From your graph determine solubility at 50oC (1mark) ……………………………………………………………………………………………………………….………………………………………………………………………………………………………………..(iv) If a saturated solution of potassium chloride is cooled from 50oC to 10oC. What mass of the crystals would be obtained? (2marks)

………………………………………………………………………………………………………………..………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

(v) Calculate the concentration of the saturated solution at 50oC. (K=39.0, Cl = 35.5) (1mark) ………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

(c) The set-up below was used to remove hardness in water.



(i) Identify the above method of removing water hardness (1mark) ………………………………………………………………………………………………………………..(ii) The above system eventually lack the ability to soften hard water. Explain how it can be reactivated. (1mark) ………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………

(iii) State **one** advantage of hard water (1mark)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………..7. The scheme below shows various reactions starting with hydrogen and nitrogen. Study it carefully and answer the questions that follow.

Step III

Catalyst

Step I

Copper (II) oxide

Hydrogen

Nitrogen

Ammonia

Salt P

Gas Y + solid Q

Nitric acid

Copper (II) nitrate

Colourless gas X **+** other products

Iodine, nitrogen oxide **+** water

Step II

Step IV

Oxygen (catalyst) water

Heat

Aqueous potassium iodide

Copper metal

Dilute sulphuric acid

i) Give **one** condition other than the use of a catalyst that would favour reaction in step I. (1 mark)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………

ii) Name the catalyst used in step I and II. (2 marks)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………

iii) Name substances P, Q, X and Y. (2 marks)

………………………………………………………………………………………………………………………………………………………………………………………………………………………………

iv) Write equations for the reactions that take place in step II. (3 marks)

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………..

………………………………………………………………………………………………………………………………………………………………………………………………………………………………..

v) Name the oxidizing agent for the reaction that takes place in step IV. (1 mark)

………………………………………………………………………………………………………………

 **THIS IS THE LAST PRINTED PAGE**