Name: …………………………………………………………………………….. Class: ………… Adm.No……………..

School: …………………………………………………………………………… Date: ………………………………………

Sign:………………………………………..

**233/2**

**CHEMISTRY**

**Paper 2**

**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 | 10 |  |
| 2 | 12 |  |
| 3 | 10 |  |
| 4 | 12 |  |
| 5 | 13 |  |
| 6 | 12 |  |
| 7 | 11 |  |
| **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. In an experiment to determine the percentage of oxygen in air, the apparatus below were set up. Study the set up and the information provided to answer the

questions that follow.

**K**

Copper turnings

100

200

300

400

500

**J**

Water

**I**

Heat

Flask **H** (500cm3)

A 500cm3 measuring cylinder **K** was filled with water and assembled for gas collection. Copper turnings were heated red hot and water was slowly passed into 500cm3 flask **H** until it reached the 500cm3 mark. A colourless gas was collected in **K**.

(i) What was the purpose of passing water into flask **H**? **(1 mark)**

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

(ii) What observations were made in the tube **I**? **(1 mark)**

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

(iii) Name one of the gases that is likely to be found in **J**. **(1 mark)**

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

(iv) What was the volume of the gas collected in the measuring cylinder at the end of the experiment? **(1 mark)**

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

(v) Calculate the percentage of oxygen in air using the above results. **(2 marks)**

**B.** Study the diagram below and answer the questions that follow.

Ice cold water

Copper (II) oxide



Colourless liquid **Y**

Heat

(a) Give ***one*** observation made in the combustion tube after some time. **(1 mark)**

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

(b) Write an equation for the formation of the colourless liquid **Y**. **(1 mark)**

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

(c) What was the aim of the above experiment as demonstrated in the combustion

tube? Explain. **(2 marks)**

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

2. Use the information below to answer the questions that follow. The letters are not the actual symbols of the elements.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Atomic No.** | **M.P0C** | **B.P0C** | **Ionic radius (nm)** |
| P | 11 | 98 | 890 | 0.095 |
| Q | 12 | 650 | 1110 | 0.065 |
| R | 13 | 660 | 2470 | 0.050 |
| S | 14 | 1410 | 2360 | 0.041 |
| T | 15 | 44.2 & 590 | 280 | 0.034 |
| U | 16 | 113 & 119 | 445 | 0.184 |
| V | 17 | -101 | -35 | 0.181 |
| W | 18 | -189 | -186 | - |

(a) (i) Write the electronic configuration of the atoms represented by letters **T** and **W**. **(1 mark)**

(ii) State the nature of the oxides of the elements represented by **Q** and **U**.  **(2 marks)**

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

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

(b) Why does the elements represented by the letters **T** and **U** have two values of melting points? **(1 mark)**

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

(c) Explain the following observations in terms of structure and bonding.

(i) There is an increase in boiling point from **P** to **R**. **(2 marks)**

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

(ii) Element **S** has a high boiling point.  **(2 marks)**

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(iii) There is a decrease in boiling points from **U** to **W**. **(2 marks)**

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

(d) (i) Compare the atomic radius of **U** and **V**. **(1 mark)**

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

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

(ii) Why is there no ionic radius for **W** reported in the table? **(1 mark)**

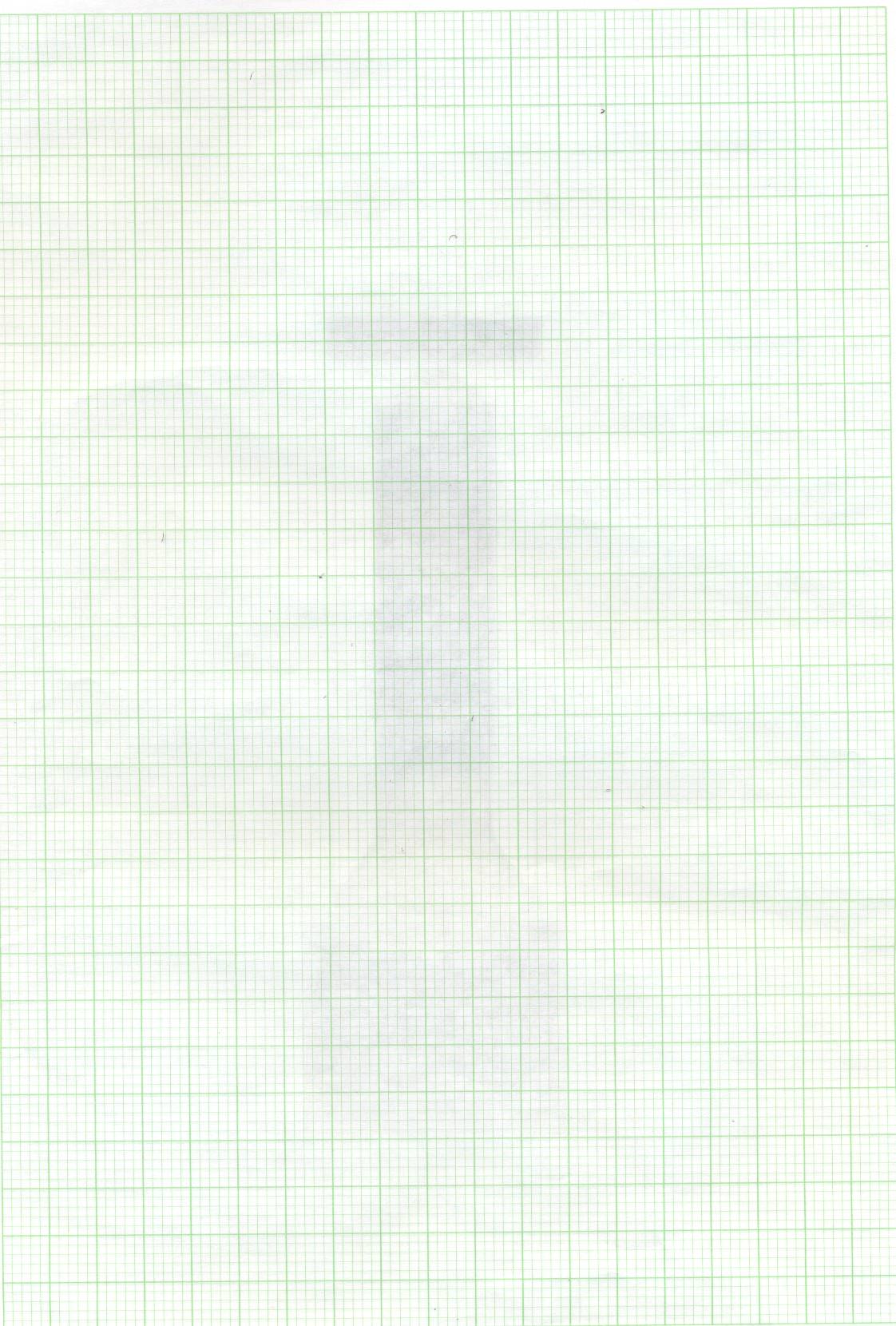
……………………………………………………………………………………………………………………………

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

3. (a) The solubilities of potassium nitrate and potassium bromide at different temperatures was determined. The following data was obtained.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Temperature 0C | | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
| Solubility g/100g H2O | KNO3 | 5 | 15 | 26 | 43 | 61 | 83 | 105 | 135 | 165 |
| KBr | 50 | 55 | 60 | 65 | 70 | 77 | 85 | 90 | 95 |

(i) Draw solubility curves for both salts on the same axis. **(3 marks)**



(ii) What was the solubility of each salt at 650C? **(1 mark)**

(iii) 100g of a saturated solution of potassium nitrate at 700C was cooled to 200C. What mass of the crystals will be crystallized? **(2 marks)**

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

Solution

**C**

Dil. HCl

Solid **A**

+

Gas **B**

Heat

Metal carbonate

A few drops of NH3(aq)

Deep blue solution **E**

Excess of

NH3(aq)

Solid **D**

(i) Write an equation for the formation of solid **A** and gas **B**. **(1 mark)**

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

(ii) Name;

Solution **C** - ………………………………………………….. **(1 mark)**

Solid **D** - ………………………………………………….. **(1 mark)**

(c) Write the formula of the complex ion in solution **E**. **(1 mark)**

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

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

**II**

**III**

NaOH

Heat



Na2CO3

**W**

NaOH

**I**



NaOH

**IV**

Na



**Q**



**V**

**Z**

**X**

HI

**R**



**VI**

H H

C C

H H

**Y**

n

(a) Name substance. **(3 marks)** X - ………………………………………………………………….

Q - ………………………………………………………………….

R - ………………………………………………………………….

(b) Write down an equation for the reaction represented by step III. **(1 mark)**

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

(c) What are the conditions and reagent required for steps?

1. **I** **(2 marks)**

Reagent - …………………………………………………………………………………..

Condition - …………………………………………………………………………………..

1. **IV (2 marks)**

Reagent - …………………………………………………………………………………..

Condition - …………………………………………………………………………………..

(b) Name the process represented by: **(4 marks)**

**I** - ……………………………………………………………………….

**II** - ……………………………………………………………………….

**IV** - ……………………………………………………………………….

**V** - ……………………………………………………………………….

5. **I.** Study the scheme below and answer the questions that follow.

Water

Colourless

gas **D**

Brown gas

Nitric (V) acid

Ammonia gas

Substance **B**

Substance**A**

**Step I**

Oxygen

Catalyst **F**

**Step II**

Oxygen

(a) Identify substances. **(3 marks)**

**A** - …………………………………………………………………..

**B** - …………………………………………………………………..

**D** - …………………………………………………………………..

(b) State the catalyst necessary for; **(2 marks)**

Step **I** - …………………………………………………………………………………………

Step **II** - …………………………………………………………………………………………

(c) Write an equation for the reaction taking place in step **II**. **(1 mark)**

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

(d) Write two balanced chemical equations for the reaction between chlorine

gas and;

(i) Hot and concentrated sodium hydroxide. **(1 mark)**

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

(ii) Dilute and cold sodium hydroxide. **(1 mark)**

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

**II.** The diagram below shows an experiment in which the Lead (II) nitrate crystals are heated.

Powdered Pb(NO3)2

Gas **Y**

Ice

Liquid **P**

1. Name; **(2 marks)**
2. Liquid **P** - ………………………………………………………………………..
3. Gas **Y** - ………………………………………………………………………..
4. Write a balanced chemical equation for the decomposition of Lead (II) nitrate. **(1 mark)**

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

1. Explain how you can distinguish between nitrogen (II) oxide and nitrogen (I) oxide.

**(2 marks)**

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

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

6. **I.** Study the standard electrode potentials given below and answer the questions that

follow.



1. Identify the strongest:
2. Reducing agent ……………………….. **(1 mark)**
3. Oxidizing agent ……………………….. **(1 mark)**

(b) Calculate the e.m.f of a cell made of G and M. **(2 marks)**

(c) Write the cell representation for the above cell in (b). **(1 mark)**

1. Draw a cell diagram for the cell in (b) above. **(2 marks)**
2. Write the cell reaction for the drawn cell diagram in (d) above. **(1 mark)**

**II**. Electrolysis of aqueous solution of metal M resulted in the deposition of 1.07g of metal upon passage of a current of 1.32 amperes for 75 minutes.

(M = 52, 1F = 96500C)

1. Calculate the quantity of electricity passed through the cell. **(1 mark)**
2. Calculate the charge on the metal ion. **(3 marks)**

7. Extraction of iron involves two main processes, smelting and refining. Below is the blast furnace which is used to smelt iron from its ore.

CO2, CO

as waste

3000C

5000C

6000C

8000C

16000C

**C**

Carbon (IV) oxide recycled

**B**

**A**

Fire brick lining

Hot air blast from stove

Slag tap

Slag

Iron

Molten iron from tap

(a) (i) What does the word smelt mean? **(1 mark)**

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

(ii) Name the reducing agent in the process. **(1 mark)**

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

1. What is the role of the hot air blast in the process? **(2 marks)**

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

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

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

(b) Write equations for the reactions that take place at the region marked A, B and C. **(3 marks)**

A - ……………………………………………………………………………………………………….

B - ……………………………………………………………………………………………………….

C - ……………………………………………………………………………………………………….

(c) What is the purpose of limestone in the extraction process? **(1 mark)**

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

1. Write equations to show how impurities are removed from the ore.

**(3 marks)**

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