Name..... Index No: .....

School Exam Number:.....Signature:.....

*Candidates should **NOT** write their Centre Name or Centre Number anywhere on this booklet*

545/2
CHEMISTRY
Paper 2
4 August 2023
2 hours

ENTEBBE JOINT EXAMINATION BUREAU

Uganda Certificate of Education

CHEMISTRY

Paper 2

2 hours

INSTRUCTIONS TO THE CANDIDATES

Section **A** *consists of 10 – structured questions. Attempt* **all** *questions in this* Section.

Answers to Section **A** *must be filled in the spaces provided.*

Section **B** *consists of* 4 *semi – structured questions. Attempt any* **two** *questions from this* Section. *Answers to this* Section *must be written in the answer pages provided overleaf.*

In both Sections, *all your working must be clearly shown.*

1 mole of any gas occupies 22,400 cm^3 at standard temperature and pressure (s.t.p.)

1 mole of any gas occupies 24,000 cm^3 *at room temperature.*

[$S = 32$, $N = 14$, $O = 16$, $C = 12$, $H = 1$]

FOR EXAMINERS' USE ONLY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL

SECTION A: (50 MARKS)

1. Chloroform is denser than water, and the two liquids are immiscible.

(a) State what is meant by the term **immiscible liquids**. *(01 mark)*

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(b) Name the

(i) suitable method that can be used to separate a mixture of chloroform and water. *(01 mark)*

.....

(ii) component of the mixture that would be collected last if the mixture was separated by the method named in (b)(i) above. *(01 mark)*

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(c) A small amount of sodium metal was added to the component in (b)(i) above in a beaker.

(i) Write equation for the reaction that took place. *(1½ marks)*

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(ii) The resultant mixture in (c)(i) above was tested with litmus paper. State what was observed. *(01 mark)*

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2. The full symbols of atoms of some elements **X** and **Y** are $^{32}_{16}X$ and $^{40}_{20}Y$ respectively.

(a) State the group and period in the Periodic Table to which ***Y*** belongs.

(i) Group. *(½ mark)*

.....

(ii) Period. *(½ mark)*

.....

(b) Write the formula of the

(i) most likely ion of ***Y***. *(01 mark)*

.....

(ii) compound that can be formed when ***X*** reacts with ***Y***. *(01 mark)*

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.....

(c) Determine the number of neutrons in the nucleus of the atom of element ***Y***. *(01 mark)*

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(d) Atoms ***Z*** and ***Y*** are isotopes. Briefly explain the statement. *(01 mark)*

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3. The reaction between magnesium metal and dilute hydrochloric acid is an example of a redox reaction, which takes place according to the following equation.

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

(a) Name the substance in the reaction that undergoes the following processes.

(i) Oxidation *(½ mark)*

.....

(ii) Reduction *(½ mark)*

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(b) Write an ionic equation to show the reaction that takes place in the processes above.

(i) oxidation *(01 mark)*

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(ii) reduction *(01 mark)*

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(c) Calculate the volume of 1M hydrochloric acid required to react with 0.48 *g* of magnesium powder. *(02 marks)*

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4. Name a reagent that can be used to distinguish between the following pairs of oxides. In each case, state what would be observed when each oxide in the pair is separately treated with the reagent you have named.

(a) SO_2 and SO_3 *(2½ marks)*

Reagent:

.....

Observation:

.....

.....

(b) CO and CO_2 *(2½ marks)*

Reagent:

.....

Observation:

.....

.....

5. Polyethene is a thermo softening plastic while rubber is a thermo setting plastic.

(a) Distinguish between **thermo softening plastic** and **thermo setting plastic.** *(02 marks)*

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(b) (i) Write an equation for the reaction leading to the formation of polyethene. *(1½ marks)*

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(ii) Give **one** use of polyethene. *(½ mark)*

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.....

(c) Natural rubber in its raw form is of little use.

(i) Name the process by which the properties of natural rubber can be improved. *(½ mark)*

.....

(ii) State how the process that you have named above is carried out. *(½ mark)*

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6. When concentrated nitric acid was warmed with sulphur in a glass beaker, a gas was evolved.

(a) (i) Name the gas that was evolved. *(½ mark)*

.....

(ii) Write equation for the reaction that took place. *(1½ marks)*

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.....

(b) The resultant solution was diluted with water and the mixture electrolysed using platinum electrodes.

(i) State what was observed at the negative electrode. *(½ mark)*

.....

(ii) Write ionic equation for the reaction that took place at the positive electrode. *(1½ marks)*

.....

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(c) Identify the relative amounts of the gaseous products formed at the negative and positive electrodes. *(01 mark)*

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7. (a) Burning sulphur in air is an example of an exothermic reaction.

(i) State what is meant by the term **exothermic reaction**. *(01 mark)*

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(ii) Write an equation to show the reaction that takes place when sulphur is burnt in air. *(01 mark)*

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(b) The molar enthalpy of combustion of sulphur is -297 $KJmol^{-1}$. When 5.0 g of sulphur was completely burnt in air, the heat produced raised the temperature of 500cm^3 of water from 25.0^0 *C* to $T_2{}^0$ *C*. Determine the final temperature of water, T_2. *(The specific heat capacity of water = 4.2$Jg^{-1}{}^0C^{-1}$, density of water = 1.0gcm^{-3} and S = 32)* *(03 marks)*

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8. Dilute sodium hydroxide solution was added to a mixture containing lead(II) nitrate and calcium nitrate dropwise until the alkali was in excess and the mixture was filtered.

(a) Name the cation present in the

(i) filtrate *(½ mark)*

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(ii) residue *(½ mark)*

.....

(b) Write an ionic equation for the reaction leading to the formation of the residue. *(1½ marks)*

.....

.....

(c) To the filtrate was added dilute nitric acid drop wise until the filtrate was just acidic. State what would be observed when the following reagents were added to the acidic filtrate:

(i) excess aqueous ammonia solution *(1½ marks)*

.....

.....

(ii) potassium iodide solution *(01 mark)*

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9. (a) Chlorine can be prepared in the laboratory by reacting concentrated hydrochloric acid and an oxide of element ***R***.

(i) Name ***R***. *(½ mark)*

.....

(ii) Write an equation for the reaction between hydrochloric acid and the oxide of element ***R***. *(1½ marks)*

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.....

(b) When excess chlorine gas was passed through Iron(II) sulphate solution and the resultant mixture treated with aqueous ammonia solution, a reddish-brown precipitate was formed.

(i) Identify the reddish-brown precipitate. *(½ mark)*

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(ii) Write an ionic equation for the reaction leading to the formation of the reddish-brown precipitate. *(1½ marks)*

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(iii) Explain what happened when chorine gas was passed over a solution of Iron(II) sulphate. *(01 mark)*

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10. A compound ***Q*** *(Rmm = 120)* contains 20.0% Magnesium, 26.7% Sulphur and the rest being Oxygen.

(a) (i) Calculate the empirical formula of ***Q***. *(02 marks)*

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(ii) Determine the molecular formula of **Q**. *(01 mark)*

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(b) Compound ***Q*** was dissolved in water and the resultant solution treated as follows:

(i) To the first part of the solution was added a few drops of sodium carbonate solution. Write an ionic equation for the reaction that took place. *(1½ marks)*

.....

.....

(ii) The second part was treated with a few drops of soap solution. State what was observed. *(½ mark)*

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SECTION B: 30 MARKS

Attempt **two** *questions from this* Section

11. (a) Describe how a pure and dry sample of carbon dioxide gas can be prepared in the laboratory. *(No diagram required)* *(07 marks)*

(b) Explain why ethanoic is not used to prepare carbon dioxide in the laboratory. *(03 marks)*

(c) A lighted candle was lowered into a gas jar containing carbon dioxide. Explain what was observed. *(1½ marks)*

(d) 10.0 g of Zinc carbonate was strongly heated in a combustion tube until there was no further change.

(i) Write an equation for the reaction. *(1½ marks)*

(ii) Calculate the mass of the residue formed. *(02 marks)*
(Zn = 65, C = 12, O = 16)

12. Iron is manufactured by passing a blast of hot air through a mixture of Iron ore, coke and calcium carbonate in the blast furnace.

(a) Explain the role of the following substances during the extraction of iron

(i) hot air *(03 marks)*
(ii) coke *(02 marks)*
(iii) calcium carbonate *(04 marks)*

(b) Write an equation for the reaction that takes place between Iron and
(i) steam *(1½ marks)*
(ii) chlorine *(1½ marks)*

(c) Dilute sodium hydroxide solution was added to Iron(II) nitrate solution and the mixture allowed to stand.
(i) State what was observed. *(1½ marks)*
(ii) Write equation for the reaction that took place. *(1½ marks)*

13. (a) Using equations, describe how nitric acid is prepared on a large scale from ammonia. *(06 marks)*

(b) (i) Write equation for the reaction between moderately-concentrated Nitric acid and Copper. *(1½ marks)*

(ii) State **one** use of nitric acid other than manufacture of fertilisers. *(½ mark)*

(c) Nitric acid reacts with most metals to form nitrates. Write equations to show the action of heat on

(i) sodium nitrate. *(1½ marks)*

(ii) silver nitrate. *(1½ marks)*

(d) Copper (II) nitrate decomposes when heated strongly according to the following equation: *[N = 14, O = 16, Cu = 64, 1 mole of gas occupies 22.4dm³ at s.t.p]*

$$2\,Cu(NO_3)_{2\,(s)} \longrightarrow 2\,CuO_{(s)} + 4NO_{2\,(g)} + O_{2\,(g)}$$

Calculate the mass of copper(II) nitrate that would produce 448.0cm³ of Oxygen measured at standard temperature and pressure (s.t.p) *(4½ marks)*

14. (a) Excess Zinc oxide was added to dilute sulphuric acid.

(i) State what was observed. *(1½ marks)*

(ii) Write an equation for the reaction that took place. *(1½ marks)*

(iii) Briefly describe how crystals of Zinc sulphate can be obtained from the reaction mixture in (a)(i) above. *(3½ marks)*

(b) To a mixture containing Zinc sulphate and aluminium sulphate was added aqueous ammonia dropwise until the alkali was in excess and the resultant mixture was filtered. Name the cation present in the

(i) filtrate *(½ mark)*

(ii) residue *(½ mark)*

(c) (i) Write equation for the reaction leading to the formation of the residue. *(1½ marks)*

(ii) Write the formula of the species in the filtrate. *(01 mark)*

(d) To the filtrate was added dilute nitric acid drop wise until the filtrate was just acidic. State what was observed. *(1½ marks)*

(e) Barium chloride solution was added to the acidic filtrate in (d). Explain what was observed. *(03 marks)*

END