

NAME: _____

P525/1

CHEMISTRY
PAPER 1
NOV. 2024
2 HRS 45 MINS



S.5
PCB/SM
BCM/ICT
PCM/ICT
BCA/SM
BCG/SM & FCM

FINAL MARKS



Tick your
subject
Combination

NYONDO SECONDARY SCHOOL

UGANDA ADVANCED CERTIFICATE OF EDUCATION

S5 PROMOTIONAL EXAMINATIONS 2024

CHEMISTRY PAPER 1

DURATION: 2 Hours 45 minutes

INSTRUCTIONS TO CANDIDATES:

- ❖ This paper consists of two sections A and B, Section A is compulsory and attempt only six questions from Section B. Any additional question(s) answered will **not** be marked.
- ❖ Incorrect symbols, formulae and spellings of especially technical terms will lead to loss of marks.
- ❖ The **periodic table**, with **relative atomic masses**, is **attached at the end** of the paper.
- ❖ Illustrate your answers with **equations where applicable**, **Non-programmable scientific calculators** may be used

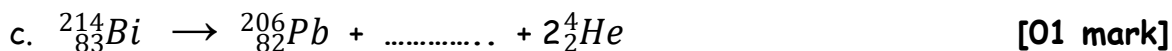
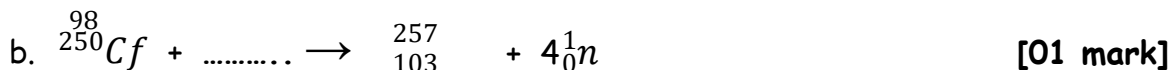
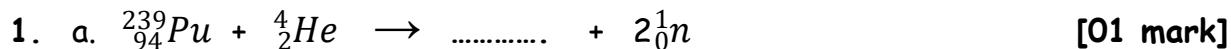
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL

NYONDO SECONDARY SCHOOL

CHEMISTRY DEPARTMENT@2024



SECTION A (46 Marks)



- d. 5.00g of thorium was left to decay. Calculate the mass of thorium that remained after 2.500×10^{10} years. (The half-life of thorium is 1.400×10^{10}) [03 marks]

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2. (a) Define diagonal relationship. (01 mark)

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- (i) State two properties in which beryllium resembles Aluminium. (02 marks)

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- (ii) State two reasons why beryllium resembles Aluminium. (01 mark)

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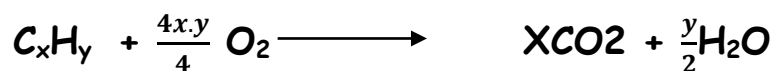
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(iii) State any other pair of elements on a periodic table that exhibit diagonal relationship. (01 mark)

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3. A hydrocarbon Q, with molecular formula C_xH_y reacts with oxygen according to the following equation.



When 20cm^3 of Q was exploded in 200cm^3 of an excess amount of oxygen, it burnt completely with a sooty flame. The volume of the residual gas after cooling to room temperature was 160cm^3 . When aqueous potassium hydroxide was added, the gas that finally remained was 30cm^3 .

a. Determine the molecular formula of Q. [02½ marks]

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b. When Q was treated with bromine in the presence of anhydrous iron (III) chloride, the bromine was decolorized.

i. Identify Q. [01 mark]

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ii. Write the mechanism for the reaction that took place between

bromine and compound Q.

[03½ marks]

4. The energy changes that takes place during the formation of barium chloride are shown in the table below:

Process:	ΔH^θ /Kj mol ⁻¹
$\text{Ba(s)} \xrightarrow{\text{A}} \text{Ba(g)}$	+176.00
$\text{Ba(g)} \xrightarrow{\text{B}} \text{Ba}^{2+}(\text{g})$	+1480.00
$\text{Cl}_2(\text{g}) \xrightarrow{\text{C}} 2\text{Cl}(\text{g})$	+242.00
$\text{Cl}(\text{g}) + e^- \xrightarrow{\text{D}} \text{Cl}^-(\text{g})$	-364.00
$\text{Ba}^{2+}(\text{g}) + 2\text{Cl}^-(\text{g}) \xrightarrow{\text{E}} \text{BaCl}_2(\text{s})$	-2018.00

- a. Name the energy changes for reaction processes: [02½ marks]

A:

B:

C:

D:

E:

- b. Calculate the standard enthalpy of formation of barium chloride. [02½marks]

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5. Write equation for the reaction between aqueous sodium hydroxide and: -

a. Aluminium oxide. [01½ marks]

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b. Beryllium oxide. [01½ marks]

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c. Tin (II) oxide. [01½ marks]

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6. a. Define the term freezing point constant of a substance. [01½ marks]

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b. A solution containing 1.54g of naphthalene, C₁₀H₈ in 18.0g of camphor freezes at 148.3°C. Calculate the freezing point constant of camphor. (K_f for

camphor is 175°C)

[03 marks]

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7. 2-bromobutane was treated with sodium ethoxide in ethanol and the mixture heated to form compound T.

a. Write the equation and suggest a mechanism for the reaction between 2-bromobutane and ethoxide ion. [02½ marks]

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b. The compound T formed in (a) can be synthesized from an alcohol. Write the equation and include a mechanism for the reaction leading to the formation of T from an alcohol. [02½ marks]

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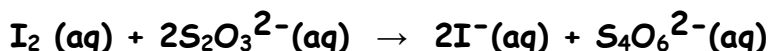
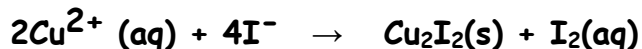
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8. 0.89g of a copper ore was leached with dilute Sulphuric acid and the

resultant solution diluted to 250cm^3 . To 30cm^3 of this solution was added 10% potassium iodide solution. The liberated iodine required 23.5cm^3 of 0.05M sodium thiosulphate solution for complete reaction. Calculate the percentage of copper in the ore. The reactions taking place are: -[04½ marks]



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9. Draw the structure and name the shape of the following anions. In each case, state the oxidation state of the chlorine atom. [04½ marks]

Anion	Structure	Shape	Oxidation state of chlorine
ClO_2^{-}			

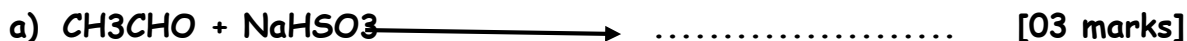
ClO_3^-			
ClO_4^-			

SECTION B (54 Marks)

Attempt ANY SIX Questions from this Section.

Additional Questions Shall not be marked.

10. Complete the following equations of reactions and in each case outline a mechanism for the reaction.



Mechanism:

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Mechanism:

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Mechanism:

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11. (a) What is meant by the following terms

(i) Hydration energy (01 mark)

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(ii) Lattice energy (01 mark)

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(iii) Enthalpy of solution (01 mark)

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(b) State two factors which can affect the magnitude of lattice energy. (01 marks)

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(c) The lattice hydration energies of salts RX and TX are given in the table below.

Salt	Lattice energy(kJmol ⁻¹)	Hydration energy(kJmol ⁻¹)
RX	880	860
TX	790	800

Calculate the enthalpy of solution of each salt.

(i) RX (02 marks)

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(ii) TX (02 marks)

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(iii) Which ¹one of the two salts is more soluble in water at a given temperature? (0 $\frac{1}{2}$ mark)

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(iv) Give a reason for your answer in c (iii) above (0 $\frac{1}{2}$ mark)

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c. Calculate the enthalpy of solution of calcium chloride. [02 $\frac{1}{2}$ marks]

[Enthalpy of hydration of Ca²⁺ and Cl⁻ are -1689 and -383.7 kJmol⁻¹ respectively]

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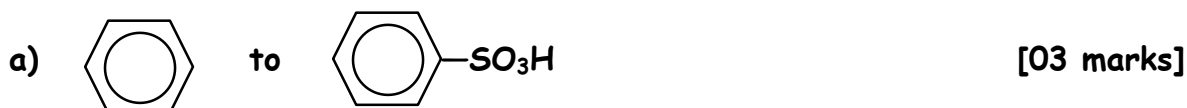
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d. Comment on the solubility of calcium chloride. [01 mark]

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12. Write a mechanism to show how each of the following conversion can be effected.



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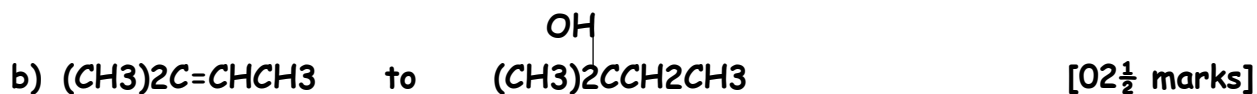
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c) $\text{CH}_3\text{C}\equiv\text{CH}$ to CH_3COCH_3 [03½ marks]

13. (a) The table below shows the melting points of period 3 elements of the Periodic Table.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Melting point(K)	370.	923	933.	1687	317.	388.2	171.5	83.6

Explain why:

(i) Magnesium has a higher melting point than sodium. (03 marks)

(ii) Silicon has the highest melting point (03 marks)

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(iii) Sulphur has a higher melting point than phosphorus. (03 marks)

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14. Potassium manganate (VII) is not used a primary standard in volumetric analysis and has to be standardized.

a. Explain why potassium manganate (VII) is not used as a primary standard. [01 mark]

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b. Explain why hydrochloric acid is not usually used to acidify solution of potassium manganate(VII) during volumetric analysis. [01 mark]

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c. Acidified potassium manganate (VII) reacts with ethane-1,2-dioic acid.

i. the half -reaction equations for the reaction. [02 mark]

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ii. the overall equation for the reaction. [01½ mark]

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d. 20.00cm^3 of a 0.01M manganate(VII) ion solution required exactly 16.55cm^3 of a solution containing 5.10g per liter of an ethanedioate,

$(\text{COO}^-\text{X}^+)_2 \cdot 2\text{H}_2\text{O}$. Determine the atomic mass of element X. [03½ marks]

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15. During the extraction of aluminum from bauxite, $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$, the ore is first purified.

a) Name two major impurities in the ore. [01 mark]

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b) Write equations to show how the ore is purified. [06 marks]

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c) Describe briefly how Aluminium can be obtained after the ore has been purified. [02 marks]

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16. Name a reagent that can be used to distinguish between each of the following pairs of compounds/ ions. In each case state what would be observed if each member of the pair is treated with the reagent you have named.

a) $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH}$ and $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$

[03 marks]

i. Reagent:

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ii. Observation:

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b) -Cl and $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$.

[03 marks]

i. Reagent:

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Observation:

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c) Ca^{2+} and Ba^{2+}

[03 marks]

ii. Reagent:

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iii. Observation:

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17. a. A compound W contains 37.3% manganese, 19.1% nitrogen, the rest being oxygen. Calculate the empirical formula of compound W. [02½ marks]

[Mn=54.9, N=14, O=16]

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b. 10.0g of compound W in 1000g of water lowered the freezing point of water by 0.127°C. Determine the molecular formula of W. [02 marks]

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c. When a few drops of concentrated nitric acid were added to a solution of W, followed by a little lead (IV) oxide and the mixture boiled, a purple coloured solution was formed. Write:

- i. formula and name of W. [01 mark]
Formula:

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Name:

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ii. Equation for the reaction leading to the formation of the purple coloured solution. [01½ marks]

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e. A few drops of aqueous sodium carbonate was added to a solution of W.

- i. State was observed. [01 mark]

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ii. Write an equation for the reaction that took place. [01½ marks]

PERIODIC TABLE

1	2											3	4	5	6	7	8
1 H 1.0																1 H 1.0	2 He 4.0
3 Li 6.9	4 Be 9.0											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
11 Na 23.0	12 Mg 24.3											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.4	18 Ar 40.0
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc 98.9	44 Ru 101	45 Rh 103	46 Pd 103	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tl 204	82 Pb 207	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)															
			57 La 139	58 Ce 140	59 Fr 141	60 Nd 144	61 Pm (145)	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 162	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
			89 Ac (227)	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf 251	99 Ea (254)	100 Fm (257)	101 Mv (256)	102 No (254)	103 Lw 260

1. **H – indicates Atomic number**
2. **H – indicates relative Atomic mass 1.0**

END