Name: _____Centre/index No____

Signature: _____

P525/1

CHEMISTRY

Paper 1

Aug. 2023

2 ¾ hours

RUKUNGIRI DISTRICT SECONDARY SCHOOLS'

JOINT MOCK EXAMINATIONS 2023

Uganda Advanced Certificate of Education

Chemistry

Paper 1

2 Hours 45 Minutes.

INSTRUCTIONS TO CANDIDATES.

- *Answer all questions in section A and any **six** questions in section **B**.*
- *All questions must be answered in the spaces provided*
- *The periodic table, with relative atomic masses, is attached at the end of the paper.*
- *Non-programmable scientific electronic calculators may be used.*
- *Illustrate your answers with equations where applicable.*
- *Molar gas constant, $R = 8.31 JK^{-1}mol^{-1}$*
- *Molar volume of gas at s.t.p is 22.4 litres.*

For Examiner's Only																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

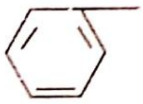
SECTION A (46 MARKS)

*Answer **all** questions in this section.*

1. Complete the following reaction equations and write I.U.P.A.C names of the main product in each case.

(a)  $+ H_2 \xrightarrow{Pd}$ .....(01mark)

Name of product .....(½ mark)

(b)  $CH_2MgCl \xrightarrow{H_2O/\ H^+_{(aq)}}$ .....(01mark)

Name of product .....(½ mark)

$CH_3C(CH_3) = CHCH_3 \xrightarrow{MnO_{4(aq)}^-/\ OH_{(aq)}^-}$ .....(01mark)

Name of product.....(0½ mark)

2. (a) When a radioactive isotope was left to stand, it decayed by $^3/_4$ of the original mass in 48 days. Calculate the half life of the radioactive isotope. (02marks)

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(b)Complete the following nuclear reaction. (03marks)

(i) $^{233}_{91}Pa \xrightarrow{\beta}$

(ii) $^1_1H \longrightarrow$ ..... $+ \ ^1_0n$

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(iii) ..... $\longrightarrow \ ^{234}_{90}Th + \propto + \gamma$

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(c) What is meant by stability of a nucleus. (01mark)

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3. State the conditions and equations for the reaction between water and

(a) Magnesium. (03 ½ marks)

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(b) Chromium. (02marks)

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4. Ozonolysis and hydrolysis of alkenes gave products which on analysis were found to have the following structures.

(a) A $\xrightarrow[Zn/H_2O,\ \text{heat}]{O_3}$ $CH_3CH_2\overset{O}{\overset{\|}{C}}CH_3 + CH_3CHO$

(i) Write structural formula of A (01mark)

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(ii) Name A (01mark)

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(b) B $\xrightarrow[Zn/H_2O,\ \text{heat}]{O_3}$ $CH_3CH_2\overset{O}{\overset{\|}{C}}CH_3 + CH_3\overset{O}{\overset{\|}{C}}CH_3$

(i) Write structural formula of B (01mark)

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(ii) Name B (01mark)

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5. (a) When 142cm^3 of a hydrocarbon P of molecular mass 58 was exploded with oxygen and cooled to room temperature, the volume of the residue gas was 694cm^3. After addition of concentrated potassium hydroxide, the volume decreased to 126cm^3. Determine the molecular formular of *P*. (04marks)

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(b) Name compound P and state the possible isomers of P. (02marks)

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6. (a) Aluminium powder was added to sodium hydroxide solution.

(i) State what was observed. (01mark)

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(ii) Write equation for the reaction that took place. (01 ½ marks)

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(b)Sodium carbonate was added to a solution of aluminium chloride.

(i) State what was observed. (01mark)

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(ii) Write equation for the reaction that took place. (01 ½ marks)

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7. Name one reagent that can be used to distinguish between each of the following pairs of compounds. In each case, state what is observed if the reagent is separately treated with each member of the pair.

(a) CH_3CH_2COOH and $HCOOH$ (03marks)

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(b) $CH_3CH_2CH_2OH$ and $(CH_3)_3COH$. (03marks)

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8. (a)Methane reacts with steam according to the following equation:

$$CH_{4(g)} + 2H_2O_{(g)} \rightleftharpoons CO_{2(g)} + 4H_{2(g)}$$

The enthalpies are -76, -242 and $-394 KJmol^{-1}$ respectively. Calculate the enthalpy change for the backward reaction. (04marks)

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(b)What is meant by the term enthalpy of formation? (01mark)

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9. Aluminium in group three of the periodic table shows some similarities with beryllium in group two of the periodic table.

(a) State two chemical properties in which aluminium and beryllium show similarities. (02marks)

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(b) Give a reason why aluminium shows some similarities in properties with beryllium. (01marks)

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SECTION (54MARKS)

Answer any six questions from this section.

10. (a)(i) What is meant by the term soap as used in organic chemistry? (01mark)

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(ii)Name two sources of animal fat used in manufacture of soap.

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(b)Discuss the cleansing action of soap. (03marks)

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(c) A sample of soap was prepared from 12g of a vegetable oil containing an ester of hexadecanoic acid ($C_{15}H_{31}COOH$). Calculate the mass of soap formed. (04marks)

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11. (a)(i) Write electronic configuration of iron. (½ mark)

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(ii) State the most oxidation state of iron. (½ mark)

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(b)Iron(III) chloride is an important reagent in distinguishing different classes of organic compounds. Sate;

(i) the classes. (01mark)

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(ii) what is observed with the above classes. (02marks)

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(c) State what is observed and write equation for the reaction between;

(i) a solution of iron(II) ions and concentrated nitric acid and warm the mixture. (02marks)

observation

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equation

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(ii) sulphur dioxide gas and a solution of iron(III) ions . (02marks)

observation

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equation

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12. (a) (i) Sketch a graph of molar conductivity against square root of concentration. (02marks)

(ii)Explain the shape of your sketch graph in a(i). (03marks)

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(b)(i)What is meant by the term electrolytic conductivity? (01mark)

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(ii)A conductivity cell with resistance of 1.16Ω contains potassium chloride solution of conductivity $1.29\Omega^{-1}m^{-1}$. The second electrolyte in the same cell was found to have resistance of 15Ω. Calculate the conductivity of the second electrolyte. (03marks)

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13. (a)(i)Describe the extraction of nitric acid from catalytic oxidation of ammonia. (05marks

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(ii)Give one use of nitric acid. (½ mark)

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(b)Concentrated nitric acid is 50% weight per weight and has a density of $1.42gcm^{-3}$. Calculate the molarity of concentrated nitric acid. (02marks)

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(c)Write an equation for the reaction between ammonia and boron trichloride. (1 ½ marks)

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14. Complete the following equation and in each case, write the accepted mechanism for the reaction.

(a) $CH_3CH_2\overset{O}{\overset{\|}{C}}CH_3 + NaHSO_3 \longrightarrow$ .....

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(b) $CH_3COCl + CH_3CH_2OH \xrightarrow{\text{Pyridine}}$ .....

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(c) $CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2OH \xrightarrow[360^oC]{\text{conc. } H_3PO_4}$ .....

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15. (a) What is meant by the term order of reaction? (02marks)

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(b) Various concentration of A and B were reacted at constant temperature. The table below shows the initial concentration of A and B and their initial rates for the reaction

Experiment	[A] ($moldm^{-3}$)	[B]($moldm^{-3}$)	initial rate ($moldm^{-3}s^{-1}$)
1	0.8	0.4	$5.6x10^{-3}$
2	0.4	0.4	$1.4x10^{-3}$
3	0.2	0.2	$3.5x10^{-4}$

(i) State the order of reaction with respect to A and B. (02marks)

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(ii) Give reasons for your answer in b(i) above. (02marks)

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(iii) Determine the overall order of reaction. (01mark)

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(iv) Calculate the value of the rate constant for the reaction. (02marks)

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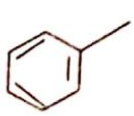
16. Write equations to show how the following compounds can be synthesized.

(a)  from  (03marks)

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(b) $CH_3CH_2NH_2$ from CH_3CHO (03marks)

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(c)  from $CH_3CH = CH_2$. (03marks)

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17. (a)(i) Write equation for the hydrolysis of sodium methenoate in aqueous solution. (01mark)

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(ii) Write an expression for the hydrolysis constant, K_h of sodium methanoate. (01mark)

(b)The pH of a 0.1M aqueous sodium ethanoate solution is 8.85. calculate the hydrolysis constant of the solution. ($K_w = 1x10^{-14}\ mol^2dm^{-6}$) (04marks)

(c) The solubility of strontium hydroxide is 0.524g per 100cm^3 of water at 20°C. Calculate the solubility product of strontium hydroxide at 20°C. (03marks)

END

THE 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 65.7	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 106	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 Pr 141	60 Nd 144	61 Pm (145)	62 Sm 152	63 Sm 150	64 Eu 152	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 Es (254)	100 Fm (257)	101 Mv (256)	102 No (254)	103 Lw

1. $\frac{1}{H}$ ← indicates Atomic number.

2. $\frac{H}{1.0}$ ← indicates relative Atomic mass.