Name: _____ Centre/index No____

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P525/1

CHEMISTRY

Paper 1

Aug. 2022

2 ¾ hours

RUKUNGIRI DISTRICT SECONDARY SCHOOLS'

JOINT MOCK EXAMINATIONS 2022

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 from this section.

1. (a) Define a transition element. (01marks)

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(b)Explain two reasons why transition elements form complexes. (02marks)

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(c)Name the following complexes.

(i) $[Fe\ OH(H_2O)_5]^{2+}$ (01mark)

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(ii) $Cr\ (H_2O)_6\ Cl_3$ (01mark)

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(iii) $K_4Fe(CN)_6$ (01marks)

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2. (a) The activity of Bismuth was reduced by ¾ in 40 minutes.
Determine its halflife. (02marks)

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(b) Complete the following nuclear equations.

(i) $^{1}_{1}H \longrightarrow$ ..... $+ {}^{1}_{0}n$ (01mark)

(ii) $^{7}_{3}Li$ + ... $\longrightarrow 2\alpha$ (01mark)

(c)Give one application of radioactivity. (½ marks)

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3. Complete the following equations and in each case state the name of the major product.

(a) $CH_2=CHCH_2OH \xrightarrow{Mn\,O_4^- / \bar{O}H}$ .....

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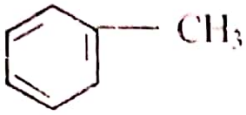
(b)  $\xrightarrow{CrO_2Cl_2}$ .....

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(c) $CH_3CH_2CO_2H + CH_3CH_2OH \xrightarrow[\text{heat}]{\text{con. } H_2SO_4}$ .....

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4. (a) Name the reagent(s) that can be used to distinguish between the nitrate ion and nitrite ion. (01mark)

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(b)State what would be observed if a solution of the above ions is treated separately with the reagent (s) you have named in (a) above. (02marks)

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(c) Draw the structure and name the shape of the following ions.

ion	Structure	shape
NO_3^-		
NO_2^-		

5. (a) Write electronic configuration of iron. (01mark)

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(b)Iron(III) chloride was dissolved in water and solution tested with litmus paper. State what was observed and explain your answer. (03marks)

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8. Complete the following equations and in each case, write an accepted mechanism for the reaction.

(a) $CH_3\overset{O}{\overset{\|}{C}}H + NaHSO_3 \longrightarrow$ ..... (03marks)

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(b) $CH_3\underset{Cl}{CH}\underset{Cl}{CH}CH_3 \xrightarrow{CH_3CH_2\overset{-}{O}\overset{+}{Na}/CH_3CH_2OH}$ (03marks)

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9. The standard electrode potentials of two half cells are given in the table below.

Half cell	ϵ^{θ} (v)
$H^+(aq) / H_2(g)$	0.00
$Cd(s) / Cd^{2+}(aq)$	0.40

(a) Write the cell notation for the cell formed by combining the two half cells. (01mark)

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(b) Write ionic equation for the ;

(i) reaction at cathode. (01mark)

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(ii) reaction at anode. (01mark)

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(iii) Overall cell reaction. (01mark)

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(c) Calculate the emf of the cell. (01mark)

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SECTION B (54 MARKS)

*Answer any **six** questions from this section.*

10. (a)(i) What is meant by the term thermosoftening plastics? (01mark)

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(ii)Name two thermosoftening plastics. (01mark)

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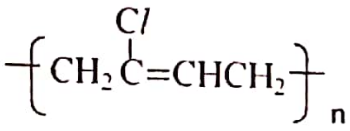
(b) The structural formula of the polymer, synthetic rubber is:



(i) Write the structural formula and name of monomer. (02marks)

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(ii) State the type of polymerization that occur in synthetic rubber. (01mark)

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(iii) State one disadvantage of synthetic polymers. (01mark)

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(c) A sample of soap was produced from 20g of vegetable oil containing an ester of heptadecanoic acid ($C_{16}H_{33}COOH$) and concentrated potassium hydroxide.

Calculate the mass of soap formed. (03marks)

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11. State what would be observed and write equation for the reaction that would take place if;

(a) tin(II) chloride is added to acidified potassium manganate(VI). (02marks)

(b) Ethene was added to the solution of bromine in tetrachloromethane. (02marks)

(c)excess hydrogen peroxide was added to acidified potassium dichromate(VII) (02 ½ marks)

(d)oxalic acid is added to acidified potassium manganate(VII) and the mixture heated. (02 ½ marks)

12. (a) Define the term enthalpy of formation. (03marks)

(b)The enthalpies of formation of methane, water and carbondioxide are -76, -242 and -394 $Kgmol^{-1}$ respectively. Calculate the enthalpy change for the forward reaction of this equation;

$CH_4(g) + 2H_2O(g) \rightleftharpoons CO_2(g) + 4H_2(g)$ (03marks)

(c) Carbondioxide burns in oxygen according to the following equation

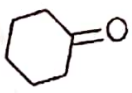
$2CO(g) + O_2(g) \longrightarrow 2CO_2(g)$

Calculate the ethalpy of combustion of carbondioxide given that the heats of formation of carbonmonoxide and carbondioxide are $^{-}108\ KJmol^{-1}$ and $^{-}393\ KJmol^{-1}$ respectively. (03marks)

(d) Define the term enthalpy of combustion. (01mark)

13. Using equations. show how the following compounds can be synthesized.

(a) $CH_3CH_2\ CH_2NH_2$ from ethanol. (03 ½ marks)

(b)  from  (02marks)

(c)  NH_2 from benzoic acid (03 ½ marks)

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14. (a) What is meant by the term buffer solution? (03marks)

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(b) A 0.1M aqueous methanoic acid solution was titrated with a 0.1M sodium hydroxide solution until the acid was exactly halfway neutralized. Calculate the pH of the resultant solution. ($Ka = 1.6 \times 10^{-4} moldm^{-3}$) (04marks)

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(c) A few drops of dilute hydrochloric acid was added to the resultant solution in (b) state what happened to the pH of the solution and explain your answer. (02marks)

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15. (a) What is meant by the term ionization energy? (02marks)

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(b)The table below shows the ionization energies (I.E) in $KJmol^{-1}$ of four elements A, B, C and D.

Element	1st I.E	2nd I.E	3rd I.E	4th I.E
A	500	4600	6900	9500
B	740	1500	7700	10500
C	900	1800	14800	21000
D	589	1800	2700	11600

(i) State the two elements which belong to the same group in the periodic table. Identify the group and give a reason for your answer. (02 ½ marks)

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(ii) Which one of these elements is most likely to form an ion with a charge of positive one. Give a reason for your answer. (02marks)

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(iii) Write an equation for the reaction between the chloride of D and water.

(01 ½ marks)

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(c)State any two factors that affect ionization energy. (02marks)

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16. (a) Define the term empirical formula. (01mark)

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(b) 1.86g of compound Y contains carbon, hydrogen and nitrogen only.
Y on combustion liberated 5.28g of carbondioxide gas and 224cm^3 of nitrogen gas at s.t.p.

(i) Determine the empirical formula of Y. (03marks)

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(ii) When vapourised, 0.2g of Y occupied 81cm^3 at 184.1°C and 101.325 Kpa.
Determine the molecular formula of Y. (03marks)

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(c)Y burns with a sooty flame and the pH of its aqueous solution is greater than 7.

Write the molecular structure of Y. (01mark)

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(d)Y was reacted with sodium nitrite in the presence of hydrochloric acid at 5°C.

Write equation for the reaction that took place. (01mark)

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17. (a) State three conditions for the manufacture of sulphuric acid. (03marks)

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(b)Write equation to show how sulphuric acid is manufactured from sulphurdioxide gas by contact process. (03marks)

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(c)Explain why in the manufacture of sulphuric acid, sulphurdioxide is not dissolved in water but in another suitable solvent. (01 ½ marks)

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(d)Write equation for the reaction when sulphurdioxide gas is bubbled through an aqueous solution of iron(III) chloride. (01 ½ marks)

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END

THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1																1.0 H 1	4.0 He 2
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Rn 86
223 Fr 87	226 Ra 88	227 Ac 89															

139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103