Name……. signature…..……

P525/2
CHEMISTRY
PAPER 2
2 ½ HOURS

Apex Examination Council

UGANDA ADVANCED CERTIFICATE OF EDUCATION

PRE REGISTRATION EXAMINATIONS 2025

SENIOR SIX CHEMISTRY

PAPER 2

2 HOURS 30 MINUTES

INSTRUCTIONS TO CANDIDATES:

- Attempt **five** questions including **three** questions from section A and **two** questions from section B.
- Each question must be answered on separate answer sheets.
- Where required use the following data;

  Molar gas constant R = 8.314J $mol^{-1}K^{-1}$

  C = 12 O = 16 H = 1 Pb = 207

SECTION A
Answer any three questions from this section

1. The mass spectrometer can be used to determine the relative atomic mass of elements consisting of various isotopes.

a) What is meant by the following terms: (@01 mark)
(i) Relative intensities.
(ii) Relative abundance.
(iii) Relative atomic mass.

b) Briefly describe how the relative atomic mass of mass metal which consists of three isotopes can be determined using a mass spectrometer.[Diagram not required] (06 marks)

c) The relative atomic mass of magnesium with isotopes $^{24}_{12}Mg$, $^{25}_{12}Mg$ & $^{26}_{12}Mg$ is 24.3.If the percentage abundance of $^{25}_{12}Mg$ & $^{26}_{12}Mg$ are equal.

(i) Calculate the percentage abundance of each isotope of magnesium. (01½ marks)

(ii) Sketch the mass spectrum of magnesium. (02 marks)

d) The table below shows the results of radioactive decay of a radioactive isotope of magnesium $^{26}_{12}Mg$.Use the data to plot a graph of log(mass) against time. (04 marks)

Mass of $^{26}_{12}Mg$(g)	18.7	14.6	11.3	8.8	6.9	5.4
Time (s)	300	600	900	1,200	1,500	1,800

e) Using the graph plotted in (d) above determine the:

(i) Order of radioactive decay of $^{26}_{12}Mg$. (01 mark)

(ii) Rate constant and hence half-life of $^{26}_{12}Mg$. (01½ marks)

(iii) Original mass of $^{26}_{12}Mg$. (01 mark)

2 (a) Write the formulae of the chlorides of group (IV) elements. (03½ marks)

(b) State the condition (s) and write equation for the reaction to show the preparation of:

(i) Chloride of carbon. (02½ marks)

(ii) Chloride of silicon (02½ marks)

(iii) Chlorides of lead (05 marks)

c) Describe the reactions of chlorides of group elements with water. (06½ marks)

3. (a) **What is meant by the term ideal solution?** (03 marks)

b) Ethanol and butanol are liquids that form an ideal solution. The data below shows the mole fraction butanol in the liquid and vapour phases varying with temperature for ethanol – butanol system

Boiling point (°C)		117	110	100	90	85	78.5
e fraction of butanol (%)	liquid	100	90	66	40	22	0
	vapour	100	70	40	18	10	0

(i) On the same axes plot a graph of boiling point against percentage of butanol in both liquid and vapour phases and label your graph completely. (05 marks)

(ii) Explain the shape of the graph. (04 marks)

(iii) Describe how a liquid mixture containing 45% ethanol is fractionally distilled. (04 marks)

c) State Raoult's law as applied to miscible. (01 mark)

d) Explain why some liquid mixtures don not obey Raoult's law. (03 marks)

4. (a).A **gaseous alkene, Y** diffuses **0.57735 times** faster than nitrogen gas. Determine the **molecular formula** of alkene, Y. (03 marks)

i. On ozonolysis followed by hydrolysis **alkene, Y** produced **propanal** and **propanone** as the major organic products. Identify **alkene, Y**. (01 mark)

b. Write the equation and suggest a mechanism for the reaction between:

Alkene, Y and benzene in the presence of an acid. (04 marks)

ii) **Alkene, Y** and bromine water. (04 marks) iii)

Propanal and phenylhydrazine in acidic medium. (04 marks)

c. Using equations only show how **alkene, Y** can be synthesized from propyne. (04 marks)

SECTION B

Answer any two questions from this section

5. Explain the following observations.

a) The shapes of the molecules BF_3 and PCl_3 are different. (05 marks)

b) The melting point of sodium is 98C where as that of magnesium is 650°C. (04 marks)

c) An aqueous solution of sodium sulphate is neutral to litmus while aqueous solution of sodium sulphite turns red litmus paper blue.

(04 marks)

d) When excess carbon dioxide gas was separately bubbled through sodium aluminate and sodium carbonate solution both forms white precipitate. (04 marks)

e) When warm concentrated nitric acid was added to sulphur, the yellow solid dissolved with effervescence of reddish brown gas and colourless solution was formed. (03 marks)

6. (a) (i) Define the term **colligative property**.(01 mark)

(ii)State the **colligative properties** of a solution. (02 marks)

(b) (i) Describe how molecular mass of cane sugar can be determine using one of the colligative properties. (06 marks)

(ii)State limitations of the method used. (02 marks)

(c) The table below shows the freezing points of various solutions of cane sugar in solvent **X**.

Mass of cane sugar (g /1000g of solvent **X**)	26	42	66	78	118	148	173
Freezing point. (^oC)	5.11	4.87	4.51	4.33	3.73	3.28	2.91

(i) Plot a graph of freezing against mass of cane sugar and use graph to determine the: (03 marks)

(ii) Freezing point of solvent **X.** (01 mark)

(iii)Freezing point constant for solvent **X**. (02 marks)

[RMM of cane sugar = 342]

(d) State and explain how the freezing points of the solution would be affected if cane sugar associates in solution **X**. (03 marks)

7(a) Complete the following equations and in each case outline a mechanism for the reaction.

i). $CH_3CH_2(CH_3)C=CHCH_3 \xrightarrow{Br_2/H_2O}$ ..... (04 marks)

ii). $(CH_3)_3CBr \xrightarrow[EtO^-/EtOH]{Heat}$ .....

(04 marks)

b. Write equations to show how the following compounds can be synthesised.

i). Propan-1-ol from Propyne (03 marks)

ii). 2,2-dibromopropane from Propan-1-ol (04 marks)

(c).Describe the reaction of: Ethanol with sulphuric acid. (05 marks)

8 (a) Describe how pure Aluminium can be extracted from bauxite. [Your answer should include relevant equations for the reactions that take place during extraction process. (12 marks)

b) .Using equations only, show how Aluminium can be converted in to Aluminium hydroxide. (03 marks)

c) Potash alum, $K_2SO_4.Al_2(SO_4)_3.24H_2O$ was dissolved in water and potassium hydrogen carbonate solution added to the resultant solution.

d) i) State and explain what was observed. (03 marks)

ii) Write equation for the reaction that took place. (02 marks)

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 TI 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