NAME ……..

Signature: ……**Combination:** ……

P525/2

CHEMISTRY **S.5 SCI**

PAPER 2

2Hours 30 minutes

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 2

2Hour 30minutes

INTRUCTIONS:

*Answer **five (5)** questions, **three** questions from section **A** and **two** questions in section **B**.*

Each question being answered MUST begin on a fresh page and illustrate your answers with equations where applicable.

Molar gas constant, R = 8.314JK^{-1}mol^{-1}

Molar volume of gas at s.t.p is 22.4litres.

For Examiners' Use Only								
1	2	3	4	5	6	7	8	Total

SECTION A (60 MARKS)

Answer only 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;
      (i) Isotopes
      (ii) Relative abundance.
      (iii) Relative atomic mass ***(03 marks)***
   b) Briefly describe how the relative atomic mass of an element three isotopes can be determined using mass spectrometer. ***(06 marks)***
      (i) The relative atomic mass of X with isotopes $^{24}_{12}X$, $^{25}_{12}X$ and $^{26}_{12}X$. Given that the percentage abundance of $^{25}_{12}X$ and $^{26}_{12}X$ are equal,
      (ii) Calculate the percentage abundance of each isotope of X
      (iii) Sketch the mass spectrum of x showing the relative abundance versus. Isotopic masses of X ***(02 marks)***

2) The results for radioactive decay of radioactive isotope of X; $^{26}_{12}X$ are shown in the table below.

Mass of $^{26}_{12}X(g)$	18.7	14.6	11.3	8.8	6.9	5.4
Time (s)	30	60	90	120	15	180

   a) Define the term radioactive decay. ***(01 mark)***
   b) Use the data above to plot a graph of $\log_{10}$**mass** against time ***(04 marks)***
   c) Using your graph in (d) , determine the;
   (i) Rate constant hence half-life of $^{26}_{12}X$. ***(1 ½ marks)***
   (ii) Original mass of $^{26}_{12}X$. ***(01 mark)***

3) **10.0cm³** of hydrocarbon $P, (C_xH_y)$ was exploded in ***90cm³*** of oxygen. On cooling to room temperature; the residual gases occupied ***70.0cm³***. When the residual gases were passed over potassium hydroxide solution, the volume was reduced to ***40.0cm³***
   a) (i) Define the term hydrocarbon ***(01 marks)***
      (ii) Write the equation for the reaction between P and Oxygen gas.

(1 ½ marks)

b) (i) Determine the molecular formula of hydrocarbon P ***(03marks)***
(ii) Write the structural formula and name of hydrocarbon P,

(02 marks)

c) Write equation to show how hydrocarbon P can be prepared from ethanol. ***(03 marks)***

d) Write equations to show how the following compounds can be synthesized and in each case indicate the conditions of reaction.

(i) $CH_3CH_2CH_2CH_3$ From CH_3CH_2OH ***(03 marks)***

(ii) $CH_2 = CH_2$ to $CH_3C{\equiv}CH$ ***(03marks)***

e) Distinguish between the following pair and in each case, name the reagent that can be used and state what would be observed when each compound is treated separately with the reagent. ***(03marks)***

$CH_3C{\equiv}CH$ and $CH_3CH = CH_2$

(i) Reagent:
(ii) Observations.

4) (a) Differentiate between **ionization** energy and **electron** affinity.

(3marks)

(b)Explain how the following factors affect the magnitude of ionization energy.

(i) Nuclear charge ***(3marks)***
(ii) The shielding effect of electrons ***(3marks)***
(iii) Atomic radius ***(3marks)***

b. The table below shows the first ionization energies, ***I.E*** and atomic numbers, Atomic number of elements in the third period of the periodic table

Element	**Na**	**Mg**	**Al**	**Si**	**P**	**S**	**Cl**	**Ar**
1st I.E (KJmol^{-1})	502	745	587	791	1020	1000	1260	1530
Atomic number	11	12	13	14	15	16	17	18

(i) Plot a graph of the first ionization energy against Atomic number of the elements of the third period (4 marks)

(j) Explain the shape of the graph (4 marks)

5) ***a)*** What is meant by the term **colligative properties?** ***(01 mark)***

b) State the colligative properties of substances apart from boiling point elevation ***(1 ½ marks)***

c) Describe briefly how the molecular mass of a glucose in solution can be determined by boiling point elevation method. ***(06 marks)***

d) (i) Explain why the boiling point elevation is not suitable for determining the Molecular mass of polymers ***(02 marks)***

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

e) The table below shows the freezing points of various solutions of glucose in solvent X.

Mass of glucose g/1000g of solvent X	26	42	66	78	118	148	173
Freezing point (^{0}c)	5.11	4.82	4.51	4.33	3.73	3.28	2.91

Plot a graph of freezing point against mass of glucose and use the graph to determine the;

(i) Freezing point of solvent X ***(01 mark)***

(ii) Freezing point constant (K_f) of the solvent X ***(02 marks)***

(RMM of glucose = 342).

SECTION B (40 Marks)

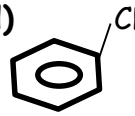
Attempt any two questions from this section.

5. Complete the following equations and outline the possible mechanism for the reaction in each case;

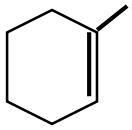
a) $CH_3CH_2CH_2CH_2OH \xrightarrow[180^oC]{Conc\ H_2SO_4}$ ***(3½ marks)***

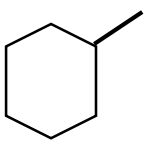
b) $CH_3CH_2CH_2Br \xrightarrow[CH3CH2OH]{CH3CH2ONa,/Heat}$ ***(3 marks)***

c) $CH_3CH = CH_2 + HCl \longrightarrow$ ***(2½marks)***

d)  $\xrightarrow[\text{Warm}]{H^+/H_2O}$ ***(3 marks)***

e) $CH_3CH = CH_2 + Br_2 \xrightarrow{H_2O}$ ***(03½ marks)***

f)  $+ HBr \longrightarrow$ ***(2½marks)***

g)  $\xrightarrow[180^oC]{Conc\ H_2SO_4}$ (02marks)

6. Explain the following observations. In each illustrate with equations where necessary

a) The melting point of Aluminium chloride is lower than that of Aluminium fluoride. ***(04marks)***

b) Both 2 – nitrophenol and 4 – nitrophenol exhibit hydrogen bonding and yet the boiling points of the two compounds differ greatly. ***(04marks)***

c) Aluminium chloride dissolves in water with a resultant solution whose pH is less than 7 whereas sodium chloride does not. ***(04marks)***

d) When a piece of magnesium ribbon was added to the resultant solution of Aluminium salt, bubbles of a colourless gas that ignites in air with "pop" sound given out. ***(04marks)***

e) Beryllium differs from other members of group II in its chemical behavior but resembles that of Aluminium in group III elements. ***(04marks)***

7. *Na, Mg, Al, Si, P, S* and *Cl* are period 3 elements of the Periodic Table. Below is a table showing the melting points of their chlorides.

Chloride	$NaCl$	$MgCl_2$	$AlCl_3$	$SiCl_4$	PCl_5	S_2Cl_2
m.pt/ °C	1075	987	180	203	345	110

a) (i) State the trend in the melting points of period 3 chlorides. (***1mark***)
(ii) Explain the trend including any anomalous behavior. (4***½marks)***

b) Describe how each of the above elements react with:
(i) Oxygen (2***½marks)***
(ii) Sulphuric acid (4***½marks)***
(iii) Sodium hydroxide (4***½marks)***
(iv) Water ***(3marks)***

******END******