P525|2

CHEMISTRY

Paper 2

APRIL /MAY. 2024 **S.5**

2 ½ hours.

Uganda Advanced Certificate of Education

END OF TERM 1

SENIOR FIVE

[redacted]

CHEMISTRY

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

- Answer **FIVE** questions, including **THREE** questions from section A and any **TWO** from section **B**.
- **Begin** each question on a fresh page.
- Mathematical tables and graph papers are provided.
- Non-programmable scientific electronic calculators may be used.

- Use equations where necessary to illustrate your answers.

Number attempted						
Marks						

Section A. (60 marks)

Attempt any three questions from this section.

1. (a) What is meant by the following terms?

(i) Colligative properties. **(03 marks)**

(ii) Relative vapour pressure lowering. **(01 mark)**

(iii) Boiling point of a liquid. **(01 mark)**

(b) One of the colligative properties of a solution is lowering of vapour pressure. It has different limitations such as the solute should be non-volatile but should be volatile and also the solute should not dissociate in a solvent. Explain why the solute should;

(i) Be non-volatile. **(02 marks)**

(ii) Not dissociate in a solvent and state its effect on RMM of the solute if it does. **(04 marls)**

(c) The vapour pressure of water at 18^0C is $2.33x10^3$pa. A solution is made by dissolving 53.6g of sucrose ($C_{12}H_{22}O_{11}$) in 500g of water. Calculate;

(i) Vapour pressure of a solution at 18^oC. **(03 marks)**

(ii) The vapour pressure lowering of the solution. **(02 marks)**

(d) Explain your results in (c) (ii) above. **(04 marks)**

2. (a) Define the terms;

(i) First ionization energy **(01 mark)**

(ii) Atomic radius **(01 mark)**

(b) State and explain any three factors that affect atomic radius. **(06marks)**

(c) The table below shows the first ionization energy of Period 3 elements of the Periodic Table.

Element	Na	Mg	Al	Si	P	S	Cl
Atomic number	11	12	13	14	15	16	17
First ionization energy ($kJmol^{-1}$)	496	737	577	786	1012	999	1255

(i)Write equation to show the first ionization energy of magnesium atom. **(01mark)**

(ii) Plot a graph of first ionization energy against atomic number. **(03 marks)**

(iii) Explain the shape of your graph. **(05 marks)**

(d) Describe the reactions of magnesium and with air. **(03 marks)**

3. (a) Distinguish between position and functional isomers. **(01 mark)**

(b) Compound W and Y have molecular formulae of $\mathbf{C_6H_{14}O}$ and $\mathbf{C_4H_6}$ respectively. Write the structural formulae and I.U.P.A.C names of any two position and functional isomers.

(i) Compound Y. **(04 marks)**

(ii) Compound W. **(04 marks)**

(c) An organic compound R contains 52.2% carbon, 13.0% hydrogen and the rest being oxygen. When vapourised, 0.1g of R occupied $78.8cm^3$ of at 157^0C and pressure of about 740mmHg.

(i) Determine the molecular formula of R. **(05marks)**

(ii) Write the structural formulae of all possible isomers of R and give their IUPAC names. **(04 marks)**

(c) From the isomers given in (c) (ii) above, state the homologous series to which they may belong and give a reason in each case. **(02 marks)**

4. Explain each of the following observations. **[Include equations where applicable)**

(a) After explosion of a given hydrocarbon with oxygen, there is a contraction in volume on cooling and also reduction in volume of residual gas when passed through a combustion chamber with red hot copper turning. **(04 marks)**

(b) Ethanol boils at780C but when 0.56g of camphor was dissolved in ethanol, the solution had a boiling point of 78.278^{o}C. **(06 marks)**

(c) Atomic radius increases down the group in the periodic table but decreases across a given period. **(05 marks)**

(d) When two pieces of cotton wool were each separately soaked in concentrated ammonia solution and concentrated hydrochloric acid respectively and simultaneously inserted into opposite ends of a wide horizontal glass tube, a white ring was formed close/near to the end with cotton wool soaked in hydrochloric acid. **(05 marks)**

SECTION B. (40 MARKS)

Attempt any two questions from this section.

5. (a) Distinguish between **structural** and **geometrical** isomerism. **(02 marks)**

(b) Using the organic compound W with the molecular formula of $C_6H_{10}Cl_2$, write the structural formulae and their IUPAC names to distinguish between structural and geometrical isomers. **(04marks)**

(c) Write down the structural formulae of the following compounds. **(06marks)**

(i) 2, 4-dimethylpentane

(ii) 2, 2, 3, 4-Tetramethylhexane.

(iii) Trans-3, 4-dibromohex-3-ene.

(iv) 2-chloro-2-ethylbutane.

(v) 3-Ethyl-2-metthylhexane.

(vi) 3-Hydroxy propanoic acid.

(d) 14cm^3 of a gaseous hydrocarbon R was exploded with 121cm^3 of excess oxygen. The residual gas occupied 86cm^3. On treatment with concentrated potassium hydroxide solution, its volume reduced to 30cm^3.

(i) Write equation(s) for the reaction that occurred when residual gas was passed through potassium hydroxide solution. **(03 marks)**

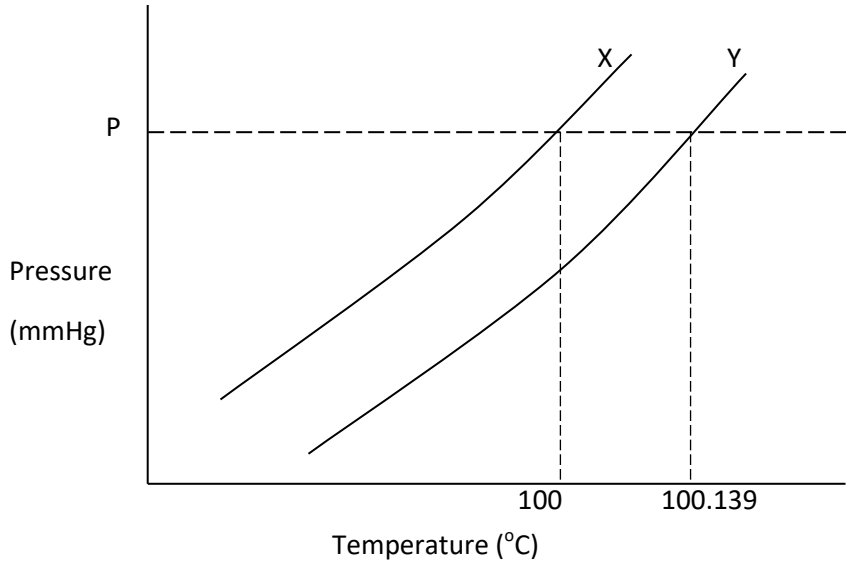
(ii) Determine the molecular formula of R. **(03 marks)**

(iii) Write the structure and name of the possible isomer(s) of R. **(02 marks)**

(iv) With a reason, state the homologous series to which R can belong**.** **(01 mark)**

6. (a) What is meant by;
(i) Boiling point constant of a liquid **(01mark)**
(ii) Colligative property **(03 marks)**
(iii) Vapour pressure of a liquid. **(01 mark)**

(b) 5.5g of a non-volatile substance B was dissolved in 125g of a solvent. The vapour pressure curves for the solution and pure solvent at constant pressure P are shown below



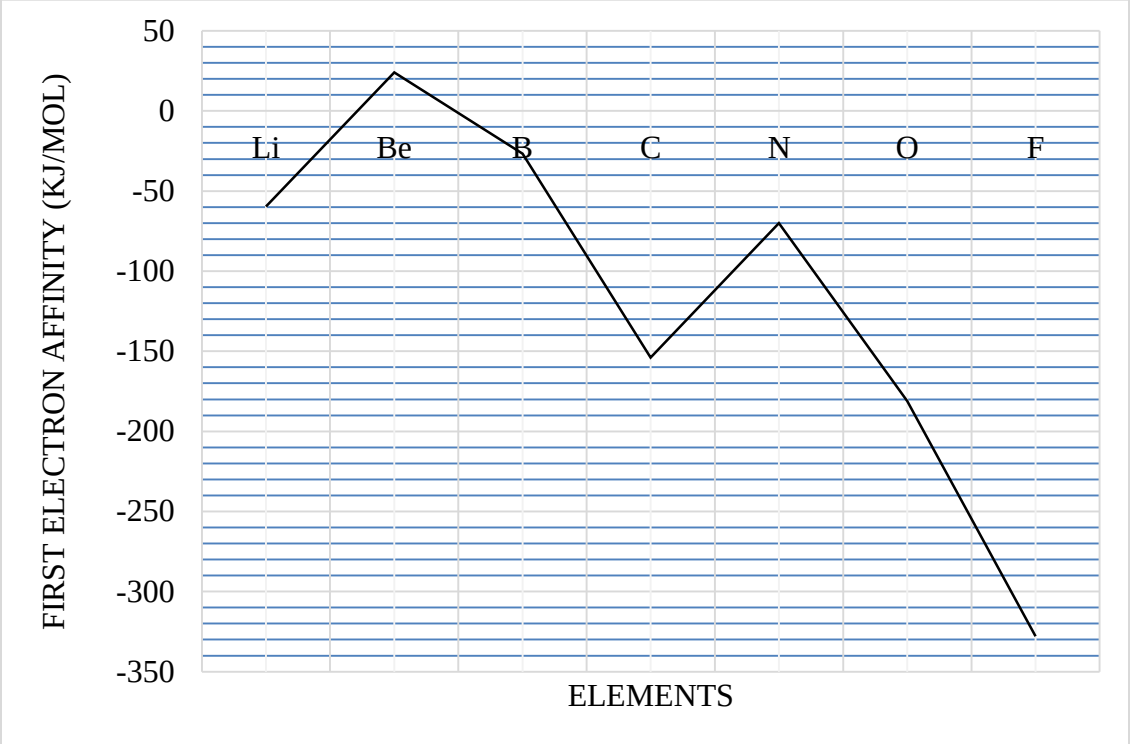
(i) Identify the curve for the solution and solvent. Give a reason for your answer **(02 mark)**

(ii) Calculate the molecular mass of B (The boiling point elevation constant for the solvent K = 0.52^{o}C per mole^{-1}kg^{-1}) **(03marks)**

(iii) State three limitations of your calculations in (b). **(03marks)**

(d) Describe an experiment to determine the relative molecular mass of a solute using the above method illustrated in the graph. **(07 marks)**

7. The graph below shows electron affinities of elements in the second period of the Periodic Table. Use it to answer the questions that follow.



(a) Define the following terms

(i) Electron affinity. **(02marks)**

(ii) Electronegativity **(01 mark)**

(b) Explain the general trend in first electron affinity among Period 2 elements. **(05 marks)**

(c) Suggest an explanation for the anomalies in the above trend. **(04 marks)**

(d) The first electron affinity of oxygen is exothermic whereas the second electron affinity is endothermic. Explain. **(04 marks)**

(e) Explain why the first electron affinity of fluorine is lower than expected compared to other Group (VII) elements. (04 marks)

8. (a) Explain the meaning of

(i) Radioactivity **(02 marks)**

(ii) Nuclear stability **(02 marks)**

(b) The activity of Th was reduced to 30% in 50 days. Determine the half-life of Th **(05 marks)**

(c) When chlorine gas Cl_2 was analyzed through mass spectrometer, the peaks were observed at mass number of 70, 72 and 74.

(i) Explain this observation **(03 marks)**

(ii) If the height of the peaks were in the ratio of 9:6:1, respectively, calculate the average relative atomic mass of chlorine. **(03 marks)**

(d) (i) Distinguish between a real gas and an ideal gas **(02 marks)**

(ii) Show graphically how compressibility factor varies with pressure for a real gas at two different temperature **(03 marks)**

END

WISH YOU NICE HOLIDAYS