Candidate's Name.....

Signature.....School.....Index No.....

**P525/1**
**CHEMISTRY**
**(THEORY)**
**PAPER 1**
**JULY/AUGUST, 2023**
2¾ hours

**TESO SECONDARY SCHOOLS MOCK EXAMINATIONS ASSOCIATION (TESSMEA) 2023**

**Uganda Advanced Certificate of Education**

CHEMISTRY

**(THEORY)**

**Paper 1**

2 hours 45Minutes

**INSTRUCTIONS TO CANDIDATES**

*Answer **all** questions in section A and **six** questions from section B.*

*All your answers **must** be written in the spaces provided.*

*The periodic table, with relevant atomic masses, is attached at the end of the paper.*

*Illustrate your answers with equation (s) where applicable.*

*Where necessary, use the following;*

*Molar gas constant, $R = 8.31JK^{-1}mol^{-1}$.*

*Standard gas volume at s.t.p is 22.4 litres*

*Standard temperature = 273K*

*Standard pressure = $101325Nm^{-2}$*

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | Total |
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## SECTION A

*Attempt all questions*

1. Thorium undergoes nuclear decay according to the following equation.

$$^{232}_{90}Th \xrightarrow{\propto} X \xrightarrow{\beta} Y \xrightarrow{\beta} Z$$

(a) Identify the species X, Y and Z *(3marks)*

X.....

Y.....

Z.....

(b) 5.0g of thorium was left to decay. Calculate the mass of thorium that remained after $2.5 \times 10^{10}$ years. (The half-life of thorium is $1.4 \times 10^{10}$ years) *(2marks)*

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2. (a) State three properties in which beryllium is resembles aluminum *(3marks)*

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(b) (i) What is the name given to the type of relationship in (a)? *(½mark)*

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(ii) Name another pair of elements that show the type of relationship in (a) *(½mark)*

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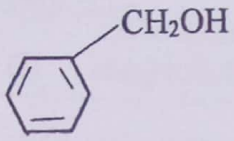
3. Show how the following conversations can be carried out.

(a)  to  *(2½ marks)*

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(b) $CH_3CH_2\ CH_2OH$ **to** $CH_3\underset{OH}{C}H\ CH_3$ *(3marks)*

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4. (a) $50cm^3$ of an amine R, $C_nH_{2n+1}NH_2$, diffused through a small hole in 126s. under the same conditions, the same volume of hydrogen gas diffused through the hole in 26.57s.

(i) Calculate the molecular mass of R *(1½marks)*

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(ii) Determine the molecular formula of R. *(1½marks)*

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(b) (i) Write the structural formulae and IUPAC names of all the possible isomers of R. *(2marks)*

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(ii) R reacts with nitrous acid to form a clear solution with evolution of a colourless gas. Identify R. *(1mark)*

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5. (a) Define the term partial pressure. *(1½ marks)*

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(b) The vapour pressures of pure chloroform and carbon tetrachloride are 199.1 and 114.5mmHg respectively at 25°C.

(Assume that a mixture of two liquids behave as an ideal gas and that it contains 0.96mole of each pure liquid)



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Calculate;

(i) the partial pressure of each component in the mixture. *(2½marks)*

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(ii) the total pressure. *(½ mark)*

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(iii) the percentage of chloroform in the vapour in equilibrium with the liquid mixture. *(1mark)*

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6. (a) Write;

(i) an equation for the ionization of ethylamine in water. *(1½marks)*

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(ii) the expression for the base dissociation constant $K_b$, for ethylamine. *(½ mark)*

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(b) A solution containing 1M ethylamine is 1.34% ionized. Calculate $K_b$ fo ethylamine. *(1½marks)*

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7. 1,2-dobromo ethane may be obtained by bubbling ethene gas into liquid bromine in tetrachloromethane;

(a) Write the equation for the reaction leading to the formation of 1,2-dibrom ethene *(1mark)*

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(b) 10g of 1,2-dibromo ethane was formed during the above reaction;

Calculate;

(i) the mass of bromine used *(1½marks)*

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(ii) Volume of ethene required to form 1,2-dibromo ethane at standard temperature and pressure. *(2marks)*

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8. (a) State three characteristic properties of copper as a transition element. *(1½ marks)*

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(b) (i) Write the electronic configuration of copper. *(1mark)*

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(ii) State the common oxidation states exhibited by copper in its compounds. *(½ mark)*

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(c) Sate what is observed and, in each case, write equation of reaction that takes place when the following is added to copper (II) sulphate solution.

(i) Potassium hexacyanoferrate (II) solution. *(1½ marks)*

Observation

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Equation

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(ii) Potassium iodide solution. *(1½ marks)*

Observation

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Equation

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9. (a) Write equation to show how but -2- ene can be prepared from an alcohol. *(1mark)*

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(b) A mixture of bromo- and chloro-compounds are formed when but -2-ene reacted with hydrogen bromide in the presence of chloride ions. Outline a mechanism leading to the formation of two products. *(3marks)*

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10. A compound Q contains 14.77% carbon, 1.85% hydrogen, 19.69% oxygen and the rest lead.

(a) Calculate the empirical formula of Q (2½marks)

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(b) Determine the molecular formular of Q if a 2% aqueous solution of Q freezes at -0.14°C. (4½marks)

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(c) Q reacts with iron (III) chloride solution to give a white solid and brown solution.

(i) Identify Q. *(½ marks)*

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(ii) Write equation for the reaction that takes place. *(1½marks)*

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11.(a) (i) State what is meant by the term thermoplastic. *(1½ marks)*

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(ii) Name two examples of thermoplastics. *(1mark)*

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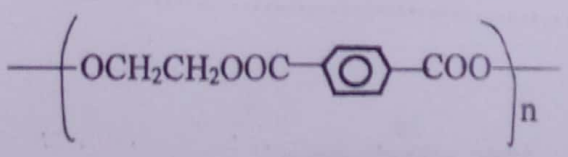
(b) The structural formula of a polyester is



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Write the structural formulae and name(s) of the monomer (s) *(3marks)*

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(c) State;

(i) the type of polymerization involved in the formation of polyester. *(1mark)*

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(i) one use of polyester *(1mark)*

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(d) Distinguish between thermosetting plastic and thermo softening plastic. *(1½marks)*

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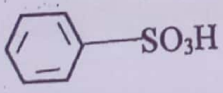
12. Show how the following organic compounds can be prepared indicating a mechanization for the reaction in each cases. *(3½marks)*

(a)  *(3½ marks)*

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(b) $CH_3\ CHSO_3^-Na^+$
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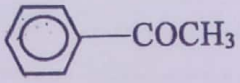
(c)  *(3½ marks)*

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13. The equations for some redox reactions are shown below.

$2H^+(aq) + 2Fe^{2+}(aq) \rightleftharpoons H_2(g) + Fe^{3+}(aq)$

$3H_2O(l) + 3Zn(s) + 6OH^-(aq) + BrO_3^-(aq) \rightleftharpoons 3Zn(OH)_4^{2-}(aq) + Br^-(aq)$

(a) For each of the reaction, write half cell reactions taking place at the

(i) Anode *(2½ marks)*

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(ii) Cathode *(2½ marks)*

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(b)(i) For each reaction, write the cell notation of the cell made by combining the electrodes of each half-cell. *(2marks)*

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(ii) State what each symbol used in b stands for. (2marks)

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14. Carbon, silicon, germanium, tin and lead are in group (IV) of the periodic table.

(a)(i) Write the general outermost electronic configuration of the elements. *(1mark)*

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(ii) State the common oxidation states exhibited by the elements in their compounds or Ions. *(1mark)*

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(b) State what would be observed and write equation for the reaction that would take place if, if any, when the following compounds are treated with water.

(i) $CCl_4$ *(1mark)*

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(ii) $SiCl_4$ *(3marks)*

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(iii) $SnCl_4$ *(3marks)*

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15.(a) Distinguish between the terms molecularity and order of reaction. *(2marks)*

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(b) The kinetic data for the reaction between T and sodium hydroxide is shown in the table below.

| **Concentration ($moldm^{-3}$)** | 0.105 | 0.088 | 0.074 | 0.051 | 0.037 | 0.026 | 0.016 | 0.010 |
|---|---|---|---|---|---|---|---|---|
| **Time (hours)** | 0.0 | 3.5 | 7.0 | 14.5 | 20.0 | 27.0 | 35.5 | 45.0 |

Plot a graph of concentration of T against time. *(3½marks)*



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(c) Using the graph in (b) determine; *(2 marks)*

(i) The half-life of T.

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*(1½marks)*

(ii) The order of reaction.

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16. Name a reagent that can be used to distinguish between each of the following pairs of compounds.

In each case state what would be observed and write equation of reaction where applicable when each compound is separately treated with the reagent you have named.

*(3marks)*

(a) $CH_3CHO$ and $CH_3CH_2CHO$

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*(3marks)*

(b) $CH_3CH_2NH_2$ and $CH_3NHCH_3$

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(c) $CH_3COO^- Na^+$ and $\begin{matrix} COO^- Na^+ \\ COO^- Na^+ \end{matrix}$

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17. Describe the reaction of chlorine and fluorine with;

(a) Water *(3marks)*

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(b) Sodium hydroxide. *(6marks)*

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***END***



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