P525/2
CHEMISTRY
Paper 2
July/Aug. 2022
$2\frac{1}{2}$hours

NEW HITECH HIGH SCHOOL - KAJJANSI

Uganda Advanced Certificate of Education

S5 CHEMISTRY

(Principal Subject)

Paper 2

2 hours 30 Minutes

INSTRUCTIONS TO CANDIDATES

Answer FIVE questions, including three questions from section A and any two from section B.

Answered booklets are provided and all necessary working must be done in the answer booklet.

Begin each question on a fresh page

Graph paper is provided

Non-programmable calculators may be used.

SECTION A (60 Marks)

Answer any 3 questions from this section

1. (a) What is meant by the term cryoscopic constant of a solvent? (2 marks)

   (b) Describe an experiment that can be carried out to determine the molar mass of naphthalene in methyl benzene using depression in freezing point. (8 marks)

   (c) In an experiment, 5% of glucose (**$C_2H_{12}O_6$)** in water was found to give the same freezing point depression as 3.3% aqueous solution of X (**$C_nH_{2n}O_n$).** Determine the molecular formula of **$C_nH_{2n}O_n$** hence the structural formula of **X.** **(5 marks)**

   (d) Explain what will happen to the RMM of glucose if it associates with water molecules. (5 marks)

2. **Be, Mg, Ca, Sr** and **Ba** are elements in group (II) of the periodic table.

   (a) Describe the trend of the following properties down the group (II) elements.

   (i) Ionization energy. (3 marks)

   (ii) Electron affinity. (5 marks)

   (iii) Solubility of hydroxides. (5 marks)

   (b) Compare the reactivity of group (II) elements with;

   (i) Water. (3 marks)

   (ii) Dilute hydrochloric acid. (4 marks)

3. Write equations to show how the following conversions can be effected.

   (a) Ethane to Butane. (4 marks)

   (b) Phenol from Benzene. (5 marks)

   (c) Propan-2-ol from propan-1-ol. (6 marks)

(d) Benzene from calcium carbide. (5 marks)

4. (a)(i) What is meant by the term standard enthalpy of combustion. (1 mark)

(ii) Describe an experiment that can be carried out to determine the enthalpy of combustion of liquid cyclohexane. (5 marks)

(b) Define the following terms;

(i) Standard enthalpy of formation of a substance. (2 marks)

(ii) Heat of reaction. (2 marks)

(iii) An exothermic reaction. (3 marks)

(c) The table below shows the values for standard enthalpies of formation of benzoic acid, carbon dioxide and water in $kjmol^{-1}$. Use the data to calculate the enthalpy of combustion of benzoic acid. (7 marks)

Compound	C_6H_5COOH	CO_2	H_2O
ΔH^{θ}_{f} ($kjmol^{-1}$)	-408	-393	-286

SECTION B (40 marks)

Answer any two questions in this section

5. A hydrocarbon **W** contains **88.8%** by mass of carbon. Its formula mass is 54.

   (a) Calculate the molecular formula of **W.** **(**7 marks)

   (b) Write down all the possible isomers of **W** and name each of them according to the IUPAC naming system. (4 marks)

   (c) One of the isomers of **W** gives positive results with Tollen's reagent. Write down the isomer which gives positive results with Tollen's reagent. (1 mark)

   (d) Write equations to show how **W** can be synthesized from butan-1-ol. (7 marks)

6. Sodium, magnesium, Aluminium, Silicon, Sulphur, Chlorine and Argon are period 3 elements.

   (a) Describe the trend in atomic radius across the period. (4 marks)

   (b) Write the formula of the chlorides formed by each element and state the type of bonding in each chloride. (5 marks)

   (c) Describe how the chlorides above react with;

   (i) Water. (5 marks)

   (ii) Sodium hydroxide solution. (4 marks)

   (d) Write an equation for the reaction between aluminium oxide and sodium hydroxide solution. (2 marks)

7. (a) Define the following terms;

   (i) Half – life. (2 marks)

(ii) Rate constant. (2 marks)

(iii) Order of reaction. (2 marks)

(b)(i) Define the term nuclear stability. (3 marks)

(ii) Explain any four factors that determine the stability of the nucleus.

(8 marks)

(c) Radium takes 350 years to decay from 4000g to 2000g. Determine the fraction of radium which will remain after 120 years. (3 marks)

8. Explain the following observations.

(a) When ammonia solution is added to a solution of copper (II) sulphate, a blue precipitate soluble in excess to form a deep blue solution is observed. (6 marks)

(b) Beryllium does not react with any form of water while Barium reacts with cold water vigorously yet the are all group (II) elements. (5 marks)

(c) The second ionization of oxygen is greater than its first ionization energy. (4 marks)

(d) Sodium ion is smaller than sodium atom. (5 marks)

END