MOCK SET I EXAMINATIONS 2019
Uganda Advanced Certificate of Education
CHEMISTRY PAPER
P525/2
Time: 2 Hours

Instructions to Candidates
- *Answer **five** questions, including **three** from **section A** and any **two** from section **B**.*
- *Additional questions answered will not be marked.*
- *Begin each question of fresh page.*
- *Mathematical tables and graph papers are provided.*
- *Non programmable scientific electronic calculator may be used.*
- *Illustrate your answer with questions where applicable*
 *(H = 1, C = 12, O = 16, N = 14, S = 32)*

SECTION A:

1. (a) (i) What is meant by the term **solvent extraction**? (01mk)
   ii) State **three** limitations of solvent extraction. (1 ½ mks)
   iii) State why in solvent extraction, small portions are preferred to big volumes.
   (02mks)
   b) 0.9656 g of Iodine was shaken with a mixture of 50 cm^3 of trichloromethane and 50cm^3 of water in a separating funnel for some time until equilibrium was attained at 25°C.
   After the layers had settled, 25 cm^3 of the aqueous layer required 4.4 cm^3 of 0.01M sodium thiosuphate solution using starch as an indicator.

   i) Determine the distribution coefficient of Iodine between trichloromethane and water at 25°C. (5 ½ mks)

   ii) If 50 cm^3 of trichloromethane layer in (b) (i) above was again shaken with 100 cm^3 of water at 25°C, determine the mass of Iodine that remained in the trichloromethane layer.
   (03mks)

   iii) Explain why trichloromethane is a better solvent in the extraction of iodine than water.
   (02mks)

   iv) Describe briefly how the formula of the silver complex $[Ag (NH_3)_2]^+$ can be determined in the laboratory. (05mks)
2. (a) What is meant by the terms;
   i) Initial rate (01mk)
   ii) Activated complex (01mk)

b) The rate equation for the reaction

$$S_2O_{8\ (aq)}^{2-} + 2I_{(aq)}^{-} \longrightarrow 2\ SO_{4\ (aq)}^{2-} + I_{2\ (aq)} \text{ is Rate} = K\ [S_2O_8^{2-}]\ [I^-]$$
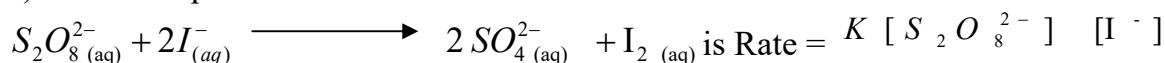
i)   State how the rate would be affected if the concentrations of the reactants are both doubled.   (01mk)

ii) Describe an experiment to determine the order of the reaction with respect to $S_2O_8^{2-}$ in the laboratory.

c) The table below shows the kinetic data for the reaction between potassium Iodide and potassium peroxosulphate.

Time (min)	$[S_2O_8^{2-}]$ moldm^{-3}
30	0.190
60	0.130
90	0.082
120	0.053
150	0.035

Plot a graph of $10g_{10}[S_2O_8^{2-}]$ against time and use it to determine;

i)   The initial concentration of $S_2O_8^{2-}$ (01mk)

ii) The rate constant of the reaction and state its units.   (03mks)

d) State and explain one factor that affects the activation energy of the reaction.
                                                                                       (03mks)

3. (a) Write the name and formula of the ore from which aluminum metal is extracted.
                                                                                       (02mks)

b) Outline the steps used in the extraction of aluminum from its ore. Your answer should include all the necessary equations (No diagram is required).   (8 marks)

c) In the extraction of aluminum, state

i)   Why a low voltage is used.   (01mk)

ii) One disadvantage involved   (01mk)

d) State **two** uses of aluminum in relation to its properties.   (02mks)

e) How and under what conditions does aluminum react to form aluminum chloride, Al_2Cl_6?
                                                                                       (02mks)

(f) State why soap is not used in washing aluminum source pans   (3 marks)
Illustrate your answer using equations

4. (a) A compound **M, C$_7$H$_{14}$O$_2$** reacted with sulphuric acid on heating to form compounds **P, C$_4$H$_{10}$O** and **C$_3$H$_6$O$_2$**. **P** reacted with sodium with effervescence but had no effect on litmus paper.

i)   Write the names and structural formulae of all the possible isomers of **P**. (04mks)

ii) Name a reagent that can be used to distinguish between the isomers in (i) and state what would be observed if the isomers are reacted with the reagent.   (04mks)

b) **P** reacted with acidified dichromate solution to give **W**, which formed a **yellowsolid** when reacted with alkaline iodine solution;

i)   Identify **P**, **W** and the **yellow solid**.   (03mks)

ii)   Name the reagent that can be used to identify the functional group in **P**. (01mk)

c) Write equations and indicate a mechanism for the reaction between **P** and;

    i)   Concentrated orthophosphoric acid   (04mks)

    ii)   Ethanoyl chloride   (03mks)

SECTION B
Attempt <u>two</u> questions from this section.

5   Using equations only, show how the following inter conversions of compounds can be carried out in the laboratory.

a) Ethanol to methylpropanoate.   (4 Marks)

b) Butane-1,4-dioic acid from bromoethane.   (3 ½ Marks)

c) $C_6H_5NHCH_3$ from benzene.   (4 ½ Marks)

d) $(CH_3)_2COHCH_2CH_3$ from 1-chloropropane.   (4 Marks)

e) Nylon-6,6 from cyclohexene   (4 Marks)

6. Explain the following observations;

a) Ice is less dense than water and floats on water.   (04mks)

b) Methanioc acid reacts with ammoniacal silver nitrate solution, whereas ethanoic acid does not.   (04mks)

c) The first electron affinity of the halogens decrease down the group, however the first electron affinity of fluorine is abnormally high.   (04mks)

d) When ammonia solution is added to silver nitrate solution, a brown precipitate soluble in excess ammonia is formed.   (04mks)

e) The boiling point of ethanol is 78^oC whereas that of methoxymethane is 24^oC yet both ethanol and methoxymethane have the same molecular mass.   (04mks)

7. The atomic numbers and melting points of the oxides of period 3 elements are shown in the Table below.

Element	Na	Mg	Al	Si	P	S	Cl
Atomic number	11	12	13	14	15	16	17
Oxide	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl_2O_7
Melting point ^oC	1275	2827	2007	1607	560	30	-91

a) i)   Plot a graph of melting points of oxides against atomic number of elements.   (4mks)

    ii)Explain the shape of the graph.   (6½ marks)

b) Write equation to show the reaction between,
    i)   Water and P_2O_5 (1½ marks)
    ii)   Sodium hydroxide and
        Al_2O_3 (2½marks)
        SiO_2 (2½ marks)
        SO_3 (1½ marks)
    iii) Hydrochloric acid and Al_2O_3 (1½marks)

8.(a) Explain what meant by the terms
    (i) Enthalpy of solution   (2 marks)

    (ii) Enthalpy of hydration   (2 marks)

  (b) State two factors that affect the enthalpy of hydration.   (2 marks)

  (c) Describe how you would determine the standard enthalpy of solution of potassium

    iodide.   (7 marks)

  (d) The lattice energy of potassium iodide is $+649 \text{ Kjmol}^{-1}$. The enthalpy of hydration of

    potassium ion is -321 Kjmol^{-1} and that of iodide ions is -296 Kjmol^{-1}

    (i) Determine the enthalpy of solution of potassium iodide   (2 marks)

    (ii) Explain why potassium iodide is soluble in water   (2 marks)

    (iii) Sketch a potential energy diagram for the dissolution of potassium iodide in b (ii)

    above   (3 marks)

END