

Name..... Centre & Index No.....
Signature

P525/1
CHEMISTRY
(THEORY)
Paper 1
July /August 2023
2 ¾ Hours

ASSHU ANKOLE JOINT MOCK EXAMINATIONS 2023
Uganda Advanced Certificate of Education
CHEMISTRY
(THEORY)
Paper 1
2 Hours 45 Minutes

INSTRUCTIONS TO CANDIDATES

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

All questions **must** be answered in the spaces provided.

The periodic table; with relative atomic masses is supplied.

Mathematical tables (3 figure tables) are adequate or non-programmable scientific electronic calculators may be used.

Illustrate your answers with equations where applicable.

Where necessary, use the following

Molar gas constant, R $= 8.31 \text{ J K}^{-1} \text{ Mol}^{-1}$

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

Standard temperature $= 273 \text{ K}$

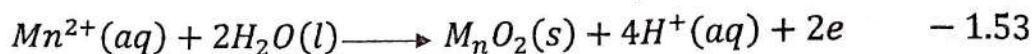
Standard pressure $= 101325 \text{ N m}^{-2}$.

For Examiner's Use only																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

SECTION A (46 MARKS)

Answer all questions from this section

1. The standard electrode potentials for some half-cell reactions are given below.



- (a) Write the;
i) cell notation for the cell formed when the two half cells are combined. (1 mark)

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- ii) equation for the overall cell reaction= (1 ½ marks)

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- (b) Calculate the e.m.f of the cell in (a) (i) (1 ½ marks)

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- (c) State whether the cell reaction is feasible or not. Give a reason for your answer. (1 mark)

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2. (a)(i) Explain what is meant by the term first electron affinity.

(1 mark)

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- (ii) Write an equation to represent the first electron affinity of Sulphur. (1 mark)

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(b) Explain why the value for the first electron affinity of Sulphur is negative whereas the value for the second electron affinity is positive.

(3 marks)

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3. An organic compound Z has the structure



(a) Name the functional groups in the structure of Z. (1 mark)

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(b) State what is observed and write equation for the reaction in each case that takes place when Z is

(i) treated with a cold aqueous alkaline solution of potassium manganate (VII) (2 marks)

Observation:

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Equation:

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(ii) added aqueous sodium hydrogen carbonate solution (1½ marks)

Observation:

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Equation:

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4. (a) Define the term electrolytic conductivity. (1 mark)

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- (b) The electrolytic conductivity of a 0.0634 molar solution of a weak acid HA at 25°C is $1.138 \times 10^{-3} \text{ scm}^{-1}$ and its molar conductivity at infinite dilution is $388.5 \text{ scm}^2 \text{ Mol}^{-1}$. Calculate the :

- i) degree of ionization of HA (2 marks)

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- ii) acid dissociation constant, K_a at 25°C (1½ marks)

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5. (a) Write equation for the reaction between chlorine and;

- i) cold dilute sodium hydroxide solution (1 ½ marks)

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- ii) Potassium iodide solution (1 ½ marks)

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- (b) State what:

i) would happen if the resultant mixture in (a) (i) was heated. (1½ marks)

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ii) happened in (a) (ii)

(1 mark)

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6. (a) Nylon - 6, 6 is formed by the reaction between hexane -1, 6 - diamine and hexane -1, 6 - dioic acid.

i) Write equation for the formation of nylon -6, 6. (1 ½ marks)

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ii) State the type of polymerization involved in the formation of nylon -6, 6. (½ mark)

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(b)(i) The osmotic pressure of a solution containing 2gdm^{-3} of nylon-6,6 at 25°C was 20308Nm^{-2} . Calculate the relative molecular mass of nylon 6, 6. (2 marks)

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(ii) State one use of nylon 6, 6

(½ mark)

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7. (a) Complete the following equations and in each case, outline the mechanism for the reaction



8. Write equation for the dissolution of each of the following salts in water.
State whether the resultant solution is neutral, basic or acidic.

a) Potassium chloride (2 marks)

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b) Aluminium chloride (2 marks)

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c) Sodium propanoate (2 marks)

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9. Various concentrations of A and B were reacted at a constant temperature. The table below shows the initial concentrations of A and B and their initial rates for the reaction.

Experiment	[A] (Moldm ⁻³)	[B] (Moldm ⁻³)	Initial rate (Moldm ⁻³ s ⁻¹)
1	0.4	0.4	7.0×10^{-4}
2	0.8	0.8	2.8×10^{-3}
3	1.6	0.8	1.12×10^{-2}

(a) State the order of reaction with respect to A and B.

A..... (½ mark)

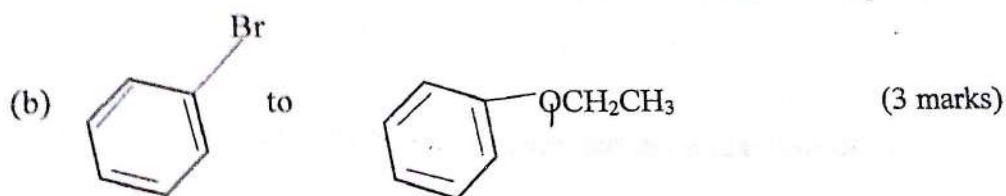
B..... (½ mark)

(b) Give a reason for your answer in (a) (2 marks)

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(c) Determine the overall order of the reaction. (1 mark)

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11.(a) When ammonium dichromate was heated a green solid R was formed. Write equation for the reaction that took place. (1 ½ marks)

(NH₄)₂Cr₂O₇

(b) R was heated with potassium hydroxide in contact with air. (1 mark)

i) State what was observed

ii) Write the equation for the reaction that took place. (1 ½ marks)

(c) The compound formed in (b); when treated with water gave a yellow solution. The yellow solution turned orange when acidified with dilute sulphuric acid. Identify;

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i) the ion that gives the yellow solution its colour. (½ mark)

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ii) the ion that gives the orange solution its colour. (½ mark)

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iii) Write ionic equation for the reaction leading to the formation of the orange colour. (1 ½ marks)

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(d) The resultant solution in (c)(iii) was added to excess sodium hydroxide solution

(i) State what was observed. (1 mark)

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(ii) Write equation for the reaction that took place (1 ½ marks)

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12.(a) Nitric acid and water are miscible in all proportions. They form a constant boiling point mixture having a boiling point 121°C , composition 68% by mass of nitric acid and density 1.42gcm^{-3} .

i) Define the term constant boiling point mixture (1 mark)

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ii) Sketch a labelled diagram of the boiling point – composition for nitric acid and water system. (The boiling point of water and nitric acid are 100°C and 83°C respectively) (3 marks)

- iii) Describe what would happen when 20% nitric acid is fractionally distilled. (2 marks)

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- (b) Explain why nitric acid and water form a constant boiling point mixture. (1 mark)

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(c) Calculate the molarity of the boiling point mixture (2 marks)

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13. 0.0291g of compound **P** containing carbon, hydrogen and oxygen gave 0.0581g of carbon dioxide and 0.0239g of water on combustion.

a) Calculate the empirical formula of **P** (3 marks)

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b) When 0.14g of **P** was vapourised at 20°C and 740 mmHg pressure, it occupied a volume of 39.5cm³.

i) Determine the molecular formula of **P** (2 marks)

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- ii) P reacted with sodium hydrogen carbonate with effervescence. Write the structural formulae and IUPAC names for all the possible isomers of P (2 marks)

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- (c) Write equation to show how one of the isomers of P can be converted to 1-Chloro-2-methylpropane (2 marks)

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14.State what would be observed and write equations for the reactions that would take place when:

- a) Potassium iodide is added to acidified potassium manganate (VII) solution. (2 ½ marks)

Observation

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Equation

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- b) Dilute hydrochloric acid is added to sodium thiosulphate solution (2 ½ marks)

Observation

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Equation

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- c) 2 or 3 drops of 2, 4 – dinitrophenylhydrazine is added to a dilute solution of propanone. (1 ½ marks)

Observation

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Equation

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- d) Tin (II) chloride is added to Iron (III) sulphate solution . (2 ½ marks)

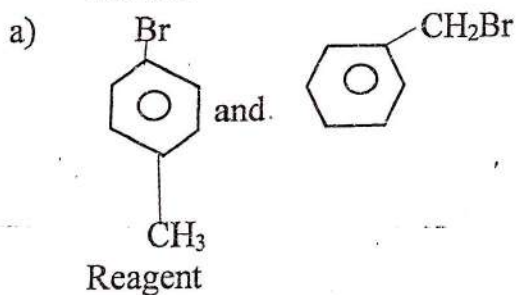
Observation

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Equation

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15. Name one reagent that can be used to distinguish the following pairs of organic compounds and in each case state what would be observed when each compound of the pair is separated treated with the reagent you have named.

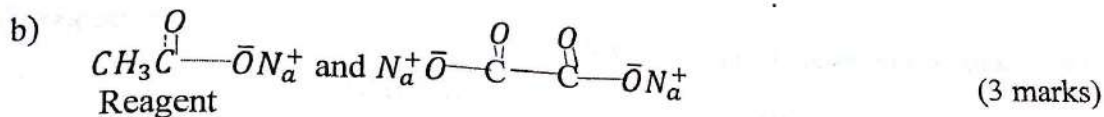


(3 marks)

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Observation

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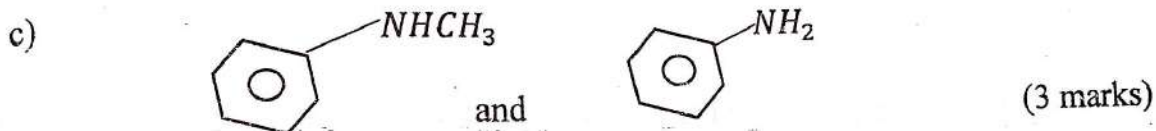
Observation

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Reagent

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Observation

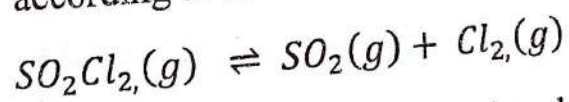
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16. Sulphur dichloride dioxide, SO_2Cl_2 , decomposes at high temperature, according to the following equation



When 13.5g of SO_2Cl_2 was placed in a 2 litre vessel and heated at a pressure of 2 atmospheres; 1.5g of chlorine was formed at equilibrium.

(a) Write the expression for the equilibrium constant, K_p . (1 mark)

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(b) Calculate the value of K_p and state its units

(5 marks)

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(c) State what would happen to the position of equilibrium when;

(i) Pressure is reduced

($\frac{1}{2}$ marks)

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(ii) Sulphur dioxide is removed from the equilibrium mixture.

($\frac{1}{2}$ marks)

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(iii) Chlorine is added to the equilibrium mixture. ($\frac{1}{2}$ marks)

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(d) Explain your answer in c(iii) above .

(1 $\frac{1}{2}$ marks)

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17.(a)(i) Write the formula and name of main ore of Zinc. (1 mark)

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(ii) State the method which can be used to concentrate the ore you have named in (a) (i). (½ mark)

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(b) The concentrated ore in (a) (ii) was converted to zinc oxide.

i) State how the conversion was carried out. (½ mark)

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ii) Write an equation for the reaction that led to the formation of zinc oxide. (1 ½ marks)

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(c) The zinc oxide in (b) was mixed with coke and limestone; the mixture put in a blast furnace and hot air blown into the furnace.

i) State the purpose of adding coke (½ mark)

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ii) Write equation for the reaction that takes place leading to the formation of Zinc. (1 mark)

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(d) Zinc powder was added to dilute sodium hydroxide solution.

i) State what was observed. (1 ½ marks)

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ii) Write equation for the reaction that took place. (1 ½ marks)

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(e) Explain why it is advantageous to have a sulphuric acid manufacturing plant near a zinc extraction plant (1 mark)

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END