

Name: ..... Index No. ....

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P525/1  
Chemistry  
Paper 1  
July/August 2022  
2 3/4 hours



KAYUNGA SECONDARY SCHOOLS EXAMINATIONS COMMITTEE (KASSEC)  
JOINT MOCK EXAMINATIONS, 2022  
*Uganda Advanced Certificate of Education*  
**CHEMISTRY**  
**Paper 1**  
**2 hours 45 minutes**

**INSTRUCTIONS TO CANDIDATES:**

- Answer all questions in section A and six questions in section 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  $R = 8.31 \text{ JK}^{-1} \text{ mol}^{-1}$
- Molar volume of a gas at s.t.p is 22.4 litres.
- Standard temperature = 273 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

**Turn Over**

**SECTION A ( 46 MARKS)**

1. State condition(s) and write equation for the reaction of aluminium and;
- (i) Sodium hydroxide. (2 marks)
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- (ii) Iron(III) oxide (2 marks)
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2. (a) State what is meant by the term ebullioscopic constant. (1 mark)
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- (b) 0.40g of camphor when dissolved in 33.5g of trichloromethane produces a solution boiling at  $0.30^{\circ}\text{C}$  above the boiling point of pure solvent. Calculate the ebullioscopic constant of trichloromethane. (molar mass of camphor = 155) (3marks)
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3. (a) State what is observed and write equation for the reaction when
- (i) Ethanal is mixed with a saturated solution of sodium bisulphite. (2marks)
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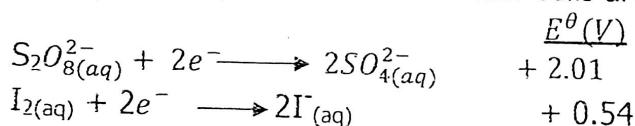
- (ii) Neutral iron(III) chloride solution is added to aqueous solution of hydroxybenzene. (2 marks)

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4. (a) State what is meant by the term electrode potential (1 mark)

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- (b) The electrode potential of some half cells are given below.



Write,

- (i) The cell notation of cell formed when the half cells are combined. (1 marks)

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- (ii) Equation for the overall cell reaction (1 ½ mark)

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(iii) Calculate the e.m.f of cell.

(1 mark)

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(iv) State whether the cell reaction is feasible or not. Give a reason for your answer.

(1 mark)

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5. (a) State two properties in which beryllium shows diagonal relationship with aluminium.

(2 marks)

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(b) Write equations to illustrate the properties stated in (a)

(3 marks)

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6. State what would be observed and write equation for the reaction that takes place when

(a) Chlorine gas is passed through a solution of potassium manganate (vi). (2 ½ marks)

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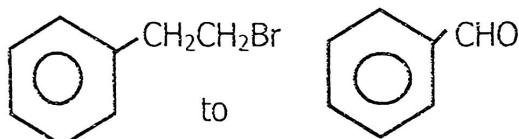
- (b) A few drops of hydrogen peroxide solution is added to acidified potassium dichromate (VI) solution. (2 ½ marks)

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7. Write equations to show how the following conversions can be effected.  
(a)  $(CH_3)_2CHOH$  to  $(CH_3)_3COH$  (2 ½ marks)

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(b)



(2 ½ marks)

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8.  $30\text{cm}^3$  of hydrocarbon Q was exploded with  $200\text{cm}^3$  of oxygen in excess. The volume of the residual gas on cooling to room temperature was found to be  $155\text{cm}^3$ . When the residual gas was treated with concentrated potassium hydroxide solution, the volume reduced to  $35\text{cm}^3$ .

- (a) Calculate the molecular formula of Q. (3 marks)

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(b) Write the structures of all possible open chain isomers of Q. (1 m)

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(c) Q reacts with ammoniacal copper (I) chloride solution.

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

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

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9. The molar conductivity of a 0.093M solution of ethanoic acid at  $25^{\circ}\text{C}$  is  $5.34 \times 10^{-4} \text{ sm}^2\text{mol}^{-1}$ . The molar conductivity at infinite dilution of  $\text{H}^+$  and  $\text{CH}_3\text{COO}^-$  ions are  $3.5 \times 10^{-2} \text{ sm}^2\text{mol}^{-1}$  and  $0.4 \times 10^{-2} \text{ sm}^2\text{mol}^{-1}$  respectively. Calculate the;

(i) Molar conductivity of ethanoic acid at infinite dilution. (1 ½ marks)

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(ii) Degree of dissociation,  $\alpha$  of ethanoic acid (1 ½ marks)

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(iii) Acid dissociation constant,  $K_a$  at  $25^{\circ}\text{C}$ . (1 ½ marks)

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## **SECTION B (54 marks)**

**Attempt only six questions from this section.**

10. (a) An organic compound **Z** has a molecular formula  $C_3H_6Br_2$ .

Write down the structural formula and IUPAC names of all isomers of **Z**.

(3 marks)

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- (b) When **Z** was heated with sodium metal in ethanol, a compound **Y** was formed. **Y** reacts with water in the presence of sulphuric acid and Mercury sulphate at  $60^{\circ}C$  to form a compound **X**. **X** does not react with Fehling's solution but forms an orange precipitate with Brady's reagent. Identify compound **X**, **Y** and **Z**. (1 ½ marks)

**X**.....

**Y**.....

**Z**.....

- (c) Write the equation and suggest the mechanism for the reaction between

- (i) **Z** and sodium metal in ethanol.

(2marks)

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(ii) X and Brady's reagent. (2 ½ marks)

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11. Explain each of the following observations (Your answer should include balanced equations if any)

(a) When hydrogen iodide is treated with concentrated sulphuric acid, iodine is liberated whereas when hydrogen chloride is similarly treated, chlorine is not evolved.

(3marks)

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- (b) An aqueous solution of sodium sulphite has a PH greater than 7 whereas that of sodium hydrogen sulphite is less than 7.

(3marks)

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- (c) When hydrogen sulphide is bubbled through an aqueous solution of iron(III) chloride, a yellow precipitate is observed. (3 marks)

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12. (a) State Raoult's law as applied to binary liquid systems. (1 mark)

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- (b) The mixture of water and nitric acid deviates negatively from Raoult's law. The mixture forms an azeotropic mixture at 68.2% nitric acid and boiling point 121°C.  
(i) Sketch a labelled boiling point – composition diagram for the mixture above. (Bpts of HNO<sub>3</sub> and H<sub>2</sub>O respectively are 78.2°C and 100°C at 760mmHg pressure)

(3 marks)

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- (ii) Describe briefly what happens when a mixture containing 50% nitric acid is distilled.

(2 ½ marks)

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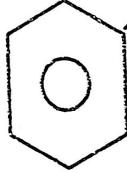
(c) Explain why the mixture deviates negatively from Raoult's law. (1 ½ marks)

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(d) Name one method of obtaining pure nitric acid from the azeotropic mixture. (1 mark)

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13. Name the reagents that can be used to distinguish between the following pair of organic compounds. In each case state what is observed when the compounds are separately treated with the reagent.

(a)  COOH and HCOOH

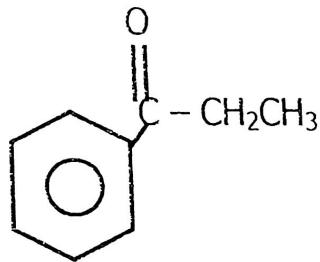
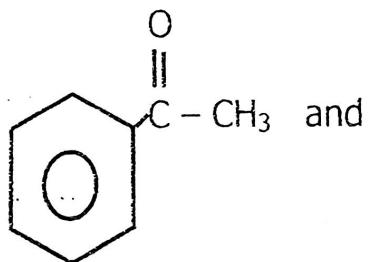
Reagent

(3marks)

Observation

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(b)



(3 marks)

### Reagent

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## Observation

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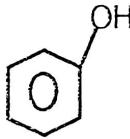
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(c)



and



## Reagent

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## Observation

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14. (a) 0.111g of a vaporized sample of an organic compound R occupied  $48.0\text{cm}^3$  at  $20^\circ\text{C}$  and  $700\text{mmHg}$  pressure. Calculate the relative molecular mass of R.

(2 ½ marks)

- (b) R consists 59.9% carbon, 13.5% hydrogen and the rest is oxygen. Determine  
(i) the empirical formula of R (2 ½ marks)

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- (ii) the molecular formula of R (1½ marks)

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- (c) Write down the structural formulae and give the IUPAC names of all isomers of R. (3 marks)

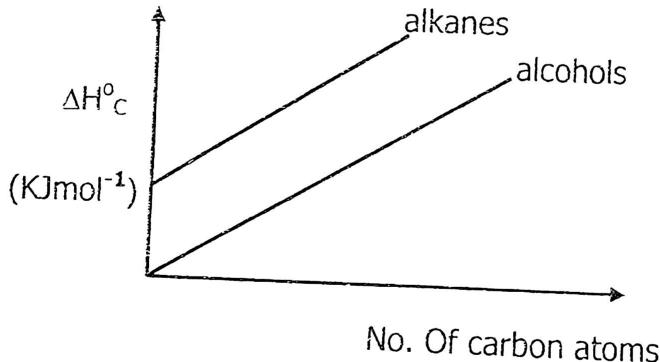
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- 15.(a) State two characteristic properties exhibited by manganese as a transition element. (2marks)

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- (b) (i) Write the electronic configuration of manganese. (1 marks)
- .....
- (ii) State the common oxidation states exhibited by manganese in its compounds. (1½ marks)
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- (c) Manganese (IV) oxide reacts with concentrated hydrochloric. Write the equation of reaction that takes place. (1½ marks)
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- .....
- .....
- (d) Lead(V) oxide was added to an aqueous solution of manganese(II) chloride, followed by concentrated nitric acid. The mixture was then heated.
- (i) State what was observed. (1½ marks)
- .....
- .....
- (ii) Write equation of reaction that takes place. (1½ marks)
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16. (a) The standard enthalpies of combustion of some straight chain alkanes and alcohols against number of carbon atoms is shown below.



- (a) Explain the shape of the graphs. (5marks)
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- .....

(b) Explain why the graph of enthalpy of combustion for alkanes does not pass through Zero yet for the alcohols passes through Zero. (4marks)

17. (a) Explain what is meant by the term complex ion (1 mark)

(b)(i) Some complex ions are given below. In each case, state the coordination number and oxidation state of the central atom. (3 marks)

Formulae of complex ion	Coordination number	Oxidation state
$C_0 Cl_4^{2-}$		
$Fe(CN)_6^{3-}$		
$Ag(NH_3)_2^+$		

(ii) Explain why transition metals form complex ions.

(2 marks)

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(c) In each case, write an equation catalyzed by the following ions/ species.

(1 ½

marks)

(i) Vanadium penta oxide

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(ii) Manganese (II) ions

(1 ½ marks )

**END**