Candidate's Name: .....

Signature .....

P525/1

CHEMISTRY

Paper 1

2¾ hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION

PRE-mock Examination 2023

CHEMISTRY

Paper 1

2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES

- Answer **all** questions in Section A and **six** questions from Section B.
- All questions must be answered in the spaces provided.
- The periodic table, with relative atomic masses, is attached at the end of the paper.
- Where necessary, use the following;
  - *Molar gas constant,* R = 8.31JK^{-1} mol^{-1}.
  - *Molar volume of gas at s.t.p is* 22.4 litres.
  - *Standard temperature = 273* K.
  - *Standard pressure = 101325* NM^{-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 IN THIS SECTION

1. (a) Bond energies for some bonds are given below;

Bond	Bond energy ($kjmol^{-1}$)
C=C	+813
C-C	+346
C-H	+413
H-H	+436

a) Calculate the enthalpy of hydrogenation of ethyne. (03amrks)

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b) State whether hydrogenation of ethyne is feasible or not. (01 mark)

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2. Complete the equation and write the accepted mechanism in each case.

$CH_3CH_2\underset{\underset{0H}{|}}{CH}\,CH3 \xrightarrow[180^0C]{Conc.H_2SO_4}$ (2½ marks)

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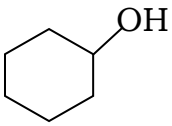
b)  $\xrightarrow[heat]{Conc.\ H_2SO_4}$ (2½ marks)

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3. Write equation for the reaction between aqueous sodium hydroxide solution and ;

a) Chromium(III) oxide

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b) Beryllium oxide

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c) Sulphur (IV) oxide

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4. (a) Complete the following nuclear reactions and name the particle in each case. (03 marks)

i) $^{238}_{92}\mathrm{U} + {}^{I}_{0}n \longrightarrow {}^{239}_{93}P_U + $ _____

Name of particle :_____

ii) $^{241}_{95}AM + {}^{4}_{2}He \longrightarrow {}^{243}_{97}Bk + $ _____

Name of particle :_____

iii) $^{27}_{14}Si \longrightarrow {}^{27}_{13}AL + $ _____

Name of the particle _____

b) The mass of a radio isotope T, reduced by 32% in 40 days. Calculate the half-life of T. (2½ marks)

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5. State what is observed and write equation of reaction in each case when the following compounds are mixed.

(a) Methanolic acid and ammoniacal silver nitrate solution and heated. (6½marks)

Observation

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Equation

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(b) Benzoic acid and sodium bicarbonate solution.

Observation

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Equation

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(c) propanone and Brady's solution

Observation

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Equation

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6. Calculate the PH of solution formed by mixing $80cm^3$ of 0.1M hydrochloric acid with $120cm^3$ of 0.1M potassium hydroxide.

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7. (a) Write the

(i) Equation for ionization of methanolic acid in water. (1½ marks)

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(ii) Expression for the constant Ka, for methanolic acid. (1½marks)

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(b) The molar conductivity of 0.1M methanoic acid at 25^oc is $16.25cm^2mol^{-1}$. Calculate the;

(i) Degree of ionization of methanoic acid at 25^0c. (molar conductivity of methanoic acid at infinite dilution at 25^0c is $4055cm^2mol^{-1}$) (1½marks)

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(ii) Ionization constant, Ka, for methanoic acid at 25^0c. (1½marks)

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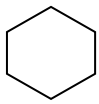
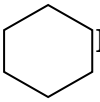
8. Write equation to show how the following conversions can be effected.

a)  $NHCOCH_3$ from  Br (2½ marks)

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b) CH_3COOH from $HC \equiv CH$ (2½marks)

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9. Bauxite is the principal used in extraction of aluminum (a)

(i) Write the formula of Baluxite (01 mark)

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(ii) Name the impurities present in Bauxite (01 mark)

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(b) Bauxite was treated with concentrated sodium hydroxide solution. Write equation(s) for the reaction(s) that take place. (02 marks)

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(c) The mixture in (b) was filtered and carbon dioxide was bubbled through the filtrate. State what is observed and write equation for the reaction.
(02 marks)

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d) State one use of aluminium. (½ marks)

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SECTION B (54 MARKS)

Answer six questions from this section

Any additional question(s) will not be marked

10. (a) 3.4g of an organic compound K, containing carbon, hydrogen and oxygen on complete combustion produced 5.04dm3 of carbon dioxide and 2.7g of water at s.t.p. calculate the empirical formula of K. (2½ marks)

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b) When K was steam distilled at 760mmHg and at 95^0c the distillate contained 77.1% by mass of K. calculate the molecular formula of K. (The saturated vapour pressure of water at 95^0c was 526mmHg). (03 marks)

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c) K burns with a sooty flame and reacts with sodium metal to produce a colorless gas that burns with a pop sound. When K was heated with acidified potassium chloromate solution, there was no observable change.

(i) Identify k (01 mark)

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(ii) Write equation for the reaction and suggest a suitable mechanism when K was reacted with concentrated orthophosphoric acid. (2½ marks)

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11. (a) State three characteristics of chemical equilibrium (1½ marks)

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(b) Phosphorous (v) chloride, when heated decomposed according to the following equation.

$PCl_5(g) \rightleftharpoons PCl_3 + Cl_2(g)$

i) Write the expression for the equilibrium constant, Kc at 350^0c.

(3½ marks)

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ii) When 1 mole of phosphorus(v) chloride was heated in a closed vessel at 350^0c, the equilibrium mixture was found to contain 38.4% of chloride. Calculate the equilibrium constant, kc at 350^0c. (3½marks)

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iii) The equilibrium constant at 350^0c is 1.54, state whether the reaction is exothermic or endothermic. Give a reason for your answer.(1½ marks)

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c) State what would happen to the concentration of chlorine if the pressure in the vessel was decreased while the temperature is maintained at 350^0c. give a reason for your answer. (1½ marks)

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12. Sodium, silicon and aluminium belong to period 3 of the periodic table. State the type of bonding and structure adopted by of the chloride of the elements. (03 marks)

Formula of chloride	Bonding	Structure
NaCl		
$SiCl_4$		
$AlCl_3$		

b) Write equation of reaction that takes place when the chlorides are reacted with water. (03 marks)

(i) Sodium chloride

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(ii) Aluminium chloride

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(iii) Silcon (IV) chloride

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c) State what would be observed when aqueous sodium carbonate is added to an aqueous solution of aluminum chloride and write equation of reaction that takes place. (03 marks)

observation

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Equation

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13. Complete the following and write mechanism for the reaction in each case.

a) $(CH_3)_3$ CBr $\xrightarrow[heat]{CH_3\,CH_2O^-Na^+}, ethanol$

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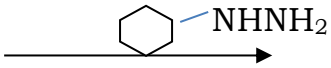
b) $CH_3CH_2COCH_3$  (04 marks)

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c)  (2½marks)

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14. The standard electrode potentials, Eθ for half-cell reactions are given below

$M_n0^-_{4(aq)} + 8H^{+(aq)} + 5e^- \longrightarrow Mn^{2+}_{(aq)} + 4H_2O_{(l)}$ +1.52

$S0^{2-}_{4(aq)} + 2H^+(aq) + 2e^- \longrightarrow SO^{2-}_{3(aq)} + H_20_{(l)}$ + 0.20

$Br_{2(aq)} + 2e \longrightarrow 2Br^-_{(aq)}$ +1.06

$Cl_{2(aq)} + 2e \longrightarrow 2Cl^-_{(aq)}$ +1.36

a) Write the cell notation for the reaction between sulphate ions and acidified potassium manganate(Vii) solution. (1½ marks)

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b) Write the ionic equation for the overall cell reaction (1½ marks)

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c) Calculate the e.m.t of the cell. (1½ marks)

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d) Explain why hydrochloric acid is not used to acidify titrants in volumetric analysis involving potassium manganate (VII). (2½ marks)

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e) State which of bromine and chlorine a stronger oxidizing agent is and give a reason for your answer. (01 mark)

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15. (a) Write the electronic configuration of copper. (01 mark)

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(ii) State three properties which show copper as a d-block element. (1½marks)

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b) Excess ammonia was shaken with equal volume of trichromethane and a 0.05M aqueous solution of copper(ii) sulphate and allowed to stand. Some ammonia reacted with copper(II) ions to form a complex, $[CU[NH_3]n]^{2+}$
At equilibrium, the concentration of ammonia in the trihalomethane and in the aqueous layers were 0.021 moldm^{-3} and 0.725 moldm^{-3} respectively. (The partition coefficient KD1 of ammonia between water and trihalomethane is 25)
Calculate;

i) The concentration of ammonia in the aqueous layer (1½marks)

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ii) The concentration of ammonia that formed the complex with copper. (1½marks)

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iii) The value of n in the complex. (2½marks)

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c) State any two uses of copper. (01 mark)

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16. (a) Draw the structure and name the shapes of the following oxyanions. (4½ marks)

Oxyanion	Structure	Name of Shape
NO_2^-		

$Cr0_4^{2-}$		
CO_3^{2-}		

(c) Write equation for the reaction of ;

(i) NO_2^- with acidified potassium dichromate solution (1½ marks)

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(ii) $Cr0_4^{2-}$ with dilute hydrochloric acid. (1½ marks)

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(iii) CO_3^{2-} with water. (1½ marks)

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17. Both chlorine and sodium hydroxide are manufactured by electrolysis of concentrated sodium chloride solution.

a) Name the substance used as the;

i) Cathode

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ii) Anode

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b) Write the equation(s) for the reaction(s) leading to the formation of.

i) Chlorine (01 mark)

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ii) Sodium hydroxide

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c) State what would be observed and write the equation for the reaction that would take place if chlorine is bubbled through; (02 marks)

(i) sodium iodide solution

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ii) Concentrated sodium hydroxide solution. (02 marks)

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d) Give a reason for your answer in (c) (i) (01 mark)

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f)

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iv)

19.