Name of School:...

Candidate's Name:...

Centre No. /Index No: .... **Signature:**.................

P525/1
CHEMISTRY
Paper 1
July - August
2 ¾ Hours

ELITE EXAMINATION BUREAU MOCK 2019
Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1

2 Hours 45 Minutes

INSTRUCTIONS TO CANDIDATES:

- *This paper consists of **two** sections **A** and **B**.*
- *Section **A** is compulsory.*
- *Attempt only **six** questions in section B*
- *Answers must be written in the spaces provided only.*
  (R=0.0821 L.atm.mol^{-1}K^{-1})

For examiner's use only																	TOTAL
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	

SECTION A: (46 marks)

Answer all questions from this section.

1. The standard electrode potentials for some half – cells are shown below.

$$Fe^{3+}_{(aq)}, Fe^{2+}_{(aq)}/Pt(s) \qquad +0.77V$$

$$Sn^{4+}_{(aq)}, Sn^{2+}_{(aq)}/Pt(s) \qquad +0.15V$$
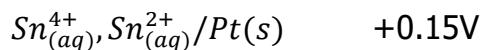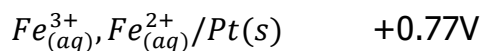
a) Write the convention for the combined cell.   (1½ marks)

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b) Write equation for the:

   i)   reaction at the cathode   (01 mark)

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   ii) reaction at the anode   (01 mark)

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   iii) overall cell reaction   (1½ marks)

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c) Calculate the e.m.f of the cell.   (01 mark)

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d) State one application of electrode potentials.   (01 mark)

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2. a) Draw the structure and name the shape of the following oxides. In each case state the oxidation state of the Sulphur atom. (02 marks)

Oxide	Structure	Shape	Oxidation state of sulphur
SO_2			
SO_3			

b) i) Name the reagent that can be used to distinguish between the oxides in (a). (01 mark)

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ii) State what would be observed, if a solution of each oxide is treated separately with the reagent you have named in b(i). (01 mark)

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iii) Write equation(s) for the reaction(s) that would take place when solutions of each oxides are treated separately with the reagent you have named in b(i). (1½ marks)

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3. a) Define the term solubility product. (01 mark)

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b) Calculate the solubility product of a solution containing 8.35×10^{-3}g of magnesium hydroxide in one litre of solution at 25^0C. (03marks)

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c) State one application of solubility product. (01 mark)

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4. a) Write equation for the reaction between water and

i) iron (III) chloride (1½ marks)

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ii) tin (II) chloride (1½ marks)

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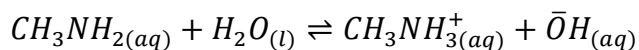
b) A piece of clean magnesium ribbon was added to the solution in a(i). State what was observed and write equation for the reaction that took place. (2½ marks)

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5. Methylamine ionises in water according to the following equation.

$$CH_3NH_{2(aq)} + H_2O_{(l)} \rightleftharpoons CH_3NH_{3(aq)}^+ + \bar{O}H_{(aq)}$$

a) Write the expression for the ionization constant K_b of methylamine.

(01 mark)

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b) 0.2 moles of methyl ammonium chloride was added to one litre of 0.2M methylamine.
   i) Calculate the PH of the resultant solution. [The ionization constant Kb of methylamine is 4.4 x 10^{-4}mol l^{-1}, Kw is 1.0 x 10^{-14} mol^2 l^{-2} at 25^{0}C].

(03 marks)

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   ii) State the assumption(s) you have made in b(i).   (½ mark)

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6. Write equations to show how the following compounds can be synthesized.

   a)   CH = N − OH

                              from benzene   (2½ marks)

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b) $CH_3\overset{OH}{\underset{|}{C}}HCH_3$ from ethanol   (2½ marks)

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7. To an aqueous solution of **CoCl$_2$.6H$_2$O** was added concentrated hydrochloric acid dropwise until in excess.
   a) Name:
      i) the cobalt species present in the solution before hydrochloric acid was added.   (01 mark)

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      ii) the cobalt species present in the solution containing excess hydrochloric

      acid.   (01 mark)

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   b) The solution containing excess hydrochloric acid was diluted with water

      i) State the colour change that took place.   (01 mark)

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      ii) Write an equation for the reaction that took place.   (1½ mark)

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8. a) When propene reacts with bromine in presence of sodium chloride solution, a mixture of a dibromo and bromochloro compounds are formed. Outline a mechanism for the reaction leading to the formation of the two compounds.   (03 marks)

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b) Name the type of mechanism for the reaction in (a).

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9. The data below was obtained for the reaction.

   A + B ⟶ Products
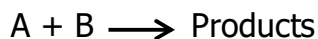
Experiment	Initial concentrations (mol dm^{-3})		Initial rate mol d m^{-3} S^{-1}
	A	B	
1	2.0	2.0	3.2 x 10^{-5}
2	2.0	4.0	6.4 x 10^{-5}
3	4.0	2.0	x
4	4.0	4.0	25.6 x 10^{-5}

a) Write the rate equation.   (01 mark)

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b) Calculate

   i) the value of x   (01 mark)

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   ii) the rate constant for the reaction and state its units.   (02 marks)

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SECTION B (54 Marks)

Answer six questions from this section.

10. Complete the following equations and write a mechanism for the reaction in each case.

a)

$$CH_3CH_2 \backslash$$
$$C = O + \text{(phenylhydrazine } NHNH_2H^+)$$
$$CH_3 /$$

(04 marks)

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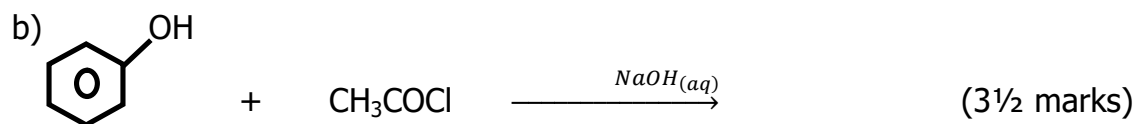..

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b)

(phenol with OH) $+$ CH_3COCl $\xrightarrow{NaOH_{(aq)}}$

(3½ marks)

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c) CH_3CH_2Cl $\xrightarrow[dry\ ether]{HC \equiv \bar{C}Na^+}$

(1½ marks)

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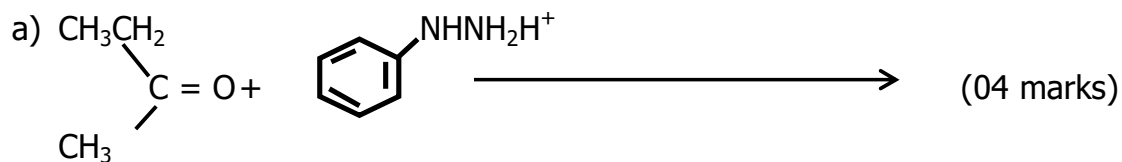
11. a) State
   i) the common oxidation states of manganese. (1½ marks)

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   ii) the most stable oxidation state of Manganese. (½ mark)

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   iii) the reason for your answer in a(ii). (½ mark)

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   b) Write a half equation for the reduction of permanganate ion in
   i) acid medium (01 mark)

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   ii) alkaline medium (01 mark)

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   c) An acidified solution of potassium iodide was added to a solution of potassium permanganate.
   i) State what was observed. (01 mark)

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   ii) Write the ionic equation for the reaction that took place. (1½ marks)

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   d) State
   i) two advantages of using potassium permanganate as a reagent in volumetric analysis. (01 mark)

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ii) two reasons why potassium permanganate is not a primary standard.
(01 marks)

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12. a)   Define the term **"Partition coefficient"**   (01 mark)

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b) Copper (II) ions forms a complex $Cu(NH3)_n^{2+}$ with ammonia.   The table below shows the results of partition of ammonia between 0.1M copper (II) ions and trichloromethane.

$[NH_3]$ $(0.1M\ Cu^{2+}_{(aq)})$	0.88	1.08	1.34	1.56	1.80
$[NH_3(CHCl_3)]$.	0.02	0.03	0.04	0.05	0.06

i) Plot a graph of $[NH_3]$ $(0.1M\ Cu^{2+}_{(aq)})$ against $[NH_3(CHCl_3)]$.   (03 marks)

ii) Determine the value of n in the complex. (2½ marks)

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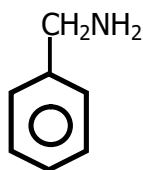..

c) i) Determine the partition coefficient, K_D of ammonia between aqueous copper (II) ions and trichloromethane. (1½ marks)
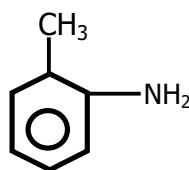
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ii) State what the value of K_D you have determined indicates about the distribution of ammonia. (01 mark)

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13. Name a regent that can be used to distinguish between the following pairs of organic compounds and in each case state what is observed.

  and   (3marks)

Reagent: ....

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Observation:

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b) HCOOH and CH_3COOH

Reagent: ....

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Observation:

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(c)

CH₂Br on benzene ring   and   CH₃ on benzene ring with —Br
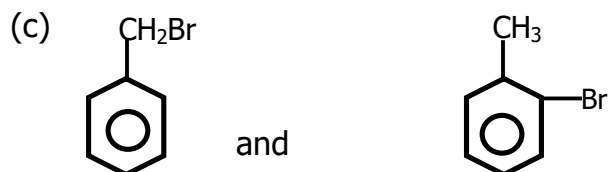
Reagent:

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Observation:

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14. Carbon, silicon, germanium, tin and lead are in group IV of the periodic table.
a) State;
   i) the common oxidation states exhibited by the elements in their ions or compounds. (01 mark)

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   ii) how the stability of each oxidation state in a(i) varies down the group. (01 marks)

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b) Give a reason for your answer in (a) (ii). (01 mark)

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c) Compare the thermal stabilities of carbon tetrachloride and lead tetrachloride (include equations of reactions if any)   (2½ marks)

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d) Describe the reaction if any between each of carbon tetrachloride and lead tetrachloride with water.

   i)   Carbon tetrachloride   (01 marks)

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   ii) Lead tetrachloride   (2½ marks)

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15.   State what would be observed and write equation for the reaction that would take place when
   a) Solid sodium iodide is heated with concentrated sulphuric acid. (2½ marks)

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   b) A mixture of benzoic acid and iron (III) chloride solution is heated.

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c) Sodium nitrite was added to acidified potassium dichromate solution.

(2½ marks)

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d) A mixture of ethanal and silver nitrate in ammonia solution.   (02 marks)

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16.   The conductimetric curve for the titration of ethanoic acid and ammonia solution is given below.
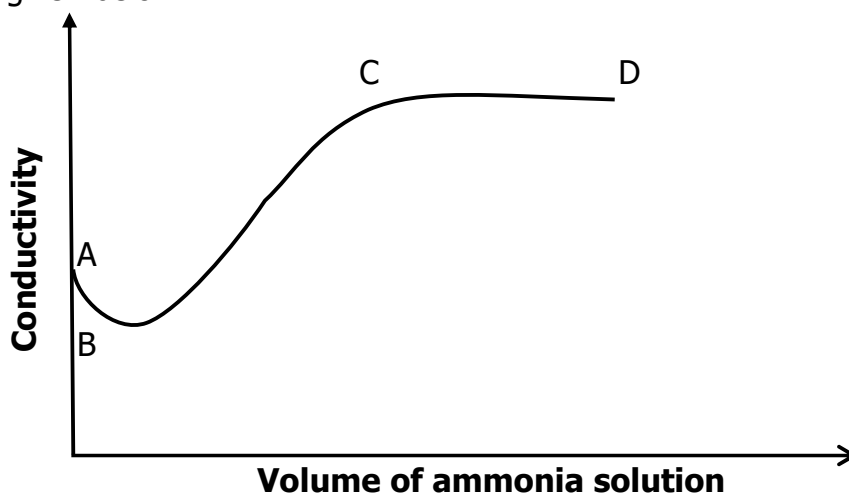
Explain the shape of the graph.   (04 marks)

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b) The molar conductivity of nitric acid, sodium bromoethanoate and sodium nitrate are 421, 89.3 and $121.3\Omega^{-1}cm^2\ mol^{-1}$ respectively at inifinite dilution at 25^0C.Calculate the:

i) molar conductivity of bromoethanoic acid at infinite dilution.(1½ marks)

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ii) Dissociation constant, Ka, of a 0.1M bromoethanoic acid solution. (The electrolytic conductivity of bromoethanoic acid is $4.38\ x\ 10^{-3}\Omega^{-1}cm^{-1}$)

(3½ marks)

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17.   a)   Differentiate between soap and soapless detergents.   (02 marks)
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b) Write equations to show how a soapless detergent can be prepared from dodecanol, $CH_3(CH_2)_{10}CH_2OH$.   (02 marks)

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c) Explain the cleansing action of soap. (03 marks)

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d) State the advantage and disadvantage of using a soapless detergent instead of soap in washing.
i) Advantage (01 mark)

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ii) Disadvantage (01 mark)

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END