NAME:		INDEX NO:	
SCHOOL:		SIGNATURE:	

P525/1
CHEMISTRY
Paper 1
August, 2019
2¾Hrs

UNNASE
Community

UNNASE MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

CHEMISTRY

PAPER 1

Time: 2hours 45minutes

Instructions

❖ Attempt **all questions in section A** and **only six questions** from section B.

❖ All questions are to be answered in the spaces provided.

❖ A periodic table with relevant atomic masses is supplied at the back of the paper.

❖ Mathematical tables (3figures) and non-programmable silent scientific calculators may be used.

❖ A piece of graph should be provided.

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. Standard electrode potentials for some half-cell reactions are given below.

   (i) $Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn_{(s)} - 0.76(v)$

   (ii) $2 MnO_{2(s)} + H_2O_{(L)} + 2e^- \longrightarrow Mn_2O_{3(s)} + 2OH^-_{(aq)} + 0.74(v)$

   (a) Write the cell notation of the cell formed when the half cell (i) and (ii) are combined
   (1 mark)

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   (b) Write the overall cell reaction.
   (1½ marks)

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   (c) Calculate the E.M.F of the cell.
   (1½ marks)

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

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2. (a) Complete the following equations and name the organic product that is predominant.

(i) [structure: cyclohexene with CH₃ substituent] $\xrightarrow{\text{HCl}}$ (1½marks)

Name the product

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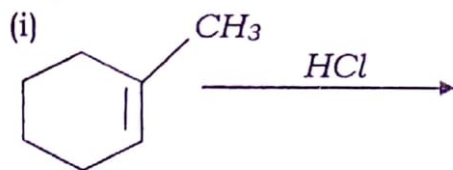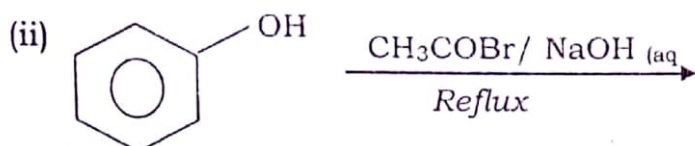
(ii) [structure: benzene ring with OH] $\xrightarrow[\text{Reflux}]{\text{CH}_3\text{COBr/ NaOH}_{(aq)}}$ (1½ marks)

Name the product

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(b) Write the mechanism for the reaction in (ii).   (1½ marks)

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3. State what would be observed and in each case write the equation(s) for the reaction that takes place when acidified Potassium Manganate (VII) solution is reacted with;
   (i) Sulphur dioxide gas.   (2½ marks)
   Observation

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Equation

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(ii) Aqueous Potassium iodide.   (2½ marks)
   Observation

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   Equation

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4. (a) Write;
   (i) Equation for ionsiation of bromoethanoic acid in water.   (1½ marks)

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   (ii) The expression for the acid dissociation constant.   (½ marks)

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(b) The molar conductivity of nitric acid, sodium bromoethanoate and sodium nitrate are 421, 61.2 and $89.3\,\Omega^{-2}cm^2mol^{-1}$ respectively at infinite dilution. Calculate the;

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

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(ii) Acid dissociation constant Ka, of a 0.1 Mbromoethanoic acid solution. (The electrolytic conductivity of bromoethamic acid is $4.38 \times 10^{-3}\,\Omega^{-1}cm^{-1}$).   (3marks)

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5. (a) State the oxidation state of the central atom in each of the following complex ions and in each case give the name of the complex ion.

(4½ marks)

Complex ion	Oxidation state of central atom	Name of complex ion
$[Co(NH_3)_4Cl]^+$		
$[CuBr_4(H_2O)_2]^{2-}$		
$Zn(OH)_4^{2-}$		

(b) Explain why transition metals form complex ions. *(02 marks)*

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6. Write equations to show how the following conversions can be effected.
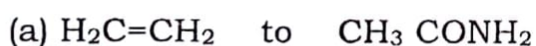
    (a) $H_2C=CH_2$ to CH_3CONH_2 *(3 marks)*

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(b) CH_3CHO to $CH_3COOCH_2CH_3$.   (2½ marks)

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7. (a) State Le chatelier's principle.   (1 mark)

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(b) Hydrogen and iodine react according to the following equation.

$$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)} \qquad \Delta H = (^+Ve)$$
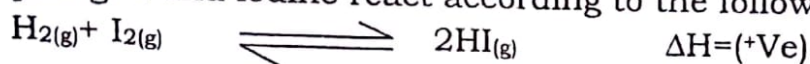
State what would happen to the position of equilibrium when;

(i) Temperature is lowered   (½ mark)

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(ii) Pressure is increased   (½ mark)

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(c) When Molar quantities of hydrogen and iodine are reacted in a sealed vessel at 500^0c and 10 atmospheres. The equilibrium mixture was found to contain 1.6 moles of hydrogen iodide.

Calculate the equilibrium constant K_P for the reaction at 500^0c (3½ marks)

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8. Explain the following observations;

(a) Silicon (VI) oxide is a solid at room temperature whereas carbon dioxide is a gas at room temperature. (3 marks

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(b) Ammonium nitrate is readily soluble in water even though the standard enthalpy of solution has a positive value. (3 marks

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9. 30g of compound Y depressed the freezing point of 50g of water by 6.2°c.

(a) Calculate the relative molecular mass of y; (3 marks)
   (K_f = 1.86°C per 1000g of water)

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(b) The empirical formula of Y is CH_2O. Determine its molecular formula.

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(c) Write equations to show how Y can be converted to chloromethane.

(1½ marks)

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SECTION B: (54 MARKS)
Answer any six questions from this section.

10. The figure below shows the melting points of the elements in period 3 of the periodic table.

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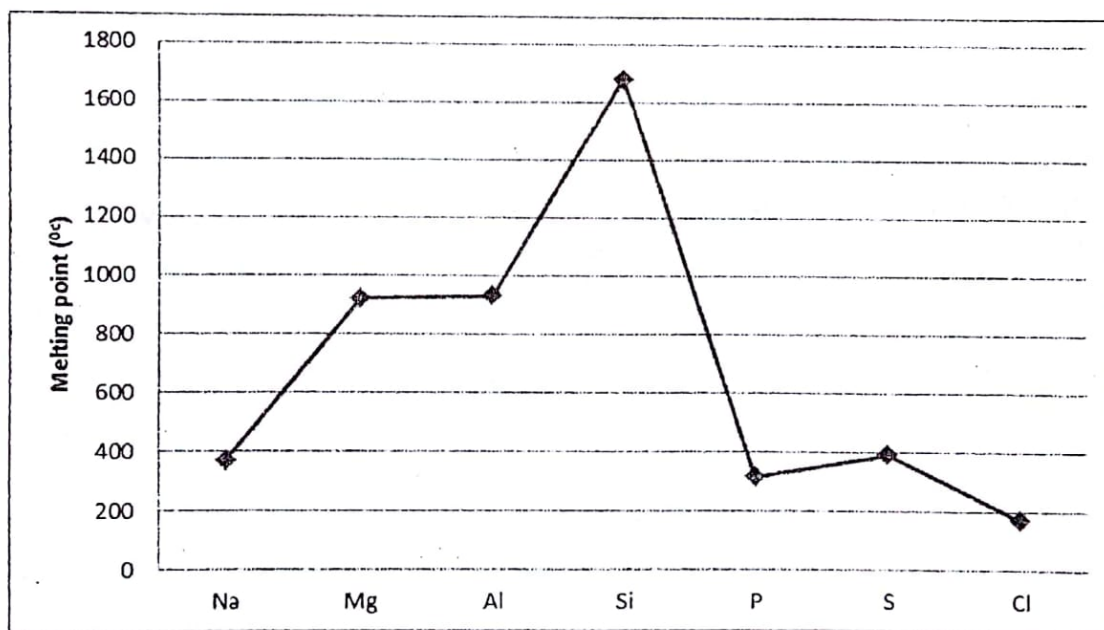
Explain each of the following observations

(i) Magnesium has higher melting point than Sodium. (3 marks)

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(ii) Phosphorous has a lower melting point than sulphur. (3 marks)

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(iii) Silicon has the highest melting point. (3 marks)

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11. A compound R contains 63.69% lead, 14.77% carbon, 1.85% hydrogen and the rest being oxygen.
    (a) Calculate the empirical formula of R. (2½ marks)

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(b) A 2% aqueous solution of R freezes at -0.14°C. Determine the molecular formula of R. *(4½ marks)*

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(c) R reacts with aqueous iron (III) chloride solution to give a brown solution and a white solid.

(i) Identify R. *(½ mark)*

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(ii) Write equation for reaction that takes place. *(1½ marks)*

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12. (a) Write equations to show how each of the following chlorides of group (IV) elements of the periodic table can be prepared.

(i) Carbon tetrachloride. *(1½ marks)*

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(ii) Lead (II) Chloride. *(1½marks)*

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(iii) Lead (IV) chloride. *(1½ marks)*

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(b) Compare the thermal stability of carbon tetrachloride and lead (IV) chloride. (Include equation for the reactions if any). *(2½ marks)*

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(c) Lead (IV) chloride is covalent whereas lead (II) chloride is ionic. Explain this observation. *(02 marks)*

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13. Complete the following reactions and in each case write the accepted mechanism leading to the formation of the major product.

    (a) $CH_3 - C \equiv CH + CH_3Br$ $\underline{Na/\ liquid\ NH_3}$ *(4 marks)*

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(b) $\dfrac{NH_2OH}{Reflux}$ *(5 marks)*

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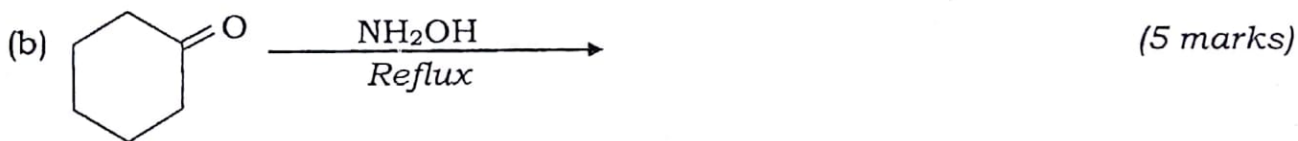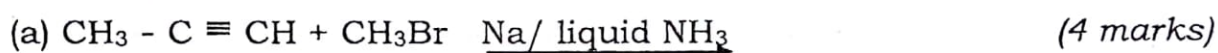
14. Describe the reaction(s) between chlorine and;
    (a) Benzene   (4½ marks)

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(b) Sodium hydroxide   (4½ marks)

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15. Silver carbonate is sparingly soluble in water.
    Write;
    (i) Equation for solubility of silver carbonate in water.   *(1½ marks)*

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(ii) The expression for the solubility product for silver carbonate.   *(1 mark)*

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(b)The solubility product for silver carbonate at 20^0c is 8×10^{-12} mol^3dm^{-9}.
    Calculate the;
(i) Solubility of silver carbonate in water in $moldm^{-3}$ at 20^0c *(2 marks)*

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(ii) Mass of silver carbonate precipitated in a 0.1M aqueous solution of
potassium carbonate.   *(3 marks)*

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(c) State what would happen to the solubility of silver carbonate when aqueo ammonia is added to the solution in b(i). Give a reason for your answer.

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16. Oxygen diffused through a porous plug in 1.3 times than an alkyne y.
(a) (i) Calculate the formula mass of Y.

(2 marks

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(ii)Determine the molecular formula of Y.

(1½ marks)

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(b) Write the formulae and names of all possible isomers of Y.   (2 marks)

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(c) Y forms a red precipitate with ammoniacal copper (i) chloride solution.

    (i) Identify Y.   *(1 mark)*

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(ii) Write equations to show how Y can be converted to butan-2-ol.   *(2½ marks)*

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17. (a) (i) State the distribution law.   *(1 mark)*

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  (ii) Under which conditions is the law you have stated in (i) valid. *(1 mark)*

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(b) The table below shows the concentration of succinic acid in ether and water at equilibrium in $moldm^{-3}$.

Experiment number	1	2	3	4	5	6
[succinic acid] water	0.023	0.028	0.036	0.044	0.052	0.055
[succinic acid] Ether	0.15	0.18	0.24	0.30	0.36	0.38

(i) Plot a graph of [succinic acid] in ether against [succinic acid] in water.
(3 marks)

(ii) Use the graph to determine the distribution constant of succinic acid between Ether and water.
(1 mark)

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(c) 100cm³ of ether was shaken with an aqueous solution containing 18g of succinic acid per dm³ of solution.
Calculate the mass of succinic acid that remained in the aqueous layer.
(2½ marks)

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(d) State one application of the distribution constant. (½mark)

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