P525/2
CHEMISTRY
Paper 2
JULY/AUGUST – *2018*
2 ½ HRS

ARUA DISTRICT SECONDARY SCHOOLS EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

MOCK EXAMS 2018

CHEMISTRY

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

- *Answer five questions, including three questions from section A and any two from Section B.*
- *Begin each question on a fresh page.*
- *Mathematical tables and silent non programmable calculators may be used.*
- *Use equations where necessary to illustrate your answers.*

(Mn = 55, C = 12. O = 16. H = 1)

SECTION A (60 MARKS)

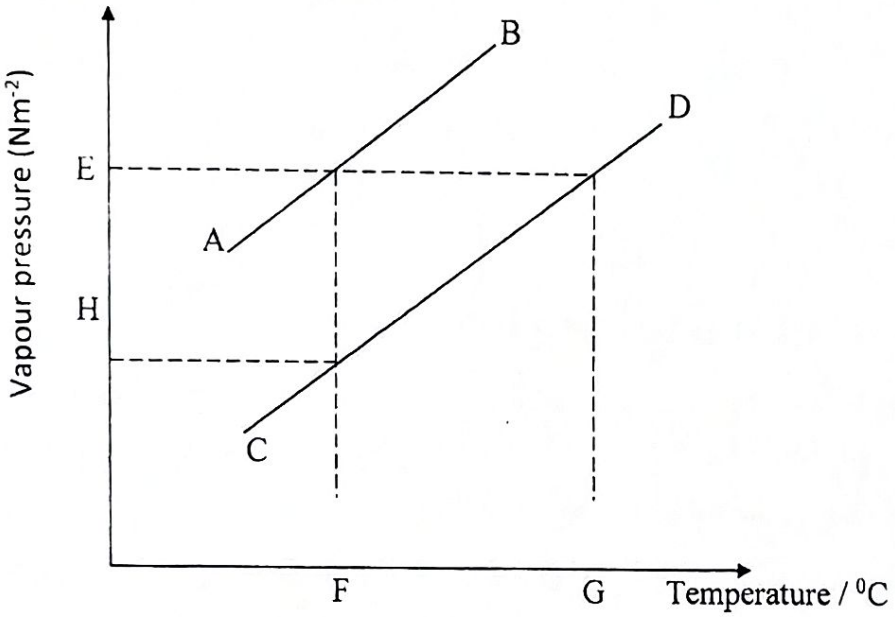
Answer any three questions from this section.

1. (a) State;

(i) what is meant by vapour pressure ***(01 mark)***

(ii) why the boiling point of a solvent is lower than that of its solution ***(1½ marks)***

(b) A non volatile solute P was added to a solvent X. The diagram below shows how the vapour pressure of the solution and that of the pure solvent vary with temperature



(i) Identify the curves AB, CD and points E , F and G ***(3½ marks)***

(ii) State the value of the normal vapour pressure at point E ***(½ mark)***

(iii) Show how the graph can be used to derive an expression for calculating the molecular mass of a non volatile solute ***(3½ marks)***

(c) State the partition law ***(01 mark)***

(d) 25cm^3 of 0.05M iodine solution in tetra chloromethane was shaken with 50cm^3 of water at 25°C. After equilibrium had been attained, 25cm^3 of aqueous layer required 2.74cm^3 of M sodium thiosulphate solution

(i) Calculate the partition coefficient of iodine between the two solvents. ***(06 marks)***

(ii) Explain how addition of potassium iodide to the aqueous layer would affect the distribution of iodine in the solvents ***(03 marks)***

(e) Explain why the ratio of concentration of iodine in water and carbon tetrachloride is constant while that of hydrogen chloride between the two solvents is not constant. ***(01 mark)***

2. Explain the following observations;

(a) Addition of alkaline potassium manganate (VII) solution to methylbenzene produces no white precipitate while a white precipitate is formed on addition of acidified potassium manganate (VII) solution to methylbenzene. *(6½ marks)*

(b) White fumes are seen when water was added to silicon (IV) chloride while no white fumes are seen with tetra chloromethane. *(3½ marks)*

(c) The boiling point of 2, 3 – dimethyl butane is lower than that of hexane. *(03 marks)*

(d) Hexane burns with clean flame while benzene burns with a smoky flame. *(3½ marks)*

(e) When but – 2 – ene was passed through alkaline potassium manganate (VII) solution, a purple solution turns colourless and dark brown solid was formed. *(04 marks)*

3. (a) (i) Write the electronic configuration of manganese (Atomic Number of manganese is 25). *(½ mark)*

(ii) State why manganese is classified as a transition element. *(01 mark)*

(b) Describe the reaction of manganese with *(06 marks)*

(i) Air

(ii) Hydrochloric acid *(03 marks)*

(c) State what is observed and write equation if:

(i) dilute sulphuric acid is added to potassium manganate (VI) *(2½ marks)*

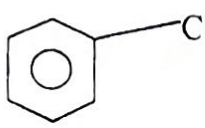
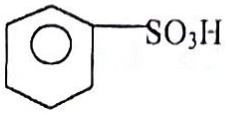
(ii) a few drops of concentrated nitric acid followed by a little solid sodium bismuthate were added to manganese (II) sulphate and then warmed gently. *(02 marks)*

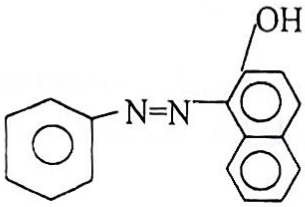
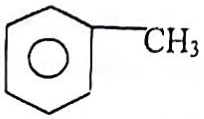
(d) Acidified Potassium manganatc (VII) is commonly used in volumetric analysis.

(i) Explain two advantages and one disadvantage of using it in volumetric analysis *(1½ marks)*

(ii) Briefly describe how percentage purity of iron in an ore can be determined using potassium manganate (VII) *(04 marks)*

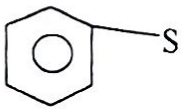
4. Write equations and conditions to show how the following compounds can be synthesized

(a)  from  *(05 marks)*

(b)  from  *(06 marks)*

(c) But – 2 – yne from 2 – bromobutane *(03 marks)*

(d) $CH_3\underset{OH}{\underset{|}{C}}H\,COOH$ from Bromoethane *(04 marks)*

(e)  from Ethyne *(02 marks)*

SECTION B

5. (a) (i) State the difference between a thermoset and a thermoplastic *(01 mark)*

(ii) Explain your answer in (a)(i) above *(03 marks)*

(iii) Name one thermoset and one thermoplastic *(01 mark)*

(b) Perspex, $\left\{ CH_2 - \underset{COOCH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}} \right\}_n$ and terylene $\left\{ CO - C_6H_4 - COO - (CH_2)_2 - O \right\}_n$

are synthetic polymers.

(i) Write the structural formulae of their monomers and name them. *(03 marks)*

(ii) Name the type of polymerization leading to their formation *(01 mark)*

(c) Name;

(i) one natural polymer that is formed by addition polymerization. *(01 mark)*

(ii) the monomers of the polymer in (c)(i)above *(01 mark)*

(d) A soap is made by boiling a mixture of fats or oils with alkali solution and then adding hot brine solution to the product mixture.

(i) What is meant by the term "soap"? *(01 mark)*

(ii) Name the chemical process leading to soap manufacture. *(01 mark)*

(iii) Write equation for the reaction leading to the formation of soap. *(1½ marks)*

(iv) Explain why hot brine solution is added to the product mixture. *(1½ marks)*

(v) Explain how soap removes dirt on a white shirt. *(04 marks)*

6. Carbon, silicon, Germanium, Tin and Lead are group (IV) elements of the Periodic Table

(a) Write the general outer most shell electronic configuration of the elements. *(½ mark)*

(b) Write equation(s) and state conditions for the reaction of the elements with

(i) water *(7½ marks)*

(ii) sodium hydroxide *(2½ marks)*

(c) Explain the trend in the following physical properties of the elements

(i) Relative stability of the oxidation states *(1½ marks)*

(ii) Nature of their dioxides *(02 marks)*

(iii) Catenation *(02 marks)*

(d) A mixture of Lead (II) ethanoate and sodium chlorate (I) solution was heated

(i) State what was observed *(½ mark)*

(ii) Write an equation for the reaction *(1½ marks)*

(e) Compare the thermal stability of lead (IV) oxide and silicon (IV) dioxide. Write equation(s) for the reaction if any *(02 marks)*

7 (a) Define the terms :

(i) Exothermic reaction *(01 mark)*

(ii) Enthalpy of combustion *(01 mark)*

(iii) Enthalpy of reaction *(01 mark)*

(b) Zinc displaces copper from its compounds in aqueous solutions

(i) Give the ionic equation for this reaction *(01 mark)*

(ii) Describe how you would determine the enthalpy change for this reaction experimentally *(05 marks)*

(c) When 12g of each of carbon, hydrogen and methanol are completely burnt in oxygen, 393.5, 1715.4 and 272.4 KJ are evolved respectively. Calculate the enthalpy of formation of methanol

(d) The following processes and enthalpy changes are involved in the formation of calcium chloride, $CaCl_2$

Process			$\Delta H/KJmol^{-1}$
$Ca_{(s)}$	⟶	$Ca_{(g)}$	190
$Ca_{(g)}$	⟶	$Ca^{+}_{(g)}$	590
$Ca^{+}_{(g)}$	⟶	$Ca^{2+}_{(g)}$	1150
$\frac{1}{2} Cl_{2(g)}$	⟶	$Cl^{-}_{(g)}$	-360
$Ca^{2+}_{(g)} + 2Cl^{-}_{(g)}$	⟶	$CaCl_{2(g)}$	-2255

(i) Draw a well labelled energy level diagram for the formation of solid calcium chloride

(ii) Use your diagram to calculate enthalpy of formation of calcium chloride.

(e) The bond energies for Br – Br, H – Br, C – Br and C – H bonds are 192.28, 363.66, 267.52 and 413.82 KJ mol^{-1} respectively. Calculate the enthalpy of the reaction

$$CH_{4(g)} + 4Br_{2(g)} \longrightarrow CBr_{4(g)} + 4HBr_{(g)}$$

8. (a) (i) State Kohlrausch's law *(01 mark)*

(ii) What is meant by the terms; "conductance" and conductivity? *(02 marks)*

(b) In a particular conductivity cell, a 0.02 mol dm^{-3} aqueous potassium chloride solution had a resistance of 74.58Ω. The molar conductivity of this potassium chloride solution is 138.3Ω^{-1} mol^{-1}. Determine the cell constant. *(03 marks)*

(c) In a study of the dependence of molar conductivity on concentration. the following data were obtained for aqueous sodium chloride solution

C/mol dm^{-3}	0.0005	0.001	0.005	0.01
$\Lambda\ /\Omega^{-1}cm^2mol^{-1}$	124.5	123.7	120.6	118.3

(i) Plot a graph of molar conductivity against square root of concentration of solution *(04 marks)*

(ii) Determine the molar conductivity at infinity dilution for sodium chloride *(01 mark)*

(d) (i) Sketch a graph to show how molar conductivity of ethanoic acid depends on reciprocal of concentration *(01 mark)*

(ii) Explain the shape of the above graph *(02 marks)*

(e) The molar conductivity of a solution of ethanoic acid containing $1x10^{-3}$ mol dm^{-3} is 52.5$\Omega^{-1}cm^2$ mol^{-1} and molar conductivity at infinite dilution for the electrolytes: HCl, NaCl and CH_3COO Na are 426.1, 126.5 and 91.0cm^2 $mol^{-1}ohm^{-1}$. respectively. Calculate;

(i) degree of ionization of ethanoic acid at this concentration *(02 marks)*

(ii) acid dissociation constant *(1½ marks)*

(iii) pH of the solution *(2½ marks)*

END