P525/21
Chemistry
Paper2
July/August 2022
2 ½ hours

KAYUNGA SECONDARY SCHOOLS EXAMINATIONS COMMITTEE (KASSEC)

JOINT MOCK EXAMINATIONS 2022

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

- *Answer **5** questions including **3** questions from section **A** and **2** questions from section **B**.*
- *Begin each question on a fresh page.*

SECTION A

Answer **3** questions only in this section

1. The following table shows the elements of period (iii) of the periodic table and their corresponding melting points.

Element	Na	Mg	Al	Si	P	S	Cl
Atomic number	11	12	13	14	15	16	17
Melting point (°C)	98	650	660	1423	44	119	-101

(i) Draw a graph of melting point against atomic number (3marks)

(ii) Explain the shape of the curve (8 marks)

(a) Describe the reaction of sodium hydroxide with

(i) Aluminum (2marks)

(ii) silcon (2 marks)

(b) Describe the reaction of water with

(i) Silcon(Iv)chloride (2 marks)

(ii) Phosphorous (v) chloride (2marks)

(c) Write the equation for the reaction between sulphur(IV) oxide and sodium Hydroxide. (1mark)

2. (a) Define:-

(i) Freezing point (1mark)

(ii) Freezing point constant (1mark)

(b) (i) With aid of a diagram, describe an experiment to show how the relative molecular mass of a compound can be determined using the freezing depression method. (8 marks)

(ii) State the limitations of the freezing point method. (2marks)

(c) Explain why the freezing point depression method is not good for determining the relative molecular mass of

(i) magnesium chloride in water. (2marks)

(ii) starch in water (2 marks)

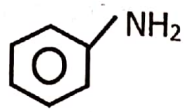
(d) A solution containing 2.0g of ethanoic acid in 100g of benzene had a freezing point of 0.85°c lower than that of pure benzene.(K_f= 5.12°c per 1000g)

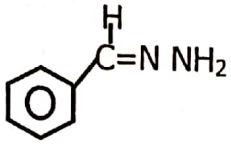
(i) Calculate the relative molecular mass of ethanoic acid in benzene. (3marks)

(ii) Comment on your answer. (1mark)

3. Write equations to show how the following compounds can be synthesized. Indicate the reagents and conditions.

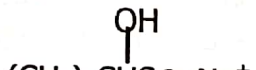
(a) Phenol form benzene using propene. (2 ½ marks)

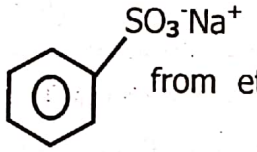
(b)  from phenol (3 marks)

(d)  from benzene (3marks)

(d) CH_3CH_2COOH from ethane (2 ½ marks)

(e) Propene to $CH_3C \equiv CCH_3$ (3 ½ marks)

(f)  from ethanol (3marks)

(g)  from ethyne (2 ½ marks)

4. (a) (i) State Raoult's law. (1 mark)

(ii) Explain what is meant by an 'Ideal solution') (2marks)

(b) Benzene (boiling point 80oc and methylbenzene (boiling point 111°c) form a liquid mixture that obeys Raoult's law.

A liquid mixture was made by dissolving 0.2 moles of benzene in 0.6 moles of methylbenzene a 25°c. At this temperature the vapour pressures of benzene and methylbenzene are 1521 and 570mmHg respectively. Calculate the;-

(i) vapour pressure of the mixture (3 marks)

(ii) mole fraction of each in the vapour (2 marks)

(c) Nitric acid and water forms non- ideal a liquid mixture that deviates negatively from Rault's law. The azeotropic mixture boils at 120°c and contains 68% of nitric acid . its density is $1.42gdm^{-3}$.

(i) Explain why the mixture shows negative deviation from Raoult's law. (3marks)

(ii) Draw a labeled boiling point-composition diagram of mixture.(3marks)

(iii) Using the diagram, describe what happens when a liquid mixture containing 50% of each component is distilled. (3marks)

(iv) Calculate the molar concentration of nitric acid in the azeotroic mixture. (1 ½ marks)

(v) Calculate the volume of the acid required to prepare 250cm^3 of a 0.05M solution.(H=1;O=16;N=14) (1 ½ marks)

SECTION B

Answer only **2** question in this section

5. Explain the following observations .Write equations for the reactions that take place where necessary.

(a) When chloroethane is heated with sodium hydroxide solution, the product acidified with dilute nitric acid followed by silver nitrate, a white precipitate is formed. When chlorobenzene is treated the same way, there is no observable change. (5marks)

(b) When ammonia solution is added to a solution of magnesium sulphate a white precipitate is formed. However, when it is added to the same solution in the presence of ammonium chloride solution no precipitate is formed. (5marks)

(c) phenol is sparingly soluble in water but very soluble in sodium hydroxide solution. (3marks)

(d) The PH of water is 7.00 at 25°c and 6.14 at 100°c. (3marks)

(e) Ethoxythane boils at 35°c whereas butan-1-0*l* boils at 124°c. (4marks)

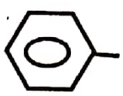
6. Complete the following equations and outline the mechanisms.

(a) $CH_3\underset{\underset{OH}{|}}{C}HCH_2CH_3 \xrightarrow{\text{Conc. } H_2SO_4}$ (3marks)

(b)  $\xrightarrow[\text{Heat}]{\text{Fuming } H_2SO_4}$ (3 ½ marks)

(c)  $+CH_3COBr \xrightarrow{AlCl_3}$ (3 ¼ marks)

(d) $CH_3COCH_3 + NaHSO_3$ (2 ½ marks)

(e) $CH_3CHO +$  $NHNH_2H \xrightarrow{H^+}$ (4 ½ marks)

(f) $CH_3CH_2NH_2 + CH_3Cl \xrightarrow{\text{heat}}$ (3marks)

7. (a) Define
   (i) order of reaction (1 mark)
   (ii) molecularity (1 mark)

(b) Propane reacts with iodine in the presence of an acid catalyst according to the equation.

$CH_3COCH_3(aq) + I_2(aq) \longrightarrow CH_3CHOCH_2I(aq) + HI(aq)$

The reaction is first order with respect to propanone and zero order with respect to iodine. Describe an experiment to show that the reaction is zero order with respect to iodine.

(c) The following data was obtained for the reaction $\mathbf{A} + 2\mathbf{B} \rightleftharpoons 2\mathbf{C} + \mathbf{D}$

Time (min)	0	7.2	18	36	72	108
Concentration of A (mol 1^{-1})	0.1	0.091	0.079	0.063	0.040	0.025

(d) Plot a graph of concentration of against time. (3marks)

(e) (i) Determine order of reaction. Explain your answer (2marks)
(ii) Calculate the rate constant (2marks)

(f) (i) Draw a labeled energy diagram for the reaction in (c) above (ΔH^{ϑ} = -50kj/mole and Ea = 250KJ/mole) (2marks)
(ii) Calculate the activation energy for the backward reaction. (1 mark)

(g) Draw a sketch graph to show the change in the concentration of C with time at two temperatures T_1 and T_2 where $T_2 < T_1$ (2marks)

8. (a) (i) Write the formula and name of the main ore of aluminium. (1mark)
(ii) Name two compounds that occur with aluminium as impurities. (2marks)

(b) Describe:-
(i) the ore is purified
(ii) pure aluminium is obtained from the purified ore. (7 marks)

(c) Describe the reaction of aluminium with (3marks)
(i) Sulphuric acid
(ii) Sodium hydroxide (2marks)

(d) Explain what happens when a solution of sodium hydrogen carbonate is added to a solution of aluminium sulphate. (2marks)

(4marks)

END