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IndexNo..... Signature.....

P525/1

CHEMISTRY

PAPER I

July/Aug. 2023

2  $\frac{3}{4}$  Hours

### KANUNGU DISTRICT JOINT MOCK EXAMINATIONS

### UGANDA ADVANCED CERTIFICATE OF EDUCATION

#### CHEMISTRY

#### PAPER I

2 HOURS 45 MINUTES.

##### Instructions to Candidates:

Answer all questions in section A and any six questions in section B.

All questions must be answered in spaces provided

Illustrate your answers with equations where applicable.

Molar gas Constant,  $R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$

Molar volume of a gas at stp is  $22400\text{cm}^3$

Standard temperature =  $273\text{k}$

Standard pressure =  $101325 \text{ Nm}^{-1}$

FOR EXAMINERS USE ONLY																	TOTAL
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	

1(a) A Solid Q Contains 9.37% by mass of Magnesium, 10.39% nitrogen and 42.18% Water.

(i) Calculate the empirical formula of Q.

(3marks)

(i) Calculate the empirical formula of Q.

(ii) Determine the molecular formula of Q (RFM of Q = 256)

(1 mark)

b) Solution of Q reacts with Iron (II) Sulphate in the presence of concentrated sulphuric acid to form a brown ring. Identity Q. (½ mark)

(c) Write equation for the reaction that would take place if O was heated.

(1½ marks)

2. Name the reagent that can be used to distinguish between the following pairs of Compounds. In each case state what would be observed if each member of the pair was treated with the reagent you have named.

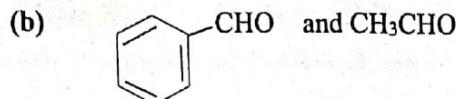
a)  $\begin{array}{c} \text{CH}_3 & \text{CH} & \text{C} \equiv \text{CCH}_3 \text{ and } \text{CH}_3\text{CH}_2\text{CH} & \text{C} \equiv \text{CH} \\ & | & & | \\ & \text{CH}_3 & & \text{CH}_3 \end{array}$

Reagent.....

### Observation

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**Turn Over**

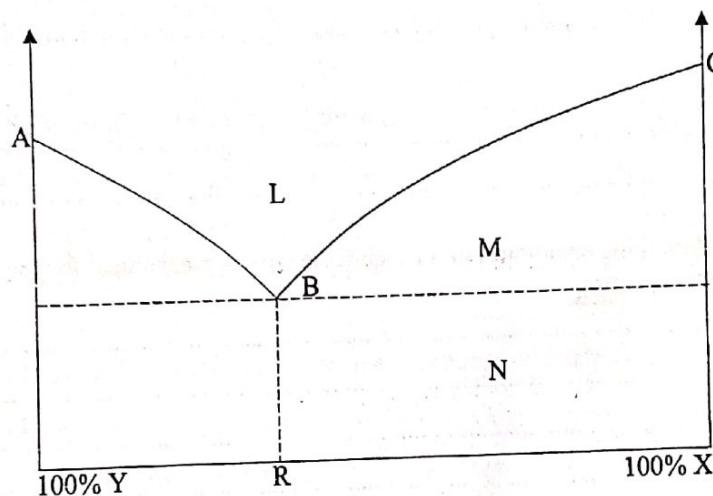


Reagent..... (1mark)

Observation

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3. The temperature Composition diagram for a System Containing two components X and Y is shown below.



a) State What the following represents (½ mark @)

(i) Regions

L.....

M.....

N.....

(ii) Points

A.....

B.....

C.....

(iii) Curves

AB.....

BC..... (½ mark)

(b) State what would happen when a mixture of Composition R is heated

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4. Write equation for the reaction between aqueous sodium hydroxide and (1½ marks@)

a) Chromium (III) oxide

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b) Beryllium oxide.

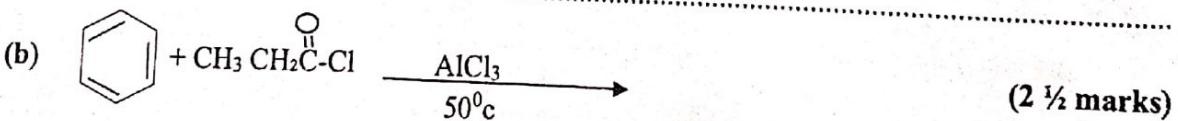
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c) Tin (II) oxide.

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5. Complete the following equations and in each Case write a mechanism for the reaction.

a)  $(CH_3)_2 C=CHCH_3 \xrightarrow{HBr}$  (2½ marks)



6. State what would be observed and write equation for the reaction that would take place when:

(a) excess concentrated hydrochloric acid was added to lead (II) oxide (2½ marks)

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(b) potassium iodide was added to Copper (II) sulphate Solution (2 ½ marks)

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7 (a) (i) State the Conditions for Steam distillation. (1½ marks)

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(ii) State one advantage of steam distillation over fractional distillation. (½ mark)

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(b) Substance A distills with steam at  $98.3^{\circ}\text{C}$  under Pressure of 753 mmHg. Calculate the Percentage by mass of A in the distillate (The Vapour pressure of water at  $98.3^{\circ}\text{C}$  is 715 mmHg;

A=123)

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8. State the properties of the following Compounds in which boron resembles silicon but differs from aluminium (4marks)

Compound	Boron- Silicon	Aluminium
Oxides		
Hydrides		

9. (a)(i) Write the equation for the hydrolysis of Sodium ethanoate in aqueous solution (1mark)

(ii) Write an expression for the hydrolysis constant,  $k_h$ , of sodium ethanoate (1mark)

(b) The pH of a 0.1M aqueous sodium ethanoate Solution is 8.9. Calculate the hydrolysis Constant of the solution. ( $K_w = 1 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ ) (3marks)

**SECTION B: (54 marks)**

*(Answer Six Questions)*

10. (a) One of the limitations of the method of determining relative molecular mass by freezing point method is that the solute should not associate or dissociate in solution.

- (i) State three other limitations of determining Molecular mass by freezing point method

(1½ marks)

- (ii) Explain how association of a solute in a Solution affects the molecular mass determined by freezing point method. (3 ½ marks)

(3 ½ marks)

- (b) A Solution containing 0.142g of Naphthalene in 20.25g of benzene caused a lowering in freezing point of  $0.284^{\circ}\text{C}$ . Calculate the Molar mass of Naphthalene.

( $K_f$  for benzene is  $5.12^0 \text{ cm}^3 \text{ mol}^{-1} \text{ kg}^{-1}$ )

(4 marks)

- 11(a) (i) Write the electronic Configuration of chromium.

(1 mark)

(ii) State three characteristics of chromium as a transition metal.

(1½marks)

(b) Chromium (III) chloride was dissolved in water and the solution tested with litmus paper. State what was observed and explain your answer.

(4marks)

(c) Ammonia solution was added drop wise to an aqueous solution of chromium (III) salt until in excess.

(i) State what was observed

(1 mark)

(ii) Write equation for the reaction that took place

(1½ marks)

**12.** 1.86 g of compound Contains Carbon, hydrogen and nitrogen only. X On Combustion liberated 5.28g of Carbon dioxide gas and 22.4 cm<sup>3</sup> of nitrogen gas at s.t.p

(a) Determine the empirical formula of X. (3marks)

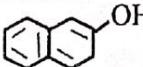
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(b) When Vapourised, 0.2g of X occupied 81cm<sup>3</sup> at 184.1°C and 101.325 kPa. Determine the molecular formula of X (2 ½ marks)

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(c) X burns with a Sooty flame and the pH of its aqueous solution is greater than 7. Write the molecular structure of X. (1mark)

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(d) X was reacted with Sodium nitrite in the Presence of hydrochloric acid at 5°C and the Product treated with 2-naphthol; 

(i) State what was observed. (½ mark)

(ii) Write equations for the reactions that took Place. (2marks)

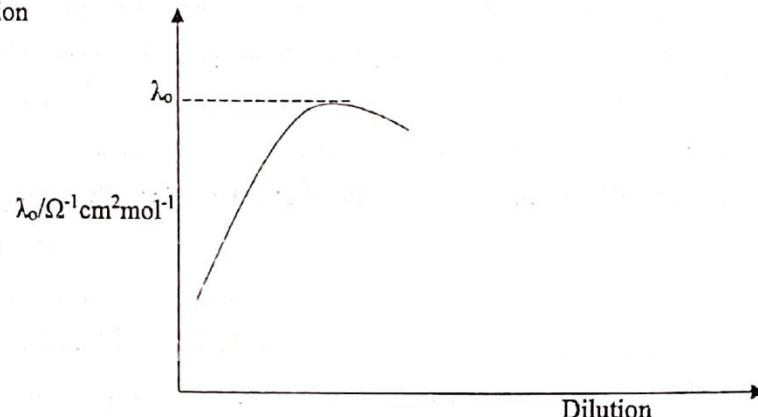
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13 (a) State three factors that can affect molar Conductivity of electrolytes.

(1½ marks)

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(b) The graph below shows the Variation of molar Conductivity of a strong electrolyte with a dilution



Briefly explain the shape of the graph

(2½ marks)

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(c) The Molar Conductivity of nitric acid, potassium nitrate and potassium flouride are 421, 145 and  $129 \Omega^{-1} \text{cm}^2 \text{mol}^{-1}$  respectively at infinite dilution.

Calculate the:

(i) Molar Conductivity of hydroflouric acid at infinite dilution.

(2 marks)

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(ii) Dissociation Constant  $K_a$ , of a 0.1M hydroflouric acid solution. (The electrolytic Conductivity of hydroflouric acid is  $3.15 \times 10^{-5} \Omega^{-1} \text{cm}^{-1}$ ).

(3 marks)

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14. Carbon, Silicon, germanium, tin and lead are in group (iv) of the periodic table.

a(i) Write the general outermost electronic Configuration of the elements. (1mark)

(ii) State the Common oxidation states exhibited by the elements in their compounds or ions.

(1 mark)

b) State what would be observed and write equation for the reaction that would take place if any, when the following are treated with water.

(i)  $\text{CCl}_4$  (2marks)

(ii)  $\text{SiCl}_4$  (3marks)

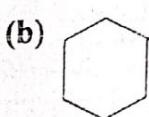
(iii)  $\text{SnCl}_4$  (3marks)

15. Write equations to show how the following Compounds can be synthesized

(a)  CHO from benzene



(b)   $\text{NH}_2$  from cyclohexene (1½ marks)



(c)  $\begin{array}{c} \text{CH}_3 \text{ CH}_2 \\ \diagdown \quad \diagup \\ \text{C} = \text{NOH} \text{ from but-1-ene} \\ \diagup \quad \diagdown \\ \text{CH}_3 \end{array}$

(3 marks)

(d)  from aniline

16. Compare the reactivity of fluorine and chlorine with the following compounds. (In each case, illustrate your answer with equations)

(a) Water

(5 marks)

**(b) Concentrated sodium hydroxide solution**

(5marks)

17. The solubility product of lead (II) chloride is  $1.6 \times 10^{-5}$  mol<sup>3</sup> l<sup>-3</sup> at 25°C.

(a) Write an expression for the solubility product of lead (II) chloride.

(1mark)

**(b) Calculate**

(i) the Concentration of the chloride ion in  $\text{mol l}^{-1}$  In a Saturated solution of lead (ii) chloride at  $25^{\circ}\text{C}$  (3½ marks)

(ii) the solubility of Lead (II) chloride in grams Per litre at 25°C.

(2½ marks)

(c)(i) State what would be observed if a saturated solution of Lead (ii) ethanoate was added to a solution of lead (ii) chloride at 25°C. (1mark)

(ii) Give a reason for your answer in (c)(i) above (1mark)

END

The Periodic Table

1	2													3	4	5	6	7	8								
1.0 H 1		1.0 - atomic mass H 1 - atomic number												1.0 H 1	4.0 He 2												
6.9 Li 3	9.0 Be 4													10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10								
23.0 Na 11	24.2 Mg 12													27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18								
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30		69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36									
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48		115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54									
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80		207 Tl 81	207 Pb 82	209 Bi 83	209 Pb 84	210 At 85	222 Rn 86									
223 Fr 87	226 Ra 88	227 Ac 89											139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
			227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	256 Cf 98	154 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103										