Name of School:……

Candidate's Name:……

Centre No./Index No: …… Signature:……

P525/1
CHEMISTRY
Paper1
2 ¾ Hours
July/ August 2022

KAMSSA JOINT MOCK EXAMINATION

Uganda Advanced Certificate of Education

CHEMISTRY

Paper1

2Hours 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

For Examiner's Use Only																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

SECTION A (46 MARKS)

Attempt **all** questions in this section.

1. Beryllium, Magnesium & Calcium are **group II** elements.

   a) Write the general outer configuration of the elements. (01 mark)

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   b) Each of these elements reacts with carbon to form a carbide. Write the equation for the reaction which occurs when each carbide reacts with water. (4½ marks)

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2. a) Complete the following nuclear reactions.

   i. ${}^{9}_{4}Be + \gamma \longrightarrow$ + …..…… (01 mark)

   ii. + ⟶ ……+ (01 mark)

   b) It takes 5 days for **0.025mg** of Bismuth-214 to disintegrate into 0.0125mg of Bismuth-210.Calculate the time required for 0.016mg Bismuth-214 to change into **0.001mg** Bismuth-210. (03 marks)

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3. **Aluminium** and **Phosphorus** form compounds in the oxidation states of **3**.

   a) Briefly explain in terms of the electronic configuration why aluminum conducts electricity while all the common allotropes of phosphorus do not. (03 marks)

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   b) Write the equation for the reaction between each element with sodium hydroxide solution. (03 marks)

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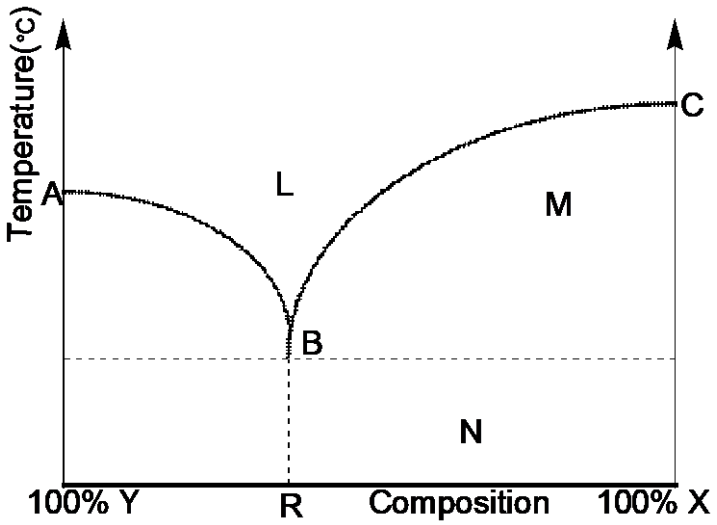
4. The **temperature-composition** diagram for a system containing two components **X** and **Y** is shown below.



a) State what each of the following represent. (½ marks@)

i. Regions:

L: ……

M: ……

N: ……

ii. Points:

A: ……

B: ……

C: ……

iii. Curves:

AB: ……

BC: ……

iv. State what would happen when a mixture of composition **R** is heated.

(½ marks)

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5. a) Draw the **structure** and name the **shape** of the following anions.

(03 marks)

Anions	Shapes	Names
SO_3^{2-}		
SO_4^{2-}		
$S_2O_3^{2-}$		

b) Name the reagent(s) which can be used to distinguish between SO_3^{2-} and SO_4^{2-} ions. State what would be observed.

Reagent(s): (01 mark)

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Observation(s): (01 mark)

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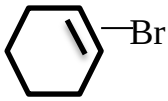
6. Complete the following equations and in name the main organic product.

(04 marks)

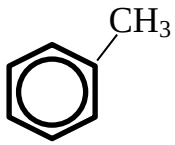
H_3O^+ / Warm

(a) $CH_3CH=C(CH_3)_2$ ⟶ ……

Name: ……..

(b)  $\xrightarrow{HBr}$ ……

Name: ……..……

(c)  $\xrightarrow{CrO_2Cl_2}$ ……..……

Name: ……..

(d) $CH_3C \equiv CH \xrightarrow{Br_2/H_2O}$ ……

Name: ……..……

7. **Phenol** was added to **bromine water**.

a) (i) State what **was observed**. (01 mark)

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

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b) Name a **reagent** which can be used to distinguish between phenol and cyclohexanol. State what would be **observed** if the reagent is treated with each compound.

Reagent: (01 mark)

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Observations: (01 mark)

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c) Write an equation showing how phenol may be prepared from benzene diazonium chloride. (1½ marks)

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8. a) State **Graham's** law of gaseous diffusion. (01 mark)

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b) Nickel forms a carbonyl; $Ni(CO)_n$. Deduce the **value of n** if carbon monoxide diffuses **2.46 times** faster than the carbonyl compound. (03marks)

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c) State the:

i. **Oxidation state** of Nickel in the compound. (0½ mark)

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ii. **Co-ordination numbers** of Nickel in the compound. (0½ mark)

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9 State what would be observed and write an equation between the following compounds and the reagent commonly used in identifying organic compounds.

a) Neutral iron (III) chloride and phenol. (02 marks)

Observation:

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Equation:

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b) Sodium nitrite in presence of concentrated hydrochloric acid and ethyl methylamine. (02 marks)

Observation:

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Equation:

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c) Fehling's solution and ethanal. (02 marks)

Observation:

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Equation:

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SECTION B (54 MARKS)

Attempt any **six** questions

10 a) A compound **Z** contains **19.15%** nitrogen, **43.5%** oxygen and the **rest** being manganese.
(i). Calculate the **empirical formula** of Z. (1½ marks)

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(ii) **10.0g** of Z in **1000.0g** of water lowered to freezing point of water by **0.127°C**.

Calculate the **molecular formula** of Z. (**K_f** for water is **1.86°C/mol/kg**) (02 marks)

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b) **Z** was dissolved in water to form a **pink solution** and divided in to two parts.
State would be **observed** and **write equation** for the reaction that took place when:

i. Acidified potassium manganite (VII) solution was added to the first part. (02 marks)
   Observation:

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Equation:

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ii. Concentrated nitric acid and lead (IV) oxide was added to the second part and the mixture boiled. (02 marks)

Observation:

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Equation:

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11. a) Distinguish between **first electron affinity** and **first ionization energy** (02 marks)

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b) The first electron affinity of sodium is **-71kjmol^{-1}** while the electron affinity of magnesium is **+50.2kjmol^{-1}**. Explain. (03 marks)

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c) The table below shows the successive ionization energies of elements **R** and **Q**.

	Successive ionization energies(kjmol^{-1})							
Element	1st	2nd	3rd	4th	5th	6th	7th	8th
R	736	1450	7740	10500	13600	18000	21700	25600
Q	1060	1900	2920	4960	6280	21200	25900	30500

(i) State the group in the periodic table to which **R** and **Q** belong (01 mark)

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(ii) Write the equation for the reaction between (02 marks)

R and oxygen

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Q and chlorine

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(iii) Write an equation for the reaction between the chloride of **Q** and water

(01 mark)

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12. a). Define the following terms: (01 mark@)

(i) Lattice energy.

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(ii) Standard heat of formation of a substance.

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b) The standard heat of formation of phosphorus trichloride is **-306KJ/mol**. The bond dissociation energy and enthalpy of atomization of chlorine and phosphorus are **314** & **242KJ/mol** respectively.

i. Draw a **Born-Haber** cycle for the formation of phosphorus trichloride. (02 marks)

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(ii) Use your cycle to calculate the P-Cl **bond energy**. (02 marks)

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ii. Calculate the standard heat of formation of ethane if the standard heats of combustion of graphite, hydrogen and ethane are **-403**,**-285** and **-1395 KJ/mol** respectively.
03 marks)

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13. a) Differentiate between addition and condensation polymers. (02 marks)

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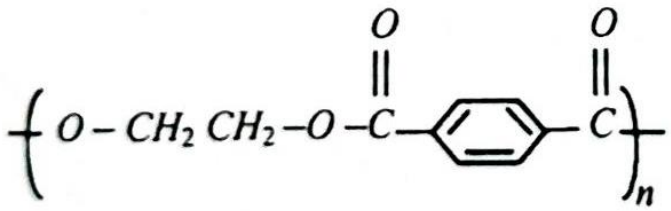
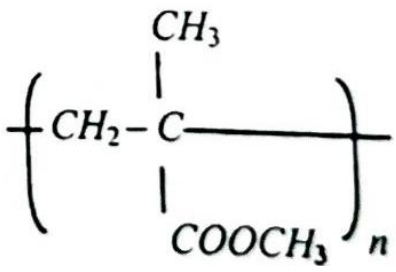
b) The structure formulae of two polymers **R** and **T** are shown below.

R



T



Name the polymer. (@01 mark)

i. R: ……..

ii. T: ……..

iii. c).Write the structural formula (e) of monomer(s) of the polymers R and T respectively. (03marks)

R: ……..……..

T: …….

d).Give one use of: (01 mark@)

iv. R:

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v. T:

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14. a) Write the name and formula of one ore from which aluminium can be extracted. (½ mark@)

Name:

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Formula of the ore:

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b) (i). Describe how the ore is **purified.** (04 marks)

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(ii).Describe the reaction of aluminium metal with acids. (04 marks)

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15. Compound **F** contains **62.1%** carbon, **10.3%** hydrogen, the rest being oxygen.

a) Calculate the **empirical formula of F**. (03 marks)

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b) **F** distils in steam at **98°C** and **1.01 X 10^5Nm^2**.If the vapour pressure of water at **98°C** is **9.5 X 10^4Nm^2**.

i. Calculate the **molecular mass of F** if the distillate contained **16.67%** by mass of **F**. (02 marks)

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c) **F** formed a grey precipitate when treated with ammoniacal silver nitrate. Write **equation** and outline a **mechanism** for the reaction between F and sodium hydrogen sulphite solution. (03 marks)

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16. When heated, carbon dioxide gas decomposes according to the equation below.

$$2CO_{2(g)} \rightleftharpoons 2CO_{(g)} + O_{2(g)}, \Delta H = -ve$$

If at a certain temperature and **1 atmospheric pressure**, **60%** of the original carbon dioxide **gas remained undissociated**.

a) Calculate the **equilibrium constant, Kp** for the reaction. (05 marks)

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b) State and explain the effect of:

i. Increasing the pressure to **2 atmospheres** on the equilibrium concentration of oxygen gas. (02 marks)

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ii. Carrying out the decomposition at a lower temperature on the value of the equilibrium constant, Kp. (02 marks)

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17. Write equations to show how the following compounds can be synthesized and in each case indicate the conditions of reaction.

a) Methylbenzoate from benzene (03 marks)

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b) 2-hydroxypropanoic acid from ethyne (03 marks)

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c) 1-phenylethanol from phenol (3marks)

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THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1																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	24.3 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	204 TI 81	207 Pb 82	209 Bi 83	209 Po 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	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103

END