Candidate's Name:.....

Index No .....Signature.....

P525/1
CHEMISTRY
Paper 1.
July/August 2024
2 ¾ hours.

ASSHU ANKOLE JOINT MOCK EXAMINATIONS 2024

Uganda Advanced Certificate of Education.

CHEMISTRY

Paper 1

2hours 45minutes.

INSTRUCTIONS TO CANDIDATES.

- Answer **all** questions in section **A** and six questions in section **B**
- All questions **must** be answered in the spaces provided.
- The periodic Table, with relative atomic masses is attached at the end of the paper.
- Mathematical tables (3-figure table) are adequate or non-programmable scientific electronic calculators may be used.
- Illustrate your answers with equations where applicable.
- Where necessary, use the following;
  - ✓ Molar gas constant, R =8.31$JK^{-1}Mol^{-1}$
  - ✓ Molar volume of gas at s.t.p. is 22.4litres

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 from the section.

1. Complete the following equations for the nuclear reactions.

a) $^{214}_{83}Bi \rightarrow {}^{206}_{82}Pb + 2\,\alpha +$ ..... *(1mark)*

b) $^{233}_{91}Pa \rightarrow {}^{0}_{-1}e +$ ..... *(1mark)*

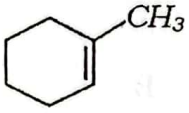
c) $^{236}_{92}U \rightarrow {}^{92}_{36}Kr +$ ..... $+ {}^{141}_{56}Ba$ *(1mark)*

d) $^{27}_{13}Al + {}^{1}_{0}n \rightarrow \beta +$ ..... *(1mark)*

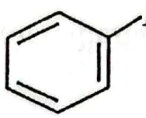
2. Complete the following organic equations and name the major organic product. *(1 ½ marks @)*

(a)  $\xrightarrow[U.V\ light]{Cl_2}$ .....

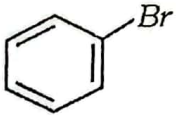
Name of product.....

(b)  $\xrightarrow[CH_3OOCH_3]{HBr}$ .....

Name of product .....

(c)  $\xrightarrow[warm]{H_2O}$ .....

Name of product.....

(d)  $+\ CH_3I \xrightarrow[dry\ ether]{Na}$ .....

Name of product .....

3. (a) Although beryllium is in group (II); it behaves differently from other group (II) elements and resembles aluminum which is in group (III) of the periodic Table. State three Chemical properties in which beryllium and aluminum show similarity.

(3marks)

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(b) Write equation for the reaction between dilute hydrochloric acid and;

i) Beryllium carbide. *(1 ½ marks)*

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ii) Calcium carbide. *(1 ½ marks)*

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4. (a) $10cm^3$ of a hydrocarbon, $R(C_xH_y)$, was exploded with $95cm^3$ of Oxygen. On cooling to room temperature, the residual gasses occupied $70cm^3$. When the residue gases were passed through potassium hydroxide solution, the volume reduced to $30cm^3$.

i) Write equation for the reaction between R and oxygen. *(1 mark)*

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ii) Determine the molecular formula of R. *(2 ½ marks)*

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(b) Write equations to show how R can be synthesized from an alcohol.

(2 marks)

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5. (a) Write the;

i) Equation for the hydrolysis of ammonium chloride in water.

(1 ½ marks)

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ii) Expression for the hydrolysis constant, Kh of ammonium chloride.

(½mark)

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(b) The PH of 0.1M ammonium chloride solution is 5.13 at 25°C.

i) Calculate the hydrolysis constant, Kh of ammonium chloride. *(2marks)*

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ii) State the assumptions you have made in b(i)above. *(1mark)*

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6. A green powder **Z** was dissolved in dilute sulphuric acid to form a blue solution. When concentrated hydrochloric acid was added to the solution of **Z** dropwise until in excess; a yellow solution was formed.

a) Identify the cation in **Z.**

(½ mark)

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b) Name the species present in the solution;

i) before addition of hydrochloric acid. *(1mark)*

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ii) after addition of excess hydrochloric acid. *(1mark)*

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c) Excess potassium iodide solution was added to the blue solution.

i) State what was observed. *(1 ½ marks)*

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ii) Write an equation for the reaction that took place. *(1 ½ marks)*

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7. Electrode potentials for some half-cells are given below.

Half cell	$E^{\theta}(V)$
$SO_4^{2-}(aq), H^+(aq), SO_3^{2-}(aq)/Pt(s)$	+0.20
$MnO_4^-(aq), H^+(aq), Mn^{2+}(aq)/Pt(s)$	+1.51

a) Write the cell notation for the cell formed when the two half cells are connected. *(1mark)*

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b) Write equation for the overall reaction. *(1mark)*

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c) (i) Calculate the free energy of the cell(1 Faraday = 96500 C). *(2marks)*

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

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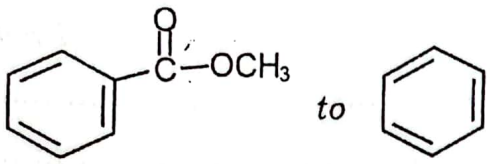
8. Write equations to show how the following conversions can be effected. Indicate the reagents and conditions for the reaction in each case.

a) *(2 marks)*



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b) CH_3CHO to CH_3NH_2 *(3 marks)*

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9. (a) Define the term enthalpy of formation. *(1mark)*

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(b) The table below shows the enthalpies of combustion of some substances.

substance	Enthalpy change of combustion($kJmol^{-1}$)
$C_{(s)}$	-393.5
$H_{2(g)}$	-285.8
Phenol, $C_6H_5OH_{(s)}$	-2009.7

i) Calculate the standard enthalpy of formation of phenol from its elements.

(2marks)

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ii) Comment on the stability of phenol. *(1mark)*

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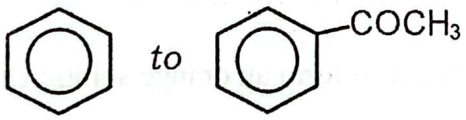
SECTION B (54 MARKS)

Answer only **six** questions from this section.

Additional questions answered will **not** be marked.

10. Write a mechanism to show how each of the following conversions can be effected.

a)  *(3marks)*

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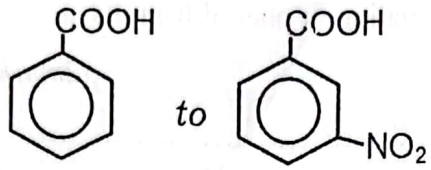
b)  *(3marks)*

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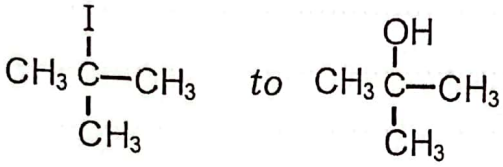
c)  *(3marks)*

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11. Ammonium dichromate(VI) dissolves in water to form an orange solution and decomposes on heating to form a green solid.

a) Write equation to show the effect of heat on ammonium dichromate(VI).

(1 ½ marks)

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b) State what would be observed and write equation for the reaction that would take place when the following substances are added to a solution of ammonium dichromate(VI).

i) Acidified hydrogen peroxide solution

Observation *(½marks)*

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Equation *(1 ½ marks)*

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ii) Aqueous sodium hydroxide

Observation *(½marks)*

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Equation: *(1 ½ marks)*

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iii) Acidified Iron(II) sulphate solution.

Observation *(1mark)*

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Equation *(1 ½ marks)*

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c) To the resultant solution in b(ii) was added silver nitrate solution.

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

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ii) Write equation for the reaction that took place. *(1mark)*

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12.(a) State two methods by which the solubility of a sparingly soluble salt can be determined. *(1mark)*

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(b) Copper (II) iodate is sparingly soluble in water. Write the,

i) Equation for the solubility of copper(II) iodate in water. *(1 ½ marks)*

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ii) Expression for the solubility product, Ksp, of copper(II) iodate. *(½ mark)*

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(c) The solubility product of copper(II) iodate at 25^0C is 1.4×10^{-7} Mol^3 dm^{-9}.

Calculate the solubility in grams per litre at 25^0C of copper (II) iodate in ;

i) water *(2 ½ marks)*

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ii) a 0.1M Potassium iodate. *(2marks)*

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(d) Comment on your answer in (c) above. *(1 ½ marks)*

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13. Name one reagent that can be used to distinguish between the following pairs of organic compounds and each case state what would be observed when each of the pair is separately reacted with the reagent you have named.

a) $HCOOCH_2CH_2CH_3$ and $CH_3COOCH_2CH_3$ *(3marks)*

Reagent;

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Observations;

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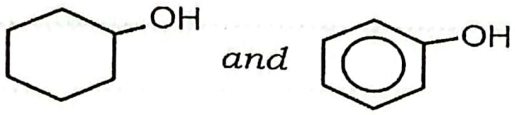
b)



(3marks)

Reagent;

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Observation;

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c) CH_3CHO and CH_3CH_2CHO *(3marks)*

Reagent;

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Observation;

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14. Write equations to show how each of chlorine and iodine react with;

a) Sodium iodide solution.

i) Chlorine *(1 ½ marks)*

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ii) Iodine *(½ marks)*

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b) Sodium thiosulphate solution.

i) Chlorine *(1 ½ marks)*

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ii) Iodine *(1 ½ marks)*

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c) hot concentrated sodium hydroxide solution.

i) chlorine *(1 ½ marks)*

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ii) Iodine *(1 ½ marks)*

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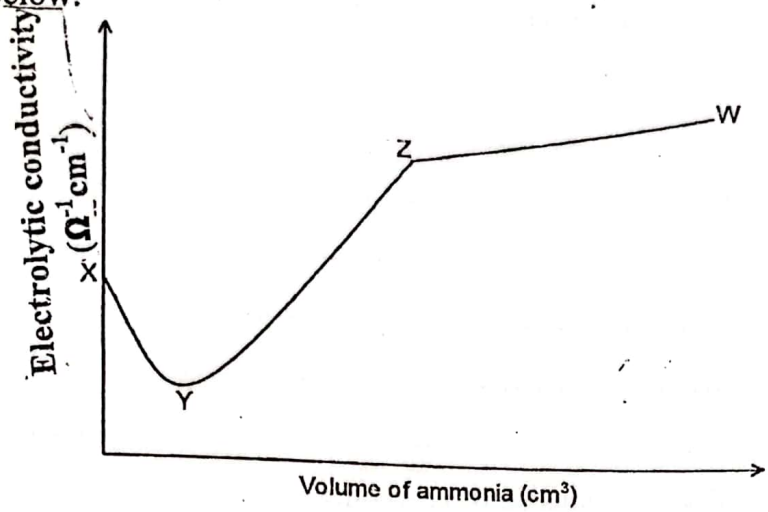
15. The conductrimetric curve for the titration of ethanoic acid and ammonia solution is given below.



a) Explain the shape of the curves (XYZW). *(4marks)*

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b) The molar conductivity of nitric acid, sodium bromoethanoate and sodium nitrate are 421, 89.3 and 121.3$\Omega^{-1}cm^2$ mol^{-1} respectively at infinite dilution at 25^0C. Calculate the;

i) molar conductivity of bromoethanoic acid at infinite dilution.

(1 ½ marks)

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ii) dissociation constant, Ka, of a 0.1M bromoethanoic acid solution(The electrolytic conductivity of bromoethanoic acid is $4.38\times10^{-3}\Omega^{-1}cm^{-1}$).

(3 ½ marks)

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16. (a) A compound W, contains 60.0% carbon;13.3% hydrogen, the rest being oxygen.

i) Calculate the empirical formula of W *(2 marks)*

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ii) 0.698g of W in 100g of a solvent lowered the freezing point of solvent by 0.190^0C. Determine the molecular formula of W
(Kf for solvent = $1.63^0Ckg^{-1}\ mol^{-1}$).

(2 ½ marks)

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(b) When W was reacted with aqueous iodine and sodium hydroxide solution, a yellow precipitate was formed. Write the;

i) Formula and Name of W

Formula; ..... *(1mark)*

Name; .....

ii) Equation leading to the formation of a yellow precipitate. *(1mark)*

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(c) Write the mechanism for the reaction between W and hot concentrated Orthophosphoric acid. *(2 ½ marks)*

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17.(a) Rubber is a natural polymer whose monomer is 2-methylbuta -1,3-diene.

Write the structure of;

i) the monomer of rubber. *(1mark)*

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ii) the polymer rubber. *(1mark)*

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(b) Name the type of polymerization involved in the formation of rubber.

(½ mark)

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(c) state how;

i) Vulcanisation of natural rubber is carried out. *(1mark)*

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ii) Vulcanisation improves the properties of natural rubber. *(2 ½ marks)*

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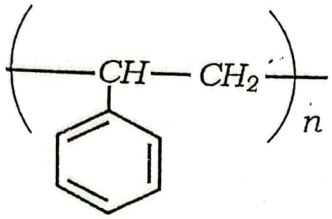
(d) The structural formula of a polymer K is



The osmotic pressure of a solution containing $5.5gdm^{-3}$ of K in benzene is 106.39Pa at $20^{0}C$.

i) Calculate the relative molecular mass of K. *(2marks)*

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ii) Determine the number of monomers that formed the polymer K.

(1mark)

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END

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