Name:.....Index no: .....

Signature:.....School: .....

P525/1
CHEMISTRY
Paper 1
July / Aug.2022
2 ¾ hours

UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1

2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **ALL** *questions in Section* **A** *and* **six** *questions in Section* **B.**

All *questions must be answered in the spaces provided.*

Mathematical tables (3-figure) and non-programmeable electronic calculators may be used.

Illustrate your answers with equations where applicable.

Molar gas constant, $R = 8.31 JK^{-1}mol^{-1}$

Molar volume of a gas at s.t.p. is 22.4 litres.

Standard temperature = 273 K

Standard pressure = $101325 Nm^{-2}$

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

Answer All questions in section A and six(6) questions in section B

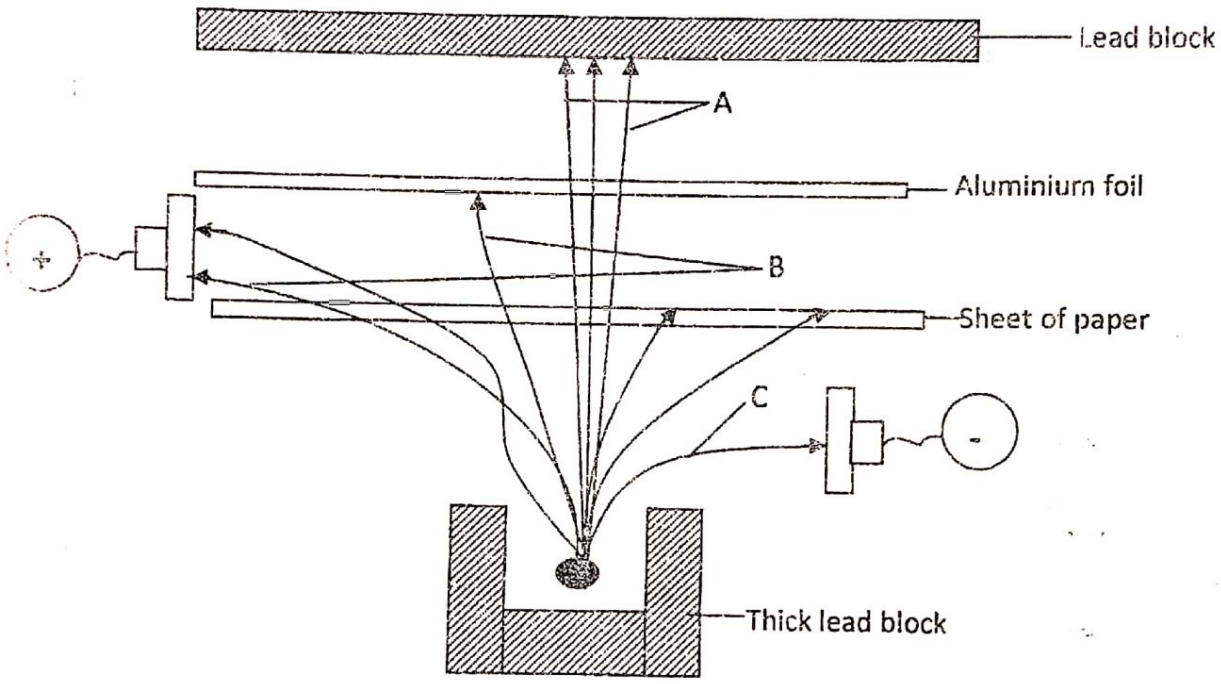
SECTION A

1. (a) Complete the following equations for nuclear reactions.

(i) $^{239}_{92}U \longrightarrow {}^{239}_{93}Np +$ ..... (½ mark)

(ii) $^{226}_{88}Ra \longrightarrow {}^{4}_{2}He +$ ..... (½ mark)

(b) The diagram below demonstrates the behavior of radioactive particles.



Giving two reasons in each case, identify groups of radiations.

(i) A . radiation.

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Reasons (02 marks)

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(ii) B: Radiation

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Reasons (02 marks)

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(iii) C : Radiation

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Reasons (02 marks)

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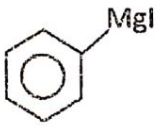
2. By means of equations only, show how the following conversions can be effected.

(a) 

to Phenylmethanol. (1 ½ marks)

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(b) $CH_3\underset{OH}{C}HCH_3$ to 1 – bromopropane. (2 ½ marks)

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3. (a) Write electronic configuration of;

(i) Beryllium. (½ mark)

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(ii) Magnesium (½ mark)

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(b) Describe one reaction in which Beryllium metal differs from magnesium metal. (illustrate your answer with an equation for the reaction). (2 ½ marks)

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(c) Explain your answer in (b). (01 mark)

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4. (a) Define the term bond energy. (01 mark)

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(b) Calculate the heat charge for the reaction;

$H_2O_{(g)} \longrightarrow H_2(g) + {}^1/_2\,O_2(g)$

Given that the bond energy for $O - H, H - H$ and $O = O$ bonds are $463 KJmol^{-1}$, $436\ KJmol^{-1}$ and $496\ KJmol^{-1}$ respectively.

(02 marks)

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5. Complete the following equations and suggest a mechanism for the reaction.

(a) $CH_3COCl \xrightarrow{CH_3NH_2}$ (3 ½ marks)

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(b) $CH_3CH = CH_2 \xrightarrow{Br_2/NaCl_{(aq)}}$ (3 ½ marks)

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6. Potassium chromate (VI) solution was added to a solution of lead (II) nitrate followed by sodium hydroxide solution.

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

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(ii) Write equation(s) for the reaction(s) that took place. (03 marks)

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7. Substances A and B react according to the equation.

$A + B \longrightarrow C + D$

The data below shows initial concentrations of A and B and their initial rates of reaction in 3 different experiments.

Experiment	$[A](moldm^{-3})$	$[B](moldm^{-3})$	Initial rate $(moldm^{-3}s^{-1})$
1	2.0×10^{-1}	2.0×10^{-1}	0.00035
2	4.0×10^{-1}	4.0×10^{-1}	0.0014
3	8.0×10^{-1}	4.0×10^{-1}	0.0056

(a) Determine the order of reaction with respect to;

(i) A (1 ½ marks)

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(ii) B (01 mark)

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(b) Write experimental rate equation for the reaction. (01 mark)

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(c) Determine overall order of reaction. (01mark)

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(d) Calculate the value for the rate constant of the reaction and state its units. (1 ½ marks)

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8. (a) Distinguish between condensation polymerization and addition polymerization. (01 mark)

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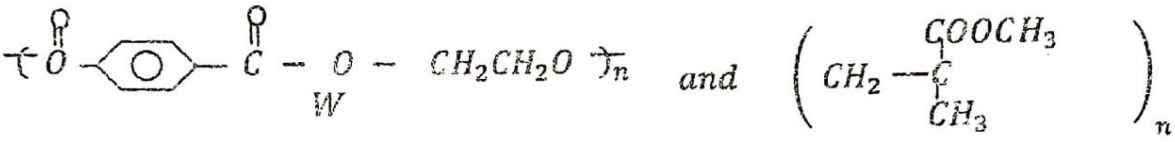
(b) The structural formulae of polymers W a nd Z are shown below;



Name the type of polymerization reaction leading to formation of;

(i) W (01 mark)

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(ii) Z (01 mark)

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(c) Write the structural formula and names of the monomers of;

(i) W (01 mark)

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(ii) Z (01 mark)

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(d) State one use of each of the polymers.

(i) W (½ mark)

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(ii) Z (½ mark)

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9. (a) Define the term disproportionation reaction. (03 marks)

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(b) Calculate the oxidation state of manganese in;

(i) MnO_4^{2-} (½ mark)

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(ii) $MnO_4 - (aq)$ (½ mark)

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(iii) MnO_2 (½ marks)

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(c) Carbon dioxide was bubbled through an aqueous solution of potassium manganate (VI).

(i) State what was observed? (1 ½ marks)

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(d) Explain your answer in;

(i) c(i). (01 mark)

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(ii) c(ii) (01 mark)

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12. When a solid compound A is strongly heated, a residue B which is yellow when hot and white when cold is formed giving off a colourless vapour that forms a yellow precipitate with 2, 4 -- dinitrophony hydrazine solution.

(a) Identify A (½ mark)

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(b) Write equation for thermo decomposition of A. (01 mark)

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(c) Residue B was resolved in war on dilute nitric acid .

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

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(ii) Write equation for the reaction that took place. (01 mark)

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(d) To the resultant solution in (c) was added ammonia solution drop wise till in excess;

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

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(c)  *and* $CH_3CH_2CH_2OH$

Reagent (½ mark)

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Observation

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Equation (1 ½ mark)

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14. (a) Define the term buffer solution. (01 mark)

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(b) Explain what would happen to the pH of a solution of Benzoic acid and sodium benzoate when a small amount of sodium hydroxide solution is added to it. (1 ½ marks)

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(c) Calculate the pH of solution made by dissolving 8.4g of sodium ethanoate in one litre of 0.1M ethanoic acid (Ka for ethanoic acid is 1.8×10^{-5} moldm^{-3})
(03 marks)

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(d) Calculate the change in pH when 1cm^3 of 1M sodium hydroxide solution is added to the solution in (c). (3 ½ marks)

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15. During manufacture of chlorine and sodium hydroxide, brine (concentrated sodium chloride solution) is electrolysed between graphite anode and mercury cathode.

(a) Write equation(s) for the reaction(s) that take place at;

(i) Anode (½ mark)

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(ii) Cathode (02 lines)

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(b) Write equations for the reaction between the product in (a) (ii) with water.

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(c) State what is observed and in each case write equation for the reaction that takes place when chlorine gas is sperately bubbled through.

(i) Cold dilute sodium hydroxide solution.

Observation

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Equation (02 marks)

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(ii) Hot concentrated sodium hydroxide solution. (02 marks)

Observation

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Equation

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(d) $10cm^3$ of Jik was diluted to $250cm^3$ of solution using distilled water. $25cm^3$ of the resultant solution was pipette into a conical flask followed by an equal volume of 10% potassium sodide solution. The iodine liberated required 23.3 cm^3 of 0.1M sodium thiosulphate solution for complete reaction using starch indicator. Calculate the molar concentration of chlorine in Jik.

16. (a) Define the term standard electrode potential. (01 mark)

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(b) Outline four factors affecting magnitude of standard electrode potential. (12 marks)

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(c) The standard electrode potentials of lead and tin electrodes are given below:

$$Pb^{2+}(aq) + 2\bar{e} \longrightarrow Pb(s) \quad E^{\theta} = -0.126V$$
$$Sn^{2+}(aq) + 2\bar{e} \longrightarrow Sn(s) \quad E^{\theta} = -0.136V$$

Write all notation / convention at;

(i) Anode (½ mark)

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(ii) Cathode (½ mark)

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(iii) Write over all cell convention. (02 mark)

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(d) Calculate the free energy of the cell and comment on your answer. (04 marks)

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17. State what is observed and in each case write equation for the reaction that takes place where;

(a) Magnesium Ribbon is dropped into an aqueous solution or iron (III) chloride.

Observation (01 mark)

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Equation (1 ½ marks)

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(b) A solution of hydrazine is added to acidified potassium managanate (VII) solution.

Observation (1 ½ marks)

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Equations (1 ½ marks)

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(c) Fehlings solution is added to ethanol and the mixture heated.

Observation (01 mark)

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Equation (01 mark)

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(d) 2, 4 dinitrophenyl hydrazine solution is added to Benzal dehyde .

Observation (½ mark)

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Equation (01 mark)

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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	96.9 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 Tl 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