P525/1
CHEMISTRY
PAPER 1
2¾ Hours

Uganda Advanced Certificate of Education

PAPER I

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
*The periodic Table with relative atomic masses is provided. *Illustrate your answers with **equations** where applicable * Molar gas constant = 8.314 j $mol^{-1}k^{-1}$ *Molar volume of a gas at s.t.p is 22.4 litres

For examiners use only

No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
Marks																		

SECTION A: (46 Marks)

Answer **all** the questions

1. (a) Explain what is meant by the term **electron affinity**. (1 mark)

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(b) Calculate the electron affinity of hydrogen using the following data ;
Enthalpy of atomization of potassium = + 90 kJ mol^{-1}
Bond dissociation energy of hydrogen = + 436kJ mol^{-1}
First ionization energy of potassium = + 418kJ mol^{-1}
Lattice energy of potassium hydride = -710kJ mol^{-1}
Enthalpy of formation of potassium hydride = -62kJ mol^{-1} (3 marks)

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2. An organic compound Z has a structure

$RCH=CHCH_2COOH$

Name the functional group which is present in Z and in each case **name** the reagent that can be used to identify the functional group, **state the observation** made and **write equations** for the reaction that takes place when the compound is reacted with the reagent.
(i) Name of the functional group ($^1/_2$mark)

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Reagent. ($^1/_2$mark)

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Observation. ($^1/_2$mark)

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Equation (1 mark)

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(ii) Name of the functional group ($^1/_2$mark)

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Reagent. ($^1/_2$mark)

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Observation. ($^1/_2$mark)

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Equation (1 mark)

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3. (a) Water was added to anhydrous iron(III) chloride drop wise until there was no further change .

(i) State what was observed. (1 mark)

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(ii) Write equation for the reaction that took place. ($1^1/_2$ marks)

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(b)To the solution formed in (a) was added a piece of magnesium ribbon.
(i) State what was observed. (1 mark)

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(ii) Write equation for the reaction that took place. ($1^1/_2$ marks)

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4. (a) Explain what is meant by the term **isotopes**. (1 mark)

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(b) Bromine has relative atomic mass of 79.9 and consists of two isotopes $^{79}_{35}Br$ and $^{81}_{35}Br$.
Determine which of the two isotopes is the most abundant. ($2^1/_2$ marks)

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(c) Sketch the mass spectrum for bromine. ($1^1/_2$ marks)

5. (a) Oxygen diffuses 2.31times as fast as a compound Z with the formula $Ni(CO)_n$.
Determine the molecular formula of Z. (3 marks)

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(b) State the;

(i) co-ordinate number of nickel in compound Z. ($^1/_2$ mark)

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(ii) oxidation number of nickel in compound Z. ($^1/_2$ mark)

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6. Write equations to show how Phenyl ethanoate can be synthesized from Chloroethane. Indicate the reagents and conditions necessary. (4 marks)

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7. The following half cell reactions are given;

	E^{θ}/V
$PbO_{2(s)} + 4H^{+}_{(aq)} + 2e \longrightarrow Pb^{2+}_{(aq)} + 2H_2O_{(l)}$	+1.46
$Fe^{3+}_{(aq)} + e \longrightarrow Fe^{2+}_{(aq)}$	+0.77

(a) Write the cell notation for the cell formed by combining the two half cells. (2 marks)

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(b) State what will be observed and write equations for the reactions that takes place at;

(i) Anode

Observation ($^1/_2$ mark)

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Equation (1 mark)

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(ii) Cathode

Observation ($^1/_2$ mark)

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Equation (1 mark)

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(c) Calculate the e.m.f of the cell. (1 mark)

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8. (a) Starting with dodecan-1-ol $CH_3(CH)_{10}CH_2OH$ describe briefly how a synthetic detergent can be prepared. ($4^1/_2$ marks)

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(b) State any **one** advantage of synthetic detergent over soapy detergents. (½ mark)

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9. State what will be observed and write equations for the reaction that takes place when;
(a) Nickel ethanoate is heated strongly and the gaseous products passed through acidified 2,4-dinitrophenyl hydrazine.

Observation ($1^1/_2$ marks)

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Equation(s) ($2^1/_2$ marks)

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(b) Ammonium hydroxide solution is added drop wise until in excess to aqueous solution of Nickel ethanoate.

Observation ($1^1/_2$ marks)

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Equation(s) ($2^1/_2$ marks)

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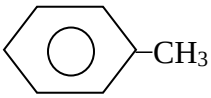
SECTION B: (54 Marks)

Answer six questionsONLY

(10) Complete the following organic reactions and outline the reaction mechanism

(a)  + Cl_2 $\xrightarrow{Fe}$ (3 ½ marks)

Mechanism

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(b) $CH_3CH=C(CH_3)_2$ + HI $\longrightarrow$ ($2^1/_2$ marks)

Mechanism

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(c) CH_3COCH_3 $\xrightarrow[20^0C]{KCN/H^+}$ (3 marks)

Mechanism

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11. (a) Draw the structure and name the shape of the following species. In each case state the oxidation state of the central atom in the structure. (6 marks)

Species	Structure	Shape	Oxidation state
CS_2			
$POBr_3$			
SnO_3^{2-}			

(b) Compare the bond angle of $POBr_3$ and SnO_3^{2-}.Give reason for your answer. (3 marks)

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12. (a) The bond dissociation energies of the following compounds are given;

Elements	Fluorine	Chlorine	Bromine	Iodine
Bond dissociation energies/ kJ mol^{-1}	33.3	57.8	46.1	36.2

State and explain variation in bond dissociation energies of the above given elements.(4marks).

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(b) Bromine and iodine can be prepared by reacting concentrated sulphuric acid with sodium bromide and sodium iodide respectively however chlorine cannot be prepared using the same method. Explain. (3 marks)

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(c) State what will be observed and write equation for the reaction that takes place when concentrated sulphuric acid is added to solid sodium bromide.

Observation ($^1/_2$ mark)

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Equation ($1^1/_2$marks)

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13. (a) Explain what is meant by the term **partition coefficient**. ($1^1/_2$ marks)

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(b) $100cm^3$ of an aqueous solution of X containing 30g per litre of X was shaken with $100cm^3$ of trichloromethane. The distribution coefficient of X between trichloromethane and water is 2. Calculate the mass of X which was extracted. (2 ½ marks)

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(c) Calculate the mass of X which will be extracted if the solution of X in (b) is shaken with two successive portions of $50cm^3$ of trichloromethane. (4marks)

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(d) Comment on your answer in (b) and (c) (1 mark)

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(e) State one application of partition coefficient apart from solvent extraction. ($^1/_2$ mark)

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14. Write equations to show how the following synthesis can be carried out. In each case indicate the reagents and conditions necessary.

(a) Propanone from ethanol (3 marks)

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(b) Ethanoic acid to Phenyl ethanol. (3 marks)

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(c) 2-Methyl propan-2-ol from 2-Bromo propane. (3 marks)

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15. A compound Y contains by mass 61.02% carbon, 15.25% hydrogen and the rest nitrogen.
(a) Determine the empirical formula of Y. (2 marks)

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(b) Compound Y has a density of 2.63gdm^{-3}at s.t.p.Determine the molecular formula of Y.

(2 marks)

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(c) Write the structural formula of the possible isomers of Y. ($1^1/_2$ marks)

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(d) Compound Y forms yellow oils when reacted with cold concentrated hydrochloric acid and sodium nitrite.

(i) Identify Y (½ mark)

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

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(e) (i) Name the reagent that can be used to confirm the functional group in compound Y. ($^1/_2$ mark)

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(ii) State the observation made. ($^1/_2$ mark)

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(iii) Write equation for the reaction that takes place when the named reagent in (e) (i) is reacted with compound Y. (1 mark)

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16. (a) Iron metal is extracted from one of its ore **siderite**. The ore is mixed with coke and lime stone and then heated strongly in a blast furnace.
Write equations for the reactions that lead towards formation of iron metal in the blast furnace.

($4^1/_2$ marks)

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(b) 1.6g of an impure sample of tin (II) chloride was added to an aqueous solution of iron(III) chloride and the mixture heated until there was no further change. The solution was diluted to 250cm^3 with water. 25cm^3 of the solution was acidified with dilute sulphuric acid and titrated with 0.02M potassium permanganate solution.16.0cm^3 of oxidant was required to reach the end point. Determine the percentage purity of tin(II) chloride. (4 ½ marks)

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(17) (a) Distinguish between terms thermosetting plastics and thermosoftening plastics.
Name one example in each case. (3 marks)

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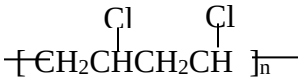
(b) A polymer Q has a structural formula of



(i) Write the name and structural formula of the monomer of the above given polymer

(1½ marks)

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(ii) Name the type of polymerization by which the above given polymer is formed.(½ marks)

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(c) When 71.76g of the monomer in (a) i was polymerized 2.67×10^{-2} moles of the polymer was formed.
Determine the;
(i) molecular mass of the polymer. (1 ½ marks)

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(ii) number of monomers in the polymer. (2 marks)

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(d) State one use of the polymer Q. (½ mark)

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PERIODIC TABLE

1	2											3	4	5	6	7	8
1 H 1.0																1 H 1.0	2 He 4.0
3 Li 6.9	4 Be 9.0											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
11 Na 23.0	12 Mg 24.3											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.4	18 Ar 40.0
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc 98.9	44 Ru 101	45 Rh 103	46 Pd 103	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 Hf 178	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Ti 204	82 Pb 207	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)															
			57 La 139	58 Ce 140	59 Fr 141	60 Nd 144	61 Pm (145)	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 162	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
			89 Ac (227)	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf 251	99 Ea (254)	100 Fm (257)	101 Mv (256)	102 No (254)	103 Lw 260

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1. H – indicates Atomic number

2. H – indicates relative Atomic mass
1.0

END