Candidate's Name:		
Commission of the commission o	Random No.	Personal No.
Signature:		1 1

(Do not write your School /Centre Name or Number anywhere on this booklet.)

P525/1

**CHEMISTRY** 

Paper 1

(Theory)

Nov./Dec. 2024

2<sup>3</sup>/<sub>4</sub> hours



## UGANDA NATIONAL EXAMINATIONS BOARD

### Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1 (Theory)

2 hours 45 minutes

#### INSTRUCTIONS TO CANDIDATES: o Mon account of

This paper consists of two Sections; A and B.

Section A is compulsory. Attempt six questions from Section B. Any additional question(s) attempted will not be marked.

All questions must be answered in the spaces provided. Use blue or black ink. Any work done in pencil, except drawings, will not be marked.

The Periodic Table, with relative atomic masses, is attached at the end of the paper.

Mathematical tables (3-figure tables) are adequate or silent non-programmable scientific electronic calculators may be used.

## Illustrate your answers with equations where applicable.

Where necessary, use the following:

Molar gas constant,  $R = 8.31 \text{ JK}_{\odot}^{-1} \text{ mol}^{-1}$ .

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

Standard temperature = 273 K.

Standard pressure =  $101325 \text{ Nm}^{-2}$ .

	For Examiners' Use Only																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
																·	
	1										6.50						2

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SECTION A: (46 MARKS)

Answer all the questions in this section.

(a)	Defi	ne the term standard electrode potential.	(01 mark
		and the state of t	
		- and the least of the rest of the least of	
(b)	The	standard electrode potentials of some half cells reactive:	ons are give
			$E^{\theta}$ (V)
	$Co^2$	$^{+}(aq) + 2e \longrightarrow Co(s)$	-0.28
ele ma	$Zn^{2+}$	$(aq) + 2e \longrightarrow Zn(s)$	-0.76
	,	$(aq) + 2e \longrightarrow 2 Cl^{-}(aq)$	+1.36
	MnC	$O_4^-(aq) + 8H^+(aq) + 5e \longrightarrow Mn^{2+}(aq) + 4H_2O_{(1)}$	+1.52
	(i)	Identify the strongest reducing agent and the strong agent.	gest oxidising (01 mark
		XX : 11	mbining the
o o o o o o o o o o o o o o o o o o o	(ii)	Write the cell notation of the cell constructed by containing the cells $Co^{2+}_{(aq)} / Co_{(s)}$ and $Zn^{2+}_{(aq)} / Zn_{(s)}$ .	50
	(iii)	Write the equation for the overall cell reaction fo	
		in b(ii).	(01 mark
••••••	(iv)		(01 mark
			•••••

2.	Nylon 6, 6	<u></u> -N—(0	0    CH <sub>2)6</sub> N,—C	$C$ $(CH_2)_4C$	is formed by
		H	H	$J_n$	

condensation polymerisation.

		g of the term condensation	, and a second	(01 mark)
	AL ARMA MENAGERA		i i ingel	
				1
(b)		tructural formula(e) and	d name(s) of the	
(b)	(i) Write the son nylon 6, 6.	tructural formula(e) and	d name(s) of the	e monomers of
	(i) Write the sinylon 6, 6.	tructural formula(e) and	d name(s) of the	e monomers of

3. Draw the structure and name the shape of each of the following ions in Table 1: (4½ marks)

Table 1

I able 1		
Ion	Structure	Name of shape
NO3	de Bernster e de Leitzerbert des ent de le 1900 tour	
SO3 <sup>2-</sup>	ave to fish the first of the	
NH4 <sup>+</sup>		

			is product
4.	Complete the following equat	tions and name the major	organic product

(a)  $CH_3COOH \ PCl_5$  (1½ marks)

Name .....

(b) 
$$CH_3$$
 $Al_2O_3$ 
 $Heat$ 
 $(1\frac{1}{2} marks)$ 

Name ......

(c)  $(CH_3COO)_2Ca \xrightarrow{Heat}$  (1½ marks)

Name

Name .....

- 5. The vapour pressure of propanone is 37330 Nm<sup>-2</sup> at 30 °C. When 33.4 g of cane sugar were dissolved in 120 g of propanone, the vapour pressure reduced by 1760 Nm<sup>-2</sup>.
  - (a) Calculate the molar mass of cane sugar.  $(2\frac{1}{2} \text{ marks})$
  - (b) Explain why the vapour pressure of the solution is lower than that of propanone. (1½ marks)

complete the following equations and in each case write the mechanic reaction(s): $CH_{3}CH_{2}OH \frac{Conc.H_{2}SO_{4}}{180  ^{\circ}C}$ Mechanism: $Conc. HNO_{3}/Conc.H_{2}SO_{4}$ (3)	
Equation:  (1)  Explain why potassium manganate(VII) is <b>not</b> acidified usi hydrochloric acid.  (2)  complete the following equations and in each case write the mechane e reaction(s):  (3)  (3)  Mechanism:  (4)  (2)  (4)  (5)  (6)  (7)  (7)  (8)  (9)  (9)  (10)	
Equation:  (1)  Explain why potassium manganate(VII) is not acidified usi hydrochloric acid.  (2)  complete the following equations and in each case write the mechanise reaction(s):  (3)  (4)  (4)  (5)  (6)  (7)  (7)  (8)  (9)  (9)  (1)  (1)  (1)  (1)  (2)  (2)  (2)  (3)  (4)  (5)  (6)  (6)  (7)  (7)  (8)  (9)  (9)  (1)  (1)  (1)  (1)  (2)  (2)  (2)  (3)  (4)  (5)  (6)  (6)  (7)  (7)  (8)  (9)  (9)  (1)  (1)  (1)  (1)  (2)  (2)  (2)  (3)  (4)  (4)  (5)  (6)  (6)  (7)  (7)  (8)  (9)  (9)  (9)  (1)  (1)  (1)  (1)  (1	
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hydrochloric acid. (2  complete the following equations and in each case write the mechanic reaction(s): $CH_3CH_2OH \frac{Conc.H_2SO_4}{180  ^{\circ}C} \qquad (3)$ Mechanism: $\frac{Conc. HNO_3/Conc.H_2SO_4}{(3)}$	
hydrochloric acid. (2  complete the following equations and in each case write the mechanic reaction(s): $CH_3CH_2OH \frac{Conc.H_2SO_4}{180  ^{\circ}C} \qquad (3)$ Mechanism: $\frac{Conc. HNO_3/Conc.H_2SO_4}{(3)}$	
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e reaction(s): $CH_{3}CH_{2}OH = \frac{Conc.H_{2}SO_{4}}{180 \text{ °C}} \qquad (3)$ Mechanism: $\frac{Conc. HNO_{3}/Conc.H_{2}SO_{4}}{(3)} \qquad (3)$	
Mechanism:    Conc. HNO <sub>3</sub> /Conc.H <sub>2</sub> SO <sub>4</sub>	
Mechanism:    Conc. HNO <sub>3</sub> /Conc.H <sub>2</sub> SO <sub>4</sub>	1/2 mark
Conc. HNO <sub>3</sub> /Conc.H <sub>2</sub> SO <sub>4</sub>	
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Conc. HNO <sub>3</sub> /Conc.H <sub>2</sub> SO <sub>4</sub>	
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Mechanism:	
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(b) The hydrogen ion					
$2.5 \times 10^{-13}  mol  l^{-13}$	<sup>-1</sup> . Calculate	e the base diss	ociation cor		
methylamine.			'nu	(3½ mar	KS)
(The ionic product	t of water, K	$C_w = 10^{-14}  mor$	$(21^{-2})$		
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			lendiness A		
The first ionisation energ	gies and ator	nic radii for so	ome elemen	ts of group(l	1)
of the Periodic Table are	given in Ta	ble 2.			٠٠٠.
Table 2	Proposition 22 Per 17 Per 19	Visit in the second		W	-
Element	Beryllium	Magnesium	Calcium	Strontium	Bar
First ionisation energy (kJ mol <sup>-1</sup> )	899	738	590	550	5
Atomic radius	0.089	0.136	0.174	0.191	0.1

(a) State how the first ion		ick rocky man	
and the property of the second second	,	 	, and an order

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		Answ		B: (54 MA)		
5. F 5.3	Any		er any six qu	estions from	this section.	arked.
	Any		er any six qu	estions from		arked.
The		additio	er any six qu nal question(	estions from (s) answered	this section. will <b>not</b> be mo	arked.
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The i	molecu	<i>addition</i>	er any six qu nal question( ula of a com	sestions from (s) answered (pound <b>P</b> is (	this section. will <b>not</b> be mo	- Lyndak - 15 Yethol an
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(a)	whicl	lar form the stru	er any six question( ula of a competural formu  boiled with a	pound P is ( lae of all the  aqueous sodic kylamine (NI	this section. will not be mo C3H6Cl2. possible isom  am hydroxide H2OH) in the	ners of P. (02 ma
(a)	Write Wher which	lar form the stru  P was h reacted reduced	er any six question( ula of a compactural formula boiled with a l with hydrox Fehling's so	pound <b>P</b> is ( lae of all the  aqueous sodic cylamine (NI colution, was f	this section. will not be mo C3H6Cl2. possible isom  am hydroxide H2OH) in the	ners of P. (02 max) , a compound presence of an
(a)	whicl	lar form the stru  P was h reacted reduced	er any six question( ula of a competural formu  boiled with a	pound <b>P</b> is ( lae of all the  aqueous sodic cylamine (NI colution, was f	this section. will not be mo C3H6Cl2. possible isom  am hydroxide H2OH) in the	ners of P. (02 ma
(a)	When which and i	lar form the the stru n P was h reacted reduced Identif	er any six question( ula of a compactural formula boiled with a l with hydrox Fehling's so	pound <b>P</b> is to lace of all the olution, was to <b>P</b> and <b>R</b> .	this section.  will not be made to the mad	ners of P. (02 max) , a compound presence of an
(a)	When which and i	lar form the the stru n P was h reacted reduced Identif	er any six question( ula of a compactural formula boiled with a l with hydrox Fehling's so	pound <b>P</b> is to lace of all the olution, was to <b>P</b> and <b>R</b> .	this section.  will not be made to the mad	ners of P. (02 max) , a compound presence of an
(a)	When which and in (i)	lar form the the stru  n P was h reacted reduced Identif	er any six question( ula of a compactural formula boiled with a l with hydrox Fehling's so	pound P is ( lae of all the  aqueous sodic cylamine (NI colution, was f	this section. will not be made to the made	ners of P. (02 max) , a compound presence of an

	el ma	(ii)	Write a mechanism for the reaction between $R$ and hydroxylamine.	(05 marks)
	• • • • • • • • • • • • • • • • • • • •			
1.	(a)	State	two factors which affect the magnitude of lattice ene	rgy. (01 mark)
	(b)		e thermochemical data are shown below:	
			alpy of atomisation of chlorine $= +122 \text{ kJ mol}^{-1}$ .	
			alpy of atomisation of magnesium = +148 kJ mol	
			ionisation energy of magnesium = +738 kJ mol nd ionisation energy of magnesium = +1451 kJ m	
		Enth	alpy of formation of magnesium chloride $= -641 \text{ kJ}$	$mol^{-1}$ .
		First	electron affinity of chlorine $= -364 \text{ kJ mol}^{-1}$ .	(O) , Wr
	an and	(i)	Construct an energy level diagram for the formation magnesium chloride.	of (03 marks)
			garangan sangsilah gerangsahaman anah gilannya garanan de san	
				,
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	(ii)	Deter	mine the lattice energy	of magnesium c	hloride. (02 mari
	(iii)	(The	nlate the enthalpy of so thydration energies of the land -381 kJ mol -1	olution of magne	esium chloride.
			· ·		
e y	s illia a plate	h girq Lu <mark>Lu</mark>	erwitjese ditte yrit eadil esquim erarli to	in dellar personal familiare, colores	en ragion e -
			. ki. z njeodalo odo z 17	Octulioches (iii	
Sup Table			Explain how transition	ia, re dio jos ou Jenistia Ligaria dia da per	4 . 5 . 2 . 7
(b)	name	of the	ne of some complex io complex ion, its oxida he central metal ion.	ns are shown in ation state and th	Table 3. Write the co-ordination (03 mar
	Tabl	e 3	in the second present the second		
Com	plex io	<b>n</b>	Name of ion	Oxidation state	Co-ordination number
(Co (SC	$(N)_4$	<u>-</u>		1 1 1	A
Cr (NH3	4.501	7+	The second of the second	and the second	the second of the second

(c) The molecular mass of a salt, Cu  $(NH_3)_{\mathcal{X}} Cl_{\mathcal{Y}} \cdot ZH_2O$  is 276. When a solution containing 1.38 g of salt was reacted with excess silver nitrate solution, 2.87 g of silver chloride was formed. Calculate the number of moles of chloride ions in 1 mole of the salt. (02 marks)

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	one formaniparions as Same in the contract of
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	(d) When a solution containing 1.38g of the salt was mixed with aqueous sodium hydroxide and heated, the ammonia liberated completely neutralised 10 cm <sup>3</sup> of a 1.0 M hydrochloric acid.
	Calculate the number of moles of;
	(i) ammonia molecules in 1 mole of the salt. (1½ marks)
	<u></u>
	그리즘 선생님들이 살아보는 사람들이 살아가는 사람들이 되었다.
	The first of the second control of the secon
	(ii) water in 1 mole of the salt. (01 mark)
	to the control of the second the field large and the goden player and other forms of the
	and the second of the second o
	the state of the s
	Write the equations to show how the following compounds can be synthesised
13.	Write the equations to show how the following compounds can be synthesised and in each case, indicate the conditions for the reaction.
	(a) CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> Br from propanone. (04 marks)

(b) COOCH <sub>3</sub> from benzene. (3½ marks)
(c) $CH_3 CH = CH_2$ from 2-bromopropane. (1½ marks)
and the second s
Vancada la companio de la companio del companio de la companio del companio de la companio del companio de la companio del companio de la companio del companio del companio del companio de la companio de la companio del compani
Sulphur dioxide and oxygen can react to form sulphur trioxide according to the following equation:
$2 SO_{2(g)} + O_{2(g)} \rightleftharpoons 2 SO_{3(g)}; \Delta H$ is negative.
3 moles of sulphur dioxide and 2 moles of oxygen were heated at 450 °C in a 1 dm <sup>3</sup> vessel at 50 atmospheres. At equilibrium the vessel contained 20 %
sulphur dioxide.
(a) (i) Write the expression for the equilibrium constant, $K_p$ . (½ mark)
(ii) Calculate the value of the equilibrium constant, $K_p$ for the
reaction at 450 °C. (04 marks)
11 Turn Over

14.

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•••••		,
(1)	a of aulahur t	riovide at
(b)	State, giving reasons, how the concentration of sulphur t	HOXIGE at
	equilibrium would be affected if;	AUL OL
	(i) pressure is increased.	$(1\frac{1}{2} marks)$
	Explain your anguige of the year	Citi
	Extensity voor absence of the Color of the C	
	(ii) temperature is increased.	$(1\frac{1}{2} \text{ marks})$
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	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	201
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	(iii) an inert gas is added at constant pressure.	$(1\frac{1}{2} \text{ marks})$
•		(4.72)
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	State	the meaning of the term bond energy.	(01 mar
			,
(b)	The l	bond dissociation energies of fluorine, chlorine,	bromine and iod
	are 1	58, 242, 193 and 151 kJ mol <sup>-1</sup> respectively.	
	(i)	State the trend in the bond dissociation energi	es of the element
		and make a same and a sum of the	$(1\frac{1}{2} mark)$
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		e traditional tradition of the property of the pro-	4
			;;·····
	GEN	Devil-in and the second	•••••
	(ii)	Explain your answer in (b)(i).	$(3\frac{1}{2} mark)$
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(c)		e an equation to show how cold dilute sodium h s with;	ydroxide solution

16.	Propan-1-ol (boiling point 97 °C) and water (boiling point 100 °C) are miscible in all proportions. A mixture of the two liquids containing 72 % propan-1-ol boils at 88 °C.											
	(a)	Sketch a labelled boiling point—composition diagram for the propan-1-ol and water.	(03 marks)									
	,											
	1											
		ing in the state of the state o										
	•••••											
	(b)	Briefly explain;  (i) why propan-1-ol and water form a minimum boilin mixture.	_									
L 0 1, 2			(04 marks)									
	• • • • • • • • • • • • • • • • • • • •		••••••									
			••••••									
	·····											
	1											

	what would happen when a mixture containing 30 propan-1-ol is fractionally distilled.	(02 marks)
10 ·		
,		
17.	Tin and lead are elements in group(IV) of the Periodic Table. De reactions of the elements with;	escribe the
	(a) cold water.	(03 marks)
	(h)	
	(b) sodium hydroxide solution.	
	(c) hot concentrated sulphuric acid.	$(2\frac{1}{2} \text{ marks})$
1		

# THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1				11	<b>3</b>							1 - 1				1.0 H 1	4.0 Ho 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 No 10
	24.3 Mg 12	( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )										27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.5 Cl 17	40.0 At 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		58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31		74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Ki 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 Rr 86
223 Fr 87	226 Ra 88	227 Ac 89								, ,					. 100		
		14	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		167 Er 68	169 Tm 69	173 Yb 70	175 L 71
			227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	1	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98		Fm	256 Md 101	254 No 102	260 L 103

