CANDIDATI	E'S FULL NAMES	
CANDIDATE IDENTIFICATION NUMB	SER SUBJECT COL	PAPER NUMBER 2
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## Three hours

Enter the information required in the boxes of the flap.

Answer ALL the SIX questions in this booklet.

The mark allocation is indicated for each question. Each question carries 20 marks.

Verify that this booklet contains six questions, no questions are repeated and there are no blank pages. Inform the invigilator in case this booklet contains less than six questions, questions are repeated or there are blank pages so that the booklet should be changed.

Blank spaces in this question booklet may be used for rough work.

In calculations you are advised to show all the steps in your working, giving your answer at each stage.

All necessary working must be shown. No marks will be awarded for answers without brief statements showing how the answers have been obtained.

Calculators may be used.

## Useful Data

Relative atomic masses (RAM) C = 12.0, O = 16.0, H = 1.0, Al = 27.0, S = 32.0, Na = 23.0

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Checked by:		
Signature:	Date:	

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## SECTION A: PHYSICAL AND GENERAL CHEMISTRY

. This questi (a) Define	on is on the mole concept, "mole" of a substance.	bonding, equilibria and energetics.	
0.05 mo	ol dm <sup>-3</sup> iodine solution and a	n of hydrated sodium thiosulphate(Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> .5H <sub>2</sub> O) was mixed with 25 allowed to react. sodium thiosulphate used.	(1 mark) cm³ of
State of the Park			And the same of the same
		CONTRACTOR OF THE STREET, AND ADDRESS OF THE STR	,
(ii) Deteri	mine the limiting reagent, g	given the balanced equation: $2S_2O_3^{2-}_{(aq)} + I_{2(aq)} \rightarrow S_4O_6^{2-}_{(aq)} + 2I_{(aq)}^{-}$	(2 marks)
	718 17 H		
(iii) Which	h indicator is most suitable	for the titration of iodine solution with sodium thiosulphate?	
		e ation recovered the books of NV A Dis-	rio edu signito
•••••		2 sectional and an amount of the	A Tanaman A
••••••	E.A.	erig fit sim a a distremp dan pareng alam a a di di di di di di di	
	Aller doubt on an or	oth transfer of the control of the c	
(c) (i) Draw	a clear diagram to show the	e shape of a water molecule	at the entire
	Molecule	H <sub>2</sub> O	taken Janet
		a de l'éjudi militière les valeutres i noutrais est u	- 1857 - 606 - 4
	ngale costs in my	read a striker and the step to your each or angives a sequence	
	Shape	THE WAY TO SEE THE TOWN ON THE SECTION OF STREET AND THE SECTION OF STREET	v con particular
		the pate in the months and in	a se não
(ii) Explain	the shape of H <sub>2</sub> O as show	n in C(i) above	- minimin')
•••••			r Chesell C . a
			(2 marks)
(d) (i)Define	an acid and a base in term	s of electron transfer.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
(ii) illustra	ate your answer by consider	ring the reaction between NH3 and BF3.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		D.C.	
			(3 marks)
44	and the second second	Carps.	2.17/1/04

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•	500 cm <sup>3</sup> of a 0.64M solution of	(Nis
(e) A buffer solution is made by adding 75.0 g of sodium ethano ethanoic acid, CH <sub>3</sub> COOH (pKa = 4.8) (RAM: C = 12, 0 = 16	the action of the second of t	
	18.0	
(i) What is a buffer solution?	12	
(ii) Write equations to show how the buffer system above neutron A: H <sup>+</sup> (aq)	alises:	
(-1)		
B: OH'(aq) agosos dans le constitue	Creardiz, veribova tel le lu calect ture the relative al	(1)
		30
(iii) Calculate the pH of the solution resulting from (e) above.		
And the second of the second o		-l.a\
	Description is the second of t	irks)
(iv) Define lattice energy		
	Literation (the reliable atonne case of Germanum.	
	and the same of th	
(v) Draw a Born-Haber cycle for the formation of Magnesium Ox	tide, MgO(s).	
(V) Draw a Born-Haber eyere for the formation		
(streat)	on has contracted by a falling of ball code relation	(%)
Substance in the serve-of the few tenes. They telever the	Index sherefield couldings of ton persons and presser	) J
,	and the second of the second o	
	Explain the term "heleropeneous equilib num"	
	and the second of the second o	
(	How come phases and how many components exect a	ill .
S and the same		
(8418m f)	"northern to mirror (4 ma	rks)
	(TOTAL = 20 ma	rks)
2. (a) Draw well-labelled diagram of the mass spectrometer.		
2. (a) Dian wen lasened		
	A Service and year communication of approximation conserved.	10 6
0.03400011.	and the second of the second o	
The second secon		
	· ··· · · · · · · · · · · · · · · · ·	
	(5 ma	rks)
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						1000
(b)	A mass spectrometer of	The second second	data for a cami	nle of naturally	occurring (	iermanium.
(~)	" IIIdss spectrometer or	the following	uata for a sairi	pic of maturally	0000111116	V 115 / Facility 15 / /

Isotope	Detector current/arbitrary units	Relative abundance
70	6.83	
72	9.13	
73	2.60	
74	12.17	and a sure of the last
76	2.60	20 1 100 000 2 12 1 10 2

(1) Complete the above table by calculating t	the relative abundance of each isotope	
The second secon		
( transport	I start to a second and the second beauty	
(ii) Determine the relative atomic mass of Ge	rmanium.	
		1000 10
	- 1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	ा Dess है है के कार उन्हर के दी <b>ट कि</b> चोर्च
<ul><li>(c) Under specified conditions of temperature a dynamic equilibrium.</li></ul>	nd pressure, ice, liquid water and wat	(5 marks) ter vapour co-exist in a heterogeneous
(i) Explain the term "heterogeneous equilibriu	ım"	
	•••••	
(ii) How many phases and how many component	ents exist in the equilibrium?	
d) (i)Define "order of reaction"	en anno en	(3 marks
	e macs sneetromeldt	
(ii) State two methods by which the rate of the	e reaction below can be followed	The street of the state of the
$2MnO_{4(aq)}^{-} + 5C_{2}O_{4(aq)}^{2-} + 16H_{(aq)}^{+} \rightarrow 2M$	$Mn^{2+}(aq) + 10CO_{2(q)} + 8H_2O_{qq}$	
	-(4) 2 - (1)	" leave the believe to the training
		the same of the sa

(iii) The data in the table below relate to the general reaction 2A + B → C+D at 500K.

Experiment	[AJ]/moldm <sup>-3</sup>	[B]/moldm <sup>-3</sup>	Initial rate/moldm <sup>-3</sup> S <sup>-1</sup>
10	0.130	0.20	1.50 x 10 <sup>-3</sup>
2	0.130	0.40	6.50 x 10 <sup>-5</sup>
3	0.065	0.40	3.00 x 10 <sup>-5</sup>
4	0.065	0.20	0.75 x 10 <sup>-5</sup>

A: Determine the order of reaction with respect to A and with respect	ect to B.
was assisted the property of t	COLUMN ERROR COLUMN CONTROL OF COLUMN
	Principul ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (
2111	
B: Calculate the value of the Rate constant from experiment 1.	(iii)
att.att.	
	(TOTAL = 20 marks)

## SECTION B: INORGANIC CHEMISTRY

and the second of the control of the second	the Line of the Aments Cobalt Nickel Iron and Zinc are	of
3. (a) This questions concern the d-block elements of the perio	die table. The elements Cobant, Nieken, non and 2000 are	1
the d-block.	4-1/-)	
(i) Which of the elements above is (are) not(a) transition me	rai(s).	
Explain.		
(office) o		
	Helips exhibits several oxidar a concession componis-	08
	ALTERNATION OF THE STREET, STR	(1
shine.	Visitate Name Live	
(ii) Distinguish between a d-block element and a transition m	netal.	
	olling and a second	
	***************************************	
	1	
	346.1	
(iii) How is a complex ion formed by a transition metals.	the second secon	
sale un reconstruit de la la		
A CONTRACTOR OF THE PARTY OF TH	The second secon	
A Company of the Comp	A STATE OF THE STA	
(iv) What do you understand by the coordination number of a	a complex ion.	
***************************************		
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v) Give the name of a cor	males setion formed by co	balt and draw its shape.	
me name of a col	npiex canon torres		
		Hamilatal Table 17 H	•
in the same of			
			(9 mark)
			(9 marks
(i) Give the general out	rmost shell electronic	periodic. (Fluorine, Chlorine figuration of these elements	ich the oxidation number is;
(ii) Give the chemical fo	rmula in each case of one	compound of Chiorine in wi	
oxidation state	compound		The state of the s
+1	Company		
+7			
		The Mark of the Substitute	xample of a reaction in which Chlorine
iv) Arrange the oxo-acids strongest. Explain your reasoning.	s of chlorine (HClO, HClO	D <sub>2</sub> , HClO <sub>3</sub> , HClO <sub>4</sub> ) in order of	(6 marks
(i) Complete the table be	elow by giving either the f	ormula, name or oxidation sta	te of the compound of fon.
Oxidation state	Name	Formula	
-2		H <sub>2</sub> S	actorisment in no state finding the (11)
	Thiosulphate		
		H <sub>2</sub> SO <sub>4</sub>	
			4
	Persulphate	$S_2O_8^{2-}$	
		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	100 1 10 10 10 10 10 10 10 10 10 10 10 1
			(5marks
			TOTAL = 20 marks
			IOIAL = 20 mark

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Indicate	the colours	associate	d with th	e fallou	7.5						Trinsign .		
E	lement		a with th	CIOHOW	ing ele				1	TE T		_	
So	odium						Flame co	lour	week.	Samuel of			
Ca	lcium					44	Total Andrew						
Po	tassium	Ash to 11 and	De dine	su arti u	at Al ra	la Litura are	tin of star	\$1.4.1.4.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	11 11 11 11	111	Section Section		of th
Sti	rontuim										<del>&gt; 0</del>		
Give one	e reaction in	each oos	4- 111	άι							1 - 1 - 2 - 2	ferant.	
A: Lithu	e reaction in	om that a	e to illus	trate ho	w the ch	nemistry o	f:						
26 mari	im differs fr												
D. D	1:00	•	SHRY	12.111.1	nich	C (MIN)	MEDIA	-0 /10	177.12				1
3: Beryll	luim differs f	irom mat	or other	eiemeni	s of gro	oup II.							
•••••				. 14	r esab	n 2110 n	nady vy		2 211.012		O 1197 m	eley	M (a)
												(6	marks
The eler	nents of the	first shor	t period (	of the po	eriodic (	table are,	Li, Be, B,	C, N, C	), F and	Ne.	e a la company		
i) Give t	he formula o	of one sta	ble oxid	e of eac	h eleme	ent of the	period.	acted.	nJ 19 10		tigil to sen		
Elem	nent	Li	Be	1	3	C	N		0	F	Ne	ga isr	mil I
Stab	le oxide			1 1	edians	200	oim gar t	nd kriječ Suna la	000iH	Machine Market	Ne	und nund	mil i
Stable St	le oxide ılanced equa	tions to s	how how	v the oxi	des of l	lithium an	d Carbon	react w	rith wate	r.	26 A1	*	i types.
Stable St	le oxide	tions to s	how how	v the oxi	des of l	lithium an	d Carbon	react w	rith wate	r.	26 A1	*	 i types.
Stable St	le oxide	tions to s	how how	v the oxi	des of I	lithium an	d Carbon	react w	rith wate	r.	26 A1	*	 I types
Stable (Stable) Give ba	le oxide llanced equa	tions to s	how how	the oxi	des of I	lithium an	d Carbon	react w	rith wate	r. accordi	26 A1	*	 i types
Stable St	le oxide  ulanced equa	tions to s	how how	the ele	des of I	lithium an	d Carbon	react w	rith wate	r. accordi	ng to thei	*	i types.
Stable (Stable) Give ba	e formulae o	tions to s	how how orides of	the ele	des of I	lithium an	d Carbon	react w	rith wate	r. accordi	ng to thei	*	d types
Stable (Stable) Give ba	e formulae of Element Formulae Chloride	tions to s	how how orides of	the ele	des of I	lithium an	d Carbon	react w	rith wate	r. accordi	ng to thei	r bond	 i types
Stable (Stable) Give ba	e formulae of Element Formulae Chloride Bond typ	of the chl	how how orides of	the ele	ides of I	lithium an	d Carbon	react w	rith wate	r. accordi	ng to thei	r bond	V. A
Stable (Stable) Give based (Stable) Give the stable (Stable) (Stab	ele oxide  alanced equa  me formulae of the control	of the chl	how how orides of	the oxi	des of I	Li, Be, B,	d Carbon	react w	rith wate	r. accordi	ng to thei	r bond	V. A
Stable (Stable) Give based (Stable) Give the stable (Stable) (Stab	e formulae of Element Formulae Chloride Bond typ	of the chl	how how orides of	the oxi	des of I	Li, Be, B,	d Carbon	react w	rith wate	r. accordi	ng to thei	r bond	V. A
Stable (Stable) Give based (Stable) Give the stable (Stable) (Stab	ele oxide  alanced equa  me formulae of the control	of the chl	how how orides of	the oxi	ments L  Carbon of Si a	lithium and Li, Be, B, B	d Carbon  C, N, O a	react w	rith wate	r.  accordi	ng to thei	r bond	V. A
Stable (Stable) Give based (Stable) Give the stable (Stable) (Stab	ele oxide  alanced equa  me formulae of the control	of the chl	how how orides of	the oxi	ments L  Carbon of Si a	Li, Be, B,	d Carbon  C, N, O a	react w	rith wate	r.  accordi	ng to thei	r bond	V. A
Stable (Stable) Give based (Stable) Give the stable (Stable) (Stab	ele oxide  alanced equa  me formulae of the control	of the chl	how how orides of	the oxi	ments L  Carbon of Si a	lithium and Li, Be, B, B	d Carbon  C, N, O a	react w	rith wate	r.  accordi	ng to thei	r bond	V. A

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(ii) Complete the table below by giving the formulae of the dioxides of the elements and their acid base character	

Silicon

Element

	Formula of dioxide			e tols an
	Acid base character		-	
		of ammonia to nitric acid spec		
	Net an ext			
		TION C: ORGANIC (MINER	tg ) a γυν ≃stan re	(2 marks) (TOTAL = 20 marks)
(2 d (400 d)		extensively whereas Silicon de		are sollid rather than h
(ii) Give the	type of hybridazation of O	Carbon and the shape of the mo	lecule in the following co	ompounds:
B: Ethyne: I	hybridization	shape	<u>C</u> )*	
(i) Describe	how the presence of nitro		pound A above.	
	17.0			
		n exhibited by compound A and		
				11 1 20 20 20 1 1 1 1 1 1 1 1 1 1 1 1 1
				essential I
c) (Write		ne following reactions of Carbo		(6 marks)
(ahan s		Che : : : o		
B: a cond	ensation reaction.		1946 - Alexandrian materials	

(ii) How would you account for the fact that Aliphatic Aldehydes are more reactive than their Ketones counterparts.

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(3 marks)

(d) An organic compound X, has the structural formula below.

$H_2N \longrightarrow \bigcirc$	CH=CH-CO <sub>2</sub> C <sub>2</sub> H

The compound undergoes combustion giving a highly lum (i) What accounts for the sootiness of the flame.	inous, sooty flame.	
		awan of Your ook (a)
<ul><li>(ii) Give the product formed when compound X reacts with.</li><li>A: Bromine in Carbon Tetrachloride.</li></ul>	The state of the s	
A, Diominio III		
which also a series in the	Appliant and the American	The state of the s
B: Bromine water.		
	200	A selection of the selection of the
(iii) Compound X reacts with dilute HCl (aq)/NaNO <sub>2(aq)</sub> at t Suggest a reason why temperatures below 5°C are needed.	emperatures below 5°C	
	and the section of Authors C. 5.4	(4 marks)
lend in records electrophile such asiE while in the	in signs on an authorities to	resettygifte H. Benzent, Phen
(e) (i) Write the structural formula of 2- Chloromethylbenze	ene	- CIE QUE
		· · · · · · · · · · · · · · · · · · ·
(ii) Show in TWO steps how you would prepare 2-Nitrom	nethybenzene from Benzene	mit melnud <b>s</b> en od sti: <b>Veik</b>
(iii) What name is given to the first step of reaction in e (ii	i) above.	
(III) What hallow grown		
LXQ.		(4 marks) (Total = 20 marks
	A ST TO THE STATE OF THE STATE	
V	man par are commented and a large	
the granden and a second second		

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6. (a) Given compounds A and B below.

H C=C	$CO_2H$ $CO_2H$ $CO_2H$
C0 <sub>2</sub> H H	same an think the different and a profile to the
B THE PROPERTY OF THE PARTY OF	and the three more off of the

THE RESERVE THE PARTY OF THE PA	
(i) How would the compound B be o	obtained from A.
	d a pure sample of this compound be obtained?
and the same of th	
(iii) How could its purity be verified?	
***************************************	and the second s
	(4 mark
(b) (i) Arrange the following compoureactive first): Benzene, Phenol, Nitrol	inds in order of their reactivity towards electrophile such as/E+ ( with the most
Explain:	ic) (i. Write the structural formula of 2-1Chloro at my heaven.
The state of the s	
	College reductions 194 Comment than a
(ii) Write the mechanism for the follow	ving reaction and with months of suggest the work work stages (IV) in work (i).  Br
Se King a substitution of the	$Br_2$
	FeBr <sub>3</sub> + HBr + FeBr <sub>3</sub>   maxis of sman tank// (iii)
(alvem a)	
west at or (1964) a 10 marks	

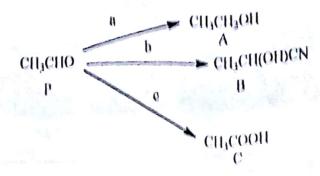
.....

(6 marks)

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rayO maT

(c) The compound P, can be converted to other products according to the scheme below.



Reaction conditions

(i) Give the reagents and reaction conditions for the conversions  $a_{\rm s}$  b and c

reagents

conversion

D		
C		
		ammunamma ==
	minimum	
(ii) Write the mechanism for the formation of B.		
(II) Write the meetining rol the formation		
	· · · · · · · · · · · · · · · · · · ·	and the state of t
	rina in the state of the state	
	en e	
(iii) Write the equation for the reaction of compound A	with concentrated sulphurle acid at 170 %,	
(III) Write the equation for the relection of every		
(iv) Name the reaction that occurs between compound C	and A.	
		(7 marks)
d) Organic compounds can be classified according to the	functional group.	
(i) Define the term "functional groups"		
(1) Define the term 1 and 1		
(ii) Write an equation for the reaction between Bromoe	ethane (CH <sub>3</sub> CH <sub>2</sub> Br) and each of the following	g compounds:
A: Potassium cyanide.		
a B tudenida		
3: Aqueous Sodium hydroxide.		
.,	a '= =	
		(3 marks)
		(Total = 20 marks)

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