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Answer ALL th	e questions. il. Use black	Write your	answ k	ers in	the sp	aces j	provid	ed in t	his qu	uestion paper.	F		
Final answers to	calculations	should be	given	to an	appro	priate	numb	er of s	ignifi	cant figures.			
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A Periodic Table The marks for in The total mark f ndicated.	e is printed or adividual ques or this paper	the back stions and is 60. The	cover the pa ere are	of thi arts of 16 pa	s pape questinges in	er. ions an this c	re sho questic	wn in on pap	round er. A	l brackets: e.g. (2 ny blank pages a	2). Ire		
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	SECTION A
1 1 1 1	
I. Use t	ne Periodic Table to identify the element that
(a) n	nainly consists of atoms which possess no neutrons.
	(1)
(b) for real real (b) for the second	forms a covalent oxide and hydride whose molecules contain three and four atoms espectively.
	(1)
(c) f	forms a bromide, XBr ₂ , with a molar mass of 184 g mol ^{-1} .
(d) c	consists of atoms each weighing 6.7×10^{-24} g
(ů) (The Avogadro constant = $6.0 \times 10^{23} \text{ mol}^{-1}$]
	(1)
	(Total 4 marks)

		3 Turn ove	
	(Total 3 marks)		
		Q2	
	Use the Periodic Table as a source of data. [The molar volume of a gas is 24 dm ³ mol ^{-1} at room temperature]		
	lithium nitride.		
	$6L_1(s) + N_2(g) \rightarrow 2L_{13}N(s)$ Calculate the volume of nitrogen measured at room temperature, needed to make 10 g of	-	
2.	Lithium reacts with hitrogen to form lithium hitride, L1 ₃ N.		

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 $| \underbrace{1}_{N} \underbrace{1}_{N} \underbrace{1}_{3} \underbrace{1}_{4} \underbrace{1}_{3} \underbrace{1}_{7} \underbrace{1}_{4} \underbrace{1}_{A} \underbrace{1}_{0} \underbrace{1}_{4} \underbrace{1}_{1} \underbrace{1}_{1} \underbrace{1}_{6} \underbrace{1}_{1} \underbrace{1} \underbrace{1}_{1} \underbrace{1}_{1} \underbrace{1}_{1} \underbrace{1}_{1} \underbrace{1$

	$Be(NO_3)_2.3H_2O(s) \longrightarrow BeO(s) + 2NO_2(g) + \frac{1}{2}O_2(g) + 3H_2O(l)$							
(a) Write de	own TWO observations v	which can be made during this pro-	cess.					
			(2)					
(b) Relevan	t standard enthalpy chan	ges of formation are given in the t	able below.					
		Standard enthalpy change of formation, $\Delta H_{\rm f}^{\ominus}$ / kJ mol ⁻¹						
	Be(NO ₃) ₂ .3H ₂ O(s)	-787.8						
	BeO(s)	-609.6						
	NO ₂ (g)	+33.2						
	O ₂ (g)	0						
	H ₂ O(1)	-285.8						
(ii) Cal	(1) Calculate the standard enthalpy change for the decomposition of hydrated							
ber	beryllium nitrate.							
_	nember to include a sign	and units in your answer.						
Rei								
Rei								
Rei								
Ren								
Rei			(2)					
Rei			(2) (Total 5 marks)					



		to three significant figures.					
	G	· · ,· · · · ,· ,·	1	• 41 4 1	1 1 1	(2)	
(c)	Son	ne ionisation energies for stronti	um are sho	own in the tal	ble below.		
			1st	2nd	3rd		
		Ionisation energy / kJ mol ⁻¹	550		4210		
	(i)	Explain what is meant by the se	econd ionis	sation energy	of strontium.		
	(ii)	Estimate a value for the second	ionisation	energy of st	rontium	(2)	
	(ii)	Estimate a value for the second	ionisation	energy of st	rontium.		
	(ii)	Estimate a value for the second	ionisation	energy of st	rontium.	(2) (1)	
(d)	(ii) You Bri	Estimate a value for the second u are provided with a small samp	ionisation	energy of st al which is e	rontium. ither strontium	(2) (1) or barium.	
(d)	(ii) You Bri Giv	Estimate a value for the second u are provided with a small samp refly describe a test you could car we the observation you would ma	lionisation le of a met ry out to id ke for eac l	energy of st tal which is e lentify which h metal.	rontium. ither strontium of these metals	(2) (1) or barium. s is present.	
(d)	(ii) You Bri Giv	Estimate a value for the second u are provided with a small samp refly describe a test you could can be the observation you would ma	lionisation le of a met ry out to id ke for eac l	energy of st tal which is e lentify which h metal.	rontium. ither strontium of these metals	(2) (1) or barium. s is present.	
(d)	(ii) You Bri Giv	Estimate a value for the second u are provided with a small samp refly describe a test you could can be the observation you would ma	lionisation le of a met ry out to id ke for eac	energy of st cal which is e lentify which h metal.	rontium. ither strontium of these metals	(2) (1) or barium. s is present.	
(d)	(ii) You Bri Giv	Estimate a value for the second u are provided with a small samp refly describe a test you could car we the observation you would ma	lionisation le of a met ry out to id ke for eac l	energy of st tal which is e lentify which h metal.	rontium. ither strontium of these metals	(2) (1) or barium. s is present.	
(d)	(ii) You Bri Giv 	Estimate a value for the second a are provided with a small samp refly describe a test you could can be the observation you would ma	lionisation le of a met ry out to id ke for eac l	energy of st tal which is e lentify which h metal.	rontium.	(2) (1) or barium. s is present.	
(d)	(ii) You Bri Giv 	Estimate a value for the second a are provided with a small samp refly describe a test you could can be the observation you would ma	lionisation le of a met ry out to id ke for eac	energy of st tal which is e lentify which h metal.	rontium.	(2) (1) or barium. s is present.	
(d)	(ii) You Bri Giv 	Estimate a value for the second a are provided with a small samp refly describe a test you could can be the observation you would ma	ionisation le of a met ry out to id ke for eac l	energy of st tal which is e lentify which h metal.	rontium.	(2) (1) or barium. s is present.	Q

a, , was formerly known as ethylene glycol. CH ₂ OH	The com
ime for ethylene glycol.	(a) (i)
(1)	
ly to be soluble in water? Give a reason for your answer.	(ii)
(1)	
for the complete combustion of ethylene glycol. fired.	(b) Writ State
(2)	
ases, give the structural formula of the organic compound	(c) In ea form
d to ethylene glycol.	(i)
(2)	
efluxed with excess acidified sodium dichromate(VI)	(ii)
(1)	

N 3 4 3 7 4 A 0 8 1 6

(d) Ethylene glycol can be manufactured from epoxyethane, which has the following structural formula:	blank
CH2-CH2	
Suggest a reagent which could be added to epoxyethane to carry out this conversion.	
(1)	Q6
(Total 8 marks)	

Turn over

7.	(a)	The table be	low gives the a	tomic and ionic rad	lii of three meta	als in Group 2.	Le bla
			Metal	Atomic radius / nm	Ionic radius / nm		
			Calcium	0.174	0.100		
			Strontium	0.191	0.113		
			Barium	0.198	0.136		
		 (i) Why is t (ii) Give TV its atom 	the atomic radi	us of strontium gre	ater than that of	f calcium? (1) s so much smaller than	
	(b)	Bone consist phosphate, C In an experim crushed and phosphate det oxide, P_2O_5 . solution of c	ts of a comp $Ca_3(PO_4)_2$. ment to estima heated strongle composed, for An excess of alcium hydrox	lex mixture of ca te the percentage of y until there was ming calcium oxid f water was added ide was obtained.	of calcium present of calcium present of further loss e and evolving a to the residue,	(2) ands, such as calcium ent, 2.0 g of bone were in mass. The calcium gaseous phosphorus(V) and, after filtration, a	
		(1) Write do	own the formul	ae of the TWO ion	s present in calo	cium phosphate. 	
10							

(ii) Write a balanced equation for the reaction which occurs when calcium phosphate	Leave blank
is heated. State symbols are not required.	
(1)	
(iii) Assuming that 0.0060 mol of calcium hydroxide is present in the solution, calculate the percentage by mass of calcium in the bone sample.	
(2)	
(iv) Assuming that the practical work has been carried out accurately, suggest TWO reasons why the answer obtained in (iii) might have been too low.	
(2)	Q7
(Total 9 marks)	

Turn over

8.	If oxygen supplies are limited, human muscle cells are able to break down glucose into lactic acid by way of the simplified stages shown below. The names given are not the systematic names of the compounds.	Leave blank
	$\begin{array}{ccc} C_{6}H_{12}O_{6} & \rightarrow & 2CH_{2}OHCHOHCHO & \rightarrow & 2CH_{3}COCO_{2}H & \rightarrow & 2CH_{3}CHOHCO_{2}H \\ glucose & glyceraldehyde & pyruvic acid & lactic acid \end{array}$	
	(a) (i) Draw a circle around a secondary alcohol group in one of the formulae above. (1)	
	(ii) On the formula below draw a circle around the group in pyruvic acid which causes it to be classified as an acid.	
	CH ₃ COCO ₂ H (1)	
	(iii) Into which other group of compounds can pyruvic acid be classified, apart from being a carboxylic acid?	
	(1)	
	(iv) Draw the fully displayed formula for glyceraldehyde.	
	(1)	
	(v) Explain why the conversion of pyruvic acid into factic acid is a reduction.	
	(1)	

(b)	b) The concentration of a solution of lactic acid was determined by measuring the temperature change in its reaction with sodium hydrogencarbonate, NaHCO ₃ .								
	25.0 cm ³ of the lactic acid solution were placed in a polystyrene cup and the initial temperature was taken. An excess of solid sodium hydrogencarbonate was added in small portions until the reaction was complete. The final temperature was recorded.								
	The results	are given below.							
		Volume of aqueous lactic acid / cm ³	25.0						
		Initial temperature / °C	22.2						
		Final temperature / °C	15.6						
	(i) Identif hydrog	y the gas evolved when lactic acid reacts gencarbonate.	with sodium						
			(1)	,					
	(ii) Why was the sodium hydrogenearbonate added in <i>small portions</i> ?								
		(1)							
	(iii) Calculate the energy change occurring during this experiment. Give a unit with your answer.								
	You may assume that								
	• the specific heat capacity of the solution is 4.2 J g^{-1} °C ⁻¹								
	• the volume of solution remains constant during the addition of the sodium hydrogencarbonate								
	• the	e density of the solution is 1.00 g cm^{-3} .							
			(2)						



Leave	(d) Suggest TWO reasons why the value for the concentration of lactic acid obtained by measuring the temperature change is usually lower than that determined by titration.
Q8	(2)
	(Total 16 marks)
	TOTAL FOR SECTION B: 45 MARKS
	TOTAL FOR PAPER: 60 MARKS
	END
15	

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A Helium 4 Lu Lutetium Lr Lawrenciun (257) Tuorine 19 Yb Ytterbium Nobelium (254) 15 Subphur Subphur Subphur Subphur Subphur Subphur 32 Setenium 34 Tablurium Tellurium 128 Reference and subphur 25 Tablurium 210 Polonium (210) oxygen 16 G ²⁰ Thulium Md lendelevi (256) Nitroge Er Erbium 167 Fermium (253) Carbon 12 Holmium Holmium Esteiniur (254) e Dy Dysprosium Zinc 55.4 65.4 Cddmium 112 80 Mercury 201 Cf Californium (251) Tb Terbium BK Berkelium (245) Cu Copper 63.5 63.5 63.5 79 79 79 79 79 79 79 THE PERIODIC TABLE Gd Gadolinium ³⁶ Curium (247) Europium Am Americium (243) Cobatt 59 85 87 87 103 103 103 113 103 113 Sm Samarium Pu Plutonium (242) Group Atomic Number Symbol Name Molar mass in g mol⁻¹ Key Neptuniur (237) Manganese 55 15 15 75 75 75 186 186 Promethic (147) Nd Neodymium Chromium 52 84 Molybdenun 96 106 106 1184 124 124 124 124 1263 1263 ⁹² Uranium 238 Vanadium Sanadium Sanadiu Sanadium Sana Pr Praseo-dymium 141 Pa Protactiniu (231) Cerium Cerium Th 232 Sc scandium 45 39 39 57 139 139 139 139 Actinium (227) Lanthanide elements Actinide elements Be Beryllium 9 Hydrogen 1 Sodium 23 K Potassiur 39 Rubidiurr 85 55 55 CS Caesium 133 87 87 Fr Lithium Period m S ø ~

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