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		Materi	ials requ	uired f	or exa	minatio	on	Items i	ncluded	d witl	h question papers		5	
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Instruction	ons t	o Candid	dates						•					
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Show all Final answ	the st	eps in an	y calcu	lation	s. Cal	culato	rs ma	y be us	sed.	_	of significant			
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Advice to												_		
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Turn over



Answer ALL questions in the spaces provided.

ι.	(a)	In some reactions, sulphur atoms are converted into sulphide ions. Draw a 'dot and cross' diagram for a sulphide ion. Show outer shell electrons only and the charge on the ion.
	(b)	State which noble gas has the same electronic configuration as a sulphide ion. Use the Periodic Table as a source of data.
		(1)
	(c)	Give the formula for potassium sulphide.
		(1)
2.	(a)	Balance the equation for the action of heat on the nitrate of a Group 2 metal, X.
		$X(NO_3)_2(s) \longrightarrow XO(s) + NO_2(g) + O_2(g)$ (2)
	(b)	Describe ONE observation you would expect to make as the reaction takes place.
		(1)
	(c)	Which Group 2 metal forms compounds giving an apple green colour in a flame test?
		(1)

Leave blank	Write an equation to represent the first ionisation energy of sodium. Include state symbols in your equation.	3. (a)
	(2)) Give the full electronic configuration of a nitrogen atom, using the s p d notation.	(b)
	(1) Suggest a reason why helium has the highest first ionisation energy of all elements.	(c)
SA	(1)	
	TOTAL FOR SECTION A. 12 MADES	

SECTION B

Leave blank

(1)

					SECT	OND			
l.			volcanic roc pes present.		n be estimat	ed by analy	sing th	e relative abun	dance of the
	incorpo	rated	into the ro	ck.		of hydrog		a, ³ H, and heliu adioactive and	
	A samp		helium froi	n a vo	olcanic rock	was found	to hav	e the following	g percentage
				³ He	0.99%	⁴ ₂ He	99.01	%	
	(a) (i)	-	olain what : wer.	is me	ant by the	term isoto p	e usin	g helium to ill	ustrate your
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	(ii)				to show the of hydroge			type of subato wn.	mic particle
			Atom	i	umber of protons	Number neutro	1	Number of electrons	
			³ H						
			³ He						
	(iii) In v	vhat way a	re the	two atoms,	$^{3}_{1}$ H and $^{3}_{2}$ H	Ie, simi	ilar?	(2)

(b)	(i)	Give the name of the instrument used to measure the relative abundances of isotopes.	Leave blank
		(1)	
	(ii)	Use the percentage composition data to calculate the average relative atomic mass of helium in this sample of helium from a volcanic rock. Give your answer to FOUR significant figures.	
		(2)	
(c)	Sug	gest how the ratio of ${}_{2}^{3}$ He to ${}_{2}^{4}$ He changes as the volcanic rock becomes older.	
	•••••		0.4
		(1)	Q4
		(Total 9 marks)	

rms que	estion is about organic compounds with the molecular formula C ₃ H ₈ O.
(a) (i)	Draw the structural formulae of the two isomers with the molecular formula C_3H_8O which are alcohols. Give the names of these alcohols.
	ALCOHOL 1 ALCOHOL 2
	Structural
	formula
	Name
	Name(4)
(ii)	What is the molecular formula of the next member of this homologous series of alcohols?
	of alcohols:
	(1)
(b) Prin	mary alcohols can be fully oxidised to carboxylic acids.
(i)	Give the name and structural formula of the carboxylic acid formed when the
• • • • • • • • • • • • • • • • • • • •	primary alcohol C ₃ H ₈ O is fully oxidised.
	Name
	Structural formula
	(2
(ii)	Name the two reagents needed for this oxidation.
	Reagent 1
	Paggant 2
	Reagent 2(2
(iii)	What colour change would you observe as the reaction takes place?
	From to
	(2

6

Leave blank

N6985

5.

(iv)	Draw a fully labelled diagram of the apparatus you would use to fully oxidise the alcohol to the carboxylic acid.		eave lank
(v)	Name the process you would use to separate the carboxylic acid from the reaction mixture. (1) (Total 16 marks)	Q	25

6.	Am nitr	monium nitrate, NH ₄ NO ₃ , can be made by reacting ammonia solution with dilute ic acid.	Leave blank
	(a)	Write a balanced equation for this reaction. Include state symbols in your equation.	
	(b)	What type of reaction is this?	
		(1)	
	(c)	Describe how you would obtain a colourless neutral solution of ammonium nitrate, using this reaction.	
		(2)	
	(d)	Describe how you would obtain pure dry crystals of ammonium nitrate from the solution in (c).	
		(4)	Q6
		(Total 9 marks)	

N6985

7.	con	ained ankles can be treated with an ice pack. An alternative is to use a divided pack taining ammonium nitrate and water which can be mixed to provide a low perature.
		$NH_4NO_3(s) + aq \longrightarrow NH_4^+(aq) + NO_3^-(aq)$ $\Delta H = +25.2 \text{ kJ mol}^{-1}$
	(a)	What would be the enthalpy change in joules if 40 g of ammonium nitrate was dissolved in water? [molar mass of ammonium nitrate = 80 g mol ⁻¹]
	(b)	Use your answer to (a) to calculate the final temperature if 40 g of ammonium nitrate was dissolved in 200 g of water which was initially at 20 °C.
		Enthalpy change = mass of water \times 4.2 \times temperature change (J) (g) (J g ⁻¹ K ⁻¹) (K)
	(c)	Suggest TWO advantages of using the ammonium nitrate/water pack over an ice pack for treating injuries in a football match.
		Advantage 1

(2)

Q7

Leave blank

(Total 5 marks)

Advantage 2

8. The decomposition of ammonium nitrate can be represented by the following equation

Leave blank

$$2NH_4NO_3(s) \mathop{\longrightarrow} 2N_2(g) + O_2(g) + 4H_2O(g)$$

(a) Show that the molar mass of ammonium nitrate is 80 g mol⁻¹. Use the Periodic Table as a source of data.

(1)

(b) What volume of nitrogen (at room temperature and pressure) would be produced if 20 g of ammonium nitrate was decomposed?

[1 mole of any gas has a volume of 24 dm³ at room temperature and pressure.]

(2)

(c) (i)	Complete the Hess cycle below so that	$\Delta H_{\text{reaction}}^{\Phi}$ can be calculated using
	standard enthalpy changes of formation.	

$$2NH_4NO_3(s) \xrightarrow{\Delta H_{reaction}^{\Theta}} 2N_2(g) + O_2(g) + 4H_2O(g)$$

(1)

(ii) Calculate $\Delta H_{\text{reaction}}^{\Theta}$ given that

$$\Delta H_{\rm f}^{\Phi}[{
m NH_4NO_3(s)}] = -365.6~{
m kJ}~{
m mol}^{-1} \ \Delta H_{\rm f}^{\Phi}[{
m H_2O(g)}] = -241.8~{
m kJ}~{
m mol}^{-1}$$

Include a sign and units in your answer.

(d)	Use the equation and your answers to (b) and (c) to suggest TWO reasons why ammonium nitrate makes a good explosive.
	Reason 1
	Reason 2
	(2)

(Total 9 marks)

(3)

Q8

TOTAL FOR SECTION B: 48 MARKS

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Period

Argon And Argon Krypton Krypto

hosphorus
31
33
48
Assenic
75
51
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S1
S1
S1
S1
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Silicon Silico

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	Advanced Level/Advanced Sul	osidiary		
	Unit Test 1		Ques Num	
	Monday 4 June 2001 – Afternoon		Sect A	
	Time: 1 hour 20 minutes		5	
	Materials required for examination Items included with q	uestion papers	6	
	Nil Nil	<u> </u>	7	
			8	
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Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname and initials, the paper reference and your signature. The paper reference is shown above. **Answer ALL questions in the spaces provided in this question paper.** Show all the steps in any calculations. Calculators may be used. Final answers to calculations should be given to an appropriate number of significant figures.

Information for Candidates

A Periodic Table is printed on the back cover of this paper.

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).

There are nine questions in this question paper. The total mark for this paper is 60.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

Turn over

Total



Answer ALL questions in the spaces provided.

1. (a) Balance the equation

$$NaHCO_3(s) \longrightarrow Na_2CO_3(s) + CO_2(g) + H_2O(l)$$
 (1)

(b) Name the reactant.

(c) What type of reaction is this?

2. A sample of lead (atomic number 82) is made up of three isotopes. The sample has the following percentage composition:

(a) What is the maximum number of neutrons in any one atom of lead in this sample?

(b) What is the average relative atomic mass of lead in this sample? Give your answer to FOUR significant figures.

(2)

	(c) Draw a diagram to illustrate the metallic bonding in a typical metal such as lead.	Leave blank
	(1)	
3.	Calcium reacts with water. The balanced equation for the reaction is:	
	$Ca(s) + 2H_2O(1) \longrightarrow Ca(OH)_2(aq) + H_2(g)$	
	(a) Suggest TWO things you would see as the reaction takes place.	
	(2)	
	(b) (i) What is the laboratory name given to the solution formed in this reaction?	
	(ii) What is this solution used to test for?	
	(1)	
1.	Give the names of the two organic compounds which could be produced on oxidising CH ₃ CH ₂ CH ₂ CH ₂ OH with sodium dichromate and sulphuric acid.	
	Compound 1	
	Compound 2(2)	SA
	TOTAL FOR SECTION A: 13 MARKS	
		•

SECTION B

Leave blank

5. (a) Ethanol can be converted into ethene.

$$C_2H_5OH(1) \longrightarrow C_2H_4(g) + H_2O(1)$$

(i) Give TWO names which describe this type of reaction.

(ii) Draw a fully labelled diagram of the laboratory apparatus, including the chemicals, you would use to convert ethanol into ethene and to collect the gas.

(4)

(2)

(iii) The diagram below shows a Bunsen valve. The valve is often put on the end of a delivery tube when a gas is collected.

Glass rod
Slit
Rubber tubing

Bunsen valve

Why is this valve useful?

(1)

(b)	(i)	Draw the displayed formula for ethene.	Leave blank
	(iii)	The equation for ethene reacting with bromine water is: $C_2H_4(g)+Br_2(aq)\longrightarrow C_2H_4Br_2(l)$ What colour change would you expect to see?	
		(2)	Q5

N6984

(Total 11 marks)

Hydrogen	n peroxide, H ₂ O ₂ , is a weak acid.	Leave blank
(a) (i)	Give the formula of the ion always present in acidic solutions.	biann
(ii)	Explain what is meant by a weak acid.	
(b) You	are asked to make 250 cm ³ of a 1 mol dm ⁻³ solution of hydrogen peroxide.	
(i)	Calculate the number of moles of hydrogen peroxide needed.	
(ii)	Calculate the mass of hydrogen peroxide, H_2O_2 , needed. Use the Periodic Table as a source of data.	
(iii)	Hydrogen peroxide is a liquid at room temperature. It has a density of $1.44~{\rm g~cm^{-3}}$. Calculate the volume of liquid hydrogen peroxide needed.	
(iv)	What colour would you expect full-range universal indicator solution to turn in a $1.0~\rm mol~dm^{-3}$ solution of hydrogen peroxide?	
	(1)	Q6
	(Total 7 marks)	

6.

7.	Hydrogen peroxide is an oxidising agent.	Leave blank
	Hydrogen peroxide will oxidise an acidified solution of iron(II) sulphate. The equation for the reaction is:)
	$2 FeSO_4(aq) + H_2O_2(aq) + H_2SO_4(aq) \longrightarrow Fe_2(SO_4)_3(aq) + 2 H_2O(l)$	
	(a) What is the charge on the iron ion in:	
	FeSO ₄	
	$Fe_2(SO_4)_3$?	
	(b) Give the formula of the spectator ion in this equation.	
	(1) (c) Rewrite this equation as an ionic equation, omitting the spectator ion.	
	(1) (d) Explain why the iron is said to be oxidised in this reaction.	
	(1)	Q7

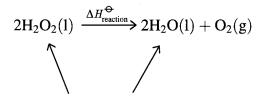
Turn over

(Total 4 marks)

8.	Hydrogen	peroxide c	an readily	decompose	into	water	and	oxygen
----	----------	------------	------------	-----------	------	-------	-----	--------

Leave blank

(a) Complete the Hess cycle below so that $\Delta H_{\text{reaction}}^{\Theta}$ can be calculated using standard enthalpies of formation. Include state symbols.



(1)

(b) Calculate $\Delta H_{\text{reaction}}^{\oplus}$ for this reaction given that

$$\begin{array}{l} \Delta H_{\rm \,f}^{\, \varphi}[H_2O_2(l)] = -187.8 \; kJ \; mol^{-1} \\ \Delta H_{\rm \,f}^{\, \varphi}[H_2O(l)] \; = -285.8 \; kJ \; mol^{-1} \end{array}$$

Include a sign and units in your answer.

(3)

(c) What volume of oxygen (at room temperature and pressure) would be produced from the complete decomposition of 17 g of hydrogen peroxide? [Molar volume is 24 dm³ mol⁻¹ at room temperature and pressure].

(2)

(d) Suggest, with a reason, ONE safety precaution which should be taken when storing hydrogen peroxide. Justify your answer.

(2) L

Q8

(Total 8 marks)

This que magnesi	estion is about the first twelve elements of the Periodic Table, hydrogen to ium.
(a) (i)	Write an equation to represent the SECOND ionisation energy of beryllium. Include state symbols in the equation.
(ii)	Suggest which one of these twelve elements would have the largest SECOND ionisation energy. Justify your choice.
(iii)	Suggest which atom of these twelve elements would have the largest atomic radius. Justify your choice.
	(2)

9.

Leave blank

(b)	(i)	Give the electr	onic con	nfiguration of	an oxide io	n, O ^{2–} , usi	ng s p d n	otation.
			•••••					(1)
	(ii)	Give the name the same electron			-		ions) whi	` '
		Name:	••••••		Formula:		*****	•••••
		Name:	••••••	•••••	Formula:	•••••	•••••••	(2)
(c)		w a 'dot and cro	_	-				lithium
		Li	Н	→	Li		н	
		Lithium atom	Hydrog atom	gen	Lit	hium hydri	ide	(2)
								(3)

Leave blank

10

	7.2	5.3	5.1	4.9	4.6	Frequency/10 ¹⁴ Hz	
(i) {	Suggest the colour	of the emis	sion see	n at 5.1	$\times 10^{14}$	Hz.	į
(ii)]	Explain how a line	in the emis	ssion sne	ectrum s	arises	(1)	
(11)		in the enne					
		••••••	••••••		•••••		
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iii) '	Why are there seve	eral lines in	the emis	ssion sp	ectrum?	(2)	
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iv) S	Suggest ONE way	in which the	emissio	n specti	um of so	odium could be of use.	
		•••••	•••••				

TOTAL FOR SECTION B: 47 MARKS

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6	Na Sodium 23										i'	34	Aluminium 27	Silicon 28	Phosphorus	Sulphur 32	Cl Chlorine 35.5	Ar Argon
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536	Rubidium 85	Strontium 4	Yttrium 89	Zr Zirconium 91	Nobium 83	MO Molybdenum 96	TC Technetium (99)	Ruthenium 101	Rh Rhodium 103	Pd Palladium 106	Ag Silver 108	Cd Scadmium	P In Institution 115	Sn Tin 119	Sb Antimony 122	Te Tellurium 128	lodine 127	Xe Xenon 131
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8	δ	Dysprosium	35		88	ర	Californium	(221)
윤	Ţ	Terbium	159		26	8	Berkelium	(245)
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22	Eu	Europium	152		88	Am	Americium	(243)
29	Sm	Samarium	150		35	2	Plutonium	(242)
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8	P	Neodymium	4		26	>	Uranium	. 238
88	<u>ڄ</u>	Praseo- dymium	141		6	Pa E	Protactinium	(1231)
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► Lanthanide elements

►► Actinide elements

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	Friday 11 January 2002 – Afternoon	S	ection A	
	Time: 1 hour 20 minutes		5	
	Materials required for examination Items included with question papers		6	
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Instructio	ns to Candidates			
In the boxe	es above, write your centre number, candidate number, your surname and e paper reference and your signature. The paper reference is shown above.	- [
Answer Al Show all the	LL questions in the spaces provided in this question paper. ne steps in any calculations. Calculators may be used.			
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Information	on for Candidates	<u> </u>		
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description	e assessed on your ability to organise and present information, ideas, s and arguments clearly and logically, taking account of your use of grammar, and spelling.			

Turn over



Answer ALL the questions in the spaces provided.

Leave blank

SECTION A

1.		te a balanced equation, including state symbols, for the reaction between calcium water.
		. (2)
2.	(a)	Draw a diagram to show the bonding in a metal.
	(b)	Explain how the bonding in metals accounts for their high electrical conductivity.
		(1)

2

(a)	Give the electronic arrangement for the element carbon, using the s,p,d notati		Leav blan
(b)	The sketch graph shows the first ionisation energies for boron, carbon nitrogen. Continue the sketch to show the first ionisation energies of the next telements of the Periodic Table.	and	
	First Ionisation Energy /kJ mol ⁻¹		
	B C N O F Ne Na		
	Elements	(3)	
Who	en carbon dioxide dissolves in water it forms the weak acid, carbonic acid.		
(a)	Explain what is meant by the term weak acid.		
(b)			
	(ii) State the result of your test.		
			SA
	(b) Wh (a)	(b) The sketch graph shows the first ionisation energies for boron, carbon nitrogen. Continue the sketch to show the first ionisation energies of the next telements of the Periodic Table. First Ionisation Energy /kJ mol ⁻¹ When carbon dioxide dissolves in water it forms the weak acid, carbonic acid. (a) Explain what is meant by the term weak acid. (b) (i) Suggest a simple test to show that carbonic acid is a weak acid. (ii) State the result of your test.	First Ionisation Energy /kJ mol ⁻¹ B C N O F Ne Na Elements (3) When carbon dioxide dissolves in water it forms the weak acid, carbonic acid. (a) Explain what is meant by the term weak acid. (b) (i) Suggest a simple test to show that carbonic acid is a weak acid. (ii) State the result of your test.

- 5. This question is about the metal indium and its compounds.
 - (a) A sample of the metal indium has two main isotopes, with relative percentage abundances as follows:

¹¹⁵₄₉In 97.31%

¹¹³₄₉In 2.69%

(i) Use the information to work out the molar mass of this sample of indium.

Remember to show your working clearly and to include units in your answer which should be given to 4 significant figures.

(2)

(ii) Name the instrument used to measure relative isotopic abundances.

(1)

(b) (i) Indium reacts with dilute sulphuric acid to form a solution of indium(III) sulphate, $In_2(SO_4)_3$, and hydrogen gas. Write a balanced equation for the reaction including state symbols.

(2)

	(ii)	Describe how dry crystals of indium(III) sulphate could be obtained from its solution.		Leave blank
		<u></u>		
		(4)		
(c)	State	the numbers of protons, neutrons and electrons in the indium(III) ion, $^{115}_{49}In^{3+}$.		
	Proto	ons		
	Neut	rons		
	Elect	rons) 5
		(3)		
	-:-	(Total 12 marks)	<u> </u>	

6.	But	an-1-	ol can be partially oxidised to butanal.
	(a)	(i)	Give the structural formula of butan-1-ol.
		(ii)	Name the TWO chemicals which are used to bring about the partial oxidation of butan-1-ol.
			(2)
		(iii)	Draw a fully labelled diagram of the apparatus which could be used to obtain the product of this partial oxidation.
			(3)
		(iv)	State how the colour of the reaction mixture changes during the reaction.
			From
			To(2)

6

Leave blank

N9267

(b)	(i)	Describe what you would see if butan-1-ol and butanal were each separately warmed with Benedict's solution.	Leave blank
		Butan-1-ol	
		Butanal	
		$(2) \mid$	
	(ii)	Explain why a sample of butanal which has been stored for some time may react with sodium carbonate solution.	
		(2)	Q6
		(Total 12 marks)	

acio	1.	on by reacting with excess stomach acid, which is effectively hydrochlori
(a)	(i)	Complete the equation for the reaction between hydrochloric acid an calcium carbonate. Include state symbols in your answer.
	CaC	$CO_3(s)$ + + $CO_2(g)$ +
	(ii)	Calculate the number of moles of calcium carbonate in one tablet. Use the Periodic Table as a source of data.
	(iii)	What volume of carbon dioxide (at room temperature and pressure) would form from one tablet. [Molar volume is 24 dm³mol⁻¹ at room temperature and pressure.]
	(iv)	Suggest ONE side effect of using these tablets to relieve indigestion.
		(1

8

Leave blank

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(b)		presence of calcium ions in the tablets can be confirmed by carrying out a le test.		ave ank
	(i)	Describe how you would carry out such a flame test.		
	(::\	What flame calcum would you arrest to see?		
	(ii)	What flame colour would you expect to see?		
	(iii)	State why magnesium cannot be detected by a flame test		
	(111)	State why magnesium cannot be detected by a flame test.		
				_
		(1)	Q	27
		(Total 12 marks)		

Iron reacts with copper(II) sulphate solution to form iron(II) sulphate solution an copper.	d									
The standard enthalpy change for the reaction between iron and copper(II) sulphate i $-153.9 \text{ kJ mol}^{-1}$.	s									
In an experiment to investigate this enthalpy change a student decided to use 25 cm ³ of 0.20 mol dm ⁻³ copper(II) sulphate solution and 0.01 mol of iron (an excess).										
(a) (i) Write an ionic equation for this reaction. Include state symbols but omit an spectator ions.	у									
(ii) Show how the standard enthalpy change for this reaction could be calculate from the standard enthalpy changes of formation of copper(II) ions an iron(II) ions. You should include a Hess cycle in your answer.	d									
(3										
(b) (i) What container could be used for the experiment?										
(ii) Calculate the mass of 0.01 mol of iron. Use the Periodic Table as a source of data.)									
(iii) Calculate the number of moles of copper(II) sulphate used.)									
(1))									

Leave blank

8.

(iv)	Calculate the energy change that would be expected for the number of moles of copper(II) sulphate calculated in (iii).		eave ank
(v)	State whether energy is given out or taken in. Justify your answer.		
(:\)			
(V1)	Calculate the expected temperature change in the reaction using the relationship:		
	Energy change = $4.18 \times \text{volume of solution} \times \text{temperature change}$.		
	Remember to include a unit in your answer which should be given to two significant figures.		
(vii)	Suggest ONE reason why the actual temperature change is likely to differ from your value.		
	(1)	Q	8
	(Total 13 marks)		

TOTAL FOR SECTION B: 49 MARKS

END

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Key

Atomic Number Symbol Name Molar mass in g mol -1					
	Atomic Number	Symbol	Name	Molar mass in	g mol

2 Helium 4

	-			\vdash			H		_							PO A1 Polonium Astat (210) (210	84 89 Po A Polonium Asta (210)		<u> </u>
	1	z	Nitrogen 14	15	_	Phosphorus 31	æ	As	Arsenic 75	51	Sb	Antimony 122		83	83 ji	83 Bismuth 209	83 Bismuth 209	83 Bismuth 209	83 Bismuth 209
	و	ပ	Carbon 12	7	S	Silicon 28	32	ge	Germanium 73	S	S	Ē £		82	Pb	82 Pb Lead 207	Pb Lead 207	82 Pb Lead 207	Pb Lead 207
	ء ا	В	Boron 11	13	₹	Aluminium 27	31	Сa	Gallium 70	\$	ء	Indium 115		8	≅ I	81 T1 Thallium 204	81 T1 Thallium 204	Thallium 204	Thailium 204
							8	Zu	Zinc 65.4	3	8	Cadmium 112		88	8 H	80 Hg Mercury 201	Hg Mercury 201	Hg Mercury 201	Mercury 201
							23	3	Copper 63.5	43	Ag	Silver 108		62	ъ Au	79 Au 60ld 197	79 Au 60ld 197	79 Au 60id 197	79 Au 60id 197
						!	28	Ż	Nickel 59	94	Pd	Patladium 106		82	≈ &	78 Pt Platinum 195	78 Ptatinum 195	78 Platinum 195	78 Pt Patinum 196
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- - -	<u> </u>						92	Fe	ron Se	4	æ	Ruthenium 101		9/	so Os	76 OS 08mium 190	76 OS Osmium 190	76 Os Osmium 190	OS Osmium 190
-	= 						52	M	Manganese 55	£\$	٦c	Technetium (99)		75	ت Re	75 Re Rhenium 186	75 Re Rhenium 186	75 Re Rhenium 186	75 Re Rhenium 186
							24	ပံ	Chromium 52	45	Wo	Molybdenum 96		74	¥ X	74 W Tungsten 184	74 W Fungsten 184	74 W Tungsten 184 106	W V Tungsten 184 106 Unh Unh
							æ	>	Vanadium 51	41	Q N	Niobium 93		27	ន E	73 Ta Tantalum 181	73 Ta Fantalum 181	Ta Tantalum 181 105	Ta Tantalum 181 105 Unp
							22	F	Titanium 48	40	ZŁ	Zirconium 91		72	元 元	72 Hf Hafnium 178	72 Hf Hafnium 178	Haffnium 178	Hafnium 178 Unq Unq
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	Ţ	Be	Beryllium 9	12	Mg	Magnesium 24	R	రొ	Calcium 40	38	Š	Strontium 88		95	se Ba	56 Ba Barium 137	56 Ba Barium 137	SS Barium 137 88 Ra	S6 Barium 137 88 Ra Radium
	3	:=	Lithium 7	=	Na	Sodium 23	61	¥	Potassium 39	37	ВВ	Rubidium 85		æ	ss Cs	55 CS Caesium 133	SS Caesium 133	SS Caesium 133 87 Fr	SS Caesium 133 87 Fr Francium
-											_		_	•					

► Lanthanide elements

		_	_	 		-	-
11	3	Lutetium	175	103	ב	Lawrencium	(22)
70	Ϋ́	Ytterbium	173		ŝ		
69	ᆵ	Thulium	169	101	Md	Mendelevium	(226)
89	山	Erbium	167	100	Ē	Fermium	(253)
19	운	Holmium	165	88	Es	Einsteinium	(254)
98	δ	Dysprasium	163	88	ర	Californium	(221)
59	<u>م</u>	Terbium	159	26	쯆	Berkelium	(245)
35	В	Gadolinium	157	96	S	Curium	(247)
23	E	Europium	152	88	Am	Americium	(243)
29	Sm	Samarium	150	35	Pu	Plutonium	(242)
19	Pm	Promethium	(147)	26	aN	Neptunium	(237)
98	Š	Neodymium	144	26	>	Uranium	822
\$	Ā	Praseo-	dymium 141	91	Pa	Protactinium	(1231)
88	පී	Cerium	140	96	£	Thorium	232

►► Actinide elements

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	Chemistry (Nuffield)			
	Advanced Level/Advanced Subsidiary			
	Unit Test 1		Question Number	Lea Bla
	Wednesday 29 May 2002 - Morning		Section A	
	Time: 1 hour 15 minutes		5	
	Materials required for examination		6	
	Nil Nil		7	
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Instruction	ns to Candidates			
In the boxe initials, the Answer AI Calculators	es above, write your centre number, candidate number, your surname and paper reference and your signature. The paper reference is shown above. LL questions in the spaces provided in this question paper. It may be used. The paper reference is shown above. The paper reference is sho	_		
Informatia	on for Candidates			
A Periodic The marks brackets: e.	Table is printed on the back cover of this paper. for individual questions and the parts of questions are shown in round	_		
	Candidates			
You will be descriptions	vised to show all the steps in any calculations. e assessed on your ability to organise and present information, ideas, s and arguments clearly and logically, taking account of your use of grammar and spelling.	-	Total	

Turn over



Answer ALL the questions in the spaces provided.

Leave blank

SECTION A

1.	(a)	Write a balanced equation, including state symbols, for the reaction between steam and heated magnesium.
	(b)	Has the magnesium been oxidised or reduced? Explain your answer.
		(1)
2.	(a)	Methanol reacts with acidified potassium dichromate(VI) to form two possible products.
		(i) Give the displayed formula of the organic product formed under mild conditions.
		(ii) Give the structural formula of the acidic organic product formed under more vigorous conditions.
	(b)	State the name of the organic product of the reaction between methanol and sodium.
		(1)

3.	Sketch a graph to show the first five ionisation energies of aluminium using the axes below.	Leave blank
	Ionisation energy /kJ mol ⁻¹	
	1 2 3 4 5 Number of electrons removed (2)	
4.	Explain why iron can be formed by reacting iron(III) oxide with aluminium, but cannot be formed by reacting iron(III) oxide with copper.	
	(2)	SA
	TOTAL FOR SECTION A: 10 MARKS	

SECTION B

Leave blank

5.		s question is about a titration between hydrochloric acid and sodium carbonate ation, which is alkaline.	016
	(a)	Write the formula of sodium carbonate.	
	(b)	The first step is to make up a solution of sodium carbonate. Calculate the number of moles of solid sodium carbonate needed to make 250 cm ³ of a solution of concentration 0.0500 mol dm ⁻³ .	
	(c)	Calculate the mass of sodium carbonate needed to make up the solution in (b). [Molar mass of sodium carbonate 106 g mol ⁻¹ .]	
	(d)	Give the name of the type of flask you would use to make up exactly 250 cm ³ of the solution.	
	(e)	(i) Name an indicator for the titration.	
		(ii) What colour is this indicator	
		in sodium carbonate solution;	
		in hydrochloric acid solution?(2)	Q5
		(Total 7 marks)	

4

6. This question is about the element hydrogen and its isotopes.
Hydrogen has three isotopes.

\$\begin{align*}
\begin{align*}
\be

(b) In 1781 Cavendish made hydrogen using the reaction of zinc with dilute hydrochloric acid, a method still used in school laboratories today.

$$Zn(s) + 2HCl(aq) \longrightarrow ZnCl_2(aq) + H_2(g)$$

Similarity

.....

What volume of hydrogen (at room temperature and pressure) can be obtained from 25 cm³ of 1.0 mol dm⁻³ hydrochloric acid? [Molar volume is 24 dm³ mol⁻¹ at room temperature and pressure.]

(3)

Leave blank

QUESTION 6 CONTINUES OVERLEAF

(c)	(i)	The spectra of sunlight and light emitted from a filament lamp are the same. Describe the main difference between the hydrogen emission spectrum and these spectra.	Leo blo	
		(2)		
	(ii)	Explain the difference you have described in (i) in terms of electron energies.		
(d)	Wh	ich is larger, a hydrogen atom or a hydrogen ion? Explain your answer.		
		(2)	Q	6
		(Total 10 marks)		

Bu	ıtan-1	-ol can be dehydrated to form gaseous but-1-ene.	Leo blo
(a)	(i)	Write a balanced equation for this dehydration reaction.	
	(ii)	Draw a fully labelled diagram of the apparatus and chemicals that you would use to dehydrate butan-1-ol and collect the gas produced.	
(b)	State	e TWO organic products of the dehydration of butan-2-ol.	
	•••••		Q7
		(Total 8 marks)	

Two aqueous solutions and two liquids are tested for electrical conductivity (measured 8. in siemens, S) giving the following results: 200 S Sodium chloride solution 17 S Ethanoic acid solution 7 S Pure water 0SHexane Give the formulae for the ions formed by sodium chloride in aqueous (a) (i) solution. **(1)** (ii) Give the electronic structure for the sodium ion using the s,p,d notation. (iii) Draw a 'dot and cross' diagram for the chloride ion showing outer shell electrons only. **(1)** Explain why the solution of ethanoic acid is a much poorer conductor than the (b) (i) sodium chloride solution. **(1)** (ii) Use your answer to (i) to classify the strength of ethanoic acid as an acid. **(1)** (c) Give the formulae for the three species present in pure water.

Leave blank

(3)

(d)	(i)	State the type of bonding present in hexane. Use the conductivity data to justify your answer.	Leave blank
		Type of bonding	
		Justification	
	(ii)	Give the structural formula for hexane.	
		(1)	Q8
		(Total 11 marks)	

9. An experiment is carried out to find the enthalpy change for the reaction of a solution of tartaric acid, C₄H₆O₆, with sodium hydrogenearbonate to form sodium tartrate, C₄H₄O₆Na₂, carbon dioxide and water.

Leave blank

$$C_4H_6O_6(aq) + 2NaHCO_3(s) \longrightarrow C_4H_4O_6Na_2(aq) + 2H_2O(l) + 2CO_2(g)$$

- (a) $25 \, \text{cm}^3$ of $0.10 \, \text{mol dm}^{-3}$ tartaric acid solution is reacted with $0.10 \, \text{mol}$ of sodium hydrogenearbonate (an excess).
 - (i) Calculate the molar mass of sodium hydrogencarbonate.

(1)

(ii) Calculate the mass of 0.1 mol of sodium hydrogencarbonate.

(1)

(iii) What precautions would you take when adding sodium hydrogencarbonate to the tartaric acid solution. Justify your answer.

(2)

(iv) The temperature of the mixture is found to increase by $6.0\,^{\circ}\text{C}$.

Calculate the energy change using the relationship:

energy change = $4.18 \times \text{volume of solution} \times \text{temperature change}$

(2)

(v) Calculate the number of moles of tartaric acid used in the reaction.

(1)

(vi) Use your answers to (iv) and (v) to calculate the standard enthalpy change of the reaction.Remember to include a sign and units in your answer, which should be given to 2 significant figures.

Leave blank

(2)

(b) Calculate the standard enthalpy change of the reaction between tartaric acid, $C_4H_6O_6$, and sodium hydrogencarbonate to form sodium hydrogentartrate, $C_4H_5O_6Na$, carbon dioxide and water. This enthalpy change cannot be determined directly, but it can be found using the following Hess cycle.

$$C_{4}H_{6}O_{6}(aq) + 2NaHCO_{3}(s) \xrightarrow{\Delta H^{\oplus}} C_{4}H_{5}O_{6}Na(aq) + H_{2}O(l) + CO_{2}(g) + NaHCO_{3}(s)$$

$$\Delta H_{1}^{\oplus} = +20 \text{ kJ mol}^{-1}$$

$$C_{4}H_{4}O_{6}Na_{2}(aq) + 2H_{2}O(l) + 2CO_{2}(g)$$

(i) Write an expression for ΔH^{\oplus} in terms of ΔH_1^{\oplus} and ΔH_2^{\oplus} .

(1)

(ii) Calculate ΔH^{\oplus} using your value for ΔH_1^{\oplus} from (a)(vi) and your expression in (i).

(2)

(c) Baking powder is a mixture of sodium hydrogentartrate and sodium hydrogencarbonate.

Suggest how baking powder acts as a raising agent in cooking.

.....

(2)

Q9

(Total 14 marks)

TOTAL FOR SECTION B: 50 MARKS

END

TABLE	
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Atomic Number Symbol Name Molar mass in			
	Key	Atomic Number Symbol	Name Molar mass in g mol ⁻¹

1 H Hydrogen 1

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Period

Helium

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=												₹	Si	_	S	ರ	Ā
Spino	Magnesium											Aluminium 27	Silicon 28	Phosphorus 31	Sulphur 32	Chlorine 35.5	Argon 40
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Potassium		Scandium	Titanium	Vanadium	Chromium	Manganese	<u></u> 5	Cobalt 59	Nickel 59	Copper 63.5	65.4 65.4	92	73	75	£	8	æ
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Rubidium		Yttrium		Niobium	Molybdenum	Technetium (99)	Ruthenium	Mnogrum 103	106	108	112	115	119	122	128	121	<u> </u>
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Caesium 133	Barium 137	Lanthanum 139	Hafnium 178	Tantalum 181	Tungsten 184	Rhenium 186	Usmium 190	192	195	197	102	204	202	58 28	(210)	(210)	(222)
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		23	à	Praseo-	dymium	141		Ī	<u>,</u>	۵	3	Protactinium	(231)
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► Lanthanide elements

►► Actinide elements

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	Chemistry (Nuffie	ld)			
	Advanced Le	vel/Ad	vanced Su	ıbsidiary		
	Unit Test 1				Question Number	
	Friday 17 Janua	ry 2003	– Morning		Section A	
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	Matarials required for average		(4		5	
	Materials required for exa Nil		tems included with Nil	question papers	6	
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Instructions to Can	didates					
Answer ALL question Calculators may be u	rite your centre number, our signature. The paper is in the spaces provided sed.	reference is in this questi	shown above. on paper.			
Information for Ca		0.1				
The marks for individe The total mark for this	inted on the back cover of all questions and the parts is paper is 60.	this paper. of questions	are shown in rour	nd brackets: e.g. (2).		
Advice to Candidat						
You will be assessed	ow all the steps in any cal on your ability to organise and logically, taking acco	and present	information, ide use of grammar,	as, descriptions punctuation and		

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Total

Answer ALL questions in the spaces provided.

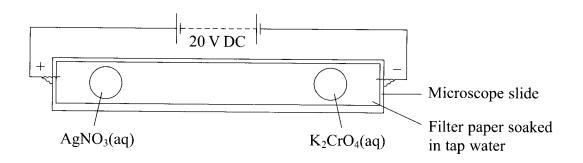
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SECTION A

1.	(a) Balance the equation for	the action of	heat on coppe	r(II) nitrate.		
	$Cu(NO_3)_2.6H_2O(s) \rightarrow$	CuO(s)+	$NO_2(g) +$	$O_2(g) +$	$H_2O(g)$	(2)
	(b) Describe TWO observat	•	<u>-</u>			
	Observation 1					
	Observation 2					
						(2)

2. In an experiment to show the migration of ions, silver(I) nitrate solution, $AgNO_3(aq)$, and potassium chromate(VI) solution, $K_2CrO_4(aq)$, were used. The experiment was set up as shown in the diagram below. After a short while, a red precipitate formed in the centre of the filter paper.

Leave blank



(a)	Write the formulae,	including charges.	of the following ions:	

(i) Nitrate ions	

(b)	Which ions would meet in the centre of the filter paper?		
		(1)	

(c)	Write a balanced ionic equation, including state symbols, for the formation of the	he
	red precipitate.	

(2)

3.	An excess of zinc powder was added to 20.0 cm ³ of a solution of copper(II) sulphate
	of concentration 0.500 mol dm ⁻³ . The temperature increased by 26.3 °C.

Leave blank

(a) How many moles of copper(II) sulphate were used in this experiment?

(1)

(b) Calculate the enthalpy change, ΔH , in kJ mol⁻¹ for this reaction given that:

energy change = specific
$$\times$$
 mass of \times temperature heat capacity solution change /J $_{\rm J}$ $_{\rm J}$

Assume that the mass of solution is 20.0 g and the specific heat capacity of the solution is $4.18\,\mathrm{J\,g^{-1}\,K^{-1}}$.

(2)

TOTAL FOR SECTION A: 12 MARKS

SA

NOW TURN OVER FOR SECTION B

SECTION B

Leave blank

4. Two important nitrogen compounds are ammonium nitrate and nitrogen(I) oxide.

These substances can be prepared as shown by the following reactions.

Reaction A $NH_3(aq) + HNO_3(aq) \longrightarrow NH_4NO_3(aq)$ Reaction B $NH_4NO_3(s) \xrightarrow{heat} N_2O(g) + 2H_2O(g)$

(a) Name the types of reaction illustrated by equations A and B.

(b) Reaction A was carried out by titration.

 $10.0\,\mathrm{cm^3}$ of $1.00\,\mathrm{mol\,dm^{-3}}$ ammonia solution was reacted with nitric acid of concentration $0.500\,\mathrm{mol\,dm^{-3}}$.

(i) What piece of apparatus would you use to measure out the 10.0 cm³ of ammonia solution?

(1)

(ii) What piece of apparatus would you use to add the nitric acid?

(1)

(iii) Suggest a suitable indicator you could use to find the endpoint of this titration and give the colour change you would expect.

Indicator

Colour change

from to

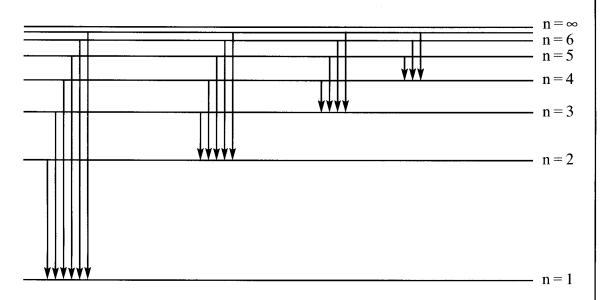
(iv) What volume of nitric acid would be required to react exactly with the 10.0 cm³ of the ammonia solution?

(1)

	(v)	This experiment was repeated without the indicator. Describe how you would obtain dry crystals of ammonium nitrate from the resulting solution.		ave ank
(a)	In n	(3)		
(0)	III I	eaction B, 4.0 g of solid ammonium nitrate reacted.		
	(i)	What is the mass of 1 mole of ammonium nitrate, NH ₄ NO ₃ ?		
		Use the Periodic Table as a source of data.		
		(1)		
	(ii)	How many moles of nitrogen(I) oxide, N_2O , were formed when $4.0g$ of ammonium nitrate reacted?		
			i	
		(1)		
	(iii)	What volume (at room temperature and pressure) will this amount of		
		nitrogen(I) oxide occupy? [Molar volume is 24 dm³ mol ⁻¹ at room temperature and pressure.]		
		[1.201at votame to 2 t and more at room temperature and pressure.]		
			!	
)4
		(1)	<u> </u>	<u> </u>
		(Total 13 marks)		

5. The diagram shows some of the transitions made by electrons, which result in the line emission spectrum for the hydrogen atom.

Leave blank



(a)	Explain why the emission spectrum	of hydrogen	consists	of	discrete	lines	rather
	than a continuous spectrum.						

(b) Which transition, shown in the diagram, corresponds to the smallest energy change?

From n = to n = (1)

- (c) (i) Draw an arrow on the diagram to represent the ionisation of a hydrogen atom from its ground state.

 (2)
 - (ii) Write an equation to represent this ionisation, including state symbols.

(2)

Q5

(1)

(Total 6 marks)

6. A sample of titanium (atomic number 22) is made up of five isotopes. The sample has the following percentage composition:

Leave blank

Mass number	% composition
46	8.0
47	7.3
48	74.0
49	5.5
50	5.2

(a) (i) What is the average relative atomic mass of titanium? Give your answer to **three** significant figures.

(2)

	(ii)	What instrument would have been used to find this percentage composition	i?
		(1)
(b)	(i)	Give the electronic configuration of a titanium atom, using s p d notation.	
		(2	 2)
	(ii)	Name the part of the Periodic Table where titanium appears.	
		(1	 1)

N13609A 10

(c)	Titanium occurs naturally as rutile, TiO ₂ . One possible method of obtaining pure titanium is to heat rutile with carbon.	Leave blank
	$TiO_2(s) + 2C(s) \rightarrow Ti(s) + 2CO(g)$	i.
	(i) What type of reaction is this?	
	(1)	
	(ii) Calculate ΔH for this reaction given that	
	$\Delta H_{\rm f}^{\Theta}[\text{TiO}_2(s)] = -940 \text{ kJ mol}^{-1}$	
	$\Delta H_{\rm f}^{\Theta}[{\rm CO}(g)] = -110 \mathrm{kJ}\mathrm{mol}^{-1}$:
	Include a sign and units in your answer.	
	(3)	
	(iii) Name the law you have used in your calculation.	
	(1)	
	(iv) When titanium is manufactured by this method, explain what pollution problem arises.	
	(2)	Q6
	(Total 13 marks)	
	(10tai 15 mai ks)	

Leave blank

7.

(c)	(i)	Draw a fully labelled diagram of the laboratory apparatus to show how t alcohol Y could be fully oxidised.	he
			(3)
	(ii)	How would you separate the organic product of this reaction from t resulting mixture?	he
			 (1)
(d)	(i)	The secondary alcohol, X , can be dehydrated. Draw the structural formul and give the names of TWO possible alkenes which could be formed.	ae

(3)

Leave blank

N13609A 14

Leav blani	(11) If either of the alkenes is shaken with acidified potassium manganate(VII), what colour change would you see?
	From to
	(iii) What other reagent could you use to show that the products of the dehydration of X are alkenes?
07	of A are alkelies:
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(1)
	(Total 16 marks)

TOTAL FOR SECTION B: 48 MARKS

TOTAL FOR PAPER: 60 MARKS

END

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THE PERIODIC TABLE	Group	Key
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Atomic Number Symbol Name

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	Lithium	Beryllium											Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon
		2										-	= E	2 2	ž	£ 4	2 12	3 2
•	= ;	2 :											2 ;	: ;	۰ (2 (= 7	٠.
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	Potassium 39	Calcium 40	Scandium 45	Titanium 48	Vanadium 51	Chromium 52	Manganese 55	Iron 56	Cobalt 59	Nickel 59	Copper 63.5	Zinc 65.4	Gallium 70	Germanium 73	Arsenic 75	Selenium 79	Bromine 80	Krypton 84
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	Rubidium 85	Strontium 88	Yttrium 89	Zirconium 91	Niobium 93	Molybdenum 96	Technetium (99)	Ruthenium 101	Rhodium 103	Pałladium 106	Silver 108	Cadmium 112	Indium 115	T. T.	Antimony 122	Tellurium 128	fodine 127	Xenon 131
	55		57		73		75	76	u	78	79	88	18	82	83	25	982	98
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	Caesium 133	Barium 137	Lanthanum 139		Tantalum 181		Rhenium 186	Osmium 190	Iridium 192	Platinum 195	Gold 197	Mercury 201	Thallium 204	Lead 207	Bismuth 209	Potonium (210)	Astatine (210)	Radon (222)
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	Francium	Radium	Actinium	-iero	Curri	Const												
	(ZZ3)	(526)	(22)	quadrum (261)	pentium (262)	hexium (263)												

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	R	P	Sm	ũ	Вg	2	Ճ	운	ш	Ē	Υp	3
ģ	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium
dymium 141	14	(147)	150	152	157	159	163	165	167	169	173	175
_	92	ಜ	35	88	9 8	97	88	86	100	101	102	183
g	>	å	<u>-</u>	Am	Ę	쓢	ర	ß	F	PW	ŝ	ב
Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium
=		(727)	(747)	(543)	(/47)	(C#7)	2	(tc7)	8	007	ŧ.	(107)

► Lanthanide elements

►► Actinide elements

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	Unit Tes	st 1				Question Number	Leave Blank
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	to Candidates						
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Calculators may	uestions in the spaces pr y be used. o calculations should be			ificant figures.			

Information for Candidates

A Periodic Table is printed on the back cover of this paper.

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2). The total mark for this paper is 60.

Advice to Candidates

You are advised to show all the steps in any calculations.

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

 $\stackrel{\text{Printer's Log. No.}}{N13612A}$



Turn over

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SECTION A

Use the Periodic Table as a source of data.

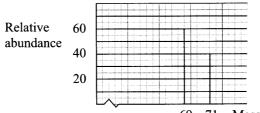
1. (a) An atom of gallium has mass number 69.

Complete the table to show the number of sub-atomic particles in this gallium atom.

Electrons	Neutrons	Protons

(2)

(b) The mass spectrum of a sample of gallium is shown below.



69 71 Mass/charge ratio

What is the average relative atomic mass of gallium in this sample? Give your answer to **three** significant figures.

(2)

(c) What type of bonding would you expect to find in gallium?

(1)

(a)	(i)	Calculate the number of moles of sulphur atoms in 4.00 g of sulphur.	Leave blank
		(1)	
	(ii)	When sulphur burns in air, it forms sulphur dioxide gas, SO ₂ .	
		What volume of sulphur dioxide, measured at room temperature and pressure, would be produced when 4.00 g of sulphur is burnt in air? [Molar volume is 24 dm³ mol⁻¹ at room temperature and pressure.]	
		(2)	
(b)	Sul _j	phur dioxide reacts with sodium hydroxide solution to form a solution of ium sulphite, Na ₂ SO ₃ .	
	The	e equation for the reaction is	
		$SO_2(g) + 2NaOH(aq) \rightarrow Na_2SO_3(aq) + H_2O(l)$	
	Rev	write this equation as an ionic equation, omitting the spectator ions.	
	•	(2)	
(c)	Sug	lium sulphite can be used as a preservative for foods such as sausage meat. gest ONE property which a food preservative should have, other than venting the growth of bacteria.	
	•••••	(1)	SA
		TOTAL FOR SECTION A: 11 MARKS	
12A		3 Turn over	

SECTION B

3.	(a)	(i)	A flame test was carried out on a sample of potassium chloride. What flame colour would be seen?	Leave blank
			(1)	
		(ii)	When light from the flame was viewed through a spectroscope, a line emission spectrum was seen. Explain how lines in the emission spectrum arise.	
			······································	
			(2)	t
	(b)	(i)	Complete the electron configuration of a potassium ion, K^+ , using s p d notation.	
			$1s^2 2s^2$ (1)	
		(ii)	Potassium ions and chloride ions contain the same number of electrons.	
			Which of the two ions has the bigger radius? Explain your answer.	
			(1)	
	(c)	(i)	Write an equation to represent the first ionisation of a potassium atom. Include state symbols in the equation.	
			(2)	
		(ii)	Explain why the first ionisation energy of potassium is smaller than the first ionisation energy of sodium.	
			(2)	Q3
			(2)	

4.	(a)	Cyclohexanol and hexan-1-ol are both alcohols containing 6 carbon molecule.	atoms per
		(i) Draw the displayed formula of each alcohol.	
		cyclohexanol hexan-1-ol	(2)
		(ii) Explain why cyclohexanol and hexan-1-ol are not isomers.	
			(1)
		(iii) State whether each of the two alcohols is a primary, secondary alcohol.	or tertiary
		Cyclohexanol	
		Hexan-1-ol	
			(2)
N1361	2A	5	Turn over

Leave blank

Name	(iv)	Hexan-1-ol was heated gently with a mixture of potassium dichromate and sulphuric acid. The product of the reaction was distilled off as it formed.
(v) The reaction in (iv) was repeated using cyclohexanol. The products which were distilled off from each of the two alcohols contain different functional groups. State a test to distinguish between these functional groups and give the result in each case. Test		Give the structural formula of the product and name it.
(v) The reaction in (iv) was repeated using cyclohexanol. The products which were distilled off from each of the two alcohols contain different functional groups. State a test to distinguish between these functional groups and give the result in each case. Test		
(v) The reaction in (iv) was repeated using cyclohexanol. The products which were distilled off from each of the two alcohols contain different functional groups. State a test to distinguish between these functional groups and give the result in each case. Test		
were distilled off from each of the two alcohols contain different functional groups. State a test to distinguish between these functional groups and give the result in each case. Test		
In each case. Test	(v)	were distilled off from each of the two alcohols contain different functional
Result with the product from hexan-1-ol		•
Result with the product from hexan-1-ol		Test
Result with the product from cyclohexanol		
Result with the product from cyclohexanol		Result with the product from hexan-1-ol
		Result with the product from cyclohexanol
(3)		(3)

6

Leave blank

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(b)	Сус	clohexanol can be converted to cyclohexene.	Leave blank
	(i)	What type of reaction is this?	
	(ii)	Draw a fully labelled diagram of the laboratory apparatus, including the chemicals, which you would use to convert cyclohexanol into cyclohexene and collect the liquid cyclohexene which forms.	
			į
		(4)	
	(iii)	Describe how you would obtain a dry sample of cyclohexene from the liquid collected.	
		(2)	Q4
		(Total 17 marks)	

5.	(a)	(i)	Strontium hydroxide, Sr(OH) ₂ , is one of the products formed when strontium reacts with water.			
			Write a balanced equation for the reaction of strontium with water.			
			(2)			
		(ii)	Explain why strontium is described as being oxidised in this reaction.			
			(1)			
	(b)	An experiment was carried out to measure the solubility of strontium hydroxide. Solid strontium hydroxide was added to water until a layer of solid remained on the base of the container. The mixture was then left overnight. 25.0 cm³ portions of strontium hydroxide solution were then measured by pipette and titrated with a 0.100 mol dm⁻³ solution of nitric acid. 16.9 cm³ of the nitric acid was needed to react with the strontium hydroxide in the solution.				
		The equation for the reaction is				
			$Sr(OH)_2(aq) + 2HNO_3(aq) \rightarrow Sr(NO_3)_2(aq) + 2H_2O(1)$			
		(i)	Why was the mixture left overnight before carrying out the titration?			
			(1)			
		(ii)	Calculate the number of moles of nitric acid used in the titration.			
			(1)			
		(iii) Calculate the number of moles of strontium hydroxide in 1 dm³ of the solution.			
			(2)			

8

Leave blank

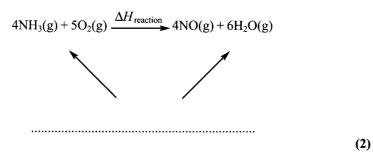
Periodic Table as a source of data.	Leav blank
(2)	
of hydrated strontium nitrate have the formula Sr(NO ₃) ₂ .4H ₂ O.	
ald you make a dry sample of hydrated strontium nitrate crystals from n of pure strontium nitrate?	
(3)	
strontium nitrate crystals decompose when heated. e and balance the equation for the reaction.	
$H_2O(1) + \dots H_2O(1) + \dots NO_2(g) + \dots NO_2(g)$ (2)	
$1\mathrm{dm^{-3}}$ solution of strontium nitrate was mixed with a 0.5 mol dm ⁻³ of potassium sulphate, K_2SO_4 .	
equation for the reaction which occurs. Add state symbols to the using the data below.	
Solubility mol/1000 g water	
KNO ₃ 3.75	
$SrSO_4$ 7.11 × 10 ⁻⁴	
	Q5
(2) (Total 16 marks)	1 1

6.	(a)		e equation below shows the reaction which occurs when ammonia is dissolved water.		
			$NH_3(g) + H_2O(1) \implies NH_4^+(aq) + OH^-(aq)$		
		(i)	Explain why water is classified as an acid in this reaction.		
			(1	 .)	
		(ii)	The ammonia is acting as a weak base in this reaction.		
			What is the difference between a weak base and a strong base?		
				••	
			(1		

Leave blank (b) Ammonia reacts with oxygen to form the gases nitrogen(II) oxide and steam.

Leave blank

(i) Complete the Hess cycle below so that $\Delta H_{\text{reaction}}$ can be calculated using standard enthalpy changes of formation. Include state symbols.



(ii) Calculate $\Delta H_{\text{reaction}}$ for this reaction using the following data.

$$\Delta H_f [NH_3(g)] = -46.1 \text{ kJ mol}^{-1}$$

 $\Delta H_f [NO(g)] = +90.2 \text{ kJ mol}^{-1}$
 $\Delta H_f [H_2O(g)] = -241.8 \text{ kJ mol}^{-1}$

Include a sign and units in your answer and give your answer to three significant figures.

(3)

(Total 7 marks)

TOTAL FOR SECTION B: 49 MARKS

END

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-	- Hydrogen						Atomic Number Symbol	umber										Helium 4	
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	Sodium 23												Aluminium 27	Silicon 28	Phosphorus 31	Sulphur 32	Chlorine 35.5	Argon 40	
	62		17	72	23	ź	52	92	ız	28	53	90	31	32	æ	8	38	88	
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	Potassium 39		Scandium 45	Titanium 48	Vanadium 51	Chromium 52	Manganese 55	<u> </u>	Cobalt 59	Nickel 59	Copper 63.5	Zinc 65.4	Gallium 70	Germanium 73	Arsenic 75	Selenium 79	Bromine 80	Krypton B4	
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	Rubidium 85		Yttrium 89	Zirconium 91	Niobium 93	Molybdenum 96	Technetium (99)	Ruthenium 101	Rhodium 103	Palladium 106	Silver 108	Cadmium 112	Indium 115	TII9	Antimony 122	Tellurium 128	127	Xenon 131	
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	ב	Lutetium	175	52	د	Lawrencium (257)	
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8	٤	Thulium	169	ē	PΜ	Mendelevium (256)	
86	ù	Erbium	167	92	표	Fermium (253)	
19	운	Holmium	165	88	Es	Einsteinium (254)	
8	۵	Dysprosium	163	88	ర	Californium (251)	
8	₽	Terbirm	159	6	ă	Berkelium (245)	
\$	မ	Gadolinium	157	88	5	Curium (247)	
ន	G	Europium	152	88	Am	Americium (243)	
29	Sm	Samarium	150	76	Pu	Plutonium (242)	
19	P	Promethium	(147)	83	Š	Neptunium (237)	
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► Lanthanide elements

►► Actinide elements

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Answer ALL questions in the spaces provided.

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SECTION A

1.	(a)	When sodium	nitrate	is	heated	a	gas	is	given	off,	which	re-lights	a	glowing	splint.
	` '	Sodium nitrite	is form	ed.											

Complete the balanced equation for this reaction, including state symbols.

	(1
What type of reaction is this?	

2. How many nitrogen molecules, N₂, are present in 12 dm³ of nitrogen gas at room temperature and pressure?

[Molar volume is $24~dm^3~mol^{-1}$ at room temperature and pressure; Avogadro constant is $6\times10^{23}~mol^{-1}$]

(2)

(a)	Draw a 'dot-and-cross' diagram for a magnesium ion.	Leave blank
	Show ALL the electrons present and give the charge on this ion.	
	(2)	
(b)	Why do salts containing magnesium ions give no colour in a flame test?	
	(1)	
(a)	When ammonia dissolves in water it behaves as a weak base.	
	Explain what is meant by the term weak base.	
	(1)	
	Suggest a simple test to show that ammonia dissolved in water is a weak base. Give the result of this test.	,
	Test	
	Result	
	(2)	SA
	TOTAL FOR SECTION A: 11 MARKS	
	(b)	(b) Why do salts containing magnesium ions give no colour in a flame test? (1) (a) When ammonia dissolves in water it behaves as a weak base. Explain what is meant by the term weak base. (b) Suggest a simple test to show that ammonia dissolved in water is a weak base. Give the result of this test. Test

Turn over

SECTION B

Leave blank

5.	Cop wit	pper h hc	r(II) sulphate solution can be prepared from solid copper(II) carbonate by rea ot dilute sulphuric acid.	ction
	(a)	Wr	rite the balanced equation for this reaction, including state symbols.	
				(2)
	(b)	Thi	is experiment was carried out using 25 cm ³ of 1.0 mol dm ⁻³ sulphuric acid.	
		(i)	How would you measure out 25 cm ³ of 1.0 mol dm ⁻³ sulphuric acid?	
				(1)
		(ii)	Calculate the number of moles of sulphuric acid used.	
				(1)
	(c)	(i)	It is usual to react the sulphuric acid with a slight excess of copper(II) carbon Calculate the mass of copper(II) carbonate needed if a 10% excess is required. [Molar mass of copper(II) carbonate = 123.5 g mol ⁻¹]	nate.
				(2)
		(ii)	The sulphuric acid is heated to boiling and the copper(II) carbonate is added in suportions.	mall
			Suggest why the copper(II) carbonate is added in small portions.	
				•••••
				(1)
		(iii)) What would be the next step needed to obtain pure copper(II) sulphate solution	. ,
				•••••
				(1)

(d)	3.98 g of copper(II) sulphate-5-water, CuSO ₄ .5H ₂ O, was obtained from this solution.	Leave blank
	(i) Calculate the molar mass of copper(II) sulphate-5-water. Use the Periodic Table as a source of data.	
	(1)	
	(ii) Calculate the percentage yield of the reaction.	
	(2)	
(e)	Suggest why copper compounds are hazardous.	
	(1)	Q5
	(Total 12 marks)	

6.	An	alcohol, X , has the molecular formula $C_4H_{10}O$.	
	(a)	X reacts with sodium, forming bubbles of a colourless gas.	
		Write a balanced equation for the reaction.	
			(2)
	(b)	When X is heated under reflux with a mixture of sodium dichromate(VI) solution concentrated sulphuric acid, a green solution forms.	and
		(i) Give the formula of the ion responsible for the green colour of the solution.	
			 (1)

(ii) Draw a labelled diagram of the apparatus used to reflux the mixture.

(3)

Leave blank

N17048A 6

	(iii) A colourless organic liquid, Y, is distilled from the green solution.	
	This liquid will not neutralise sodium carbonate solution, and it will n Benedict's solution.	ot react with
	Draw the displayed formula of Y and state its name.	
	Displayed formula	
	Name	(2)
	(iv) Deduce the structural formula of X.	
		(1)
(c)	Dehydration of X produces a mixture of products.	
	(i) Name a reagent which could be used to dehydrate X.	
		(1)
	(ii) Draw displayed formulae of TWO of the possible dehydration produc	
		(2)

Leave blank

N17048A 7 Turn over

(d)	An isomer of X	Leave blank
	• does not react with a mixture of sodium dichromate(VI) solution and concentrated sulphuric acid	
	• reacts with sodium	!
	• can be dehydrated.	
	Draw the displayed formula and state the name of this isomer of X.	
	Displayed formula	
	Name	06
	(2)	Q6
	(Total 14 marks)	

N17048A

8

7. The element gallium has two isotopes.

Leave blank

(a) (i) State ONE similarity and ONE difference between these two isotopes in terms of the numbers of their fundamental particles.

Similarity

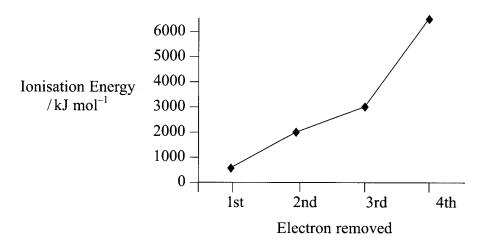
Difference

(ii) The molar mass of a sample of gallium is 69.8 g mol⁻¹.

Calculate the percentage abundance of the isotope $^{69}_{31}$ Ga in the sample.

(2)

(b) The first four ionisation energies of gallium are plotted below.



(i) Write the chemical equation, with state symbols, which corresponds to the first ionisation energy of gallium.

(2)

	(ii)	Why is there a general rise in the ionisation energy as successive electrons a removed?	re Lea blar	
		(1)	
	(iii)	Explain why there is a comparatively large increase in value between the third at fourth ionisation energies.	nd	
		(2)	
(c)	(i)	Suggest the formula of gallium chloride. (You may find it helpful to refer to the Periodic Table.)		
		(1)	
	(ii)	Gallium chloride dissolves in water to form a solution containing ions.		
		Suggest an experiment to show that the solution contains ions. State the result you would expect.	ou	
		Experiment		
-		Result	Q	7
		(Total 12 mark	2)	

N17048A 11 **Turn over**

8. This question is about a self-heating can of coffee.

Leave blank

The bottom of the can has a compartment containing copper(II) nitrate solution. When a button on the bottom of the can is pressed, magnesium powder is released into the compartment where it reacts with the copper(II) nitrate solution.

(a) (i) Write an ionic equation for the reaction between magnesium powder and copper(II) ions. Include state symbols, but omit any spectator ions.

(2)

(ii) Show how the standard enthalpy change for this reaction could be calculated from the standard enthalpies of formation of copper(II) ions and magnesium ions. You should include a Hess cycle in your answer.

(3)

(b) The can contains 150 g of a solution of coffee in water.

The temperature of the solution needs to increase by 60 °C to produce a hot drink.

(i) Calculate the energy change needed to produce a temperature increase of 60 °C in the coffee, using the relationship

Energy change = $4.2 \times \text{mass}$ of solution \times temperature change.

Remember to include a unit in your answer.

(2)

	(ii)	The standard enthalpy change for this reaction is -530 kJ mol ⁻¹ .	Leave blank
		Calculate the number of moles of reactants needed to produce the energy change in (i).	
		(1)	
	(iii)	A solution of copper(II) nitrate of concentration 8.0 mol dm ⁻³ is used.	
		Use your answer to (ii) to calculate the volume, in cm ³ , of copper(II) nitrate solution needed.	
		Your answer should be given to two significant figures.	
		(1)	
(c)		gest TWO reasons why the temperature of the coffee may not increase by as much 50 °C.	
	•••••		
	•••••		
	•••••	(2)	Q8
		(Total 11 marks)	
		TOTAL FOR SECTION R. 40 MARKS	

TOTAL FOR PAPER: 60 MARKS

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6	ш	Fluorine 19	-	ರ	Chlorine 35.5	88	ğ	Bromine	R	_	lodine	æ	₹	Astatine	60.3				
	0	Oxygen 16	92	S	Sulphur 32	ਨ	Se	Selenium 79	25	<u>6</u>	Tellurium 128	2	<u>م</u>	Polonium	(017)				
1	z	Nitrogen 14	15	۵	Phosphorus 31	æ	As	Arsenic 75	5	Sb	Antimony 172	8	æ	Bismuth		,			
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						21	တွ်	Scandium 45	æ	>	Withium 89	LS	.e	Lanthanum 139	88	Acy	Actinium	(22)	
+	Be	Berymum 9	12	Mg	zk 24	8	ပ္ပ	Calcium 40	æ	Š	Stronthum 88	æ	Ba	Barium 137	88	Ra	Radium	(526)	

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-	T I	Lutetium	175		ā	-	Lawrencium	(257)
2	χ	Ytterbium	173		Į.	Š		
8	Ē	Thulium	691		ē	W	Mendelevium	(529)
88	Ē	Erbium	191		901	Ē	Fermium	(223)
£9	H	Holmium	291		86	Es	Einsteinium	(254)
99	۵	Dysprosium	豆		88	ర	Californium	(152)
99	ą <u>.</u>	Terbium	159		97	ă	Berkelium	(245)
35	РS	Gadolinium	157		95	ű	Curium	(247)
ន	Eu	Europium	152		88	Am	Americium	(243)
62	Sm	Samarium	25		35	Pu	Plutonium	(242)
19	Pa	Promethium	(147)		83	aN	Neptunium	(237)
8	PN	Neodymium	<u>‡</u>		26	>	Uranium	238
83	<u>ځ</u>	Praseo- dymium	141		6	Pa	Protactinium	(231)
3 8	ဗီ	Cerium	140		8	£	Horium	22

► Lanthanide elements

►► Actinide elements

Period

Centre No.						Paper	Refere	nce			Sı	urname	
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Surname	Initial(s)
Signature	

Examiner's use only

Team Leader's use only

Question

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Paper Reference(s)

6251/01

Edexcel GCE

Chemistry (Nuffield)

Advanced Subsidiary

Unit Test 1

Thursday 10 June 2004 – Morning

Time: 1 hour 15 minutes

Materials	required	for	examination

Items included with question papers

Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and your

Answer ALL questions in the spaces provided in this question paper.

Calculators may be used.

Final answers to calculations should be given to an appropriate number of significant figures.

Information for Candidates

A Periodic Table is printed on the back cover of this paper.

The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2). The total mark for this paper is 60. There are 16 pages in this paper. All blank pages are indicated.

Advice to Candidates

You are advised to show all steps in any calculations.

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.



Turn over

Total



Answer ALL questions in the spaces provided.

SECTION A

1.	Iroı	n(III) oxide and aluminium react together in a reaction known as the Thermit reaction.
		$Fe_2O_3(s) + 2Al(s) \rightarrow Al_2O_3(s) + 2Fe(s)$
	(a)	The reaction is exothermic. Explain what is meant by exothermic .
		(1)
	(b)	During the reaction, is the iron(III) oxide oxidised or reduced? Explain your answer.
		(1)
2.	(a)	An isotope of the element bohrium, $^{267}_{107}$ Bh, was recently discovered. How many neutrons are there in a nucleus of this isotope?
		(1)
	(b)	What instrument is commonly used to determine the atomic mass of isotopes?
		(1)

3.	But	tan-1-ol, a primary alcohol, can be oxidised to form the aldehyde, butanal.	Leave
	(a)	Give the name or formula of an oxidising agent used in this reaction and of the other reagent required.	blank er
		Oxidising Agent	
		Other Reagent	
		(2	
	(b)	A possible by-product of this reaction is butanoic acid, CH ₃ CH ₂ CH ₂ CO ₂ H, which classified as a weak acid.	is
		Explain what is meant by a weak acid.	
		Acid	
		Weak	
		(2	 ()
4.	Wri	ite the electron configuration of a magnesium atom , using the s, p, d notation.	
	••••	(1)
5.	Bala	ance this equation showing how magnesium nitrate decomposes when heated.	
		$Mg(NO_3)_2(s) \rightarrow MgO(s) + NO_2(g) + O_2(g)$ (1	SA SA
		' -	, , ,

SECTION B

Leave blank

- 6. (a) Propan-1-ol can be dehydrated to produce propene gas.
 - (i) Draw the **displayed** formula of propan-1-ol.

(1)

(ii) One method used to dehydrate propan-1-ol uses a solid catalyst.

Draw a fully labelled diagram of the apparatus used to prepare and collect propene gas. Name the solid catalyst.

(4)

()	110	pan-1-ol reacts with sodium to produce an ionic compound and hydrogen gas.	Leave blank
	(i)	Name the ionic compound formed.	
		(1)	
	(ii)	When carrying out this reaction, a student collected 48 cm ³ of hydrogen gas at room temperature and pressure. Calculate the number of moles of hydrogen molecules collected.	
		[Molar volume is 24 000 cm ³ mol ⁻¹ at room temperature and pressure]	
		(1)	
(c)		pan-1-ol can be partially oxidised to produce the aldehyde, propanal. ne alcohols can be oxidised to produce ketones.	
	(i)	Write the structural formula and give the name of the alcohol that can be oxidised to produce the ketone, propanone.	
		Formula	
		Name(2)	
	(ii)	Describe what you would expect to see if propanal and propanone were separately warmed with Benedict's solution.	
		Propanal	
			1
		Propanone	
		(2)	Q6

reco	e foot and mouth virus affects farm animals such as cattle and sheep. One of the emmended disinfectants used to try to prevent foot and mouth disease from spreading is ium carbonate solution.
(a)	The sodium carbonate solution is used to disinfect footwear because it is alkaline and the virus cannot survive if exposed to a pH greater than 9.
	Suggest ONE reason why the disinfectant may not destroy all of the virus present on footwear.
	(1)
(b)	One method that could be used to determine the concentration of a solution of sodium carbonate is to titrate it with hydrochloric acid of known concentration.
	A 25.0 cm ³ sample of sodium carbonate solution was titrated using 1.00 mol dm ⁻³ hydrochloric acid to determine its concentration. 42.0 cm ³ of acid was needed to neutralise the sodium carbonate solution. The indicator used to find the end-point was methyl orange.
	(i) Write a balanced equation for the reaction between a solution of sodium carbonate and hydrochloric acid, including appropriate state symbols.
	(2)
	(ii) What piece of apparatus should you use to add the hydrochloric acid?
	(1)
	(iii) State the colour of the indicator:
	in sodium carbonate solution
	at the end-point of the titration. (2)

Leave blank

6

7.

(c)	(i)	Calculate the number of moles of hydrochloric acid added to the sodium carbonate solution.	Leave blank
	(ii)	Use your answer from (c)(i) and your equation from (b)(i) to work out the number of moles of sodium carbonate in the 25.0 cm ³ sample.	
	(iii)	Use your answer from (c)(ii) to work out the concentration, in mol dm ⁻³ , of the sodium carbonate solution.	
		(1) (Total 9 marks)	Q7

In the manufacture of beer, brewers often add small amounts of salts of Group 2 elements to the water used. These salts influence the chemical reactions during the brewing process. Two such salts are calcium sulphate and magnesium sulphate.
(a) A flame test can be used to confirm that a sample of a salt contains calcium ions.
(i) Describe how you would carry out a flame test.
(3)
(ii) A positive test results in a brick-red flame colour. Describe the changes that occur in calcium ions to produce a colour.
(2)
(iii) Impurities in the salt may lead to other colours being observed in the flame. What metal ion is likely to be present if a yellow flame is seen?
(1)

8

N17044A

Leave blank (b) Magnesium sulphate can be used in its anhydrous form, MgSO₄(s), or in its hydrated form, MgSO₄. 7H₂O(s).

Leave blank

An experiment was carried out to find the enthalpy change when hydrated magnesium sulphate dissolved completely in water.

$$MgSO_4.7H_2O(s) \xrightarrow{excess water} MgSO_4(aq) + 7H_2O(l)$$

12.3 g of hydrated magnesium sulphate was added to 100 g of water in a simple calorimeter and the temperature was found to fall by 1.1 °C.

(i) Calculate the energy change, in joules, that occurred in the experiment, using the relationship

Energy change (J) = $4.18 \times \text{mass}$ of water \times temperature change

(2)

(ii) Calculate the number of moles of hydrated magnesium sulphate used in the experiment. Use the Periodic Table as a source of data.

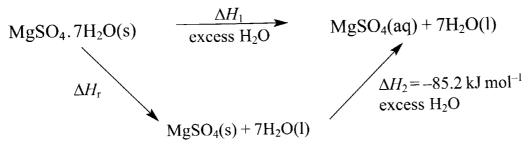
(2)

(iii) Use your answers to (i) and (ii) to calculate the enthalpy change for the reaction. Include a sign and units in your final answer, which should be given to 2 significant figures.

(2)

(c) The enthalpy change as hydrated magnesium sulphate is converted to anhydrous magnesium sulphate is very difficult to measure. The Hess Cycle below can be used to find this enthalpy change, $\Delta H_{\rm r}$.

Leave blank



(i) Use the cycle to write an expression for ΔH_r using ΔH_1 and ΔH_2 .

(1)

(ii) Use your expression in (c)(i) and your answer from (b)(iii) to calculate $\Delta H_{\rm r}$. Include a sign and units in your final answer, which should be given to 2 significant figures.

(2)

(d) Brewers are very careful to add small, controlled amounts of calcium sulphate and magnesium sulphate to the water used in brewing.

Suggest ONE possible effect if too much of either salt is added.

.....

(1)

Q8

(Total 16 marks)

9. Sod	ium is a reactive,	silver-grey	element	from	Group	1	of the Periodic	Table.
---------------	--------------------	-------------	---------	------	-------	---	-----------------	--------

Leave blank

(a)	(i)	What name is given to the type of bonding in this element?	Draw a diagram to
		illustrate this type of bonding.	

Name

(2)

(ii) Sodium reacts readily with other elements such as chlorine.

Draw a 'dot-and-cross' diagram, showing outer electrons only, of the ionic compound sodium chloride. Indicate charges clearly on your diagram.

(2)

(iii) Would you expect the radius of a sodium ion to be larger than, smaller than or the same as the radius of a sodium atom? Give TWO reasons to justify your answer.

.....

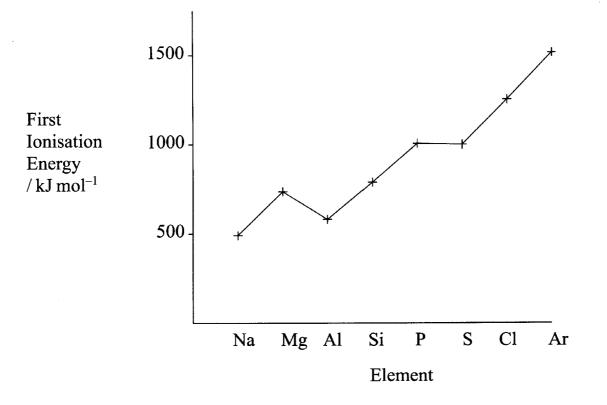
(3)

	Ionisation Ene	ergy / kJ mol ⁻¹	
1st	2nd	3rd	4th
738	1451	7733	10 541

To which Group of the Periodic Table does the element belong? Use the data to give a reason for your answer.

Group	 ••••
Reason	
	 (2)

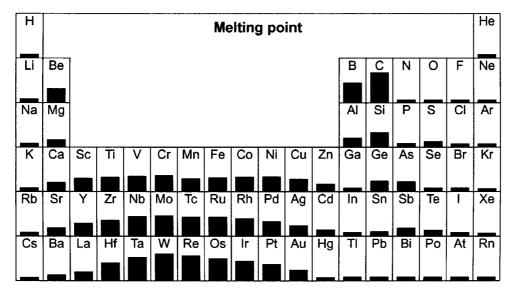
(c) The graph below shows the first ionisation energies of the elements in Period 3. One noticeable feature of this graph is the dip from magnesium to aluminium. Use your knowledge of quantum levels and sub-levels to suggest an explanation for this dip.



(d) The Periodic Table shown here is from a website designed to help students understand the idea of periodicity. The heights of the shaded bars represent the melting points of the elements.

Leave blank

Periodic Table



Source: www.schoolscience.co.uk/ptgraphs.html

	ONE similarity and ONE difference between the two tables.
	Similarity
	Difference
	(2)
(ii)	Name ONE other physical property, not mentioned in this question, that exhibits periodicity.

(i) Another table on this website shows the boiling points of the elements. Suggest

Q9

(Total 14 marks)

(1)

TOTAL FOR SECTION B: 50 MARKS TOTAL FOR PAPER: 60 MARKS

END

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	Sodium 23	Magnesium 24											Aluminium 27	Silicon 28	Phosphorus 31	Sulphur 32	Chlorine 35.5	Argon 40
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	37	8	g.	\$	÷	42	3	4	45	99	47	\$	\$	S	S.	25	83	ক্র
വ	Rubidium	Strontium	Yttrium 88	Zr Zirconium 91	Niobium 83	Molybdenum	TC Technetium (99)	Ruthenium	Rhodium	Pd Palladium	Ag Silver	Cadmium 112	T findium	S ≡ ≡	Sb Antimony	Tellurium	lodine	Xenon 131
	85	95	15	22	T	74		92	п	78	79	8	158	28	28	2	\$8	98
9	ပ္သ	Ba	La	Ŧ	<u>a</u>	*	Re	so	<u></u>	ፚ	Αn	Hg	F	P ₀	: <u>ō</u>	S.	Ą	몺
	Caesium 133	Barium 137	Lanthanum 139	Hatnium 178	Tantalum 181	Tungsten 184	Rhenium 186	Osmium 190	Iridium 192	Platinum 195	5 eł d 197	Mercury 201	Thallium 204	Lead 207	Bismuth 209	Polonium (210)	Astatine (210)	Radon (222)
	87	88	& &	104	105	901												
7	Fred	Ra	Activity	D.	Unp	Crb												
	(223)	(226)	(227)	quadium (261)	pentium (262)	hexium (263)												
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۲ .	Lutetium	175		50	ٹ –	Lawrencium (257)
5 2	Ytterbium	173		102	å	Nobelium (254)
8 <u>2</u>	Thulium	169		101	PΨ	Mendelevium (256)
8 ,	Erbium	167		100	표	Fermium (253)
.8 C	Holmium	165		88	Es	Einsteinium (254)
خ 8	Dysprosium	163		88	ర	Californium (251)
æ †	Terbium	159		97	쓢	Berkelium (245)
\$ 70	Gadolinium	157		9 8	ي ڪ	Curium (247)
8 1	Europium	152	,	88	Am	Americium (243)
29	Samarium	150		\$	P.	Plutonium (242)
19 0	Promethium	(147)		8	Š	Neptunium (237)
8 7	Neodymium	14		32	>	Uranium 238
8 9	Praseo-	141		6	g B	Protactinium (231)
æ 6	Cerium	140		8	£	Thorium 232

► Lanthanide elements

16