Location Entry Codes

As part of CIE's continual commitment to maintaining best practice in assessment, CIE uses different variants of some question papers for our most popular assessments with large and widespread candidature. The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions is unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiners' Reports that are available.

Question Paper

Introduction First variant Question Paper Second variant Question Paper

Mark Scheme

Introduction
First variant Mark Scheme
Second variant Mark Scheme

Principal Examiner's

Report	
Introduction	
First variant Examiner's F	
Second varia Examiner's F	

Who can I contact for further information on these changes?

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The titles for the variant items should correspond with the table above, so that at the top of the first page of the relevant part of the document and on the header, it has the words:

• First variant Question Paper / Mark Scheme / Principal Examiner's Report

or

Second variant Question Paper / Mark Scheme / Principal Examiner's Report

as appropriate.





UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

			1 hour 15 minutes
Paper 3 (Exten	ided)		May/June 2009
CHEMISTRY			0620/31
CENTRE NUMBER		CANDIDATE NUMBER	
CANDIDATE NAME			

READ THESE INSTRUCTIONS FIRST

No Additional Materials are required.

Write your Centre number, candidate number and name on all the work you hand in. Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer all questions.

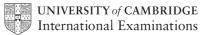
A copy of the Periodic Table is printed on page 16.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part questions.

For Examiner's Use		
1		
2		
3		
4		
5		
6		
7		
8		
9		
Total		

This document consists of **15** printed pages and **1** blank pages.



1	Some grass is crushed and mixed with the solvent, propanone. The colour pigments are extracted to give a deep green solution.		
	(a)	(i)	Draw a labelled diagram to describe how you could show that there is more than one coloured pigment in the green solution.
			[3]
		(ii)	Given a pure sample of chlorophyll, how could you show that the green solution from the grass contained chlorophyll?
			[2]
	(b)	Exp	lain the role of chlorophyll in green plants.
			[3]
			[Total: 8]

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2 The results of experiments on electrolysis using inert electrodes are given in the table.

For Examiner's Use

Complete the table; the first line has been completed as an example.

electrolyte	change at negative electrode	change at positive electrode	change to electrolyte
molten lead(II) bromide	lead formed	bromine formed	used up
	potassium formed	iodine formed	used up
dilute aqueous sodium chloride			
aqueous copper(II) sulfate			
	hydrogen formed	bromine formed	potassium hydroxide formed

[Total: 8]

3 The following is a list of the electron distributions of atoms of unknown elements.

For Examiner's Use

[Total: 10]

element	electron distribution	
Α	2,5	
В	2,8,4	
С	2,8,8,2	
D	2,8,18,8	
E	2,8,18,8,1	
F	2,8,18,18,7	

	F	2,8,18,18,7					
(a) Choo	(a) Choose an element from the list for each of the following descriptions.						
(i) It is	s a noble gas.						
(ii) It is	s a soft metal with a	a low density.					
(iii) It c	an form a covalent	compound with element A.					
(iv) It h	as a giant covalent	structure similar to diamond.					
(v) It c	an form a negative	ion of the type X ³⁻ .	[5]				
(i) [Draw a diagram tha and the arrangement Use o to represent	orm an ionic compound. It shows the formula of this cont of the valency electrons around electron from an atom of Content an electron from an atom of F.					
(ii) l	Predict two propert	ies of this compound.	[3]				
u							
11			[0]				
			[2]				

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4 The reactivity series of metals given below contains both familiar and unfamiliar elements. For most of the unfamiliar elements, which are marked *, their common oxidation states are given.

For Examiner's Use

* barium	Ва
* lanthanum	La (+3)
magnesium	
zinc	
* chromium	Cr (+2), (+3), (+6)
iron	
copper	
* palladium	(+2)

Choose metal(s) from the above list to answer the following questions.

(i)	Which two metals would not react with dilute hydrochloric acid?	
		[2]
(ii)	Which two unfamiliar metals (*) would react with cold water?	
		[2]
(iii)	What is the oxidation state of barium?	
		[1]
(iv)	Name an unfamiliar metal (*) whose oxide cannot be reduced by carbon.	
		[1]
(v)	Why should you be able to predict that metals such as iron and chromium had more than one oxidation state?	ave
		[1]
	[Total	: 7]

5	Insoluble salts are	made by	precipitation.
---	---------------------	---------	----------------

(a) A preparation of the insoluble salt calcium fluoride is described below.

To $15~\rm cm^3$ of aqueous calcium chloride, $30~\rm cm^3$ of aqueous sodium fluoride is added. The concentration of both solutions is $1.00~\rm mol$ / dm^3 . The mixture is filtered and the precipitate washed with distilled water. Finally, the precipitate is heated in an oven.

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"	i Com	niete	TNA	ലവ	Iation
۱.	,	picto		94	aatioi i.

Ca ²⁺	+	F	\longrightarrow	 [2	2]
Ca	٠.			L4	ر ۷

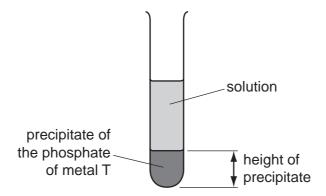
(ii)	Why is the volume of sodium fluoride solution double that of the calcium chlor solution?	ide
		F.43
		[1]
(iii)	Why is the mixture washed with distilled water?	
		[1]
(iv)	Why is the solid heated?	
		[1]

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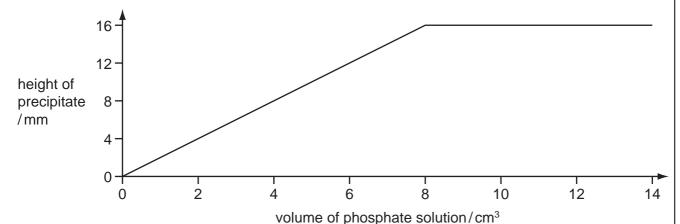
(b) The formulae of insoluble compounds can be found by precipitation reactions.

For Examiner's Use

To $12.0~\text{cm}^3$ of an aqueous solution of the nitrate of metal T was added $2.0~\text{cm}^3$ of aqueous sodium phosphate, Na_3PO_4 . The concentration of both solutions was $1.00~\text{mol/dm}^3$. When the precipitate had settled, its height was measured.



The experiment was repeated using different volumes of the phosphate solution. The results are shown on the following graph.



What is the formula of the phosphate of metal T? Give your reasoning.

[3]

[Total: 8]

8 Ammonia is manufactured by the Haber process. 6 $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ the forward reaction is exothermic (a) (i) Name the raw materials from which nitrogen and hydrogen are obtained. nitrogen from [1] hydrogen from [1] (ii) Name the catalyst used in this process. [1] (iii) What is the most important use of ammonia? [1] (b) The following graph shows how the percentage of ammonia in the equilibrium mixture changes with temperature. % ammonia at equilibrium 0 temperature (i) Explain the term equilibrium.

For Examiner's Use

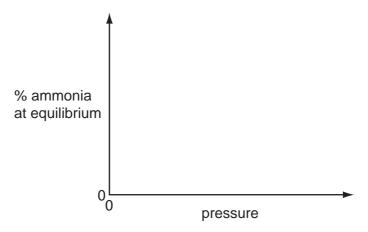
(ii) How does the percentage of ammonia vary with temperature?

[1]

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(c) (i) Sketch a graph which shows how the percentage of ammonia in the equilibrium mixture varies with pressure.

For Examiner's Use



[1]

(ii)	Explain why the graph has the shape shown.	
		••••
		[2

[Total: 10]

7 Hydrogen reacts with the halogens to form hydrogen halides.

For Examiner's Use

(a) Bond energy is the amount of energy, in kJ, that must be supplied (endothermic) to break one mole of a bond.

bond	bond energy in kJ/mol
H—H	+436
C <i>l</i> —C <i>l</i>	+242
H–Cl	+431

U	se	the	abo	ve	data	a to	show	that	the	fol	lowing	read	ction	is	exo	he	rm	ic
---	----	-----	-----	----	------	------	------	------	-----	-----	--------	------	-------	----	-----	----	----	----

H—H + C <i>l</i> —C <i>l</i>	→ 2H—C <i>l</i>	
		[3]

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(b) T	he	y react with wa	iter to fo	orm	acidic	solutio	ons.		
			HC/	+	H ₂ O	\rightleftharpoons	H ₃ O+	+	C/ ⁻
			HF	+	H ₂ O	\rightleftharpoons	H ₃ O+	+	F ⁻
(i)	Explain why w	ater be	have	es as a	base	in both	of tl	hese reactions.
									[2]
(i	i)	•	In the	othe	f the h er equ	ydrog ilibriui	en chloi	ride	exists as molecules, the rest has the hydrogen fluoride exists as
		What does this	s tell yo	u ab	out the	e strei	ngth of e	each	acid?
									[2]
(ii	i)	How would the	pH of	thes	e two	solutio	ons diffe	r?	
									[1]
									[Total: 8]

8 Lactic acid can be made from corn starch.

lactic acid

It polymerises to form the polymer, polylactic acid (PLA) which is biodegradable.

a)	Suggest two advantages that PLA has compared with a polymer made from petroleur	n.
		[2]

(b) The structure of PLA is given below.

(i) What type of compound contains the group that is circled?

		[1]
(ii)	Complete the following sentence.	
	Lactic acid molecules can form this group because they contain both an	
	group and an group.	[2]
iii)	Is the formation of PLA, an addition or condensation polymerisation? Give reason for your choice.	e a

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(C)	When	lactic	acid is	s heated	acrylic	acid is	formed
ν-/			ao.a	o modioa	,	ao.a .o	

For
Examiner's
Use

H H H—C—C—COOH H OH	H COOH
lactic acid	acrylic acid

	adily including
(i)	Complete the word equation for the action of heat on lactic acid.
	lactic acid \rightarrow +
(ii)	Describe a test that would distinguish between lactic acid and acrylic acid.
	test
	result for lactic acid
	result for acrylic acid[3]
(iii)	Describe a test, other than using an indicator, which would show that both chemicals contain an acid group.
	test
	result

[Total: 13]

[2]

9

		ies of chemicals, expressed in moles, can be used to find the formula of a und, to establish an equation and to determine reacting masses.
(a)		compound contains 72% magnesium and 28% nitrogen. What is its empirical mula?
		[2]
(b)		compound contains only aluminium and carbon. 0.03 moles of this compound reacted n excess water to form 0.12 moles of A l (OH) $_3$ and 0.09 moles of CH $_4$.
	Wri	ite a balanced equation for this reaction.
		[2]
(c)	0.0	7 moles of silicon reacts with 25 g of bromine.
		$Si + 2Br_2 \longrightarrow SiBr_4$
	(i)	Which one is the limiting reagent? Explain your choice.
		[3]
	(ii)	How many moles of SiBr₄ are formed?
		[1]
		[Total: 8]

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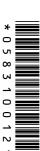
DATA SHEET
The Periodic Table of the Elements

	0	₽ 4 Helium	2	20	Ne	Neon 10	40	Ā	Argon 18	84	궃	Krypton 36	131	Xe	Xenon 54		Ru	Radon 86				175	3	Lutetium 71		۲	Lawrencium 103
	II/			19	ш	Fluorine 9	35.5	CI	Chlorine 17	80	ģ	Bromine 35		Ι	lodine 53		¥	Astatine 85				173				8	Nobelium 102
	IN			16	0	Oxygen 8	32	တ	Sulfur 16	79	Se	Selenium 34	128	Те	Tellurium 52			Polonium 84				169	Ę			Md	Ε
	>			41	z	Nitrogen 7			Phosphorus 15		As			Sb	Antimony 51	209	Ξ	Bismuth 83				167	ш	Erbium 68		Fm	
	<u>>1</u>			12	ပ	Carbon 6		Si	Silicon 14		Ge	Germanium 32	119	Sn	Tin 50	207	Pb	Lead 82				165	운	Holmium 67		Es	n Einsteinium 99
	≡			+	М	Boron 5	27	Ν	Aluminium 13	20	Ga	Gallium 31	115	I	Indium 49	204	11	Thallium 81				162		Ę		ర	_
			•								Zn	Zinc 30	112	ဦ	Cadmium 48	201	Нg	Mercury 80				159	Q L	Terbium 65			_
										64	ე ე	Copper 29	108	Ag		197	Αn	Gold 79				157		Gadolinium 64		Cm	
Group										29	Z	Nickel 28	106	Pd	Palladium 46	195	₹	Platinum 78				152	En	Europium 63		Am	Americium 95
G										59	ပိ	Cobalt 27	103		Rhodium 45	192		Iridium 77				150	Sm	Samarium 62		Pu	Plutonium 94
		1 T Hydrogen	1							26	Fe	Iron 26	101		Ruthenium 44	190	Os	Osmium 76					Pm	Promethium 61		N	Neptunium 93
											Mn	≥ ≥		ဥ	Technetium 43	186	Re	Rhenium 75				144	Š	Neodymium 60	238	>	Uranium 92
										52	ဝံ	Chromium 24	96	Mo	Molybdenum 42	184		Tungsten 74				141	Ŗ	Praseodymium 59		Ра	Protactinium 91
										51	>	Vanadium 23		Q Q	Niobium 41	181	¤	Tantalum 73				140	రి	Cerium 58	232	드	Thorium 90
										48	F	Titanium 22	91	Zr	Zirconium 40	178	Ξ	Hafnium 72							nic mass	lod	nic) number
										45	လွ	Scandium 21	88	>	Yttrium 39	139	Гa	Lanthanum 57 *	227	Ac	1 68	Spring	orion of	20	a = relative atomic mass	X = atomic symbol	b = proton (atomic) number
	=			6	Be	Beryllium 4	24	Mg	Magnesium 12	40	Ça	Calcium 20	88	Š	Strontium 38	137	Ba	Barium 56	226	Radiim	88	*58-71 anthanoid series	90 / 1 Editing Sch		a	×	Б.
	_			7	=	Lithium 3	23	Na	Sodium 11	39	¥	Potassium 19	85		Rubidium 37	133	Cs	Caesium 55	ı	Francia	87	*58-71	100-103	00-00-		Key	Ω

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	CANDIDATE NUMBER
CHEMISTRY	0620/32
Paper 3 (Extended)	May/June 2009
	1 hour 15 minutes
Candidates answer on the Question Paper	
No Additional Materials are required.	

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer all questions.

A copy of the Periodic Table is printed on page 16.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part questions.

For Exam	iner's Use
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of 15 printed pages and 1 blank page.



For Examiner's Use

/: \	
(i)	Draw a labelled diagram to describe how you could show that there is more than one coloured pigment in the green solution.
	[3]
(ii)	Given a pure sample of chlorophyll, how could you show that the green solution from the grass contained chlorophyll?
	[2]
Exp	plain the role of chlorophyll in green plants.
	[3]
	[Total: 8]
	Exp

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2 The results of experiments on electrolysis using inert electrodes are given in the table.

For Examiner's Use

Complete the table; the first line has been completed as an example.

electrolyte	change at negative electrode	change at positive electrode	change to electrolyte
molten lead(II) bromide	lead formed	bromine formed	used up
	lithium formed	chlorine formed	used up
dilute aqueous sodium chloride			
aqueous copper(II) sulfate			
	hydrogen formed	bromine formed	potassium hydroxide formed

[Total: 8]

3 The following is a list of the electron distributions of atoms of unknown elements.

For Examiner's Use

element	electron distribution
Α	2,6
В	2,8,4
С	2,8,8,2
D	2,8,18,8
E	2,8,18,8,1
F	2,8,18,18,7

		F	2,8,18,18,7	
(a) C	hoos	e an element from	n the list for each of the follow	ing descriptions.
(i)	It is a	a noble gas.		
(ii)	It is a	a soft metal with a	low density.	
(iii)	It ca	n form a covalent	compound with element A.	
(iv)	It ha	s a giant covalent	structure similar to diamond.	
(v)	It is a	a diatomic gas wit	h molecules of the type X_2 .	[5]
(b) E	i) Dr	aw a diagram tha	orm an ionic compound. It shows the formula of this control of the valency electrons aro	ompound, the charges on the ions
	Us	se o to represent a	an electron from an atom of C an electron from an atom of A	
(ii	i) Pr	edict two properti	es of this compound.	[3]
				[2]

[Total: 10]

4 The reactivity series of metals given below contains both familiar and unfamiliar elements. For most of the unfamiliar elements, which are marked *, their common oxidation states are given.

For Examiner's Use

* barium	Ва
* lanthanum	La (+3)
magnesium	
zinc	
* chromium	Cr (+2), (+3), (+6)
iron	
copper	
* palladium	(+2)

Choose metal(s) from the above list to answer the following questions.

(i)	Which two metals would not react with dilute hydrochloric acid?	
		[2]
(ii)	Which two unfamiliar metals (*) would react with cold water?	
		[2]
(iii)	What is the oxidation state of barium?	
		[1]
(iv)	Name an unfamiliar metal (*) whose oxide cannot be reduced by carbon.	
		[1]
(v)	Why should you be able to predict that metals such as iron and chromium ha	ave
()	more than one oxidation state?	
		[1]
	[Total	71
	[Total	7]

For Examiner's Use

[1]

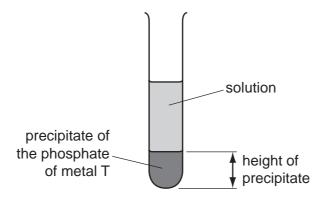
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(iv) Why is the solid heated?

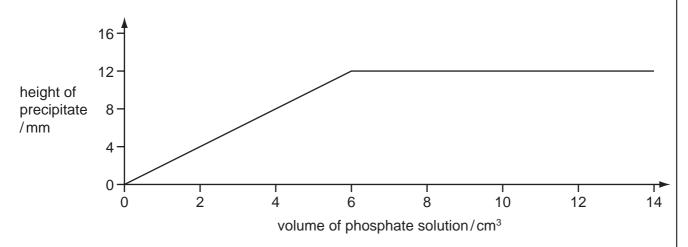
(b) The formulae of insoluble compounds can be found by precipitation reactions.

For Examiner's Use

To $18.0~\text{cm}^3$ of an aqueous solution of the nitrate of metal T was added $2.0~\text{cm}^3$ of aqueous sodium phosphate, Na_3PO_4 . The concentration of both solutions was $1.00~\text{mol/dm}^3$. When the precipitate had settled, its height was measured.



The experiment was repeated using different volumes of the phosphate solution. The results are shown on the following graph.



What is the formula of the phosphate of metal T? Give your reasoning.

[3]

[Total: 8]

6 Ammonia is manufactured by the Haber process. $3H_2(g) \rightleftharpoons 2NH_3(g)$ the forward reaction is exothermic (a) (i) Name the raw materials from which nitrogen and hydrogen are obtained. nitrogen from [1] hydrogen from [1] (ii) Name the catalyst used in this process. [1] (iii) What is the most important use of ammonia? (b) The following graph shows how the percentage of ammonia in the equilibrium mixture changes with pressure. % ammonia at equilibrium 0 pressure (i) Explain the term equilibrium.

.....

For Examiner's Use

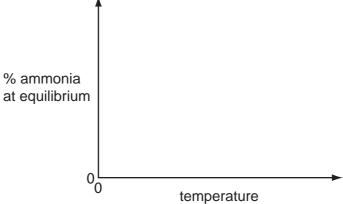
[1]

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(ii) How does the percentage of ammonia vary with pressure?

(c) (i) Sketch a graph which shows how the percentage of ammonia in the equilibrium mixture varies with temperature.

For Examiner's Use



[1]

(ii)	Explain why the graph has the shape shown.	
		[2]

[Total: 10]

7 Hydrogen reacts with the halogens to form hydrogen halides.

For Examiner's Use

(a) Bond energy is the amount of energy, in kJ, that must be supplied (endothermic) to break one mole of a bond.

bond	bond energy in kJ/mol
H—H	+436
F–F	+158
H–F	+562

Use the above data to show that the following reaction is exothermic.

H–H + F–F →	2H—F	
	,	[3]

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(b) Th	ey rea	act with	water	to fo	rm	acidic	solutio	ons.		
			ŀ	HC/	+	H ₂ O	\rightleftharpoons	H_3O^+	+	CI ⁻
				HF	+	H ₂ O	\rightleftharpoons	H_3O^{\dagger}	+	F ⁻
(i)	Exp	lain wh	y wate	er bel	าลง	es as a	base	in both	of t	hese reactions.
										[2
(ii)	forn	•	s. In	the	othe	er equ	ilibriur			exists as molecules, the rest has the hydrogen fluoride exists as
	Wha	at does	this te	ell you	u ab	out the	e strer	ngth of	each	n acid?
										[2
(iii)	Hov	v would	the pl	H of t	thes	e two	solutio	ons diffe	er?	
										[1
										[Total: 8]

8 Lactic acid can be made from corn starch.

сн—соон

lactic acid

It polymerises to form the polymer, polylactic acid (PLA) which is biodegradable.

(a)	Suggest two advantages that PLA has compared with a polymer made from petroleum.
	[2]

(b) The structure of PLA is given below.

(i) What type of compound contains the group that is circled?

		[1]
(ii)	Complete the following sentence.	
	Lactic acid molecules can form this group because they contain both an	
	group and an group.	[2]
iii)	Is the formation of PLA, an addition or condensation polymerisation? Give reason for your choice.	e a
		 [2]

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(C)	When	lactic	acid is	s heated	acrylic	acid is	formed
ν-/			ao.a	o modioa	,	ao.a .o	

For
Examiner's
Use

H H H—C—C—COOH H OH	H C=C COOH
lactic acid	acrylic acid

(i)	Complete the word equation for the action of heat on lactic acid.
	lactic acid \rightarrow + [1]
(ii)	Describe a test that would distinguish between lactic acid and acrylic acid.
	test
	result for lactic acid
	result for acrylic acid [3]
(iii)	Describe a test, other than using an indicator, which would show that both chemicals contain an acid group.
	test
	result

[Total: 13]

[2]

		ind, to establish an equation and to determine reacting masses.
(a)		compound contains 72% magnesium and 28% nitrogen. What is its empirical nula?
		[2]
(b)		ompound contains only aluminium and carbon. 0.03moles of this compound reacted excess water to form 0.12moles of $A\mathit{l}(OH)_3$ and 0.09moles of CH_4 .
	Wri	te a balanced equation for this reaction.
	•••••	[2]
(c)	0.0	8 moles of silicon reacts with 7.2 g of fluorine.
		$Si + 2F_2 \longrightarrow SiF_4$
	(i)	Which one is the limiting reagent? Explain your choice.
		[3]
	(ii)	How many moles of SiF₄ are formed?
		[1]
		[Total: 8]

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DATA SHEET
The Periodic Table of the Elements

Group	0	4 He Helium	20 Neon 10 Neon 40 Aryon	84 Kr Krypton 36	131 Xe Xenon 54	Radon 86		Lutetium 71	Lawrencium
			19 Fluorine 9 35.5 C1 Chlorine	80 Br Bromine 35	127 I lodine 53	At Astatine 85		173 Yb Ytterbium 70	Nobelium
	5		16 Oxygen 8 32 S Sulfur	79 Selenium 34	128 Te Tellurium 52	Po Polonium 84		169 Tm Thulium 69	Md delevium
	>		14 Nitrogen 7 31 Phosphorus 15	75 AS Arsenic 33	Sb Antimony 51	209 Bi Bismuth		167 Er Erbium 68	Fm Fermium
	≥		12 Carbon 6 28 Silicon 14	73 Ge Germanium 32	119 Sn Tin	207 Pb Lead 82		165 Ho Holmium 67	ES Einsteinium
	=		11 B Boron 5 A A Auminium 13	70 Ga Gallium 31	115 In Indium 49	204 T t Thallium 81		162 Dy Dysprosium 66	
				65 Zn 2inc 30	112 Cd Cadmium 48			159 Tb Terbium 65	Bk Berkelium
				64 Copper 29	108 Ag Silver 47	197 Au Gold 79		157 Gd Gadolinium 64	Cm Curium
				59 Nickeil	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu Europium 63	Americium
				59 Co Cobalt 27	103 Rh Rhodium 45	192 Ir Iridium		Sm Samarium 62	Pu Plutonium
		Hydrogen		56 Fe Iron	Ruthenium	190 Os Osmium 76		Pm Promethium 61	
				55 Mn Manganese 25	Tc Technetium 43	186 Re Rhenium 75		144 Nd Neodymium 60	238 C Uranium
				Cr Chromium 24	96 Moybdenum 42	184 W Tungsten 74		Pr Praseodymium 59	Pa Protactinium
				51 Vanadium 23	93 Nb Niobium	181 Ta Tantalum 73		140 Ce Cerium 58	232 Th
				48 T ttanium 22	2 Zroonium	178 Hf Hafnium			nic mass bol nic) number
				Scandium 21	89 ×	139 La Lanthanum 57 *	Ac Actinium †	Series	 a = relative atomic mass X = atomic symbol b = proton (atomic) number
	=		Be Beryllium 4 24 Mg Magnesium 12	40 Calcium 20	Strontium	137 Ba Barium 56	226 Ra Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	« ×
	_		7 Lithium 3 23 Na Sodium 11	39 K Potassium 19	Rb Rubidium	133 Csesium 55	Fr Francium 87	*58-71 L	Key

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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