

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
CHEMISTRY			0620/21
Paper 2		Oct	ober/November 2010
			1 hour 15 minutes
Candidates ans	wer on the Question Paper.		

READ THESE INSTRUCTIONS FIRST

No Additional Materials are required.

Write your Centre number, candidate number and name in the spaces at the top of this page. Write in dark blue or black pen.

You may need to 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 20.

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 question.

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

This document consists of 17 printed pages and 3 blank pages.



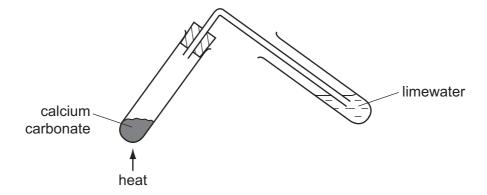
1 The diagram below shows the elements in a period of the Periodic Ta	1	The diagram below	shows the	elements in a	period of	the Periodic	Table
---	---	-------------------	-----------	---------------	-----------	--------------	-------

Li	Be	В	С	N	0	F	Ne
----	----	---	---	---	---	---	----

(a)	To	which period		Table do these eler	·	g? [1]
(b)		•	estions using o	only the elements si e, more than once o	hown in the	
	Wri	te down the s	ymbol for the e	lement which		
	(i)	has six elect	rons in its oute	r shell.		
	(ii)	is a halogen				
	(iii)	is a metal wl	nich reacts rapi	dly with cold water.		
	(iv)	has two form	ns, graphite and	d diamond.		
	(v)	is in Group I	I of the Periodic	Table.		
	(vi)	makes up at	oout 80 % of the	e air.		[6]
(c)	Cor	mplete the fol	lowing sentence	e using words from	the list belo	W.
	а	itoms	electrons	molecules	neutrons	protons
	The)	of the	elements in the Pe	eriodic Table	are arranged in order of
	incr	easing numb	er of			[2]
						[Total: 9]

[1]

2 Calcium carbonate was heated strongly in a test-tube. The gas given off was bubbled through limewater.



(a) What type of chemical reaction occurs when calcium carbonate is heated strongly?Put a ring around the correct answer.

hydration

neutralisation

oxidation

thermal decomposition

(b) (i) State the name of the gas given off when calcium carbonate is heated strongly.

[1]
(ii) State the colour change of the limewater.

[1]
(c) The product remaining in the test-tube is calcium oxide.

(i) Calcium oxide is used in steelmaking.

Describe how and why calcium oxide is used in making steel.

[2]
(ii) Steel is an alloy. What do you understand by the term alloy?

(iii)	Give one other use of calcium oxide.	
	[1]	
(iv)	Complete the symbol equation for the reaction of calcium oxide with hydrochloric acid.	
	CaO +HC $l \rightarrow CaCl_2$ +[2]	
(v)	State the chemical name of the compound ${\rm CaC}l_{_2}$.	
	[1]	

[Total: 10]

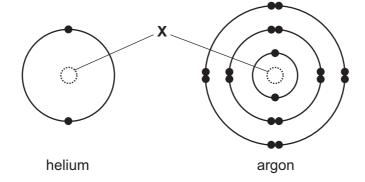
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3	Helium	and	argon	are	noble	gases.
---	--------	-----	-------	-----	-------	--------

((a)	State	one	use	of	helium
٨	~	, clate	0110	acc	\circ .	. ionaii



(b) The atomic structures of helium and argon are shown below.



(i)	State the name	of the centra	part of the	atom,	labelled	X

[1]

(ii) Which statement about helium and argon is correct?

Tick one box.

Argon has an incomplete inner shell of electrons.	
An atom of argon has 16 electrons.	

Helium has a complete outer shell of electrons.	

Helium has an incomplete outer shell of electrons.	
--	--

[1]

(iii) How many protons are there in an atom of argon?

.....[1]

(iv) The symbol for a particular isotope of helium is written as ${}^4_2\text{He}.$

Write a similar symbol for the isotope of argon which has 16 neutrons.

[1]

(c)	Argon is a liquid at a temperature of –188 °C.
	Complete the diagram below to show how the atoms of argon are arranged at -188 °C.

represents one atom of argon.

[2]

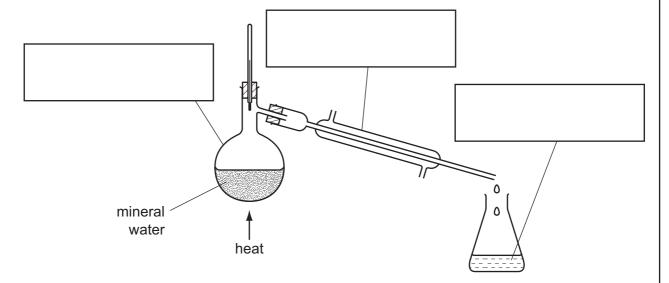
[Total: 7]

4 The table shows the mass of some ions present in a 500 cm³ bottle of mineral water.

name of ion	symbol	mass of ion / mg
calcium	Ca ²⁺	40.5
	C1-	8.1
magnesium	Mg ²⁺	11.6
nitrate	NO ₃ -	2.4
potassium	K⁺	0.9
	SO ₄ ²⁻	6.4

				30 ₄	U. T	
(a)	Stat	te the name of	the following io	ns.		
	Cl-					
	SO	2- 1				[2]
(b)	Cal	culate the mas	s of magnesium	n ions in 100 c	m³ of this mine	eral water.
						[1]
(c)	(i)	Describe a te	st for nitrate ion	S.		
						[2]
	(ii)	The gas prod State the nan	uced in this test ne of this gas.	turns damp re	ed litmus pape	er blue.
						[1]

(d) The apparatus shown is used to get pure water from impure mineral water.



(i)	Complete the diagram by putting the correct labels in the three boxes.	[3]
(ii)	Describe how this apparatus separates pure water from dissolved ionic solids.	
		[2
iii)	Water purity is important in everyday life. Describe one other area of everyday life where purity of substances is important.	ıt.

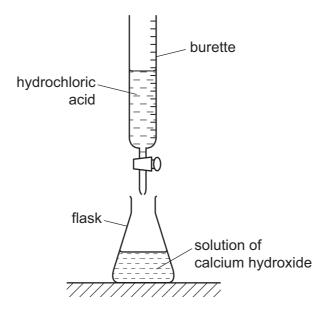
[Total: 12]

5

A so	olutio	on of calcium h	ydroxide in water is	alkaline.		
(a)		•	oH values below is the correct answer.	alkaline?		
		pH 3	pH 6	pH 7	pH 11	[1]
(b)		ich of the follov cone box.	ving is the common	name for calc	ium hydroxide?	
			cement			
			limestone			
			quicklime			
			slaked lime			
			Siaked IIITie			[1]
(c)	Son	ne farmers use	calcium hydroxide	to control soil	acidity.	
	(i)	Why is it impo	rtant to control soil	acidity?		
	.,			-		[1]
	(ii)	Acid rain can	cause soil to becom acid rain is formed.	ne acidic.		[1]
						[3]
(d)	Cal	cium hydroxide	reacts with hydroc	hloric acid.		
		calcium hydro	oxide + hydrochlori	ic acid $ ightarrow$ cal	cium chloride + water	
	(i)	State the nam	e of this type of che	emical reaction	١.	
						[.]

(ii) A dilute solution of calcium hydroxide can be titrated with hydrochloric acid using the apparatus shown.

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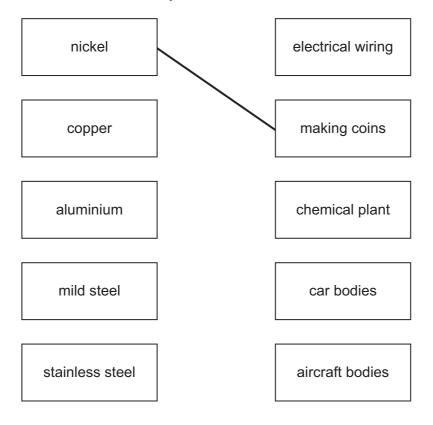
Describe now you would carry out this titration.
[3

[Total: 10]

6	Iron is extracted from its ore by reduction with carbon. Aluminium is extracted from its ore by electrolysis.				
(a) (i) State the name of an ore of aluminium.					
			[1]		
	(ii)	•	estand by the term reduction?		
	(iii)	Suggest why alumi	nium is not extracted from its ore by reduction with carbon.		
			tion about the reduction of four different metal oxides by heating		
		metal oxide	reduction conditions		
		lead(II) oxide	reduced very easily using a Bunsen burner		
	r	magnesium oxide	reduced with difficulty in a furnace above 2000 °C reduced very easily in a furnace above 680 °C		
		nickel(II) oxide			
		zinc oxide	reduced fairly easily in a furnace above 1200 °C		
	least ı	reactive	he table to suggest the order of reactivity of these metals. most reactive [2]		
	(c) Zinc powder reacts with hydrochloric acid. The speed of reaction can be followed by measuring the volume of hydrogen gas produced per minute.				
	What happens to the volume of gas produced per minute when (i) large lumps of zinc are used instead of zinc powder?				
	(ii)		ied out at a higher temperature?		

(d) Match the metals on the left with their uses on the right. The first one has been done for you.

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[4]

[Total: 11]

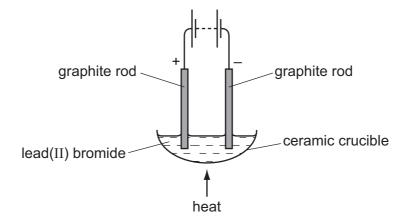
7	Eth	ene,	C ₂ H ₄ , is manufactured by cracking petroleum fractions.
	(a)	(i)	What do you understand by the term petroleum fraction?
		(ii)	Complete the equation for the manufacture of ethene from dodecane, $C_{12}H_{26}$.
			$C_{12}H_{26} \rightarrow C_2H_4 + \dots$ [1]
	(b)		fractions obtained from the distillation of petroleum are refinery gas and gasoline. e one use of each of these fractions.
		refir	nery gas
		gas	oline [2]
	(c)		ene is an unsaturated hydrocarbon. at do you understand by the following terms?
		uns	aturated
		hyd	rocarbon[2]
	(d)	Ethe	ene is used to make ethanol.
		(i)	Which of these reactions is used to make ethanol from ethene? Tick one box.
			catalytic addition of steam
			fermentation
			oxidation using oxygen
			reduction using hydrogen
			[1]

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(i	ii)	Draw th	ne structu	re of ethar	nol showing a	all atoms and	bonds.		
									[2]
(a) F	⊏tha	ana ie u	sed to ma	ake poly(et	hene)				
(Con	nplete th	ne followii	ng sentend	ces about this	s reaction.			
l	Use	words	from the I	ist below.					
ad	diti	ons	carbohy	/drates	catalysts	monon	ners	polymers	
-	The	ethene	molecule	s which jo	in to form po	ly(ethene) are	e the		
	The	poly(et	hene) mo	lecules for	med are				[2]
								[Tot	tal: 11]

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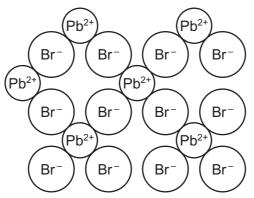
8 Lead(II) bromide can be electrolysed using the apparatus shown below.



(a) Choose **one** word from the list below which describes the graphite rods. Put a ring around the correct answer.

	cations	electrodes	electrons	insulato	ors i	metals	[1]
(b)	State the na	ime of the products	s formed during t	his electroly	sis at		
	the negative	graphite rod					
	the positive	graphite rod					[2]
(c)	Which of the Tick two box	e following conduct xes.	electricity?				
		cerar	mic crucible				
		graph	nite rod				
		molte	en lead(II) bromi	de			
		solid	lead(II) bromide				[2]

(d) The structure of lead(II) bromide is shown below.



	Writ	te the simplest formula for lead(II) bromide.
		[1]
(e)		$d({ m II})$ bromide is formed as a precipitate when aqueous solutions of lead(${ m II}$) nitrate potassium bromide are mixed.
	(i)	What do you understand by the term <i>precipitate</i> ?
		[1]
	(ii)	The formula of lead(II) nitrate is $Pb(NO_3)_2$. State the number of different types of atom present in this formula.
		[1]
	(iii)	State the total number of oxygen atoms present in this formula.
		[1]
	(iv)	Lead compounds are pollutants in the air. State one harmful effect of lead compounds on health.
		[1]
		[Total: 10]

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DATA SHEET
The Periodic Table of the Elements

Group	0	4 He Helium	20 Ne Argon	18	8 X	Krypton 36	131	Xenon 54	R	Radon 86		175 Lu Lutetium		Lawrendur 103
	II/		19 Fluorine 9 35.5 C.1	17	8 g	m		lodine 53	Ą	Astatine 85		173 Yb Ytterbium 70		Nobelium 102
	I		16 Oxygen 8 32 Suffur Suffur	16	6 V	Selenium 34	128 7	Tellurium 52		Polonium 84		169 Tm Thulium 69		Mendelevium 101
	>			15	75 Ac	Arsenic 33		>		Bismuth 83		167 Er Erbium 68	L	Fermium 100
	2		Carbon 6 Carbon 8 Silicon		73	Ε	119		207 Pb			165 Ho Holmium		Es Einsteinium 99
	=			13	۶ ر	Gallium 31	115	Indium 49	204	Thallium 81		162 Dy Dysprosium 66		Californium 98
					65	Zinc 30		Cadmium 48		Mercury 80		159 Tb Terbium 65	ā	BK Berkelium 97
					⁶⁴	Copper 29	108			Gold 79		157 Gd Gadolinium 64		Curium 96
					69 Ξ	Nickel 28	106	Palladium 46	195	Platinum 78		152 Eu Europium 63		Americium 95
					₅₀	Cobalt 27	103 7	45	192 I r	Iridium 77		150 Sm Samarium 62		Pu Plutonium 94
		Hydrogen			₽ 26	lron 26	101	Ruthenium 44	190 S	Osmium 76		Pm Promethium 61	1	Neptunium 93
					55 N	Manganese	Ę	echnetium	186 A	Rhenium 75		Neodymium 60	238	Uranium
					52 ك	Chromium 24	96	Molybdenum 43	184			Pr Praseodymium 59		Protactinium
					51	E.	93		181 F	Tantalum 73		140 Ce Cerium	232	Thorium 90
					48	Ę	91	Zirconium 40	178 ‡	72			nic mass	bol nic) number
					45	Scandium 21	8 >	Yttrium 39	139 La	Lanthanum 57 *	Actinium teges	series eries	a = relative atomic mass	X = atomic symbol b = proton (atomic) number
	=		Beryllium 4 24 Mg Magnesium	12	9 6	Calcium 20	88 0	Strontium 38	137 Ba	Barium 56	226 Ra Radium	*58-71 Lanthanoid series 190-103 Actinoid series		× = =
	_		Lithium 3 23 Na Sodium	11	® ¥	Potassium 19	85	Rubidium 37	133 C.S.	Caesium 55	Francium 87	*58-71 L	<u> </u>	ه ک

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

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