



## **Cambridge International Examinations**

Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
CHEMISTRY			0620/33
Paper 3 (Extend	led)		May/June 2015
			1 hour 15 minutes
Candidates answ	wer on the Question Paper.		

## **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 an HB pencil for any diagrams or graphs.

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

DO **NOT** WRITE IN ANY BARCODES.

Answer all questions.

Electronic calculators may be used.

A copy of the Periodic Table is printed on page 12.

You may lose marks if you do not show your working or if you do not use appropriate units.

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.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.



1

Use you	ur copy of the Periodic Table to help you answer these questions.	
(a) Pre	edict the formula of each of the following compounds.	
(i)	aluminium fluoride	[1]
(ii)	arsenic oxide	[1]
(iii)	silicon bromide	[1]
. ,	duce the formula of each of the following ions.	- 4 -
(i)	phosphide	[1]
(ii)	barium	[1]
(iii)	francium	[1]
co\ Us	aw a diagram showing the arrangement of the valency electrons in one molecule of twalent compound carbon dioxide.  e x to represent an electron from a carbon atom. e o to represent an electron from an oxygen atom.	:he

[3]

[Total: 9]

**2** This question is concerned with the following oxides.

aluminium oxide
carbon monoxide
copper(II) oxide
silicon(IV) oxide
sodium oxide
sulfur dioxide
zinc oxide

Choose **one** oxide from the above list to match each of the following descriptions. An oxide may be used once, more than once or not at all.

(a)	This oxide does not react with acid or alkali.	[1]
(b)	This oxide reacts with water to give a strong alkali solution.	[1]
(c)	This oxide is used as a bleach.	[1]
(d)	This oxide is amphoteric.	[1]
(e)	This oxide has a giant covalent structure.	[1]
(f)	This oxide is soluble in water and it is acidic.	[1]
	[Total	: 6

3	Quicklime.	which is	calcium oxide	. is	made by	v heating	limestone	in a	a furna

$$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$$

(a)	Sug	ggest why the conversion to calcium oxide is complete.
		[1
(b)	Cal	cium hydroxide, slaked lime, is made from calcium oxide.
	Wri	te an equation for this reaction.
	••••	[2
(c)		culate the maximum mass of calcium oxide which could be made from 12.5 tonnes or cium carbonate. 1 tonne = $1 \times 10^6$ g.
		[2
(d)		estone is used in agriculture to reduce the acidity of soil and for the desulfurisation of flue
	(i)	Most crops thrive in soils whose pH is close to 7. Calcium carbonate, which is insoluble in water, and calcium oxide, which is slightly soluble in water, are both used to reduce the acidity of soils.
		Suggest <b>two</b> advantages of using calcium carbonate for this purpose.
		1
		2 [2
	(ii)	Explain the chemistry of desulfurisation of flue gases.
		[3
	(iii)	Give <b>one</b> other use of calcium carbonate.
		[1

4	(a)	(i)	Coal is a solid fossil fuel.
			Name another fossil fuel.
			[1]
		(ii)	Explain what is meant by the term fossil fuel.
			[2]
	(b)		e burning of fossil fuels is largely responsible for the formation of acid rain. Two of the acids acid rain are sulfuric acid and nitric acid.
		(i)	Explain how the combustion of coal can form sulfuric acid.
			[3]
		(ii)	High temperatures generated by the combustion of fossil fuels can lead to the formation of nitric acid. Explain.
			[3]
		(iii)	Nitric acid contains nitrate ions.
			Describe a test for nitrate ions.
			[2]
		(iv)	Explain how you could determine which one of two samples of acid rain had the higher concentration of hydrogen ions.
			[2]
			<del></del>

5 The law of constant composition states that all pure samples of a compound contain the same elements in the same proportion by weight.

A typical experiment to test this law is to prepare the same compound by different methods and then show that the samples have the same composition.

Methods of making copper(II) oxide include:

- heating copper carbonate,
- heating copper hydroxide,
- heating copper nitrate,
- heating copper foil in air.
- (a) Complete the following equations.

(i)	$CuCO_3 \rightarrow \dots + \dots + \dots$	[1]
(ii)	$Cu(OH)_2 \rightarrow \dots + \dots$	[1]
iii)	$2Cu(NO_3)_2 \rightarrow \dots + 4NO_2 + \dots$	[2]
0 -		

- **(b)** Copper oxide can be reduced to copper by heating in hydrogen.
  - .....[1]
  - (ii) Explain why the copper must be allowed to cool in hydrogen before it is exposed to air.
    - .....[2]
  - (iii) Name another gas which can reduce copper(II) oxide to copper.

What colour change would you observe during the reduction?

- .....[1]
- (iv) Name a solid which can reduce copper(II) oxide to copper.
  - ......[1]

- (c) The table below shows the results obtained by reducing the copper(II) oxide produced by different methods to copper.
  - (i) Complete the table.

source of copper(II) oxide	mass of copper(II) oxide/g	mass of copper/g	percentage copper/%
CuCO <sub>3</sub>	2.37	1.89	79.7
Cu(OH) <sub>2</sub>	2.51	1.99	
Cu(NO <sub>3</sub> ) <sub>2</sub>	2.11	1.68	
Cu and O <sub>2</sub>	2.29	1.94	

١	2	
	-	

(ii)	One of the samples of copper(II) oxide is impure.						
	Identify this sample and suggest an explanation why the percentage of copper in this sample is bigger than in the other three samples.						
	[2						

6	Chemical	reactions	are alway	s accompanied b	y an energy change
_	0110111001	100010110	are array	o accompanioa s	, an one, g, on an g

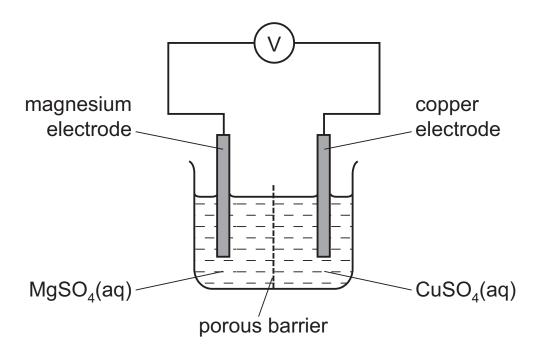
(a)	Aluminium is extracted by the electrolysis of a molten mixture which contains aluminium oxide,
	$Al_2O_3$ . This decomposes to form aluminium at the negative electrode and oxygen at the positive
	electrode.

(i)	Write an ionic equation for the reaction at the negative electrode.	
		[2

Complete the ionic equation for the reaction at the positive electrode.

Complete the ionic equation for the reaction at the positive electrode. 
$$20^{2-} \rightarrow \dots + \dots$$
 [2] Is the reaction exothermic or endothermic? Explain your answer.

(b) The cell shown below can be used to determine the order of reactivity of metals.



(i)	Is the reaction in the cell exothermic or endothermic? Explain your answer.	
		[1

	(ii)	Explain why the mass of the magnesium electrode decreases and the mass of the cop electrode increases.	per
			[4]
	(iii)	How could you use this cell to determine which is the more reactive metal, magnesium manganese?	n or
			[2]
(c)	The	combustion of propane, C <sub>3</sub> H <sub>8</sub> , is exothermic.	
	Giv	e an equation for the complete combustion of propane.	
			[2]
(d)	Pho	otosynthesis is an unusual endothermic reaction.	
	(i)	Where does the energy for photosynthesis come from?	
	(-)		
			[1]
	(ii)	Give the word equation for photosynthesis.	
			[1]
		[Total:	141
		Liotai.	1

<b>7</b> (a) Alkanes and alkenes are both hydrocarbon	7	(a) Al	kanes and	alkenes a	are both	hydrocarbon
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(i)	How does the structure of alkenes differ from the structure of alkanes?	
		[1]
(ii)	Is the straight-chain hydrocarbon C <sub>22</sub> H <sub>44</sub> an alkane or an alkene? Explain your choice.	
		[2]
(iii)	Describe how you could distinguish between pentane and pentene.	
	test	
	result with pentane	
	result with pentene	
		[3]

- **(b)** Alkenes polymerise to form poly(alkenes).
  - (i) The alkene 1,1-dichloroethene has the structural formula given below.

Draw the structural formula of the polymer formed by the polymerisation of 1,1-dichloroethene.

[3]

(ii) The structural formula of a different polymer is given below.

Deduce the structural formula of the monomer used to form this polymer.

		[2]
(iii)	There are two types of polymerisation - addition and condensation.	
	Explain the difference between them.	
		[2]
(iv)	There are two types of condensation polymer.	
	Give the name of <b>one</b> type of condensation polymer.	
		[1]
	[Total:	14]

DATA SHEET
The Periodic Table of the Elements

	0	4 <b>He</b> Helium	20 Neon 10 Ar Ar Argon	84 <b>Kr</b> Krypton 36	131 <b>Xe</b> Xenon 54	Rn Radon 86		175 <b>Lu</b> Lutetium 71	<b>Lr</b> Lawrencium 103
	IIA		19 Fluorine 9 35.5 <b>C 1</b> Chlorine	80 <b>Br</b> Bromine 35	127 <b>T</b> lodine	At Astatine 85		173 <b>Yb</b> Ytterbium 70	Nobelium
	IN		16 Oxygen 8 32 <b>S</b>	79 Selenium 34	128 <b>Te</b> Tellurium	<b>Po</b> Polonium 84		169 <b>Tm</b> Thullium 69	Md Mendelevium 101
Group	>		Nitrogen 7 31 Phosphorus 15	75 <b>As</b> Arsenic 33	122 <b>Sb</b> Antimony 51	209 <b>Bi</b> Bismuth 83		167 <b>Er</b> Erbium 68	Fm Fermium 100
	<u>N</u>		12 Carbon 6 Silicon 14	73 <b>Ge</b> Germanium 32	30 Sn Tin 50	207 <b>Pb</b> Lead Lead 82		165 <b>Ho</b> Holmium 67	Einsteinium 99
	III		11 BB Boron 5 A7 A1 Aluminium 13	70 <b>Ga</b> Gallium 31	115 <b>In</b> Indium	204 <b>T 1</b> Thallium 81		162 <b>Dy</b> Dysprosium 66	Cf Californium 98
				65 <b>Zn</b> Zinc 30	112 <b>Cd</b> Cadmium 48	201 <b>Hg</b> Mercury 80		159 <b>Tb</b> Terbium 65	<b>BK</b> Berkelium 97
				64 <b>Cu</b> Copper	108 <b>Ag</b> Silver 47	197 <b>Au</b> Gold 79		157 <b>Gd</b> Gadolinium 64	Cm Curium 96
				59 <b>N</b> ickel 28	106 <b>Pd</b> Palladium 46	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium 63	Am Americium 95
				59 <b>Co</b> Cobalt 27	103 <b>Rh</b> Rhodium 45	192 <b>I r</b> Indium 77		150 <b>Sm</b> Samarium 62	<b>Pu</b> Plutonium 94
		1 Hydrogen		56 <b>Fe</b> Iron	101 <b>Ru</b> Ruthenium 44	190 <b>Os</b> Osmium 76		<b>Pm</b> Promethium 61	Np Neptunium 93
				Manganese	Tc Technetium 43	186 <b>Re</b> Rhenium 75		144 Neodymium 60	238 <b>U</b> Uranium 92
				52 <b>Cr</b> Chromium 24	96 Molybdenum 42	184 <b>W</b> Tungsten 74		141 <b>Pr</b> Praseodymium 59	Pa Protactinium 91
				51 Vanadium 23	Nobium 41	181 <b>Ta</b> Tantalum 73		140 <b>Ce</b> Cerium 58	232 <b>Th</b> Thorium 90
				48 <b>Ti</b> Titanium 22	91 Zr Zirconium 40	178 <b>Hf</b> Hafnium 72			nic mass Ibol nic) number
				45 <b>Sc</b> Scandium 21	89 <b>×</b>	139 <b>La</b> Lanthanum 57 *	227 <b>Ac</b> Actinium 89	series eries	<ul><li>a = relative atomic mass</li><li>X = atomic symbol</li><li>b = proton (atomic) number</li></ul>
	=		Beryllium 4 24 Mg Magnesium 12	40 <b>Ca</b> Calcium	Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	<i>a</i> ★ <i>a</i>
	_		Lithium 3 23 Na Sodium 11	39 Potassium	Rb Rubidium 37	Cs Caesium 55	<b>Fr</b> Francium 87	*58-71 L	Key

The volume of one mole of any gas is  $24\,\mathrm{dm}^3$  at room temperature and pressure (r.t.p.).

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