

## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
CHEMISTRY			0620/21
Paper 2			May/June 2010
			1 hour 15 minutes
Candidates ansv	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 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 question.

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

This document consists of 16 printed pages.



1 Choose from the following list of gases to answer the questions.

## ammonia carbon monoxide chlorine ethene methane nitrogen nitrogen dioxide oxygen propane

Each gas can be used once, more than once or not at all.

<b>1/1/r</b>	าเดก	gas
v v i	поп	yas

(a)	is a greenhouse gas produced by the decomposition of vegetation,	
		[1]
(b)	is an alkane,	
		[1]
(c)	reacts with sulfuric acid to form a salt,	
		[1]
(d)	makes up about 20% of the air,	
		[1]
(e)	is a halogen,	
		[1]
(f)	is a hydrocarbon which decolourizes aqueous bromine?	
		[1]
	[Total	: 6]

2

This question is ab	out hydrogen and some	compounds	containing h	ıydrogen.
(a) Hydrogen is a	gas at room temperature	).		
Describe the a	rrangement and motion of	of the molec	cules in hydro	ogen gas.
arrangement				
motion				[2
(b) Draw the elect	ronic structure of a hydro	gen moleci	ule.	
				[1
(c) The symbols for	or two isotopes of hydrog	jen are sho	wn below.	
	<sup>1</sup> H	<sup>3</sup> <sub>1</sub> H		
(i) What do y	ou understand by the ter			
(.,	·	-		
(ii) Complete of hydroge	the table to show the nur en.	nber of Sub	atomic partic	les in these two isotopes
	isotope	1 <sub>1</sub> H	<sup>3</sup> <sub>1</sub> H	
	-	1''	1	_
,	number of electrons number of neutrons			_
,	number of protons			
	• 1			[4
(d) When hydroge	n burns, energy is given	out.		
State the name	e given to a reaction whic	ch gives out	energy.	
				[1]

- (e) Hydrochloric acid reacts both with metals and with metal carbonates.
  - (i) A student observed the reaction of hydrochloric acid with four different metals. The student used the same concentration of hydrochloric acid and the same mass of metal in each experiment.

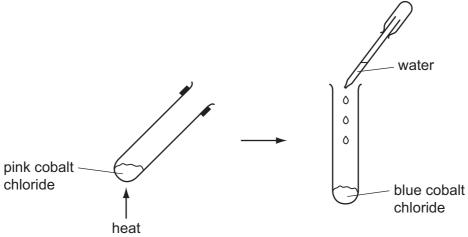
metal	observations
cobalt	dissolves very slowly and very few bubbles produced
iron	dissolves slowly and a few bubbles produced slowly
magnesium	dissolves very quickly and many bubbles produced very rapidly
zinc	dissolves quickly and many bubbles produced rapidly

Use the information in the table to suggest the order of reactivity of these metals.

most re	eactive —	→ least reactive
		[2]
	State the names of the <b>three</b> products formed when hydrocalcium carbonate.	ochloric acid reacts with
		[3]
		[Total: 14]

3 Some pink cobalt chloride was heated gently in a test-tube. The cobalt chloride turned blue.

A few drops of water were then added to the blue cobalt chloride. The cobalt chloride turned pink.



		 heat			chloride	
(a) (i)	State the nan	ne of this type	of reaction.			
						[1]
(ii)	Complete the	e following ser	ntence. Use words	s from the list b	elow.	
	alkaline	chloride	dehydrated	hydrated	water	
	When			cobalt chlor	ide is heated, it I	oses
	its		of (	crystallisation a	and changes colour.	[2]
<b>(b)</b> Co	obalt is a metal.					
(i)	State <b>two</b> phy	ysical properti	ies which are cha	racteristic of mo	etals.	
						[2]
(ii)	•		eriodic Table pred allic properties.	ict <b>two</b> physica	al properties of cob	alt in
						[2]
	obalt(II) oxide is redict <b>one</b> chem		e. of cobalt(II) oxide			
•••						[1]
					[Tot	al· 81

4 The table shows the mass of various compounds obtained when 500 cm³ of seawater is evaporated.

compound	ions present	mass of compound/g
sodium chloride	Na⁺ and C <i>l</i> ⁻	14.0
magnesium chloride	Mg²+ and C <i>l</i> -	3.0
magnesium sulfate	Mg <sup>2+</sup> and SO <sub>4</sub> <sup>2-</sup>	2.0
calcium sulfate	Ca <sup>2+</sup> and SO <sub>4</sub> <sup>2-</sup>	0.5
potassium chloride	K⁺ and C <i>l</i> ⁻	
potassium bromide		0.5
calcium carbonate	Ca <sup>2+</sup> and CO <sub>3</sub> <sup>2-</sup>	0.5
sodium iodide	Na⁺ and I⁻	
		total mass = 20.0

(a)	Which negative ion is present in seawater in the highest concentration?	
		[1]
(b)	Write the symbols for the <b>two</b> ions present in potassium bromide.	
	and	[1]
(c)	Calculate the mass of sodium chloride present in 5 g of the solid left by evaporating t seawater.	he
(d)	Describe a test for iodide ions.	[1]
	test	
	result	[2]

		1	
(e)	Aqu	eous chlorine reacts with aqueous sodium iodide.	
	(i)	Complete the equation for this reaction.	
		$Cl_2$ + 2NaI $\rightarrow$ + 2NaC $l$	
			[1]
(	ii)	What colour is the solution when the reaction is complete?	
			[1]
(i	ii)	An aqueous solution of iodine does not react with aqueous potassium bromide. Explain why there is no reaction.	
			[1]
(f)	Cal	culate the relative formula mass of magnesium chloride, $\mathrm{MgC}\mathit{l}_{2}$ .	

......[1]

[Total: 9]

5	Am	monium sulfate is used in fertilisers.	
	(a)	State the names of the three elements found in most fertilisers.	
		1	
		2	
		3	[3]
	(b)	Suggest why farmers use fertilisers.	
			[2]
	(c)	Ammonium sulfate is a salt which is soluble in water.	
		(i) What do you understand by the term soluble?	
			[1]
	(	(ii) Which of the following methods is used to make this salt in the laboratory? Tick <b>one</b> box.	
		adding an acid to a metal	
		adding an acid to a metal oxide	
		by a precipitation reaction	
		by the titration of an acid with an alkali	[1]
	(d)	A mixture of ammonium sulfate and sodium hydroxide was warmed in a test-tube. A gas was given off which turned red litmus paper blue.	
		State the name of this gas.	
			[1]

(e)	Fer	tilisers containing ammonium salts are often slightly acidic.
	(i)	State the name of a compound which farmers add to the soil to make it less acidic.
		[1]
	(ii)	Explain why it is important for farmers to control the acidity of the soil.
		[2]
(f)	The	e formula of ammonium sulfate is (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> .
	In t	nis formula state:
	(i)	the number of different types of atoms present,
	(ii)	the total number of atoms present. [1]
		[Total: 13]

- **6** Many metals are extracted from their ores by reduction with carbon.
  - (a) Name the main ore of iron.

Г	11	1
	, U	Ш

- (b) Iron is extracted from its ore in a blast furnace.
  - (i) Other than iron ore, state the names of two other raw materials used in the extraction of iron.

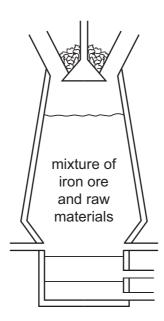
1. .....

(ii) One of the reactions taking place in the blast furnace is

FeO + C 
$$\rightarrow$$
 Fe + CO

Write a word equation for this reaction.

- (iii) The diagram shows a blast furnace.
  Label the diagram to show each of the following:
  - the slag,
  - where the molten iron collects,
  - where air is blown into the furnace,
  - where the iron ore is put into the furnace.



1	_\	フ:いっ:	a avtraata	1 frama an		aantainina	zinc sulfide.
1	$\mathbf{c}$	Z IMC: I	s exilacie	i irom an	$OI \leftarrow$	containing	zinc sumae
۸	~,	20	o onti actor	<i>a</i>	0.0	oontan mig	Ziiio caiiiac.

Part of a zinc sulfide structure is shown below.

Zn <sup>2+</sup>	Zn <sup>2+</sup>	$\left(Zn^{2+}\right)$	Zn <sup>2+</sup>
S <sup>2-</sup>	$\left( S^{2-} \right)$	$\left( S^{2-}\right)$	$\left( S^{2-}\right)$
Zn <sup>2+</sup>	Zn <sup>2+</sup>	Zn <sup>2+</sup>	Zn <sup>2+</sup>
$\left( S^{2-} \right)$	$\left(S^{2-}\right)$	$\left( S^{2-} \right)$	$\left(S^{2-}\right)$

Suggest the simplest formula for zinc sulfide.	

\_\_\_\_\_\_[1]

[Total: 10]

7 Petroleum is a mixture of hydrocarbons.

Two of the processes carried out in an oil refinery are fractional distillation of petroleum and cracking of hydrocarbon fractions. (a) Which property of hydrocarbons is used to separate petroleum into fractions? Tick one box. boiling point chemical reactivity electrical conductivity melting point [1] **(b)** Match the fractions on the left with their uses on the right. The first one has been done for you. fuel for home heating bitumen fuel oil making roads kerosene waxes and polishes

[4]

making chemicals

jet fuel

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lubricating fraction

naphtha

For
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Use

	alkenes.							
(i)	State two cond	tions needed for crac	king.					
	1							
	2			[	2]			
(ii)	hydrocarbon.	oon, $C_{14}H_{30}$ , can be quation for this reaction		ke ethene and one oth	er			
		$C_{14}H_{30} \rightarrow C_2H_4$	+	1	[1]			
(iii)	Draw the full st	ructure of ethene show	ving all atoms and	bonds.				
				ī	[1]			
(d) Sta	te the name of th	ne polymer formed fro	m ethene	ı	. ' ]			
(d) Old	to the name of the	•			[1]			
(e) Eth	ene is used to m				. ' ]			
(i)		ce is needed for this re	action?					
(1)		nd the correct answer						
	ammonia	hydrogen	oxygen	steam	.41			
(ii)		d is a catalyst in this renderstand by the term		l	[1]			
					•••			
				[	[1]			
				[Total: 1	2]			

- 8 Some substances conduct electricity, others do not.
  - (a) Which three of the following conduct electricity? Tick **three** boxes.

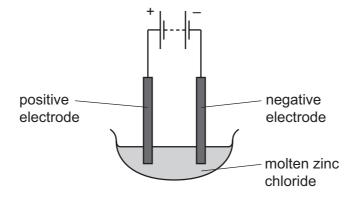
aqueous sodium chloride	
ceramics	
copper	
graphite	
sodium chloride crystals	
sulfur	

[3]

**(b)** State the name given to a substance, such as plastic, which does not conduct electricity.

......[1

(c) Molten zinc chloride was electrolysed using the apparatus shown below.



(i) Choose a word from the list below which describes the positive electrode. Put a ring around the correct answer.

anion anode cathode cation

[1]

(ii)	State the name of the product formed during this electrolysis at
	the negative electrode,
	the positive electrode. [2]
(iii)	Suggest the name of a non-metal which can be used for the electrodes in this electrolysis.
	[1]
	[Total: 8]

For Examiner's Use

DATA SHEET
The Periodic Table of the Elements

	0	Helium	3 20 Ne Neon 10	.5 40 <b>Ar</b> rine Argon 18	r Kr in Krypton 36		tine Radon 86		3 175 <b>Lu</b> oium Lutetium	
			19 Fluorine	35.5 <b>C1</b> Chlorine	1		At Astatine 85		173 <b>Yb</b> Ytterbium 70	Z
	>		16 Oxygen	32 <b>S</b> Sulfur	Selenium 34				169 <b>Tm</b> Thulium	Σ
	>		14 <b>N</b> itrogen 7	31 Phosphorus 15	AS Arsenic	Sb Antimony 51	209 <b>Bi</b> Bismuth 83		167 <b>Er</b> Erbium 68	E E
	2		12 Carbon	28 <b>Si</b> icon	73 <b>Ge</b> Germanium	119 So Tin	207 <b>Pb</b> Lead		165 <b>Ho</b> Holmium 67	ц
	=		11 Boron 5	27 <b>A1</b> Aluminium 13	70 <b>Ga</b> Gallium	115 <b>In</b> Indium 49	204 <b>T t</b> Thallium		162 <b>Dy</b> Dysprosium 66	ځ
					65 <b>Zn</b> Zinc 30	112 <b>Cd</b> Cadmium 48			159 <b>Tb</b> Terbium 65	ă
					64 Copper 29	108 <b>Ag</b> Silver	197 <b>Au</b> Gold		157 <b>Gd</b> Gadolinium 64	
Group					59 Nickel	106 <b>Pd</b> Palladium 46	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium 63	Δ
Ģ					Co Cobalt	103 <b>Rh</b> Rhodium 45	192 <b>Ir</b> Iridium		Sm Samarium 62	
		Hydrogen			56 <b>Fe</b> Iron	101 <b>Ru</b> Ruthenium 44	190 <b>Os</b> Osmium 76		Pm Promethium 61	Z
					Mn Manganese 25	Tc Technetium 43	186 <b>Re</b> Rhenium 75		Neodymium 60	238
					Cr Chromium	Moybdenum 42	184 <b>W</b> Tungsten 74		Pr Praseodymium 59	Q
					51 V Vanadium 23	93 <b>Nb</b> Niobium 41	181 <b>Ta</b> Tantalum 73		140 <b>Ce</b> Cerium	232 <b>Th</b>
					48 <b>T</b> Titanium	91 <b>Zr</b> Zirconium 40	178 <b>Hf</b> Hafnium 72			iic mass
					Scandium	89 <b>×</b>	139 <b>La</b> Lanthanum s	Ac Actinium †	l series eries	a = relative atomic mass  X = atomic symbol
	=		Beryllium	24 Mg Magnesium 12	40 Ca Calcium 20	Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	в <b>Х</b>
	_		7 <b>Li</b> Lithium	23 <b>Na</b> Sodium	39 <b>K</b> Potassium	85 <b>Rb</b> Rubidium 37	133 <b>Cs</b> Caesium 55	<b>Fr</b> Francium 87	58-71 L	Kov

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

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