



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

CANDIDATE NAME	
CENTRE NUMBER	CANDIDATE NUMBER
CHEMISTRY	0620/02
Paper 2	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 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 Examiner's Use		
1		
2		
3		
4		
5		
6		
7		
Total		

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



1 (a) Choose from the list of compounds to answer questions (i) to (v).

For
Examiner's
Use

	calcium carbonate		carbon diox	de	hydrogen chloride	
	iron(III) oxide	lead(II) br	omide	methane	sodium hydroxi	de
Ea	ch compound can be	used once,	more than on	ce or not a	at all.	
Na	me the compound wh	nich				
(i)	is a transition metal	compound,	,			
						[1]
(ii)	produces brown fun	nes at the a	node when ele	ectrolysed,		
						[1]
(iii)	is used to manufact	ure lime,				
						[1]
(iv)	dissolves in water to	o form an al	kaline solutior	١,		
						[1]
(v)	is the main constitu	ent of natura	al gas.			
						[1]

(b)	At a	a high temperature iro	n(III)	oxid	e is reduc	ed by	carb	on.		
		$Fe_2O_3$	+	3C	<del></del>	2Fe	+	3CO		
	(i)	Explain how the equa	ation	shov	vs that iro	n(III) c	oxide	is reduced by c	arbon.	
										[1]
	(ii)	Complete these sent	ence	es abo	out the ex	tractio	n of	iron using words	from the list.	
		bauxite	bla	st	conv	erter/		haematite	lime	
		limeston	е		sa	nd		sla	ag	
		limeston  Iron is extracted from								
		Iron is extracted from	١						ore with	
		Iron is extracted from	٦ <b></b>		in	а		by mixing the	ore with furnace	
		Iron is extracted from	n	iron	in and impu	a		by mixing the	ore with furnace	

**2** The table shows some observations about the reactivity of various metals with dilute hydrochloric acid.

For Examiner's Use

metal	observations
calcium	many bubbles produced rapidly with much spitting
copper	no bubbles formed
iron	a few bubbles produced very slowly
magnesium	many bubbles produced rapidly with no spitting

(a) Put these metals in order of their reactivity.

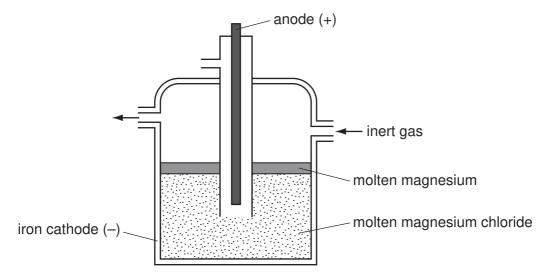
most reactive —		<b>→</b>	least reactive	;
				[1]

(b) Zinc is between iron and magnesium in its reactivity.

Suggest what observations are made about how fast the bubbles are produced when zinc reacts with dilute hydrochloric acid.



(c) Magnesium is extracted by the electrolysis of molten magnesium chloride.



(i) What information in the diagram suggests that magnesium is less dense than molten magnesium chloride?

[1

(ii	<ul><li>Suggest w its oxide w</li></ul>		s to be extracted b	by electrolysis rather than by heati	ng
					[1]
(iii	) Suggest w magnesiur	-	inert gas is blow	n over the surface of the molton	en
					[1]
(iv	) State the n	name of a gaseous	element which is	inert.	
					[1]
	some old ma agnesium.	agnesium manufac	turing plants, coal	gas is blown over the surface of the	he
		the main substanc	es in coal gas.		
	carbo	n monoxide	ethene	hydrogen	
		hydrog	en sulfide	methane	
(i	) Draw the s	structure of ethene	showing all atoms	and bonds.	
(i	) Draw the s	structure of ethene	showing all atoms	s and bonds.	
(i	) Draw the s	structure of ethene	showing all atoms	and bonds.	
(i	) Draw the s	structure of ethene	showing all atoms	and bonds.	
(i	) Draw the s	structure of ethene	showing all atoms	s and bonds.	
(i	) Draw the s	structure of ethene	showing all atoms		[1]
(i					
	) Suggest <b>tv</b> the list. substance	<b>vo</b> hazards of usir			
	) Suggest <b>tv</b> the list. substance hazard	<b>vo</b> hazards of usir			
	) Suggest <b>tv</b> the list. substance	<b>vo</b> hazards of usir		erring to <b>two</b> specific substances	

[Total: 13]

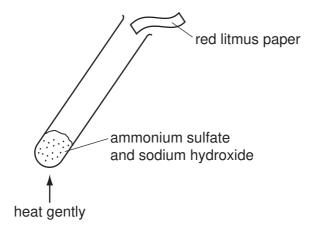
(e)		rbon monoxide can be removed from coal gas by mixing it with steam and pass mixture over a catalyst of iron(III) oxide at 400 °C.	ing
		$CO + H_2O \rightleftharpoons CO_2 + H_2$	
	(i)	Write a word equation for this reaction.	
			[1]
	(ii)	What does the symbol ⇌ mean?	
			[1]
	(iii)	Iron(III) oxide reacts with acids to form a solution containing iron(III) ions. Describe a test for aqueous iron(III) ions.	
		test	
		result	
			[2]

(a)		esel.		e separated	into fractions such a
	State the name o	f the process (	used to separate the	se fractions.	
-					[1
(b)	Name <b>two</b> other	fractions which	n are obtained from բ	oetroleum .	
-			and		[2
(c)	Give <b>one</b> use for	the paraffin fra	action.		_
					[1
			ed from petroleum a ctures are alkanes?	re alkanes.	
	Α	В	С		D
I	H   H—C—H   H	H $C = C$	H H / H—C— H H	-О—Н	H H H       H—C—C—C—F       H H H
(e)	Use words from t	he list below to	o complete the follow	ving sentence	[1
	ethane	ethene	hydrogen	nitrogen	oxygen
	reactiv	re	unreactive		water
ı	Alkanes such as		are generally		but they can
ĺ	be burnt in		to form carbon dio	xide and	[4
	Alkanes are satu What do you und				
,					
	(i) saturated,				

4 This question is about some compounds of nitrogen.

For Examiner's Use

A mixture of ammonium sulfate and sodium hydroxide was warmed in a test-tube. The gas was tested with moist red litmus paper.



(a)	State th	e name	of the	gas	released	ĺ.
-----	----------	--------	--------	-----	----------	----

	1	J
--	---	---

(b) State the colour change of the litmus paper.

Γ1	1
	-

**(c)** Complete the word equation for the reaction of ammonium carbonate with hydrochloric acid.

ammonium	+	hydrochloric ——	<b>-</b>	 +	 +	
carbonate		acid				
						[3]

(d) Ammonium salts such as ammonium nitrate, NH<sub>4</sub>NO<sub>3</sub> and ammonium chloride NH<sub>4</sub>C*l* are used as fertilisers.

(i)	Explain	why	farmers	need t	to use	fertilisers
-----	---------	-----	---------	--------	--------	-------------

[1]

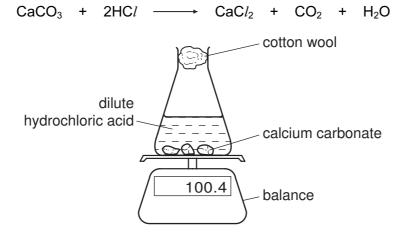
(ii) Explain why ammonium nitrate is a better fertiliser than ammonium chloride.

[1]

	(iii) Calculate the relative formula mass of ammonium nitrate.		For Examiner's Use
		[1]	
(e)	When ammonium nitrate is heated nitrogen(I) oxide is given off.  Nitrogen(I) oxide relights a glowing splint.  Name <b>one</b> other gas which relights a glowing splint.	[1]	
(f)	State <b>one</b> harmful effect of nitrogen oxides on the environment.	[1]	
	[Total:		

**5** A student used the apparatus shown below to investigate the rate of reaction of calcium carbonate with dilute hydrochloric acid.

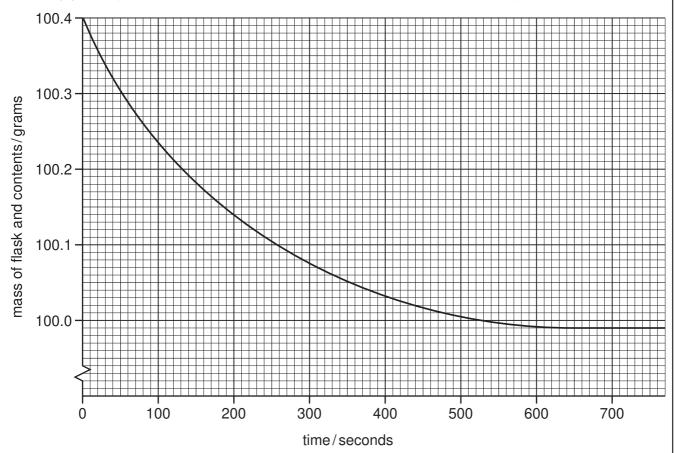
For Examiner's Use



(a)	Use the information in the equation to suggest why the mass of the flask and contents
	decreases with time.

	[1]

(b) The graph shows how the mass of the flask and its contents changes with time.



	(i)	At what time was the reaction just complete?	For
		[1	Examiner's Use
	(ii)	On the graph, mark with an <b>X</b> the point where the speed (rate) of reaction was fastest.	_
	(iii)	The student repeated the experiment but altered the concentration of the hydrochloric acid so that it was half the original value. In both experiments calcium carbonate was in excess and all other conditions were kept the same.	I
		On the graph on page 10, draw a curve to show how the mass of the flask and contents changes with time when hydrochloric acid of half the concentration was used.	s
(c)	Hov	w does the speed (rate) of this reaction change when	
	(i)	the temperature is increased,[1	ıj
	(ii)	smaller pieces of calcium carbonate are used?[1	1]
(d)	Cor	mplete the following sentence using words from the list.	
	C	ombustion expansion large rapid slow small	
	In fl	our mills there is often the risk of an explosion due to the rapid	
	of th	he very particles which have a very	
	•••••	surface area to react. [3	3]
(e)	Cel	ls in plants and animals break down glucose to carbon dioxide and water.	
		glucose + oxygen ——→ carbon dioxide + water	
	(i)	State the name of this process.	
		[1	1]
	(ii)	In this process enzymes act as catalysts. What do you understand by the term catalyst?	
		[1	ı]
		[Total: 12	2]

Bro	omine is an element in Group VI	I of the Periodic Table	
(a)	Write the formula for a molecu	lle of bromine.	
			[1]
(b)	Complete the diagram below bromine.	v to show the arrang	gement of the molecules in liquid
	represents a bromine	e molecule	
			[2]
(c)		umes were seen just	in the bottom of a sealed gas jar of above the liquid surface. After one hout the gas jar.
	air		
	start	after 2 minutes	after
	Use the kinetic particle theory	to explain these obser	vations.
			[3]

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(d)	An	nesium salts are colourless but Group VII elements are coloured. aqueous solution of magnesium bromide reacts with an aqueous solution of ine.
	ma	nesium bromide + chlorine magnesium chloride + bromine
	Sta	e the colour change in this reaction.
	•••••	[2]
(e)		lution of magnesium bromide will not react with iodine. ain why there is no reaction.
		[1]
(f)	The	structures of some compounds containing bromine are shown below.
		A B C D
	Na	$Br^{-}$ $Na^{+}$ $Br^{-}$ $Na^{+}$ $Br^{-}$ $B$
	Br	$\bigcap_{Pr} \bigcap_{Pr} $
	(Na	$(Br^-)(Na^+)(Br^-)$ $(Zn^{2+})$
	Br	(Na+) Br- (Na+)
	(i)	Write the simplest formula for the substance with structure <b>A</b> .
		[1]
	(ii)	State the name of the substance with structure <b>D</b> .
		[1]
(	(iii)	State the type of bonding within a molecule of structure <b>C</b> .
		[1]
(	(iv)	Which <b>two</b> structures are giant structures?
		and[1]
	(v)	Why does structure <b>A</b> conduct electricity when it is molten?
		[1]
		[Total: 14]

-	drogen chloride can be made by burning hydrogen in chlorine.		For
(a)	Complete the equation for this reaction.		Examiner's Use
	$H_2$ + $HCI$	[2]	
(b)	Draw a dot and cross diagram for a molecule of hydrogen chloride. Show all the electrons.		
	use <b>o</b> for an electron from a hydrogen atom use <b>x</b> for an electron from a chlorine atom		
		[2]	
(c)	Hydrochloric acid is formed when hydrogen chloride gas dissolves in water. Suggest the pH of hydrochloric acid. Put a ring around the correct answer.		
	pH 1 pH7 pH9 pH 13		
		[1]	
(d)	Complete the equation for the reaction of hydrochloric acid with zinc.	[1]	
(d)	Complete the equation for the reaction of hydrochloric acid with zinc.  zinc + hydrochloric acid zinc chloride +	[1]	
		[1]	
	zinc + hydrochloric acid zinc chloride +  Describe how dry crystals of zinc chloride can be obtained from a solution	[1] of zinc	
	zinc + hydrochloric acid zinc chloride +  Describe how dry crystals of zinc chloride can be obtained from a solution chloride.	[1] of zinc	
	zinc + hydrochloric acid zinc chloride +  Describe how dry crystals of zinc chloride can be obtained from a solution chloride.	[1] of zinc	
(e)	zinc + hydrochloric acid	[1] of zinc[2]	
(e)	zinc + hydrochloric acid	[1] of zinc[2]	

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DATA SHEET
The Periodic Table of the Elements

	0	# <b>He</b> Helium	Neon 10 Neon 40 Ar	Argon 18	84 Krypton	36	Xe Xenon	Radon 86		Lutetium 71		Lawrencium
	=		19 Fluorine 9 35.5 <b>C1</b>	Chlorine 17	80 <b>B</b> romine		I lodine	At Astatine 85		173 <b>Yb</b> Ytterbium 70	2	Nobelium
	5		O Oxygen 8	Sulfur 16	79 <b>Se</b>	34	Te Tellurium 52	<b>Po</b> Polonium 84		169 <b>Tm</b> Thulium 69		Mendelevium
	>		14 Nitrogen 7	suns	75 <b>AS</b> Arsenic		Sb Antimony 51	209 <b>Bi</b> Bismuth 83		167 <b>Er</b> Erbium 68	8	Fermium
	≥		Carbon 6 Carbon 8 28	Silicon 14	73 <b>Ge</b> Germanium	32	<b>Sn</b> Tin	207 <b>Pb</b> Lead		165 <b>Ho</b> Holmium 67	Ü	n Einsteinium
	=		11 Boron 5 27 <b>A1</b>	Aluminium 13	70 <b>Ga</b> llium	31	In Indium	204 <b>T t</b> Thallium 81		162 <b>Dy</b> Dysprosium 66	7	Californium
					65 <b>Zn</b> Zinc	30	Cadmium 48	201 <b>Hg</b> Mercury 80		159 <b>Tb</b> Terbium 65	jā	Berkelium
					64 Copper	29	Ag Silver	197 <b>Au</b> Gold 79		157 <b>Gd</b> Gadolinium 64		Curium
Group					S9 Nickel	28	Pd Palladium 46	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium 63	8	Americium
ຮັ					59 Cobait	27	Rhodium 45	192 <b>Ir</b> Iridium 77		Sm Samarium 62	ā	Plutonium
		1 Hydrogen			56 Fon	26	<b>Rut</b>	190 <b>Os</b> Osmium 76		<b>Pm</b> Promethium 61	2	Neptunium
					55 Mn	25	Tc Technetium 43	186 <b>Re</b> Rhenium 75		144 Neodymium 60	238	Uranium
					52 Chromium	24	Molybdenum 42	184 <b>W</b> Tungsten 74		Pr Praseodymium 59	G	Protactinium 91
					51 <b>V</b> Vanadium	23		181 <b>Ta</b> Tananan Tantalum 73		140 <b>Ce</b> Cerium		Thorium
					48 Titanium	22	Zr Zirconium 40	178 <b>Hat</b> Hatnium			mass	nc) number
					45 <b>Sc</b>	21	Yttrium	139 <b>La</b> Lanthanum 57 *	227 <b>Ac</b> Actinium 89	l series eries	a = relative atomic mass	b = proton (atomic) number
	=		9 <b>Be</b> Beryllium 4 Beryllium 24 Ma	Magnesium 12	40 <b>Ca</b> Calcium	20	Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium	*58-71 Lanthanoid series	в <b>&gt;</b>	
	_		Lithium 3 Lithium 3 23	Sodium 11	39 <b>K</b> Potassium	19	Rubidium	133 Caesium 55	<b>Fr</b> Francium 87	*58-71 L 190-103	Š	y dy

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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