

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

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

1 hour 15 minutes

This document consists of 16 printed pages.



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

For Examiner's Use

ammonia	carbo	n monoxide	chlori	ne	ethene	methane
nitr	ogen	nitrogen dio	kide	oxyge	en	propane

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

Which gas

(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]

Examiner's Use

2

Thi	s question is ab	out hydrogen and some	compounds	containing h	nydrogen.		
(a)	Hydrogen is a	gas at room temperatur	e.				
	Describe the arrangement and motion of the molecules in hydrogen gas.						
	arrangement.						
	motion				[2]		
(b)	Draw the elect	tronic structure of a hydr	ogen molecu	ıle.			
					[1]		
(c)	The symbols f	or two isotopes of hydro	gen are show	wn below.			
		1 1 H	³ ₁ H				
	(i) What do y	ou understand by the te	erm <i>isotope</i> ?				
					[1]		
	(ii) Complete	the table to show the nu	ımber of suba	atomic partic	les in these two isotopes		
	of hydroge	en.					
		isotope	1 ₁ H	³ H			
		number of electrons					
		number of neutrons					
		number of protons			<u> </u>		
(d)	When hydroge	en burns, energy is giver	out.		1.1		
(u)	, ,			oporav			
	State the nam	e given to a reaction wh	ich gives out	energy.	[4]		
					[1]		

4

(e) Hydrochloric acid reacts both with metals and with metal carbonates.

For Examiner's Use

(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 reactive

least reactive

[2]

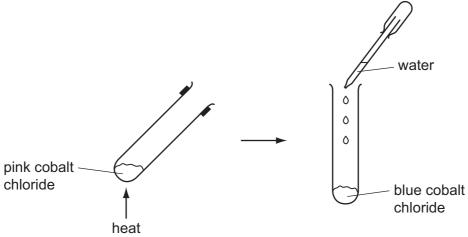
(ii) State the names of the **three** products formed when hydrochloric acid reacts with calcium carbonate.

[Total: 14]

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

For Examiner's Use

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



		heat				
(a) (i)	State the nar	ne of this type	of reaction.			
						[1]
(ii)	Complete the	e following ser	ntence. Use word	s from the list b	elow.	
	alkaline	chloride	dehydrated	hydrated	water	
	When			cobalt chloi	ride is heated	l, it loses
	its		of	crystallisation a	and changes c	olour. [2]
(b) Co	balt is a metal.					
(i)	State two ph	ysical properti	es which are cha	aracteristic of m	etals.	
						[2]
(ii)	•		eriodic Table pred allic properties.	dict two physic	al properties o	f cobalt in
	balt(II) oxide is edict one chem		e. of cobalt(II) oxide) .		
						[1]
						[Total: 8]

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

For Examiner's Use

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 ²⁺ and SO ₄ ²⁻	2.0
calcium sulfate	Ca ²⁺ and SO ₄ ²⁻	0.5
potassium chloride	K⁺ and C <i>l</i> ⁻	
potassium bromide		0.5
calcium carbonate	Ca ²⁺ and CO ₃ ²⁻	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 two ions present in potassium bromide.	
	and	[1]
(c)	Calculate the mass of sodium chloride present in 5 g of the solid left by evaporating seawater.	the
(d)	Describe a test for iodide ions.	[1]
	test	
	result	[2]

(e)	Aqı	ueous 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]
(iii)	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, ${\rm MgC}l_2$.	
			[1]
		[Total:	9]

Examiner's Use

5

Ammonium 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 laborator Tick one box.	ry?
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. A gas was given off which turned red litmus paper blue.	-tube.
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 ad	idic.
			[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 ₄) ₂ SO ₄ .	
	In t	his formula state:	
	(i)	the number of different types of atoms present,	[1]
	(ii)	the total number of atoms present.	[1]
		[Tota	l: 131

6 Many metals are extracted from their ores by reduction with carbon.

For Examiner's Use

(a) Name the main ore of iron.

F47
111

- (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.

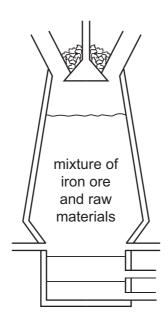
(ii) One of the reactions taking place in the blast furnace is

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

Write a word equation for this reaction.

.....[2]

- (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.

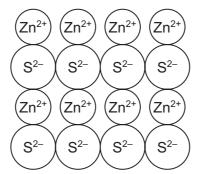


[4]

(c) Zinc is extracted from an ore containing zinc sulfide.

For Examiner's Use

Part of a zinc sulfide structure is shown below.



Suggest the simplest formula for zinc sulfide.

______[1]

[Total: 10]

Examiner's Use

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.	[1]			
		bitumen fuel for home heating				
		fuel oil making roads				
		kerosene waxes and polishes				
		lubricating fraction making chemicals				
		naphtha jet fuel				
			[4]			

Examiner's Use

	acking is used t enes.	o break down long ch	ained alkanes into s	horter chained alkane	s and	
(i)	State two conditions needed for cracking.					
	1					
	2				[2]	
(ii)	hydrocarbon.	rbon, $C_{14}H_{30}$, can be equation for this reaction		e ethene and one	other	
		$C_{14}H_{30} \rightarrow C_2H$	4 +		[1]	
(iii)	Draw the full s	structure of ethene sho	owing all atoms and	bonds.		
(d) State the name of the polymer formed from ethene. [1] (e) Ethene is used to make ethanol. (i) Which substance is needed for this reaction?						
		und the correct answe		otoom		
	ammonia	hydrogen	oxygen	steam	[1]	
(ii) Phosphoric acid is a catalyst in this reaction. What do you understand by the term catalyst?						
					[1]	
				[Total	-1. 401	

(a) Which three of the following conduct electricity? Tick **three** boxes.

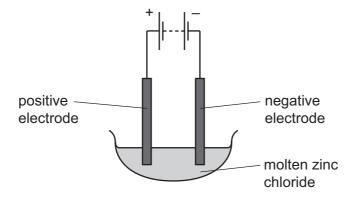
aqueous sodium chloride	
ceramics	
copper	
graphite	
sodium chloride crystals	
sulfur	

[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]

DATA SHEET
The Periodic Table of the Elements

	0	4 He Helium	20 Neon 10 Ar Ar Argon	84 Kr Krypton 36	131 Xe Xenon 54	Rn Radon 86		175 Lu Lutetium 71	Lr Lawrendum 103	
	II/		19 Fluorine 9 35.5 C 1	80 Br Bromine 35	127 I lodine 53	At Astatine 85		173 Yb Ytterbium 70	Nobelium	
			16 Oxygen 8 32 S	79 Se Selenium 34	128 Te Tellurium 52	Po Polonium 84		169 Tm Thullum 69	Md Mendelevium 101	
	>		Nitrogen 7 Nitrogen 31 Phosphorus 15	75 As Arsenic 33	Sb Antimony 51	209 Bi Bismuth		167 Er Erbium 68	Fm Fermium	
	2		Carbon 6 Carbon 8 Silicon 14	73 Ge Germanium 32	Sn In 50	207 Pb Lead		165 Ho Holmium 67	Es Einsteinium 99	
	=	=		11 B Boron 27 A1 Auminium 13	70 Ga Gallium 31	115 In Indium	204 T 1 Thallium		162 Dy Dysprosium 66	Cf Californium 98
				65 Zn Zinc 30	Cd Cadmium 48	201 Hg Mercury 80		159 Tb Terbium 65	BK Berkelium	
				64 Cu Copper 29	108 Ag Silver 47	197 Au Gold		157 Gd Gadolinium 64	Cm Ourium	
Group				59 Ni Nickel	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu Europium 63	Am Americium 95	
Ģ				59 Co Cobalt	103 Rh Rhodium 45	192 I r Iridium 77		Sm Samarium 62	Pu Plutonium 94	
		T Hydrogen		56 Fe Iron 26	Ru Ruthenium 44	190 Os Osmium 76		Pm Promethium 61	Neptunium	
				55 Mn Manganese 25	Tc Technetium 43	186 Re Rhenium 75		144 Nd Neodymium 60	238 U Uranium 92	
				52 Cr Chromium 24	96 Mo Molybdenum 42	184 W Tungsten 74		141 Pr Praseodymium 59	Pa Protactinium 91	
				51 V Vanadium 23	93 Nb Niobium 41	181 Ta Tantalum 73		140 Ce Cerium 58	232 Th Thorium	
				48 Ti Titanium 22	91 Zr Zirconium 40	178 Hf Hafnium			nic mass bol nic) number	
				45 Scandium 21	89 ×	139 La Lanthanum 57 *	Actinium Actinium Actinium Actinium Actinium Actinium Actinium	l series series	a = relative atomic mass X = atomic symbol b = proton (atomic) number	
	=		Be Berylium 4 24 Magnesium 12	40 Ca calcium 20	88 Sr Strontium	137 Ba Barium 56	226 Ra Radium 88	*58-71 Lanthanoid series	« × □	
	_		7 Lithtum 3 23 23 Na Sodium 11	39 K Potassium 19	85 Rb Rubidium 37	133 Cs Caesium 55	Fr Francium 87	*58-71L	Key	

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

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