

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
CHEMISTRY			0620/31
Paper 3 (Extend	ded)	Oct	ober/November 2010
			1 hour 15 minutes
Candidates ans	swer on the Question Paper.		
No Additional M	laterials are required.		

READ THESE INSTRUCTIONS FIRST

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 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	

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



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[Turn over

1 The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons		
Α	15	15	16		
В	15	18	16		
С	15	15	17		

(a)	What is the evidence in the table for each of the following	າg?

(i)	Particle A is an atom.	
		[1]
(ii)	They are all particles of the same element.	
(iii)	Particle B is a negative ion.	
		[2]
(iv)	Particles A and C are isotopes.	
		[2]
(b) (i)	What is the electronic structure of particle A ?	
(ii)	What is the valency of the element?	[1]
		[1]
(iii)	Is the element a metal or a non-metal? Give a reason for your choice.	
		[1]

[Total: 9]

2

About 4 tin.	4000 years ago the Bronze Age started in Britain. Bronze is an alloy of copper and
(a) (i)	Suggest a reason why a bronze axe was better than a copper axe.
	[1]
(ii)	Brass is another copper alloy. Name the other metal in brass.
	[1]
(b) The	e diagram below shows the arrangement of particles in a pure metal.
(i)	What is the name given to a regular arrangement of particles in a crystalline solid?
	[1]
(ii)	Draw a diagram which shows the arrangement of particles in an alloy.
	[2]
(iii)	Explain the term <i>malleable</i> .
	[1]
(iv)	Why are metals malleable?
	[2]

(c)	The	common	ore	of	tin	is	tin(IV)	oxide	and	an	ore	of	copper	is	malachite,
	CuC	O ₃ .Cu(OH)) ₂ .												

3 12	
Write a word equation for the reduction of tin(IV) oxide by carbon.	
	[1]
Malachite is heated to form copper oxide and two other chemicals. Name these chemicals.	
and	[2]
Copper oxide is reduced to copper which is then refined by electrolysis. Label the diagram of the apparatus which could be used to refine copper.	
power supply	
	Malachite is heated to form copper oxide and two other chemicals. Name these chemicals. and Copper oxide is reduced to copper which is then refined by electrolysis. Label the diagram of the apparatus which could be used to refine copper. power

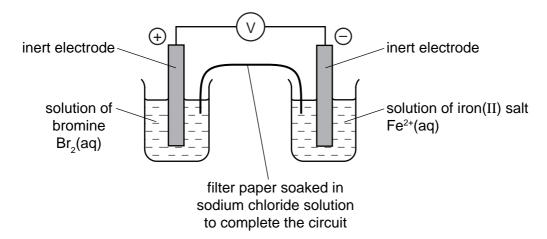
[3]

(iv) Give one use of copper, other than making alloys.

.....[1]

[Total: 15]

3 The diagram shows a cell. This is a device which produces electrical energy. The reaction in a cell is a redox reaction and involves electron transfer.



A cell will change	energy into electrical energy	[1
A cell will change	chergy into electrical energy.	

- (ii) Draw an arrow on the diagram to show the direction of the electron flow. [1]
- (iii) In the left hand beaker, the colour changes from brown to colourless. Complete the equation for the reaction.

$$Br_2 + \dots \rightarrow \dots$$
 [2]

(iv) Is the change in (iii) oxidation or reduction? Give a reason for your choice.

 [1]

(v) Complete the following description of the reaction in the right hand beaker.

(vi) When a solution of bromine is replaced by a solution of chlorine, the voltage increases. When a solution of bromine is replaced by a solution of iodine, the voltage decreases.

Suggest an explanation for this difference.

 [1]

[Total: 7]

Ammor	Ammonia is an important industrial chemical.					
(a) (i)	(i) Give the electron structure of an atom of nitrogen.					
						[1]
(ii)	Use this electronic structure formula of ammonia is NH ₃ r		an the val	ency of ni	trogen, to	explain why the
						[2]
(b) Am	monia is made by the Haber	Process.				
N_2	g) + $3H_2(g) \rightleftharpoons 2NH_3(g)$ for	ward reac	tion is exc	othermic		
_	e percentage of ammonia in the				with condi	itions
	percentage of animorna in a	TO OQUIIDIT		io varioo	With Corre	1
	pressure/atmospheres	100	200	300	400	
	% ammonia at 300 °C	45	65	72	78	
	% ammonia at 500 °C	9	18	25	31	
The	e conditions actually used are	200 atmo	spheres,	450°C an	d an iron	catalyst.
(i)	The original catalyst was pla	tinum. Su	ggest a re	ason why	it was ch	anged to iron.
						[1]
(ii)	Explain why the highest pre	ssure give	es the hia	hest perce	entage of	ammonia in the
(/	equilibrium mixture.	300o go			ormage or	
						[2]
(iii)	What happens to the unread	ted nitroge	en and hy	drogen?		
[1]						

5 Monomers polymeri	se to form	polymers o	r macromolecules.
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(a) (i)	Explain the term <i>polymerise</i> .	
	r	41

	[1]
ii)	There are two types of polymerisation - addition and condensation. What is the difference between them?
	[2]

(b) An important monomer is chloroethene which has the structural formula shown below.

$$C = C$$

It is made by the following method.

$$C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$$
 dichloroethane

This is heated to make chloroethene.

$$C_2H_4Cl_2 \rightarrow C_2H_3Cl + HCl$$

(i) Ethene is made by cracking alkanes. Complete the equation for cracking dodecane.

$$C_{12}H_{26} \rightarrow \dots + 2C_2H_4$$
 [1]

Another method of making dichloroethane is from ethane.

$$C_2H_6 + 2Cl_2 \rightarrow C_2H_4Cl_2 + 2HCl$$

(ii) Suggest a reason why the method using ethene is preferred.

	[4]

(iii) Describe an industrial method of making chlorine.

 	 [2]

(iv) Draw the structural formula of poly(chloroethene).

Include three monomer units.

For Examiner's Use

[2]

[Total: 9]

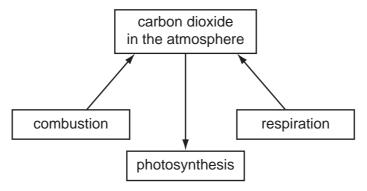
6 The table below shows the elements in the second period of the Periodic Table and some of their oxidation states in their most common compounds.

element	Li	Ве	В	С	N	0	F	Ne
number of outer electrons	1	2	3	4	5	6	7	8
oxidation state	+1	+2	+3	+4	-3	-2	-1	0

(a) (i)	What does it mean when the only oxidation state of an element is zero?
	[1]
(ii)	Explain why some elements have positive oxidation states but others have negative ones.
	[2]
(iii)	Select two elements in the table which exist as diatomic molecules of the type X ₂ .
(b) Be	ryllium hydroxide, a white solid, is an amphoteric hydroxide.
(i)	Name another metal which has an amphoteric hydroxide. [1]
(ii)	Suggest what you would observe when an excess of aqueous sodium hydroxide is added gradually to aqueous beryllium sulfate.
	[2]
(c) (i)	Give the formulae of lithium fluoride and nitrogen fluoride.
	lithium fluoride
	nitrogen fluoride[2]

(ii)	Predict two differences in their properties.
	[2]
(iii)	Explain why these two fluorides have different properties.
	[2]
	[Total: 13]

7 The diagram shows part of the carbon cycle. This includes some of the processes which determine the percentage of carbon dioxide in the atmosphere.



(i)	Carbon dioxide is one greenhouse gas. Name another one.
	[1]
(ii)	Explain the term <i>respiration</i> and how this process increases the percentage of carbon dioxide in the atmosphere.
	[3]
iii)	Explain why the combustion of waste crop material should not alter the percentage of carbon dioxide in the atmosphere.
	[2]
iv)	In 1960 the percentage of carbon dioxide in the atmosphere was 0.032% and in 2008 it was 0.038%. Suggest an explanation for this increase.
	[2]

[Total: 8]

8	Soluble salts	can be	made	using a	hase and	an	acid
U	Outuble Sails	can be	mauc	using a	Dasc and	an	aciu.

(a) Complete this method of preparing dry crystals of the soluble salt cobalt(II) chloride-6-water from the insoluble base cobalt(II) carbonate.

Step 1
Add an excess of cobalt(II) carbonate to hot dilute hydrochloric acid.
Step 2
Step 3
Step 4
[4]

(b) 6.0 g of cobalt(II) carbonate was added to 40 cm³ of hydrochloric acid, concentration 2.0 mol/dm³. Calculate the maximum yield of cobalt(II) chloride-6-water and show that the cobalt(II) carbonate was in excess.

$$\begin{split} \mathsf{CoCO_3} \ + 2\mathsf{HC}l \ \to \ \mathsf{CoC}l_2 \ + \ \mathsf{CO_2} \ + \ \mathsf{H_2O} \\ \\ \mathsf{CoC}l_2 \ + \ \mathsf{6H_2O} \ \to \ \mathsf{CoC}l_2.\mathsf{6H_2O} \end{split}$$

Maximum yield

Number of moles of HCl used =	
Number of moles of $CoCl_2$ formed =	
Number of moles of $CoCl_2$.6H ₂ O formed =	
Mass of one mole of $CoCl_2$.6H ₂ O = 238 g	
Maximum yield of $CoCl_2.6H_2O = \dots$ g	[4]
To show that cobalt(II) carbonate is in excess	
Number of moles of HCl used = (use value from above)	
Mass of one mole of $CoCO_3 = 119g$	
Number of moles of CoCO ₃ in 6.0 g of cobalt(II) carbonate =	[1]
Explain why cobalt(II) carbonate is in excess	
	[1]
[Total:	10]

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DATA SHEET
The Periodic Table of the Elements

=								Ď	Group			■	2	>	>	5	c
=												≣	2	>	>	= >	
					-		1 H Hydrogen										Helium
9 Beryllum												2 a Soron	12 C	14 N itrogen	16 Oxygen	19 Fluorine	20 Neon
4 2 4 7												5		7	8 22	9 27 77 77	10
D D												AI	i i			75	Ā
Magnesium 12												Aluminium 13	Silicon 14	Phosphorus 15	Sulfur 16	Chlorine 17	Argon 18
45 48 51 52 55	48 51 52 55	51 52 55	52 55	22			26	29	59	64		70	73	75	62	80	84
Sc Ti V Cr Mn	Sc Ti V Cr Mn	Cr Mn	Cr	Mn			Ъ	ပိ	Z	చె	Zu	Ga		As	Se	Ā	궃
Manganese 25	Scandium Titanium Vanadium Chromium Manganese 21 24 25	tanium Vanadium Chromium Manganese 23 24 25	Chromium Manganese 24 25	Manganese 25			Iron 26	Cobalt 27	Nickel 28	Copper 29	Zinc 30	Gallium 31	Germanium 32	Arsenic 33	Selenium 34	Bromine 35	Krypton 36
89 91 93 96	91 93 96	93 86	96				101	103	106	108		115	119	122	128	127	131
Y Zr Nb Mo Tc	Y Zr Nb Mo Tc	Nb Mo Tc	Mo	ည			Ru	R	Pd	Ag	ဦ	In	Sn	Sb	<u>P</u>	Ι	Xe
Strontium Yttrium Zirconium Niobium Molybdenum Technetium 38 39 40 41 42 43 43 43	Yttrium Zirconium Niobium Molybdenum Technetium 39 40 41 42 43	Niobium Molybdenum Technetium 41 43	liobium Molybdenum Technetium 42 43	Technetium 43		4	Ruthenium 44	Rhodium 45	Palladium 46		Cadmium 48	Indium 49	Tin 50	Antimony 51	Tellurium 52	lodine 53	Xenon 54
139 178 181 184	178 181 184	181 184	184		186		190	192	195	197	201	204	207	209			
La Hf Ta W Re	La Hf Ta W Re	Ta W Re	W	Re					Ŧ	Αn		11		Ö		Αt	R
Barium Lanthanum Hafnium Tantalum Tungsten Rhenlum 56 77 73 74 75	Lanthanum Hafnlum Tantalum Tungsten Rhenlum 57 * 72 73 74 75	Hafnium Tantalum Tungsten Rhenium 72 73 74 75	ntalum Tungsten Rhenium 75	Rhenium 75			Osmium 76	Iridium 77	Platinum 78	Gold 79	Mercury 80	Thallium 81	Lead 82	Bismuth 83	Polonium 84	Astatine 85	Rado 86
226 227 Ra Ac	227 Ac																
89	- 88																
141	140 141	141	141	141 144	144			150	152	157	159	162	165	167	169	173	175
Ce Pr Nd Cerúm Praseodymum Neodymum 58 69 60	Ce Pr Nd Cerúm Praseodymum Neodymum 58 69 60	Ce Pr Nd Serium Praseodymium Neodymium 59 60	Ce Pr Nd Serium Praseodymium Neodymium 59 60	Neodymium S0	Neodymium S0		Pm Promethium 61	Samarium 62	Eu Europium 63	Gd Gadolinium 64	Tb Terbium 65	Dy Dysprosium 66	Holmium 67	Er Erbium 68	Tm Thulium	Yb Ytterbium 70	Lutetium 71
238	232 238	232 238	238	238	238	_											
Pa	Th Pa U	Th Pa U	Pa	⊃	⊃		Ν		Am		쓢	ర	Es	Fm	Md	8 N	בֿ
Thorium Protactinium Uranium 91	Thorium Protactinium Uranium 90 91	Thorium Protactinium Uranium 90 91	Thorium Protactinium Uranium 92	Uranium 92	Uranium 92		Neptunium 93	Plutonium 94	Americium 95	Curium 96	Berkelium 97	Californium 98	Einsteinium 99	Fermium 100	Mendelevium 101	Nobelium 102	Lawrendu 103

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

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