



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

i apei 5 (Exteri	ueu)		1 hour 15 minutes
Paper 3 (Extend	ded)		May/June 2007
CHEMISTRY			0620/03
CENTRE NUMBER		CANDIDATE NUMBER	
CANDIDATE NAME			

#### **READ THESE INSTRUCTIONS FIRST**

No Additional Materials required.

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen in the spaces provided on the Question Paper.

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

This document consists of 14 printed pages and 2 blank pages.



1

A major	source of energy is the combustion of fossil fuels.		For Examiner's
(a) (i)	Name a solid fossil fuel.		Use
		[1]	
(ii)	Name a gaseous fossil fuel.		
		[1]	
(b) Pet	roleum is separated into more useful fractions by fractional distillation.		
(i)	Name <b>two</b> liquid fuels obtained from petroleum.		
	and	[2]	
(ii)	Name <b>two</b> other useful products obtained from petroleum that are not used fuels.		
(ii)	Name two other useful products obtained from petroleum that are not used		
(ii) (iii)	Name <b>two</b> other useful products obtained from petroleum that are not used fuels.	as [2]	
	Name <b>two</b> other useful products obtained from petroleum that are not used fuels.  and  Give another mixture of liquids that is separated on an industrial scale by fraction	as [2]	

# **2** Complete the following table.

For Examiner's Use

type of structure	particles present	electrical conductivity of solid	electrical conductivity of liquid	example
ionic	positive and negative ions	poor		
macro molecular	atoms of two different elements in a giant covalent structure	poor	poor	
metallic	and	good		copper

[Total: 6]

For Examiner's Use

			4		
3	There a	re three methods	of preparing salts.		
	Method	A – use a burette	and an indicator.		
	Method	<b>B</b> – mix two solut	ions and obtain the salt by	precipitation.	
	Method	C – add an exce filtration.	ess of base or a metal to a	a dilute acid and remove the exces	s by
			salt preparations, choose of and then write or complet	one of the methods <b>A</b> , <b>B</b> or <b>C</b> , name be the equation.	any
	(i)	the soluble salt,	zinc sulphate, from the insc	oluble base, zinc oxide	
		method reagent			
		word equation			[3]
	(ii)	the soluble salt,		e soluble base, potassium hydroxid	
		method			
		reagent			
		equation	+	$\rightarrow$ KC $l$ + H <sub>2</sub> O	[3]
	(iii)	the insoluble sal	t, lead(II) iodide, from the s	oluble salt, lead(II) nitrate	
		method			

equation  $Pb^{2+}$  —  $\rightarrow$  [4] [Total: 10]

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reagent

4	Us	e you	ır copy of the pe	eriodic table to help you answer these questions.		For Examiner's
	(a)	Pre	dict the formula	of each of the following compounds.		Use
		(i)	barium oxide		[1]	
		(ii)	boron oxide		[1]	
	(b)	Giv	e the formula of	f the following ions.		
		(i)	sulphide		[1]	
		(ii)	gallium		[1]	
	(c)			nowing the arrangement of the valency electrons in one molecule bund nitrogen trichloride.	e of	
				an electron from a nitrogen atom. an electron from a chlorine atom.	[3]	
	(d)	Pot	assium and var	nadium are elements in Period IV.		
	. ,	(i)	State <b>two</b> diffe	erences in their physical properties.		
					[2]	
		(ii)	Give <b>two</b> differ	rences in their chemical properties.		
					[2]	
					i–1	

(e)		orine and astatine are halogens. Use your knowledge of the other halogens dict the following:	to	For Examiner's Use
	(i)	The physical state of fluorine at r.t.p.		
		The physical state of astatine at r.t.p.	[2]	
	(ii)	Two similarities in their chemical properties		
			[2]	
		[Total 1	[5]	

5	(a)		anium is produced by the reduction of its chloride. This is heated with magnesium in inert atmosphere of argon.	For Examiner's Use
			$TiCl_4 + 2Mg \rightarrow Ti + 2MgCl_2$	
		(i)	Explain why it is necessary to use argon rather than air.	
			[1]	
		(ii)	Name another metal that would reduce titanium chloride to titanium.	
			[1]	
		(iii)	Suggest how you could separate the metal, titanium, from the soluble salt magnesium chloride.	ו
			[2]	
	(b)		anium is very resistant to corrosion. One of its uses is as an electrode in the cathodic tection of large steel structures from rusting.	
			steel oil rig which is cathode  sea water contains H+(aq), OH-(aq), Na+(aq), CI-(aq)	
		(i)	Define oxidation in terms of electron transfer.	
		(ii)	The steel oil rig is the cathode. Name the gas formed at this electrode.	
			[1]	
		(iii)	Name the <b>two</b> gases formed at the titanium anode.	
			and[2]	
		(iv)	Explain why the oil rig does not rust.	
			[2]	

(v)	Another way of protecting steel from corrosion is sacrificial protection.  Give <b>two</b> differences between sacrificial protection and cathodic protection.	For Examiner's Use
	[2	2]
	[Total: 12	,

For Examiner's Use

Aluminium is extracted by the electrolysis of a molten mixture that contains alumina, which is aluminium oxide, $Al_2O_3$ .
(a) The ore of aluminium is bauxite. This contains alumina, which is amphoteric, and iron(III) oxide, which is basic. The ore is heated with aqueous sodium hydroxide. Complete the following sentences.
The dissolves to give a solution of
Thedoes not dissolve and can be removed by [4]
(b) Complete the labelling of the diagram.
carbon anode (+)  mixture of aluminium oxide and
(c) The ions that are involved in the electrolysis are $Al^{3+}$ and $O^{2-}$ .
(i) Write an equation for the reaction at the cathode.
(ii) Explain how carbon dioxide is formed at the anode.

6

[2]

(d)	Give an explanation for each of the following.				
	(i)	Aluminium is used extensively in the manufacture of aircraft.		Examiner's Use	
			[1]		
	(ii)	Aluminium is used to make food containers.			
			[2]		
(	(iii)	Aluminium electricity cables have a steel core.			
			[1]		
		[Total:	161		

7 Esters, fats and polyesters all contain the ester linkage.

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[2]

(a) The structural formula of an ester is given below.

Name **two** chemicals that could be used to make this ester and draw their structural formulae. Show all bonds.

	nam	es	and	[2]
	struc	tural formulae		
				[2]
(b)	(i) I	Draw the structural formula of a polyester	uch as <i>Terylene</i> .	

(ii)	Suggest a use for this polymer.	
		[1]

(c) Cooking products, fats and vegetable oils, are mixtures of saturated and unsaturated esters.

For Examiner's Use

The degree of unsaturation can be estimated by the following experiment. 4 drops of the oil are dissolved in  $5\,\mathrm{cm}^3$  of ethanol. Dilute bromine water is added a drop at a time until the brown colour no longer disappears. Enough bromine has been added to the sample to react with all the double bonds.

cooking product	mass of saturated fat in 100 g of product/g	mass of unsaturated fat in 100 g of product/g	number of drops of bromine water
margarine	35	35	5
butter	45	28	4
corn oil	10	84	12
soya oil	15	70	10
lard	38	56	

(i) Complete	the one blank space in the table.	[1]
--------------	-----------------------------------	-----

(ii) Complete the equation for bromine reacting with a double bond.

$$C=C$$
 +  $Br_2$   $\longrightarrow$  [2]

(iii)	Using saturated fats in the diet is thought to be a major cause of heart disea Which of the products is the least likely to cause heart disease?	se.
		[1]

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(d)	A better way of measuring the degree of unsaturation is to unsaturated compound. This is the mass of iodine that rea in 100 g of the fat.	
	Use the following information to calculate the number of d of the fat.	ouble bonds in one molecule
	Mass of one mole of the fat is 884 g.	
	One mole of $I_2$ reacts with one mole $C=C$ .	
	The iodine number of the fat is 86.2g.	
	Complete the following calculation.	
	100 g of fat reacts with 86.2 g of iodine.	
	884 g of fat reacts with	g of iodine.
	One mole of fat reacts with	moles of iodine molecules.
	Number of double bonds in one molecule of fat is	[3]
		[Total:14]

14

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15

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DATA SHEET
The Periodic Table of the Elements

								Gre	Group								
_	=											≡	≥	>	>		0
							- <b>I</b>										4 <b>H</b>
							nydrogen 1										Helium 2
7	o					-						7	12	14	16	19	20
=	Be											Ω	ပ	z	0	щ	Ne
Lithium 3	Beryllium 4											Boron 5	Carbon 6	Nitrogen 7	Oxygen 8	Fluorine 9	Neon 10
23	24											27	28	31	32	35.5	40
Na	Mg											Αl	Si	۵	S	10	Ar
Sodium 11	Magnesium 12											Aluminium 13	Silicon 14	Phosphorus 15	Sulphur 16	Chlorine 17	Argon 18
39	40	45	48	51	52	55	26	59	29	64	65	20	73	75	62	80	84
×	Sa	လွ	j	>	ပ်	M	Fe	ပိ	Z	చె	Zu	Ga	Ge	As	Se	ğ	궃
Potassium 19	Calcium 20	Scandium 21	Titanium 22	Vanadium 23	Chromium 24	Manganese 25	Iron 26	Cobalt 27	Nickel 28	Copper 29	Zinc 30	Gallium 31	Germanium 32	Arsenic 33	Selenium 34	Bromine 35	Krypton 36
85	88	88	91	63	96		101	103	106	108	112	115	119	122	128	127	131
Rb	Š	>	Zr	g		ပ	Ru	Rh	Pd	Ag	පි	In	Sn	Sb	<u>е</u>	Ι	Xe
Rubidium 37	Strontium 38	Yttrium 39	Zirconium 40	Niobium 41	Molybdenum 42	Technetium 43	Ruthenium 44	Rhodium 45	Palladium 46	Silver 47	Cadmium 48	Indium 49	Tin 50	Antimony 51	Tellurium 52	lodine 53	Xenon 54
133	137	139	178	181	184	186	190	192	195	197	201		207	509			
S	Ba	Га	Ξ	Та		Re	SO.	ŀ	Ŧ		₽	<i>1</i> 1	РЬ	Ξ		¥	Ru
Caesium 55	Barium 56	Lanthanum 57 *	Hafnium 72	Tantalum 73	Tungsten 74	Rhenium 75	Osmium 76	Iridium 77	Platinum 78	Gold 79	Mercury 80	Thallium 81	Lead 82	Bismuth 83	Polonium 84	Astatine 85	Radon 86
ı	226	227															
בׁ	ξ g	Ac															
Francium 87	Radium 88	89 †	,														
*58-71	*58-71 Lanthanoid series	id sprips		140	141	144		150	152	157	159	162	165	167	169	173	175
190-103	190-103 Actinoid series	series		ဗီ ်	<b>-</b>	P	Pm		En		ᅀ	و	운	ш	ַ בַּ	Yb	r.
Ĺ				S8	Fraseodymium 59	Neodymium 60	Frometrium 61	Samarium 62	europium 63	Gadolinium 64	erpium 65	Dysprosium 66	Holmium 67	eronum 68		70	Lutetium 71
	a a	a = relative atomic mass	ic mass	232		238											
Key	×	X = atomic symbol	loc	Ħ	Ра	>	ď	Pu	Am	Cm	Ř	ర			Md		۲
q		b = proton (atomic) number	ic) number	Thorium 90	Protactinium 91	Uranium 92	Neptunium 93	Plutonium 94	Americium 95	Curium 96	Berkelium 97	Californium 98	Einsteinium 99	Fermium 100	Mendelevium 101	Nobelium 102	Lawrencium 103
			_										1	1			

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