



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CANDIDATE NAME		
CENTRE NUMBER	CANDIDATE NUMBER	

CHEMISTRY

0620/03

Paper 3 (Extended)

May/June 2007

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials 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 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 Exam	For Examiner's Use	
1		
2		
3		
4		
5		
6		
7		
Total		

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



A majo	A major source of energy is the combustion of fossil fuels.			
(a) (i)	Name a solid fossil fuel.			
(ii)	Name a gaseous fossil fuel.			
	[1]			
(b) Pe	troleum is separated into more useful fractions by fractional distillation.			
(i)	Name two liquid fuels obtained from petroleum.			
	and[2]			
(ii)	Name two other useful products obtained from petroleum that are not used as fuels.			
	and[2]			
(iii)	Give another mixture of liquids that is separated on an industrial scale by fractional distillation.			
	[1]			
	[Total: 7]			

1

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]

			4
3	There a	re three methods	of preparing salts.
	Method	A – use a burette	and an indicator.
	Method	B – mix two soluti	ons and obtain the salt by precipitation.
	Method	C – add an exce filtration.	ss of base or a metal to a dilute acid and remove the excess by
			salt preparations, choose one of the methods A , B or C , name any and then write or complete the equation.
	(i)	the soluble salt, z	rinc sulphate, from the insoluble base, zinc oxide
		method	
		reagent	
		word equation	[3]
	(ii)	the soluble salt, p	potassium chloride, from the soluble base, potassium hydroxide
		method	
		reagent	
		equation	+ → KC <i>l</i> + H ₂ O [3]
	(iii)	the insoluble salt	, lead(II) iodide, from the soluble salt, lead(II) nitrate
		method	
		reagent	
		equation Pb ²⁺ +	<u> </u>

[Total: 10]

4

Use	Use your copy of the periodic table to help you answer these questions. For Examiner					
(a)	(a) Predict the formula of each of the following compounds.					
((i)	barium oxide		[1]		
(ii)	boron oxide		[1]		
(b)	Give	e the formula of	the following ions.			
((i)	sulphide		[1]		
(ii)	gallium		[1]		
(c)			nowing the arrangement of the valency electrons in one molecule bund nitrogen trichloride.	: of		
			an electron from a nitrogen atom. an electron from a chlorine atom.	[3]		
(d)	Pota	assium and van	adium are elements in Period IV.			
	(i)	State two diffe	rences in their physical properties.			
				[2]		
	(ii)	Give two differ	rences in their chemical properties.			
				[2]		

(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	15]	

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5		anium is produced by the reduction of its chloride. This is heated with magnesium in inert atmosphere of argon.
		$TiCl_4 + 2Mg \rightarrow Ti + 2MgCl_2$
	(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.
		[2]
		anium is very resistant to corrosion. One of its uses is as an electrode in the cathodic stection of large steel structures from rusting.
		steel oil rig which is cathode sea water contains H+(aq), OH-(aq), Na+(aq), CT-(aq)
	(i)	Define oxidation in terms of electron transfer.
	(ii)	The steel oil rig is the cathode. Name the gas formed at this electrode.
	(iii)	Name the two 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 two differences between sacrificial protection and cathodic protection.	For Examiner's Use
	[2]	
	[Total: 12]	

6

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. dissolves to give a solution of does not dissolve and can be removed by [4] (b) Complete the labelling of the diagram. waste gases carbon anode (+) mixture of aluminium oxide and temperature is [4] (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. [2] (ii) Explain how carbon dioxide is formed at the anode. [2]

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(d)	l) 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:	16]	

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

For Examiner's Use

[2]

[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.

names		and	[2]
structura	ıl formulae		

(b) (i) Draw the structural formula of a polyester such as Terylene.

(ii)	Suggest a use for this polymer.	
		Г1

(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 cm³ 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	

,-	2) Consults the conclusion of the table	F41
(I	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 tunsaturated compound. This is the mass of iodine that read in 100 g of the fat.	
	Use the following information to calculate the number of do of the fat.	ouble bonds in one molecule
	Mass of one mole of the fat is 884g.	
	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]

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DATA SHEET
The Periodic Table of the Elements

	0	4 He Helium	20 Neon 10 At Argon	Krypton 36 X	Radon 86	Lutetium 71 Lawrencium 22
	=>		19 Fluorine 9 35.5 C1 Chlorine	80 Br Bromine 35 I I I I I I I I I I I I I I I I I I	At Astatine 85	Yb Ytterbium 70 No
	5		16 Oxygen 8 32 Suphur 16	Selenium 34 128 Tellurium 52	Po Polonium 84	Tm Thulium 69 Md
	>		14 Nitrogen 7 31 Phosphorus 15	75	209 Bismuth 83	Erbium 68 Fm Fermium
	≥		12 Carbon 6 Silicon 14	Germanium 32 119 Sn Tin 50	207 Pb Lead	Holmium 67 RS Einsteinium
	≡		11 B Boron 5 27 A1 Auminium	Gallum 31 115 Indium 49	204 T.t Thallium 81	162 Dy Dysprosium 66 Cf Californium
				65 Zn Znc 30 Znc 412 Cd Cadmium 48	Hg Mercury 80	Tb Terbium 65 BK Berkelium
				64 Copper 29 108 Ag Silver	197 Au Gold 79	Gd Gadolinium 64 Cm Curium
Group				59 Nickel 28 106 Pd Palladium 46	195 Pt Platinum 78	152 Eu Europium 63 Am Americium
Gre				59 Cobalt 27 103 Rhodium 45	192 Ir Indium 77	Samarium 62 Pu
		T Hydrogen		56 Fe Iron 26 101 Ru Ruthenium 44	190 Os Osmium 76	Pm Promethium 61 Np Neptunium
				Mn Manganese 25 TC Technetium 43	186 Re Rhenium 75	Neodymium 60 238 Uranium
				Chromium 24 S6 Mo	184 W Tungsten 74	Praseodymium 59 Praseodymium Pa
				Vanadium 23 93 Nicbium Nicbium 41	Tantalum	Cerium 58 232 Th
				48 Titanium 22 91 St. Zirconium 40	178 # Hafnium 72	nic mass bol hoc) number
				Scandium 21 89	Lanthanum 57 * ACtinium Actinium 1890	oid series 1 series a = relative atomic mass X = atomic symbol b = proton (atomic) number
	=		Beryllium 4 24 Mgg	Calcium 20 R8 88 Strontium 38	137 Ba Barium 56 226 Ra Radium	inoic
	_		7 Lithium 3 23 Na Sodium 11	39 K Potassium 19 85 Rb Rubidium 37	CS Caesium 55 Francium	*58-71 L 190-103 Key

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