

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

	CANDIDATE NAME		
	CENTRE NUMBER	CANDIDATE NUMBER	
*			
6	CHEMISTRY		0620/31
4 5	Paper 3 (Extend	ded)	May/June 2011
≥ 0			1 hour 15 minutes
1 8	Candidates ans	wer on the Question Paper.	
~ ~	No Additional M	aterials 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 12.

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					
8					
Total					

This document consists of **11** printed pages and **1** blank page.



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1	The foll	owing techniques are used	to separate mixtures.		For Examiner's			
	,	A simple distillation	B fractional distillation	C evaporation	Use			
		D chromatography	E filtration	F diffusion				
	From th	is list, choose the most suit	able technique to separate the	e following.				
	(a) me	thane from a mixture of the	gases, methane and ethane .	[1]				
	(b) wat	ter from aqueous magnesiu	m sulfate	[1]				
	(c) gly	cine from a mixture of the a	mino acids, glycine and lysine	[1]				
	(d) iror	[1]						
	(e) zine	c sulfate crystals from aque	ous zinc sulfate	[1]				
	(f) hex	ane from a mixture of the li	quids, hexane and octane	[1]				
				[Total: 6]				
2	Seleniu	m and sulfur are in Group \	 They have similar propertie 	S.				
	(a) One of the main uses of selenium is in photoelectric cells. These cells can change light into electrical energy.							
	(i) Name a process which can change light into chemical energy.							
	(ii)	Name a device which can	change chemical energy into	electrical energy. [2]				
	(b) The	e electron distribution of a s	elenium atom is 2 + 8 + 18 + 6	6.				
	(i)	the formula of this ionic co the valency electrons are Use o to represent an elec	compound with potassium. Dra mpound, the charges on the id und the negative ion. ctron from an atom of potassiu ctron from an atom of selenium	ons and the arrangement of Im.				

2

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	3	
	 (ii) Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound selenium chloride. Use x to represent an electron from an atom of selenium. Use o to represent an electron from an atom of chlorine. 	For Examiner's Use
	(iii) Predict two differences in the physical properties of these two compounds.	
	[2]	
(c)	The selenide ion reacts with water.	
	Se ²⁻ + H ₂ O \rightarrow HSe ⁻ + OH ⁻	
	What type of reagent is the selenide ion in this reaction? Give a reason for your choice. [3] [Total: 13]	
of t	from the blast furnace is impure. It contains about 4 % carbon and 0.5 % silicon. Most his impure iron is used to make mild steel, an alloy of iron containing less then 0.25 % bon.	
(a)	A jet of oxygen is blown through the molten iron in the presence of a base, usually calcium oxide. Explain how the percentage of carbon is reduced and how the silicon is removed.	
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3

(b)	(i)	Why are steel alloys used in preference to iron?	For Examiner's Use
	(ii)	State a use of the following alloys.	
		mild steel	
(c)	Bot	stainless steel	
()		electrons.	
	(i)	Suggest an explanation for why they have high melting points.	
		[2]	
	(ii)	Explain why, when a force is applied to a piece of steel, it does not break but just	
	. ,	changes its shape.	
		[2] [Total: 11]	
	•	ore of zinc is zinc blende, ZnS. A by-product of the extraction of zinc from this ore is ioxide which is used to make sulfuric acid.	
(a)	(i)	Zinc blende is heated in air. Zinc oxide and sulfur dioxide are formed. Write the balanced equation for this reaction.	
	(ii)	Zinc oxide is reduced to zinc by heating with carbon. Name two other reagents which could reduce zinc oxide.	
		[2]	
	(iii)	The zinc obtained is impure. It is a mixture of metals. Explain how fractional distillation could separate this mixture. zinc bp = 908 °C, cadmium bp = 765 °C, lead bp = 1751 °C	
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4

4

The forward reaction is exothermic. The conditions used are:
temperature: 450 °C pressure: 2 atmospheres catalyst: vanadium(V) oxide
Explain, mentioning both position of equilibrium and rate, why these conditions give the most economic yield.
[4]
[Total: 10]
Hydriodic acid, HI(aq), is a strong acid. Its salts are iodides.
(a) It has the reactions of a typical strong acid. Complete the following equations.
(i)Li +HI \rightarrow (1]
(ii) $zinc + hydriodic \rightarrow \dots + \dots + \dots + \dots + \dots$ carbonate + acid $\rightarrow \dots$ [1]
(iii) MgO +
your choice.
 (c) Describe how you could distinguish between hydriodic, HI(aq), and hydrobromic, HBr(aq) acids, by bubbling chlorine through these two acids.
result with hydriodic acid
result with hydrobromic acidwww.sparkl.me

 $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

(b) Sulfur dioxide is used to make sulfur trioxide in the Contact Process.

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5

(d) 20.0 cm³ of aqueous sodium hydroxide, 2.00 mol/dm³, was placed in a beaker. The temperature of the alkali was measured and 1.0 cm³ portions of hydriodic acid were added. After each addition, the temperature of the mixture was measured. Typical results are shown on the graph.

6 The structural formula of a butanol is given below.

 $CH_3 - CH_2 - CH_2 - CH_2 - OH$

petroleum \rightarrow butene \rightarrow butanol

- (a) Butanol can be made from petroleum and also by fermentation.
 - (i) Describe the chemistry of making butanol from petroleum by the following route.

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(ii)	Explain, in general terms, what is meant by <i>fermentation</i> .
	[3]
	tanol can be oxidised to a carboxylic acid by heating with acidified potassium nganate(VII). Give the name and structural formula of the carboxylic acid.
nai	me[1]
stru	uctural formula
	[1]
	tanol reacts with ethanoic acid to form a liquid, X , which has the sweet smell of nanas. Its empirical formula is $C_{3}H_{6}O$ and its M_{r} is 116.
(i)	What type of compound is liquid X ?
(ii)	Give the molecular formula of liquid X .
	[1]
(iii)	Draw the structural formula of X. Show all the individual bonds.

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[Total: 12]

7 Excess hydrochloric acid was added to powdered zinc. The hydrogen evolved was collected and its volume measured every 20 seconds.

The experiments were repeated at the same temperature using the same number of moles of powdered magnesium and aluminium.



(a) Identify metals A, B and C by choosing from zinc, magnesium and aluminium. Give a reason for each choice.



(b) Using 'moles', explain why two of the metals form the same volume of hydrogen but the third metal forms a larger volume.

[3]

[Total: 8]

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- 8 There are two types of polymerisation - addition and condensation.
 - (a) Explain the difference between them.

.....

(b) Poly(dichloroethene) is used to package food. Draw its structure. The structural formula of dichloroethene is shown below.



(c) The polymer known as PVA is used in paints and adhesives. Its structural formula is shown below.

0620/31/M/J/11

Deduce the structural formula of its monomer.

[1]

[2]

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(d) A condensation polymer can be made from the following monomers.

HOOC(CH_2)₄COOH and $H_2N(CH_2)_6NH_2$

Draw the structural formula of this polymer.

[3]

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[Total: 8]

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11

	0	4 Helium 2	20 Neon 10 Argon 18 Argon	84 Krypton 36	131 Xenon 54	Radon 86		175 Lu Lutetium 71	Lr Lawrencium 103
	VII		19 F luorine 35.5 C1 Chlorine	80 Br Bromine 35	127 I Iodine 53	At Astatine 85		173 Yb Ytterbium 70	Nobelium 102
	5	1	16 8 Oxygen 32 32 16 Sulfur 16	79 Selenium 34	128 Te lluňum 52	Polonium 84		169 Tm Thulium 69	Mendelevium 101
	>		14 Nitrogen 31 Phosphorus 15	75 AS Arsenic 33	122 Sb Antimony 51	Bismuth 83		167 Er Erbium 68	Fermium 100
	≥		6 Carbon 6 28 28 14 Silicon	73 Ge Germanium 32	119 Sn 207	20 Lead 82		165 Holmium 67	Einsteinium 99
	≡		11 B Boron 5 Auminium 13	70 Ga Galium 31	115 In Indium 49 204	Thallium 81		162 Dy Dysprosium 66	Cf Californium 98
ints				65 Zn ^{Zinc}	112 Cadmium 48	Mercury 80		159 Tb Terbium 65	BK Berkelium 97
The Periodic Table of the Elements Group				64 Cu ^{Copper}	108 AG 83iver 107	Au Gold 79		157 Gd Gadolinium 64	Cm ^{Curium} 96
: Table of th Group				59 Nickel 28	106 Pd Palladium 46	Platinum 78		152 Eu Europium 63	Americium 95
iodic Ta Gre	T Hydrogen		59 CO ²⁷	103 Rhođium 45	Iridium 77		150 Sm Samarium 62	Plutonium 94	
		Hydrogen		56 Fe Iron 26	101 Ru Ruthenium 44	Osmium 76		Promethium 61	Neptunium 93
				55 Mn ^{Manganese} 25	Tc Technetium 43	Renium		144 Neodymium 60	238 U Uranium 92
				52 Cr Chromium 24	96 MO Molybdenum 42	Tungsten 74		141 Pr Fraseodymium 59	Protactinium 91
				51 Vanadium 23	93 Niobium 41	Tantalum 73		140 Ce Cerium 58	232 Th 90
				48 Titanium 22	91 Zr Zirconium 40	Hathium			nic mass ool nic) number
				45 Sc Scandium 21	89 Yttrium 39	Lanthanum 57 *	Actinium 89 †	series eries	a = relative atomic mass X = atomic symbol b = proton (atomic) number
	=		9 Be Berylium 4 24 Ng Magnesium 12	40 Caa catcium 20	88 Strontium 38 137	Barium 56 226	Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series	р= ж р= ж р= ж
	_		7 Lithium 3 Lithium 23 23 23 23 11	39 K Potassium 19	85 Rb Rubidium 37	Caesium 55	Fr Francium 87	8-71 L ⁽ 0-103 /	key b

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