

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

CHEMISTRY Paper 3 (Extend	d a d)		0620/33 May/June 2012
CHEMISTRY			0620/22
CENTRE NUMBER		CANDIDATE NUMBER	
CANDIDATE NAME			

Candidates answer on the Question Paper.

No Additional Materials 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 Exam	iner's Use
1	
2	
3	
4	
5	
6	
7	
8	
Total	

1 hour 15 minutes

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



1 The table below includes information about some of the elements in Period 2.

element	carbon	nitrogen	fluorine	neon
symbol	С	N	F	Ne
structure	macromolecular	simple molecules N <sub>2</sub>	simple molecules F <sub>2</sub>	single atoms Ne
boiling point/°C	4200	<b>–196</b>	-188	-246

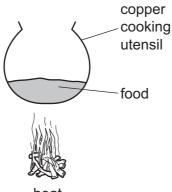
(a)	Why does neon exist as single atoms but fluorine exists as molecules?
	[2
(b)	What determines the order of the elements in a period?
	[1
(c)	When liquid nitrogen boils the following change occurs.
	$N_2(I) \rightarrow N_2(g)$
	The boiling point of nitrogen is very low even though the bond between the atoms in a nitrogen molecule is very strong. Suggest an explanation.
	[2
(d)	Draw a diagram showing the arrangement of the outer shell (valency) electrons in a molecule of nitrogen.

[2]

[Total: 7]

	mond and graphite are different forms of the same element, carbon. lain the following in terms of their structure.
(a)	Graphite is a soft material which is used as a lubricant.
(b)	Diamond is a very hard material which is used for drilling and cutting.
(c)	Graphite is a good conductor of electricity and diamond is a poor conductor.
	[Total
The	uses of a substance are determined by its properties.
(a)	Plastics are poor conductors of electricity. They are used as insulation for electric cabl Which other <b>two</b> properties of plastics make them suitable for this purpose?
(b)	Chromium is a hard, shiny metal. Suggest <b>two</b> reasons why chromium is used electroplate steel.
	Why is aluminium used extensively in the manufacture of aeroplanes?
(c)	The diameter documents of the management of developments.
(c)	
(c)	

(d) Why is copper a suitable material from which to make cooking utensils?



		food
		heat
		[2]
(e)	Des	scribe the bonding in a typical metal.
		[2]
		[Total: 10]
		[rotali roj
		of aluminium is bauxite which is impure aluminium oxide. Alumina, pure aluminium
Alu	miniu	s obtained from bauxite. um is formed at the cathode when a molten mixture of alumina and cryolite, $Na_3AlF_6$ , olysed.
		Name <b>two</b> products formed at the anode in this electrolysis.
(ω)	(')	
		[2]
	(ii)	All the aluminium formed comes from the alumina not the cryolite.
		Suggest <b>two</b> reasons why the electrolyte must contain cryolite.
		Suggest <b>two</b> reasons why the electrolyte must contain cryolite.
		Suggest <b>two</b> reasons why the electrolyte must contain cryolite.  [2]
	(iii)	
	(iii)	The major impurity in bauxite is iron(III) oxide. Iron(III) oxide is basic, aluminium oxide is amphoteric. Explain how aqueous sodium hydroxide can be used to separate
	(iii)	The major impurity in bauxite is iron(III) oxide. Iron(III) oxide is basic, aluminium oxide is amphoteric. Explain how aqueous sodium hydroxide can be used to separate

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[2]

<b>(b)</b> The	e purification of bauxite uses large amounts of sodium hydroxide.
(i)	Describe the chemistry of how sodium hydroxide is made from concentrated aqueous sodium chloride. The description must include at least one ionic equation.
	[5]
	[0]
(ii)	Making sodium hydroxide from sodium chloride produces two other chemicals. Name these two chemicals and state one use of each chemical.
	chemical
	use
	chemical
	use[2]
	[Total: 13]
1.1.	
•	an island off the west coast of Scotland. The main industry on the island is making from barley.
-	contains the complex carbohydrate, starch. Enzymes catalyse the hydrolysis of starch ution of glucose.
(a) (i)	Draw the structure of the starch.  Glucose can be represented by HO———OH

5

	(ii)	Enzymes can catalyse the hydrolysis of starch. Name another catalyst for this reaction.
		[1]
	(iii)	Both starch and glucose are carbohydrates. Name the elements found in all carbohydrates.
		[1]
(b)		st cells are added to the aqueous glucose. Fermentation produces a solution taining up to 10 % of ethanol.
	(i)	Complete the word equation for the fermentation of glucose.
		glucose → +
		[1]
	(ii)	Explain why is it necessary to add yeast and suggest why the amount of yeast in the mixture increases.
		[2]
	(iii)	Fermentation is carried out at 35 °C. For many reactions a higher temperature would give a faster reaction. Why is a higher temperature not used in this process?
		[2]
(c)	into	organic waste, the residue of the barley and yeast, is disposed of through a pipeline the sea. In the future this waste will be converted into biogas by the anaerobic piration of bacteria. Biogas, which is mainly methane, will supply most of the island's rgy.
	(i)	Anaerobic means in the absence of oxygen. Suggest an explanation why oxygen must be absent.
		[1]
	(ii)	The obvious advantage of converting the waste into methane is economic. Suggest <b>two</b> other advantages.
		[2]
		[Total: 12]

A length of magnesium ribbon was added to 50 cm³ of sulfuric acid, concentration 1.0 mol/dm³. The time taken for the magnesium to react was measured. The experiment was repeated with the same volume of different acids. In all these experiments, the acid was in excess and the same length of magnesium ribbon was used.

(a)

experiment	acid	concentration in mol/dm³	time/s
Α	sulfuric acid	1.0	20
В	propanoic acid	0.5	230
С	hydrochloric acid	1.0	40
D	hydrochloric acid	0.5	80

	(i)	Write these experiments in order of reaction speed. Give the experiment with the fastest speed first.
		[1]
	(ii)	Give reasons for the order you have given in (i).
		[5]
(b)	and	gest <b>two</b> changes to experiment C which would increase the speed of the reaction explain why the speed would increase. The volume of the acid, the concentration of acid and the mass of magnesium used were kept the same.
	cha	nge 1
	ехр	anation
	cha	nge 2
	ехр	anation
		[5]

7	The alkenes are unsaturated hydrocarbons. They form a homologous series, the members of
	which have similar chemical properties:

- easily oxidised
- addition reactions
- polymerisation
- · combustion.

(a) All the alkenes have the same empirical formu	(a)	All the	alkenes	have	the	same	empirical	formul
---	-----	---------	---------	------	-----	------	-----------	--------

(i) State their empirical formula.

r - r	. 4	٦.
	1	

(ii) Why is the empirical formula the same for all alkenes?

	 	 	 	 	 	 [1]

- **(b)** Alkenes can be oxidised to carboxylic acids by boiling with aqueous potassium manganate(VII).
  - (i) Pent-2-ene,  $CH_3-CH_2-CH=CH-CH_3$ , oxidises to  $CH_3-CH_2-COOH$  and  $CH_3COOH$ . Name these two acids.

(ii) Most alkenes oxidise to two carboxylic acids. Deduce the formula of an alkene which forms only one carboxylic acid.

[1]

(c) Complete the following equations for the addition reactions of propene.

(i) 
$$CH_3-CH=CH_2 + Br_2 \rightarrow \dots$$
 [1]

(ii) 
$$CH_3-CH=CH_2 + H_2O \rightarrow \dots$$
 [1]

**(d)** Draw the structural formula of poly(propene)

[2]

	(e)	0.01 moles of an alkene needed 2.4g of oxygen for complete combustion. 2.2g of carbon dioxide were formed. Determine the following mole ratio.
		moles of alkene: moles of O <sub>2</sub> : moles of CO <sub>2</sub>
		From this ratio determine the formula of the alkene.
		[3]
		Write an equation for the complete combustion of this alkene.
		[1]
		[Total: 13]
0	⊏ŧh	vlamina CH, CH, NH, is a base which has similar proportion to ammonia
8		ylamine, CH <sub>3</sub> –CH <sub>2</sub> –NH <sub>2</sub> , is a base which has similar properties to ammonia.
	(a)	In aqueous ethylamine, there is the following equilibrium.
		$CH_3-CH_2-NH_2 + H_2O \rightleftharpoons CH_3-CH_2-NH_3^+ + OH^-$
		Explain why water is behaving as an acid in this reaction.
		[1]
	(b)	Given aqueous solutions of ethylamine and sodium hydroxide, describe how you could show that ethylamine is a weak base like ammonia and not a strong base like sodium hydroxide.
		[3]
	(c)	Ethylamine, like ammonia, reacts with acids to form salts.
		$CH_3-CH_2-NH_2 + HCl \rightarrow CH_3-CH_2-NH_3Cl$
		ethylammonium chloride
		Suggest how you could displace ethylamine from the salt, ethylammonium chloride.

(d)	Explain the chemistry of the following reaction:
	When aqueous ethylamine is added to aqueous iron(III) chloride, a brown precipitate is formed.
	[2]
	[Total: 8]

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DATA SHEET
The Periodic Table of the Elements

	0	4 <b>He</b> Helium 2	20 Neon 10 Afr	18	84	Krypton 36	131	Xenon	54	Rn	Radon 86		175 <b>Lu</b> Lutetium		<b>Lr</b> Lawrendum 103
	II/		19 Fluorine 9 35.5 <b>C1</b>	17	8 (	m	l	lodine	53	Ą	Astatine 85		Yb Ytterbium	1	Nobelium 102
	>			16	62	=		<b>Te</b> Tellurium	52	Po	Polonium 84		169 <b>Tm</b> Thulium	3	Mendelevium 101
	>			15	75			Sb	51	209 <b>B</b> i	Bismuth 83		167 <b>Er</b> Erbium 68	Ĺ	<b>FB</b> Fermium 100
	2		Carbon 6 Carbon 8 Silicon Silicon	14	73	Ε		S ⊧	20	207 <b>Pb</b>	Lead 82		165 <b>Ho</b> Holmium 67	Ĺ	ES Einsteinium 99
	=		11 <b>B</b> Boron  5  A1  Aluminium	13	0 0	Gallium 31	115	<b>La</b>	49	204 <b>T1</b>	Thallium 81		162 <b>Dy</b> Dysprosium 66	7	Californium 98
						Zinc 30		<b>Cd</b>	48	201 <b>Hg</b>	Mercury 80		159 <b>Tb</b> Terbium	ā	Berkelium 97
					9 (	Copper 29	108	Ag		197 <b>Au</b>	Gold 79		157 <b>Gd</b> Gadolinium 64	ز ا	Curium 96
Group					69			<b>Pd</b> Palladium	46	195 <b>T</b>	Platinum 78		152 <b>Eu</b> Europium 63		Am Americium 95
Gr					26	Cobalt 27		<b>Rh</b> odium		192 <b>I r</b>			Sm Samarium	ć	Plutonium 94
		T Hydrogen			. Se	<b>16</b> Iron 26	101	<b>Ru</b> thenium	- 1	0 <b>S</b>	Osmium 76		Pm Promethium	1	Neptunium 93
					55	2≥ ≤		<b>Tc</b> Technetium			_		Neodymium	238	Uranium 92
					52	Chromium 24	96	Molybdenum	42		_		Pr Praseodymium	ć	Protactinium 91
					51	Vanadium 23		N iobium	41	181 <b>a</b>	Tantalum 73		140 <b>Ce</b> Cerium	232	Thorium
					4 48	Titanium 22	91	<b>Zr</b> Zirconium	40	178 <b>H</b>	72			nic mass	ool nic) number
					45	Scandium 21	68	Yttrium	39	139 <b>La</b>	Lanthanum 57 *	227 <b>Ac</b> Actinium	l series eries	a = relative atomic mass	<ul><li>X = atomic symbol</li><li>b = proton (atomic) number</li></ul>
	=		Be Beryllium 4 24 Mg	12	0 4	Calcium 20	88	Strontium	38	137 <b>Ba</b>	Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series		× = =
	_		Lithium 3 23 8 Na Sodium	7	38	Potassium	85	<b>Rubidium</b>	37	133 <b>CS</b>	Caesium 55	Francium 87	*58-71 L	;	ه ک

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

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