

CANDIDATE

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

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CHEMISTRY		0620	1/22
CENTRE NUMBER	CANDIDATE NUMBER		
NAME			

CHEMISTRY 0620/33

Paper 3 (Extended)

May/June 2012

1 hour 15 minutes

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	
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8	
Total	

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 ₂	simple molecules F ₂	single atoms Ne
boiling point/°C	4200	-196	-188	-246

(a)	Why does neon exist as single atoms but fluorine exists as molecules?
	TO.
(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]

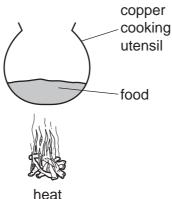
[Total: 7]

Diamond and graphite are different forms of the same element, carbon.

2

	Exp	plain the following in terms of their structure.
	(a)	Graphite is a soft material which is used as a lubricant.
		[2]
	(b)	Diamond is a very hard material which is used for drilling and cutting.
		[2]
	(c)	Graphite is a good conductor of electricity and diamond is a poor conductor.
		[2]
		[Total: 6]
3	The	e uses of a substance are determined by its properties.
	(a)	Plastics are poor conductors of electricity. They are used as insulation for electric cables. Which other two properties of plastics make them suitable for this purpose?
	(b)	Chromium is a hard, shiny metal. Suggest two reasons why chromium is used to electroplate steel.
		[2]
	(c)	Why is aluminium used extensively in the manufacture of aeroplanes?
		[2]

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



		heat
		[2]
(e)	Des	scribe the bonding in a typical metal.
		[2]
		[Total: 10]
oxic Alu	de, is mini	of aluminium is bauxite which is impure aluminium oxide. Alumina, pure aluminium s obtained from bauxite. um is formed at the cathode when a molten mixture of alumina and cryolite, $\mathrm{Na_3A}l\mathrm{F_6}$, olysed.
(a)	(i)	Name two products formed at the anode in this electrolysis.
		[2]
	(ii)	All the aluminium formed comes from the alumina not the cryolite. Suggest two reasons why the electrolyte must contain cryolite.
		[2]
((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 them.

(b) The	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]
(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]
lalas da	an integral off the county and a Continued. The grade industry on the integral is continued.
-	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

	(11)	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.
	(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?
		give a faster reaction. With 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 biration 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 two 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
А	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 two 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	lanation
	cha	nge 2
	exp	lanation
		[5]
		[v]

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	formula
---------	-----	---------	------	-----	------	-----------	---------

(i) State their empirical formula.

r	4.7	
1:	7 I	

(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 ₂ : moles of CO ₂						
	From this ratio determine the formula of the alkene.						
	[3]						
	Write an equation for the complete combustion of this alkene.						
	[1]						
	[Total: 13]						
-							
Eth	ylamine, CH ₃ –CH ₂ –NH ₂ , 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.						

8

	[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.

$${\rm CH_3-CH_2-NH_2} \ + \ \ {\rm HC} \ l \ \to \ {\rm CH_3-CH_2-NH_3C} \ l$$
 ethylammonium chloride
$${\rm Suggest\ how\ you\ could\ displace\ ethylamine\ from\ the\ salt,\ ethylammonium\ chloride}.$$

Explain the chemistry of the following reaction:	
When aqueous ethylamine is added to aqueous iron(III) chloride, a brown precipitate is formed.	S
[2	<u>']</u>
[Total: 8	3]

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DATA SHEET
The Periodic Table of the Elements

	0	He Helium	20 Neon 10 Ar Argon	84 Kr Krypton 36	131 Xe Xenon 54	Rn Radon 86		175 Lu Lutetium 71	Lr Lawrendum 103		
	II/		19 Fluorine 9 35.5 C1	80 Br Bromine 35	127	At Astatine 85		173 Yb Ytterbium 70	Nobelium 102		
	>		16 Oxygen 8 32 S Sulfur	Selenium	128 Te Tellurium 52	Po Polonium 84		169 Tm Thulium 69	Md Mendelevium 101		
	>		Nitrogen 7 7 31 31 Phosphorus 15	75 AS Arsenic 33	122 Sb Antimony 51	209 Bi Bismuth 83		167 Er Erbium 68	Fm Fermium 100		
	2				Carbon 6 Carbon 8 Silicon 14	73 Ge Germanium 32	119 Sn ™ ™	207 Pb Lead 82		165 Ho Holmium 67	Es Einsteinium 99
	=					11 B Boron 5 A 1 A Aluminium 13	70 Ga Gallium 31	115 n Indium 49	204 T 1 Thallium		162 Dy Dysprosium 66
				65 Zn Zinc 30	Cd Cadmium 48	201 Hg Mercury 80		159 Tb Terbium 65	Bk Berkelium 97		
				64 Copper 29	108 Ag Silver 47	197 Au Gold 79		157 Gd Gadolinium 64	Carium 96		
Group				59 Nickel	106 Pd Palladium 46	195 Pt Platinum 78		152 Eu Europium 63	Am Americium 95		
G			1	59 Cobalt 27	Rh Rhodium 45	192 r r Iridium 77		Samarium 62	Pu Plutonium 94		
		Hydrogen 1		56 Fe Iron	Ruthenium 44	190 Os Osmium 76		Pm Promethium 61	Neptunium		
				Mn Manganese 25	Tc Technetium	186 Re Rhenium 75		144 Nd Neodymium 60	238 U Uranium		
				52 Cr Chromium 24	96 Mo Molybdenum 42	184 W Tungsten 74		Pr Praseodymium 59	Pa Protactinium 91		
				51 Vanadium 23	Niobium 41	181 Ta Tantalum 73		140 Cerium 58	232 Th Thorium		
			-	48 T Titanium	91 Zr Zirconium 40	178 Hf Hafnium			mic mass abol mic) number		
				Scandium 21	89 Y	139 La Lanthanum 57 *	227 Ac Actinium	d series series	a = relative atomic mass X = atomic symbol b = proton (atomic) number		
	=		Be Beryllium 4 24 Mg Magnesium 12	40 Ca Calcium 20	Strontium	137 Ba Barium 56	226 Ra Radium 88	*58-71 Lanthanoid series	<i>a</i> ★		
	_		7 Lithium 3 23 Na Sodium 11	39 Potassium	Rubidium 37	133 Cs Caesium 55	Fr Francium 87	*58-711 190-103	Key		

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

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