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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CHEMISTRY



Paper 3 (Extended)

0620/03

May/June 2005

1 hour 15 minutes

Candidates answer on the Question Paper. No Additional Materials required.

Candidate Name						
Centre Number	Τ		Candidate Number			

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.

WRITE IN THE BOXES PROVIDED ON THE QUESTION PAPER

DO NOT WRITE IN THE BARCODE.

DO NOT WRITE IN THE GREY AREAS BETWEEN THE PAGES.

Do not use staples, paper clips, highlighters, glue or correction fluid.

You may use a calculator.

Answer all questions.

The number of marks is given in brackets [] at the end of each question or part questions.

A copy of the Periodic Table is printed on page 16.

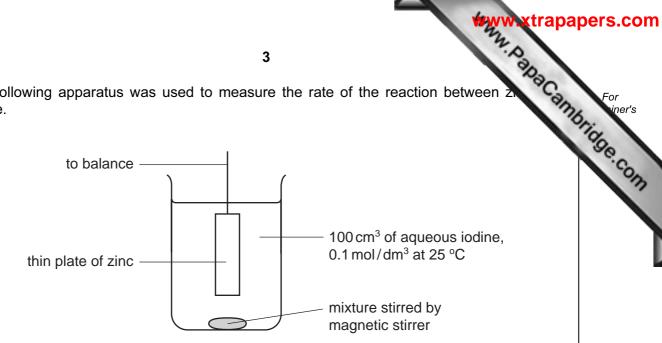
For Examiner's Use			
1			
2			
3			
4			
5			
6			
Total			

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

Three of the halogens in Group VII are: 1

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		2	W. Day
Thr	ee o	of the halogens in Group VII are: chlorine bromine iodine	**Www.xtrapapers.co
(a)	(i)	How does their colour change down the Group?	
	(ii)	How does their physical state (solid, liquid or gas) c	hange down the Group?
			[1]
	(iii)	Predict the colour and physical state of fluorine.	
		physical state	
(b)		scribe how you could distinguish between aqueous ptassium iodide.	otassium bromide and aqueous
	test	.t	
	res	sult with bromide	
	res	sult with iodide	[3]
(c)		on 15 moles of iodine react with 0.045 moles of chlorine oduct. Complete the equation.	to form 0.030 moles of a single
	I ₂	cl₂ →	[2]
(d)		aces of chlorine can be separated from bromine vapolich gas would diffuse the faster and why?	ur by diffusion.
			ro.
			[2]

2 The following apparatus was used to measure the rate of the reaction between 2 iodine.



3

The mass of the zinc plate was measured every minute until the reaction was complete.

(a)	Write an ionic equation for the redox reaction that occurred between zinc atoms and iodine molecules.
	[2]
(b)	Describe how you could show by adding aqueous sodium hydroxide and aqueous ammonia that a solution contained zinc ions.
	result with sodium hydroxide
	excess sodium hydroxide
	result with aqueous ammonia
	excess aqueous ammonia [3]

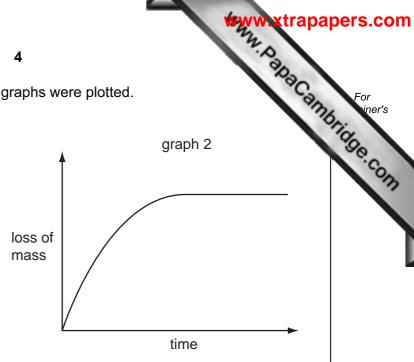
(c) From the results of this experiment two graphs were plotted.

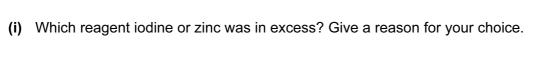
graph 1

time

mass of

plate





- (ii) Describe how the shape of graph 1 would change if 100cm³ of 0.05 mol/dm³ iodine had been used.
- (iii) On graph 2, sketch the shape if the reaction had been carried out using 100 cm³ of 0.1 mol/dm³ iodine at 35 °C instead of at 25 °C.

WANN. Papac Cambridge. Com A South Korean chemist has discovered a cure for smelly socks. Small particles of six 3 attached to a polymer, poly(propene), and this is woven into the socks. (a) (i) Give the structural formula of the monomer. [1] (ii) Draw the structural formula of the polymer. [2] (iii) Suggest which one, monomer or polymer, will react with aqueous bromine and why? (b) To show that the polymer contains silver the following test was carried out. The polymer fibres were chopped into small pieces and warmed with nitric acid. The silver atoms were oxidised to silver(I) ions. The mixture was filtered. Aqueous sodium chloride was added to the filtrate and a white precipitate formed. (i) Why was the mixture filtered? [1] (ii) Explain why the change of silver atoms to silver ions is oxidation. [1] (iii) Give the name of the white precipitate. [1]

[1]

(c) The unpleasant smell is caused by carboxylic acids. Bacteria cause the fats on to be hydrolysed to these acids. Silver kills the bacteria and prevents the hydrolysthe fats.

(i)	Fats are esters.	Give the na	ame and stru	ictural formula	of an ester.
۱-/					

name	[1
structural formula	

- (d) Propanoic acid is a weak acid.
 - (i) The following equation represents its reaction with ammonia.

(ii) Explain the expression weak acid.

1	of these	arlsbad caverns in New Mexico are very large underground caves. Although the caves are coated with gypsum (hydrated calcium sulphate), the caves have in limestone.					
	(a) It is	believed that the caves were formed by sulphuric acid reacting with the limestone.					
	(i)	Complete the word equation.					
		calcium + sulphuric calcium + + + carbonate acid + sulphate + [1]					
	(ii)	Describe how you could test the water entering the cave to show that it contained sulphate ions.					
		test					
		result [2]					
	(iii)	How could you show that the water entering the cave has a high concentration of hydrogen ions?					
		[1]					
		drogen sulphide gas which was escaping from nearby petroleum deposits was being dised to sulphuric acid.					
	(i)	Complete the equation for this reaction forming sulphuric acid.					
		$H_2S + O_2 \longrightarrow$ [2]					
	(ii)	Explain why all the hydrogen sulphide should be removed from the petroleum before it is used as a fuel.					

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2,				

(iii) Draw a diagram to show the arrangement of the valency electrons in one months of the covalent compound hydrogen sulphide.

The represent an electron from a sulphur atom.

Plactron from a hydrogen atom.

[2]

(c) Sulphuric acid is manufactured by the Contact Process. Sulphur dioxide is oxidised to sulphur trioxide by oxygen.

$$2SO_2 + O_2 \longrightarrow 2SO_3$$

(i)	Name the catalyst used in this reaction.

(iii) Describe how sulphur trioxide is changed into sulphuric acid.

		[2]

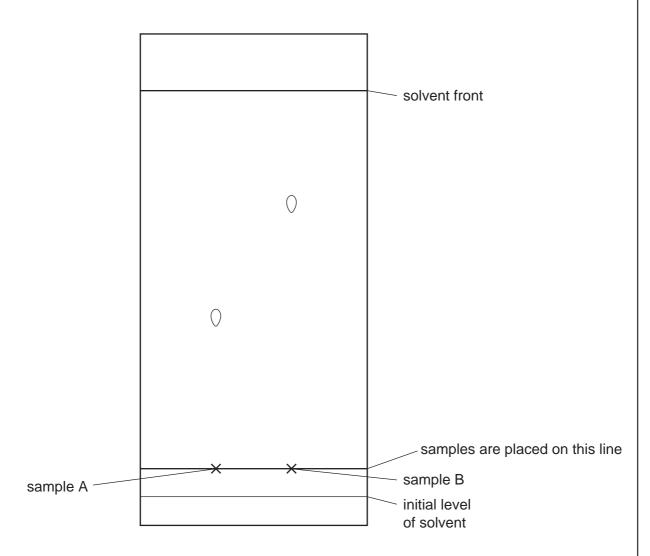
(d) Gypsum is hydrated calcium sulphate, CaSO₄.xH₂O. It contains 20.9% water by mass. Calculate x.

*M*_r: CaSO₄, 136; H₂O, 18.

20.9 g of
$$H_2O =$$
 _____moles

5 Enzymes are biological catalysts. They are used both in research laboratories industry.

WWW. Papa Cambridge Com (a) Enzymes called proteases can hydrolyse proteins to amino acids. The amino acids can be separated and identified by chromatography. The diagram below shows a typical chromatogram.



(i) The R_f value of a sample = distance travelled by sample distance travelled by solvent front

Some R_f values for amino acids are:

glutamic acid = 0.4

glycine = 0.5

alanine = 0.7

leucine = 0.9

Identify the two amino acids on the chromatogram.

A is

B is

[2]

(ii) Explain why the chromatogram must be exposed to a locating agent before $R_{\rm f}$ values can be measured.

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		10 A. Da	
	(iii)	Measuring $R_{\rm f}$ values is one way of identifying amino acids on a chroma Suggest another. [1] The synthetic polymer, nylon, has the same linkage as proteins. Draw the structural formula of nylon.	For iner's
		[1]	26°
	(iv)	The synthetic polymer, nylon, has the same linkage as proteins. Draw the structural formula of nylon.	OH
			1
		[3]	
(b)	Enz	zymes called carbohydrases can hydrolyse complex carbohydrates to simple sugars	
		ch can be represented as HO — OH. Draw the structure of a complex bohydrate.	

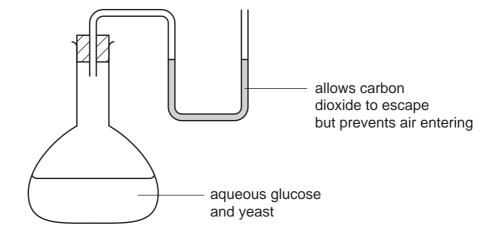
[2]

a few of For iner's

[1]

(c) Fermentation can be carried out in the apparatus drawn below. After a few on reaction stops. It has produced a 12% aqueous solution of ethanol.





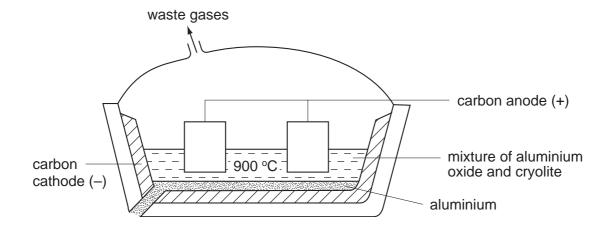
(i)	Comp	lete the	equation.
-----	------	----------	-----------

$C_6H_{12}O_6$		+	
glucose	ethanol	carbon dioxide	[2]

(ii) Zymase catalyses the anaerobic respiration of glucose. Define the term respiration. [2] (iii) Suggest a reason why the reaction stops after a few days. (iv) Why is it essential that there is no oxygen in the flask? [1] (v) What technique is used to concentrate the aqueous ethanol?

magnesium aluminium zinc copper

(a) Aluminium is extracted by the electrolysis of its molten oxide.



(i)	Name	the	main	ore	of	aluminium
-----	------	-----	------	-----	----	-----------

[1	1
 Γ.	4

(ii) Why does the molten electrolyte contain cryolite?

(iii) Oxygen is produced at the positive electrode (anode). Name another gas which is given off at this electrode.

(b) Aluminium reacts very slowly with aqueous copper(${
m II}$) sulphate.

$$2Al(s) + 3CuSO_4(aq) \longrightarrow Al_2(SO_4)_3(aq) + 3Cu(s)$$

(i) Which of the two metals has the greater tendency to form ions?

(ii) Describe what you would see when this reaction occurs.

(iii) Explain why aluminium reacts so slowly.

Complete the provided.	following table	13 by writing "reaction" or	"no reaction" in the	For iner's
oxide	type of oxide	reaction with acid	reaction with alkali	Tage
magnesium	basic			OH
aluminium	amphoteric			וווו
				[2]

(d)	Predic	ct the equations for the c	decomposition of the f	ollowing aluminium co	mpounds.
	(i)	A l(OH)₃ →		+	[2]
	(ii)	aluminium nitrate —		++	
					[2]

14

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15

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The Periodic Table of the Elements **DATA SHEET**

								Gro	Group								
_	=								-			≡	≥	>	5	=	0
							- :										4
							T Hydrogen										Helium
		[2
7	6											£	12	41		19	20
=	Be											Ω	ပ	z	0	ш	Ne
Lithium	Beryllium 4											Boron 5	Carbon 6	Nitrogen 7	ω	Fluorine 9	Neon 10
23	24											27	28	31		35.5	
Na	Mg												Si	₾		CI	
Sodium 1	Magnesium 12											_	Silicon 14	Phosphorus 15	_	Chlorine 17	Argon 18
39	40	45	48	51	52	55	56	59		64			73	75		80	
¥	Ca	Sc	F	>	ပ်	Mn	Ъ	ပိ	Ż	Cn			Ge	As	Se	Ā	궃
Potassium 9	Calcium 20	Scandium 21	Titanium 22	Vanadium 23	Chromium 24	Manganese 25	Iron 26	Cobalt 27	Nickel 28	Copper 29		Gallium 31	Germanium 32	Arsenic 33	Selenium 34	Bromine 35	Krypton 36
85	88	88	91	93	96			103	106	108		115		122	128	127	131
Rb	Š	>	Zr	Q	Mo	ည		Rh	Pd	Ag		In		Sb	<u>e</u>	Ι	Xe
Rubidium 7	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		192	195	197		204		209			
Cs	Ва	Га	Ξ	Б	≯	Re			₹	Αn	Hg	11	Pb	Bi		Ą	Ru
Caesium i5	Barium 56	Lanthanum 57 *	Hafnium 72	Tantalum 73	Tungsten 74	Rhenium 75	Osmium 76	Iridium 77	Platinum 78	Gold 79	Mercury 80	Thallium 81		Bismuth 83	Polonium 84	Astatine 85	Radon 86
	226	227															
<u>ਛ</u> '	В	Ac															
Francium 7	Radium 88	Actinium 89															
38-711;	58-71 Lanthanoid series	אפוזפא לי		140	141	44			152	157	159	162		167	169	173	175
10-103 4	30-103 Actinoid series	יסייסי		ပီ	Ą	PN			Eu	рg	Д	D		ш	Tm	Υb	Γn
5		מבובס		Cerium 58	Praseodymium 59	Neodymium 60	Promethium 61	_	Europium 63	Gadolinium 64	Terbium 65	Dysprosium 66	19	Erbium 68		Ytterbium 70	Lutetium 71
							- 1	$^{+}$					-				I

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

Mendelevium 101 β

Fm Fermium 100

Einsteinium

Californium

BKBerkelium
97

Curium

Am Americium 95

238 **U** Uranium 92

Ра

232 **Th** Thorium 90

b = proton (atomic) number

a = relative atomic mass X = atomic symbol

т В

e