

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
CHEMISTRY			0620/23
Paper 2			May/June 2013
			1 hour 15 minutes
Candidates ans	swer on the Question Paper.		
No Additional M	Naterials are required.		

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may need to 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.

Electronic calculators may be used.

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

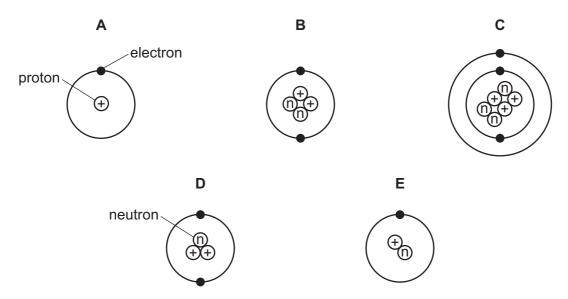
You may lose marks if you do not show your working or if you do not use appropriate units.

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.



1 The structures of five atoms, A, B, C, D and E, are shown below.



- (a) Answer the following questions about these structures. Each structure can be used once, more than once or not at all.
 - (i) Which **two** structures are hydrogen atoms? and
 - (ii) Which structure represents an atom of a metal?
 - (iii) Which structure has a proton (atomic) number of 3?
 - (iv) Which structure has two neutrons in its nucleus? [5]
- **(b)** The structure of carbon-12 can be written ${}^{12}_{6}$ C.

Write the structure of atom **D** in a similar way.

[1]

(c) Complete the following sentences about isotopes using words from the list below.

	atoms	energy	iron	molecules	
	neutrons	protons	radioactive	stable	
Isotopes a	are atoms of the	e same elemen	t with the same	number of	
and different numbers of Some isotopes such as uranium-235 are					
		235 can be used	as a source of		[4]

[Total: 10]

2 The table shows some physical properties of the Group VII elements.

halogen	melting point /°C	boiling point /°C	atomic radius /nanometres	colour
fluorine	-220	-188		pale yellow
chlorine	-101	-35	0.099	
bromine	– 7	+59	0.114	red-brown
iodine	+114	+184	0.133	grey-black

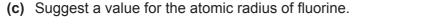
(i)	chlorine is a gas at room temperature,	
		[41]

(ii)	bromine is a liquid at room temperature

.....[1]

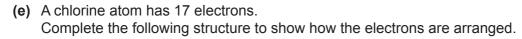
(b)	Describe the trend in atomic	c radius going do	own the group from	chlorine to iodine.

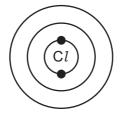












[2]

(f) Chlorine reacts with potassium bromide to form potassium chloride and bromine.

(i) Complete the symbol equation for this reaction.

$$Cl_2 + \dots KBr \rightarrow 2KCl + \dots$$
 [2]

(ii) Explain why iodine does **not** react with potassium bromide.

[1]

[Total: 10]

- 3 Aluminium and gallium are in Group III of the Periodic Table.
 - (a) The heat from your hand is sufficient to melt gallium.

 Describe the change in state from solid to liquid in terms of the kinetic particle theory. In your answer include
 - the difference in arrangement and closeness of the particles in a solid and a liquid,

the difference	in the	motion o	f the	particles	in a	solid a	nd a	liquid

 	 	 	 [5]

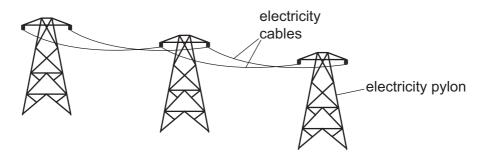
(b) Gallium is a metal. Describe **three** physical properties of gallium which are typical of most metals.

Ί.		 	
2	1		
۷.		 	
2			101

(c) When it is a gas, gallium(III) chloride has the structure shown below.

Write the molecular formula for gallium(III) chloride.

(d) Aluminium is used to make high voltage electricity cables.



The table shows some properties of four metals which could be used for overhead power cables.

metal	relative strength	density in g/cm³	relative electrical conductivity	price \$ per tonne
aluminium	9	2.70	0.4	2120
copper	30	8.92	0.7	9600
tungsten	100	19.35	0.2	450
steel	50	7.86	0.1	700

(i) Suggest why aluminium, rather than tungsten, is used in overhead power cables?
[1]
(ii) Suggest why steel, rather than copper, is used as a core for overhead power cables.
[1]
(iii) Give two reasons why aluminium is used for overhead power cables rather than copper.
1
2
(e) State one use of aluminium other than as an electrical conductor.
[1]
[Total: 14]

Impure	water needs to	be treated if it i	s to be use	d in the ho	me.	
(a) (i)	Explain why f	iltration and chlo	orination are	e used in th	ne water treatmo	ent process.
(ii)		e of water in the				[2]
(b) Des		cal test for water				[1]
tes	t					
res	ult					[2]
(c) (i)	Complete the	diagram below	to show the	electron a	rrangement in a	water molecule.
		Н		Н		[1]
(ii)		g in water covale n for your answe		?		
						[1]
		tral. Which one of the correct answ		values is i	neutral?	
	рН	0 pH 6	pH 7	pH 9	pH 13	[1]
		sodium. The pro ation for this read		sodium hyd	droxide and hyd	
						[1]
						[Total: 9]

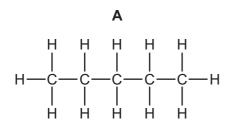
- **5** Energy is given out when fuels burn.
 - (a) State the name given to a chemical reaction which releases energy.

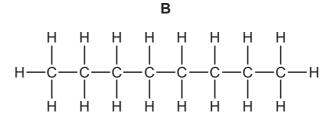
......[1]

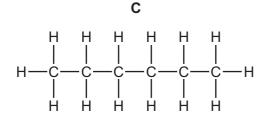
(b) Hydrogen can be used as a fuel.Complete the symbol equation for the burning of hydrogen in oxygen.

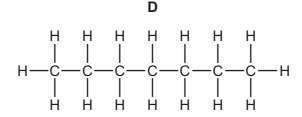
..... $H_2 + \rightarrow 2H_2O$ [2]

(c) Gasoline is a mixture of hydrocarbons containing between 5 and 10 carbon atoms. Four of these hydrocarbons are shown below.









(i) Which **one** of these structures, **A**, **B**, **C** or **D**, has the highest relative molecular mass?

You are not expected to do any calculations.

[1]

(ii) Give one use of gasoline.

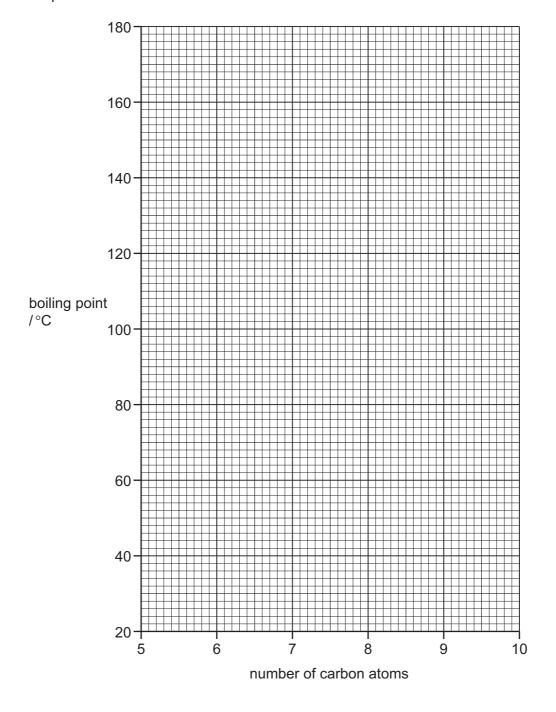
.....[1]

(d) The table shows the boiling points of the straight-chain hydrocarbons in the gasoline fraction.

For Examiner's Use

number of carbon atoms	5	6	7	8	9	10
boiling point/°C	36	69		126	151	174

(i) On the grid below, plot a graph to show how the boiling point changes with the number of carbon atoms in these hydrocarbons. Draw a smooth curve through the points.



[3]

(ii) Use your graph to deduce the boiling point of the hydrocarbon with 7 carbon atoms.

boiling point°C [1]

(e)	The	alkanes are a homologous series of hydrocarbons.
	(i)	What is meant by the term homologous series?
		[2]
	(ii)	Alkanes can be cracked to form alkenes and smaller alkanes. State the conditions needed for cracking.
		[2]
		[Total: 13]

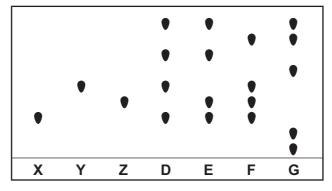
For Examiner's Use

- 6 Inks are mixtures of different dyes.
 - (a) A student used paper chromatography to separate the dyes in a particular ink. Describe how paper chromatography is carried out. You may draw a diagram to help explain your answer. In your description include
 - the apparatus you would use,

•	how	chroma	itography	is	carried	out
-	11044	OI II OI I I O	itograpity	10	ourrica	Ou

• • • • • • •
• • • • • • •
 [4]

(b) The chromatogram below shows the results of a chromatography experiment.
 X, Y and Z are pure dyes containing only one compound.
 The dyes present in four different inks, D, E, F and G are also shown.



(i)	Which ink, D , E , F or G , contains all the dyes X , Y and Z ?	
		[1]
(ii)	Which ink, D , E , F or G , does not contain any of the dyes X , Y and Z ?	
		[1]
(iii)	Which ink contains the greatest number of different dyes?	
		[1]

For Examiner's Use

(c) Some inks contain ethanoic acid.

Complete the structure of ethanoic acid.

[1]

(d) Ethanoic acid can be used as a solvent. What is the meaning of the term *solvent*?

.....[1]

(e) The structure of a dye called Gambine R is shown below.

(i) How many different types of atom are there in one molecule of Gambine R?

[1]

(ii) How many carbon atoms are there in one molecule of Gambine R?

.....[1]

[Total: 11]

For
Examiner's
Use

Hydrogen peroxide, H₂O₂, decomposes in the presence of an enzyme called peroxidase. The products of this reaction are water and oxygen.

(a) (i) What is meant by the term enzyme?

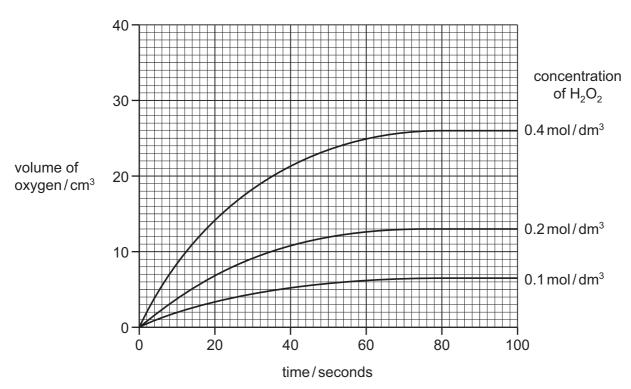
.....[2]

(ii) Complete the symbol equation for this reaction.

.....
$$H_2O_2 \rightarrow 2H_2O + O_2$$
 [1]

(b) A student followed the course of this reaction by measuring the volume of oxygen released over a period of time.

The diagram below shows some results that he obtained using hydrogen peroxide at three different concentrations.



(i) Describe how the concentration of hydrogen peroxide affects the rate of this reaction.

.....[1]

(ii) On the graph above, draw a line to show the course of the reaction when the starting concentration of hydrogen peroxide is 0.3 mol/dm³. [2]

(iii) For the concentration of hydrogen peroxide of 0.4 mol/dm³, deduce

• the volume of oxygen given off when the reaction is complete,

..... cm³

• the time it takes to produce 14 cm³ of oxygen.

..... seconds [2]

For Examiner's Use

(c)		ne presence of sulfuric acid, hydrogen peroxide reacts with iodide ions to form iodine I water. This involves the reduction of hydrogen peroxide.
	(i)	What is the meaning of the term <i>reduction</i> ?
		[1]
	(ii)	Complete the word equation for the reaction of sulfuric acid with calcium hydroxide.
	S	sulfuric acid + calcium hydroxide $ ightarrow$ +
		[2]
	(iii)	Describe a test for iodide ions.
		test
		result[2]
		[Total: 13]

BLANK PAGE

BLANK PAGE

DATA SHEET
The Periodic Table of the Elements

								Gro	Group								
_	=											≡	≥	>	>	\	0
							1 Hydrogen										4 He Helium
7 Li Lithium	9 Be Beryllium											11 Boron 5	12 C Carbon 6	14 N itrogen 7	16 Oxygen	19 F luorine	20 Ne Neon
Na Na Sodium	Magnesium	-										27 A1 Aluminium 13	28 Si icon	31 P Phosphorus 15	32 S Sulfur 16	35.5 C1 Chlorine	40 Ar Argon
39 K Potassium	Ca Calcium 20	Scandium	48 Ti Titanium	51 V Vanadium 23		Manganese	56 Iron	59 Cobalt	59 K Nickel 28	64 Copper	65 Zn Zinc 30	70 Ga Gallium 31		AS AS Arsenic	79 Selenium 34	80 Br Bromine 35	84 Kr ypton
Rb Rbidium 37	Strontium 38	89 Y	2r Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	Ru Ruthenium 44	Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 T lodine 53	131 Xe Xenon
133 CS Caesium 55	137 Ba n Barium 56	139 La Lanthanum *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74		190 Os Osmium 76		195 Pt Platinum 78	197 Au Gold	1	204 T 1 Thallium	207 Pb Lead	209 Bi Bismuth 83	Po Polonium 84	At	Radon 86
Francium 87	226 Ra	Actinium terminal Actinium ter															
*58-71 190-10	*58-71 Lanthanoid series	id series series		140 Ce Cerium	Praseodymium 59	Neodymium	Pm Promethium 61	Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
Key	e ×	a = relative atomic massX = atomic symbolb = proton (atomic) number	1	232 Th Thorium	Pa Protactinium 91	238 C Uranium	Np Neptunium	Pu Plutonium 94			BK Berkelium 97			Fm Fermium		Nobelium 102	Lr Lawrendu 103

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

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.