

CANDIDATE NAME

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

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CENTRE NUMBER	CANDIDATE NUMBER	
CHEMISTRY		0620/22
Paper 2	Octo	ober/November 2010

Candidates answer on the Question Paper.

No Additional Materials 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.

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

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	
Total	

1 hour 15 minutes

This document consists of 15 printed pages and 1 blank page.



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1 Choose from the following list of oxides to answer the questions below. You can use each oxide once, more than once or not at all.

carbon dioxide carbon monoxide magnesium oxide nitrogen dioxide sulfur dioxide water

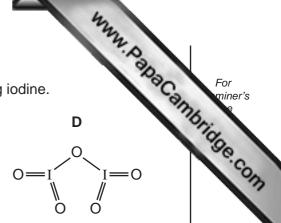
(a)	Which <b>one</b> of these oxides is a basic oxide?	
		[1]
(b)	Which <b>two</b> oxides cause acid rain?	
	and	[2]
(c)	Which <b>two</b> oxides are formed when a hydrocarbon undergoes complete combustion	?
	and	[2]
(d)	Which <b>one</b> of these oxides turns white copper(II) sulfate blue?	
		[1]
(e)	Which oxide is formed when calcium carbonate undergoes thermal decomposition?	
		[1]
	[Total	: 7]

2 The diagram shows the structure of some compounds containing iodine.

	Α	
Cl_		Cl
	\ <sub>I</sub> /	
	C1	

	В			
[- ]	Na <sup>+</sup>	I <sup>-</sup>	(Na <sup>+</sup> )	
la <sup>+</sup>	I-)	Na <sup>+</sup>	I <sup>-</sup>	)
r_ \/	$\sim$	· )		

С



D

(a)	(i)	What do you understand by the term <i>compound</i> ?	
(4)	(.)	vinat de yeu underetand by the term competina.	
	(ii)	Which <b>one</b> of these compounds, <b>A</b> , <b>B</b> , <b>C</b> or <b>D</b> , has a high melting point? Explain your answer.	
		compound	
		explanation	[2]
	(iii)	Which <b>one</b> of these compounds is similar in structure to hydrogen chloride?	
			[1]
(b)	Cor	mpound <b>B</b> is sodium iodide.	
	(i)	Which statement about the electrical conductivity of sodium iodide is correct? Tick <b>one</b> box.	
		It conducts electricity when molten.	
		It conducts electricity when solid.	
		It does not conduct electricity when molten.	
		It does not conduct electricity in aqueous solution.	[1]
	(ii)	Describe a test for iodide ions.	
		test	
		result	[2]
(c)		mpound <b>D</b> is iodine(V) oxide. It is an acidic oxide. ggest why iodine(V) oxide is an acidic oxide.	
			[1]

[Total: 8]

Some properties of the Group I elements are given in the table. 3

element	melting point /°C	boiling point /°C	density in g/cm³
lithium	181	1342	0.53
sodium	98	883	0.97
potassium	63		0.86
rubidium	39	686	1.53
caesium	29	669	1.88

(a)	(i)	Predict the boiling p	oint of potas	ssium.			
							[1]
	(ii)	Which Group I elem	ents are liqu	uids at 50°	C?		
							[2]
	(iii)	How, in general, do	es the densi	ty of the G	roup I ele	ments change do	own the group?
							[1]
(b)	Cor	mplete the following sow.	sentences a	bout the G	roup I ele	ments using wor	ds from the list
		crystallising	decrease	es .	hard	increases	
		melt	ing	similarity		soft	
	The	e Group I elements	are relatively	y		metals which sl	how a trend in
		point	and reaction	n with wate	er.		
	The	e reactivity with water		do	wn the gr	oup.	[3]

**(c)** The equation for the reaction of sodium with water is given below.

2Na + 
$$2H_2O \rightarrow 2NaOH + H_2$$

Write a word equation for this reaction.

[3]

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- (d) Chlorine reacts with sodium to form sodium chloride.
  - (i) Complete the equation for this reaction.

Na	+ Cl <sub>2</sub>	$\rightarrow$	NaC <i>l</i>

(ii) Chlorine is a diatomic gas. What do you understand by the term diatomic? .....[1]

(iii) Describe the arrangement and motion of the molecules in chlorine gas.

arrangement ..... 

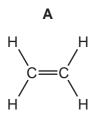
(iv) Draw a diagram to show the arrangement of the electrons in a molecule of chlorine.

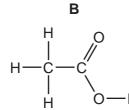
Show only the outer electrons.

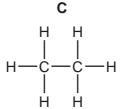
[2]

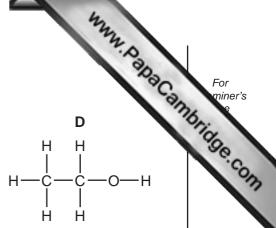
[Total: 16]











(a) (i) State the name of the type of bonding between the atoms in these four compounds.

-		-
	11	- 1
	11	- 1

(ii) Which one of these compounds, A, B, C or D, is a saturated hydrocarbon?

r		1
	Ш	

(iii) Which one of these compounds is acidic?

(iv) State the name of compound **D**.

r.	4.7	
l'	7 I	

(v) Compound A contains a C=C double bond. Describe a test for a C=C double bond.

test ......

- **(b)** Compound **C** is a member of the alkane homologous series.
  - (i) State two features of an homologous series.

1		
1	• • • • • • • • • • • • • • • • • • • •	 •

(ii) State the formula and name of another alkane in the same homologous series as compound **C**.

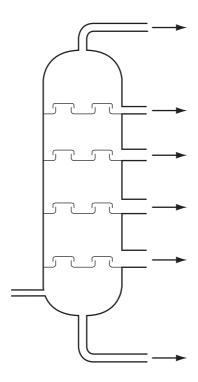
formula

name [2]	name	[2	]
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**(c)** The alkanes present in petroleum can be separated by fractional distillation. The diagram below shows a fractional distillation column.



- (i) On the diagram, label where the temperature in the column is the lowest.

  Mark this with the letter X.

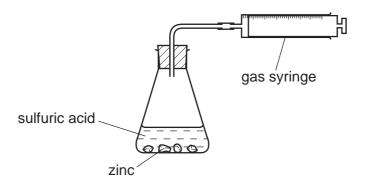
  [1]
- (ii) On the diagram, label where the bitumen fraction is collected.

  Mark this with the letter Y. [1]

[Total: 12]

www.PapaCambridge.com A student used the apparatus shown below to investigate the speed of reaction whe 5 lumps of zinc reacted with excess sulfuric acid.

 $zinc + sulfuric acid \rightarrow zinc sulfate + hydrogen$ 



(a) As the reaction proceeds, describe what happens to

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	ι.	J

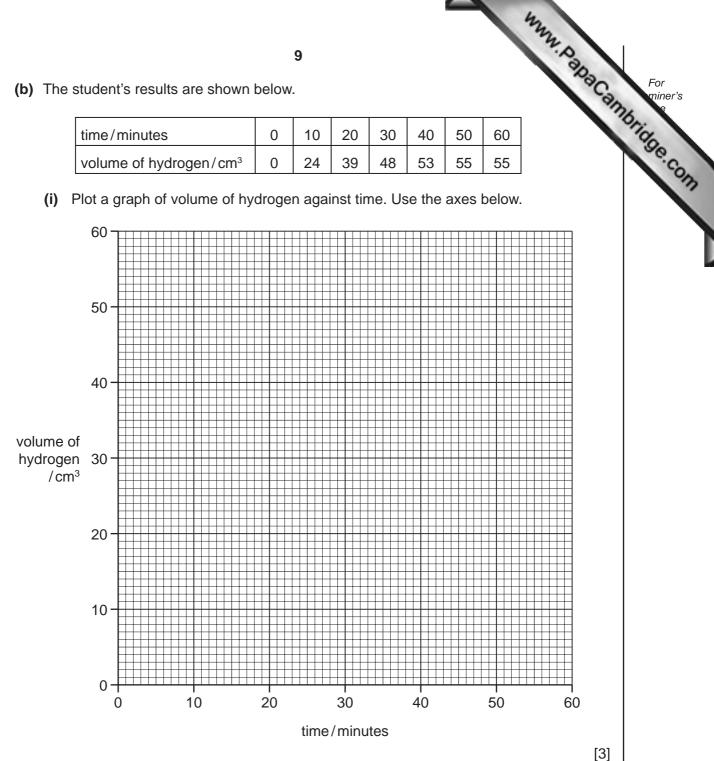
(ii) the concentration of zinc sulfate in the solution in the flask.

[1]	]
-----	---

(b) The student's results are shown below.

time/minutes	0	10	20	30	40	50	60
volume of hydrogen/cm <sup>3</sup>	0	24	39	48	53	55	55

(i) Plot a graph of volume of hydrogen against time. Use the axes below.



(ii)	Use your graph to calculate the volume of hydrogen given off after 25 minutes.	
	volume of hydrogen	[1]

(iii) Explain why no more hydrogen was given off after 50 minutes.

(iv) Describe a test for hydrogen.

test
------

result	[2]	l

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(c)	Wh	at happens to the speed of the reaction when
` ,	(i)	smaller pieces of zinc are used?
		[1]
	(ii)	some water is added to the sulfuric acid?
		[1]
(d)		e reaction between zinc and sulfuric acid is catalysed by copper(II) sulfate solution. at do you understand by the term <i>catalyst</i> ?
		[1]
		[Total: 12]

## 11 Iron is a transition element. (a) State three properties of transition elements which are not shown by the Group elements. 1. ..... 2. ..... **(b)** The symbols for two isotopes of iron are shown below. <sup>54</sup><sub>26</sub>Fe <sup>57</sup><sub>26</sub>Fe (i) How do these two isotopes differ in their atomic structure? .....[1] (ii) State the number of nucleons present in one atom of the isotope <sup>57</sup>/<sub>26</sub>Fe. .....[1] (iii) How many electrons are there in one atom of the isotope <sup>54</sup>/<sub>26</sub>Fe? .....[1] **(c)** Pure iron rusts very easily. (i) State the **two** conditions that are needed for rusting to take place. 1. .....

(ii) Describe and explain **one** method of preventing rusting.

method .....

explain why this method works .....

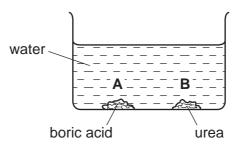
......[2]

[Total: 14]

		4	
		12 M. D.	
(d)	In t	ne blast furnace, iron(III) oxide reacts with carbon monoxide.	Car
		$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$	13
		he blast furnace, iron(III) oxide reacts with carbon monoxide. $ Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2 $ ich substance gets reduced in this reaction? blain your answer.	
	sub	stance	
	exp	lanation	
			[2]
(e)	(i)	Carbon monoxide is a pollutant gas produced in motor car engines.  Explain why carbon monoxide is formed.	
			[1]
	(ii)	State <b>one</b> harmful effect of carbon monoxide.	
			[1]

www.PapaCambridge.com 7 Boric acid is an acid. Urea is a base. Both compounds are crystalline. A student placed some crystals of boric acid and urea in a large beaker of water. The value of the water at the start of the experiment was pH 7.





(a) After 15 minutes	the pH at point A	<b>A</b> in the beaker	was pH 6.2.
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(i)	Suggest why the pH at point <b>A</b> had decreased.

 [1	Ŋ	ı

(ii) What was the most likely pH at point **B** in the beaker after 15 minutes? Put a ring around the correct answer.

pH 1	[1]
------	-----

(iii) The particles of boric acid and urea diffuse throughout the solution. What do you understand by the term *diffusion*?

 [1]

(iv) After 24 hours the pH throughout the whole solution was pH 7. Use your knowledge of acids and alkalis to explain why the pH returned to pH 7.

**(b)** The structure of urea is shown below.

(i) Write the simplest formula for urea.

(ii) Calculate the relative molecular mass of urea. Use your Periodic Table to help you.

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			[1]
(c)	Ure	a is used as a fertiliser.	
	(i)	Which element present in urea is an essential part of most fertilisers?	
			[1]
	(ii)	Explain why farmers put fertilisers on their fields.	
			[2]
(d)	Des	scribe how you can obtain pure, dry crystals of urea from an aqueous solution of a.	
			[2]
		[Total:	11]

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

	0	4 <b>He</b> lium	20 <b>Ne</b> on Neon 10	40 <b>Ar</b> Argon	84 Krypton 36	131 <b>Xe</b> Xenon	Radon 86		175 <b>Lu</b> Lutetium
	II/		19 <b>T</b> Fluorine	35.5 <b>C1</b> Chlorine	80 <b>Br</b> Bromine	127 <b>I</b> lodine 53	At Astatine 85		173 <b>Yb</b> Ytterbium
	5		16 Oxygen	32 <b>S</b> Sulfur	79 Selenium 34	128 <b>Te</b> Tellurium	Po Polonium 84		169 <b>Tm</b>
	>		14 <b>N</b> itrogen 7	31 <b>P</b> Phosphorus 15	AS Arsenic	122 <b>Sb</b> Antimony 51	209 <b>Bi</b> Bismuth 83		167 <b>Er</b> Erbium
	2		12 <b>C</b> Carbon	28 <b>Si</b> licon	73 <b>Ge</b> Germanium 32	119 <b>Sn</b> ™	207 <b>Pb</b> Lead		165 <b>Ho</b>
	=		11 Boron 5	27 <b>A1</b> Aluminium 13	70 <b>Ga</b> Gallium	115 <b>In</b> Indium	204 <b>T 1</b> Thallium		162 <b>Dy</b> Dysprosium
					65 <b>Zn</b> Zinc 30	Cd Cadmium 48	201 <b>Hg</b> Mercury		159 <b>Tb</b> Terbium
					64 <b>Cu</b> Copper	108 <b>Ag</b> Silver 47	197 <b>Au</b> Gold		157 <b>Gd</b> Gadolinium
Group					59 <b>R</b> Nickel 28	Pd Palladium 46	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium
Ğ					59 <b>Co</b> Cobalt	103 Rhodium 45	192 <b>Ir</b>		150 <b>Sm</b> Samarium
		1 Hydrogen			56 <b>Fe</b> Iron	101 <b>Ru</b> Ruthenium 44	190 <b>OS</b> Osmium 76		<b>Pm</b> Promethium
					55 <b>Mn</b> Manganese 25	Tc Technetium 43	186 <b>Re</b> Rhenium 75		144 <b>Na</b> Neodymium
					52 <b>Cr</b> Chromium 24	96 <b>Mo</b> Molybdenum 42	184 <b>W</b> Tungsten 74		141 <b>Pr</b> Praseodymium
					51 V Vanadium 23	93 <b>Nb</b> Niobium	181 <b>Ta</b> Tantalum 73		140 <b>Ce</b> Cerium
					48 <b>T</b> Titanium 22	91 <b>Zr</b> Zirconium 40	178 <b>#</b> Hafnium 72		
					45 Sc Scandium 21	89 <b>Y</b> ttrium 39	139 <b>La</b> Lanthanum 57 *	227 <b>Ac</b> Actinium 89	series eries
	=		Be Beryllium	24 Mg Magnesium	40 <b>Ca</b> Calcium	88 <b>Sr</b> Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series 190-103 Actinoid series
	_		7 <b>L.i</b> Lithium	23 <b>Na</b> Sodium	39 <b>K</b> Potassium 19	85 <b>Rb</b> Rubidium 37	133 CS Caesium 55	Francium 87	*58-71 Lε

www.papaCambridge.com **Ta** ğ Fm Fermium Erbium 운 Es ٥ ರ Bk Berkelium Ferbium Gadolinium Gd **Curium** Am En Sm Pu Neptunium Š Ра ቯ 232 **Th** Thorium **Cerium** 28 06 b = proton (atomic) number a = relative atomic mass

X = atomic symbol

в ×

Key

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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