

**CANDIDATE** 

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

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NAME			
CENTER NUMBER		CANDIDATE NUMBER	
CHEMISTRY	(US)		0439/21
Paper 2		Oct	ober/November 2012
			1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

## **READ THESE INSTRUCTIONS FIRST**

Write your Center 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 Exam	iner's Use
1	
2	
3	
4	
5	
6	
7	
Total	

This document consists of 13 printed pages and 3 blank pages.



The diagram shows the structures of five compounds, A, B, C, D and E, containing of

Α

В

C

D





E, containing of the C	Ĺ
E E, containing c	For miner's e
H H     H—C—C—O—H     H H	3e.com

(a) Answer these questions using the letters A, B, C, D or E. Each compound can be used once, more than once or not at all.

Which one of these compounds

- (vi) is a product of fermentation? ......[1]
- (c) Compound **B** is inert to most chemical reagents.

It is made by reacting chlorine with carbon disulfide in the presence of an aluminum chloride catalyst.

What do you understand by the following terms?

compound	
	. [1]
inert	. [1]
catalvst	. [1]

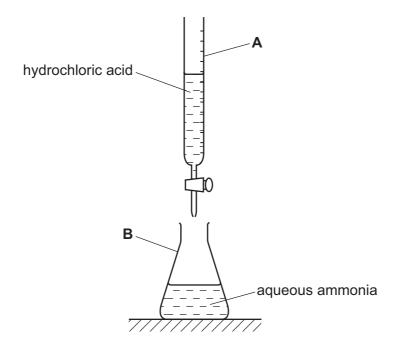
[Total: 10]

- 2 Hydrogen chloride, HCl, is an acidic gas.
  - (a) Draw a dot and cross diagram of a molecule of hydrogen chloride. Show only the outer electrons.

[2]

**(b)** Hydrogen chloride dissolves in water to form a solution of hydrochloric acid.

A student titrated aqueous ammonia with hydrochloric acid using the apparatus shown below.



(i) State the name of the pieces of apparatus labeled **A** and **B**.

A is a	 [1]
<b>B</b> is a	 [1

(ii) Describe how the pH value of the solution in **B** changes as hydrochloric acid is added until the acid is in excess.

[3]		

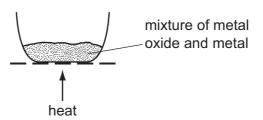
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	(iii)	Con	nplet	e the	wor	d and	l symb	ol equ	ations	for th	is rea	ction.			ASC.
			am	moni	ia +	hydr	ochlor	ic acid	→						
					. +		HC1		$\rightarrow$		NH <sub>4</sub> 0	Cl			[2]
(c)	Des	scribe	wh	at ha	арре	ns wh	nen yo	a is in	l aque exces	ous a s.	mmor		a solutio	·	

[Total: 13]

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www.PapaCambridge.com The reactivity of different metal oxides was compared by heating them with metal 3 crucible.



The results are shown in the table below.

mixture	observations
iron oxide + zinc	reacts
lead oxide + iron	reacts
magnesium oxide + zinc	no reaction

(a) (i) Use the results in the table to suggest the order of reactivity of the metals iron, lead, magnesium and zinc.

most reactive ————————————————————————————————————	→ least reactive
	[2]
(ii) Predict whether iron will react with zinc oxide. Explain your answer.	
(b) Which two of the following statements about metals are correct Tick <b>two</b> boxes.	
Metals conduct electricity and heat.  All Group IV elements show metallic properties.  Magnesium is extracted by heating its oxide with carbon.  All metals have high densities.  Iron is a transition element.	
	[2]

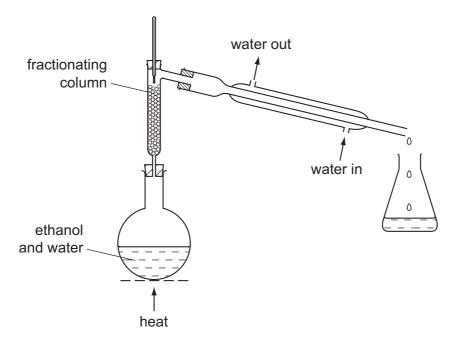
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- (c) Sand and salt (sodium chloride) are both solids.
  - (i) Describe the arrangement and movement of the particles in a solid. arrangement .....

	May	
	6 and salt (sodium chloride) are both solids.	
Sar	nd and salt (sodium chloride) are both solids.	For miner's
(i)	Describe the arrangement and movement of the particles in a solid.	bridge Co
	arrangement	Se.C.
	movement [2]	O'TH
(ii)	Describe how you could separate the sand from a mixture of sand and salt. Give full details of how this is carried out.	

.....[3]

(d) The diagram below shows the apparatus used to separate ethanol and water from a mixture of ethanol and water.



Complete the following sentences about this separation using words from the list below.

diatillation

condenser	crystallization	distillation	паѕк	neavy		
higher	lower	solid	volatile	vapor		
Fractional	is used	d to separate a	mixture of water	and ethanol. The		
temperature at the top of the fractionating column is than the temperature						
at the bottom. The more liquid evaporates and moves further up the						
column. It eventu	ally reaches the	w	here the	changes		
to a liquid.				[5]		

[Total: 15]

- Lithium has two naturally-occurring isotopes, <sup>6</sup><sub>3</sub>Li and <sup>7</sup><sub>3</sub>Li.
  - (a) What do you understand by the term *isotope*?

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nium has two naturally-occurring isotopes, ${}^6_3$ Li and ${}^7_3$ Li.  What do you understand by the term <i>isotope</i> ?	For miner's e
	(COM)

(b) Draw a **labeled** diagram to show the atomic structure of an atom of  ${}_{3}^{7}Li$ .

Show the particles in the nucleus as well as the electrons.

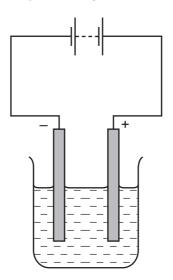
[5]

(c) Lithium reacts with oxygen to form lithium oxide, Li<sub>2</sub>O. Complete the equation for this reaction.

[3]

For miner's e

(d) Aqueous lithium chloride is electrolyzed using the apparatus shown below.



- (i) On the diagram above, label:
  - the electrolyte
  - the anode. [2]
- (ii) What do you understand by the term aqueous?

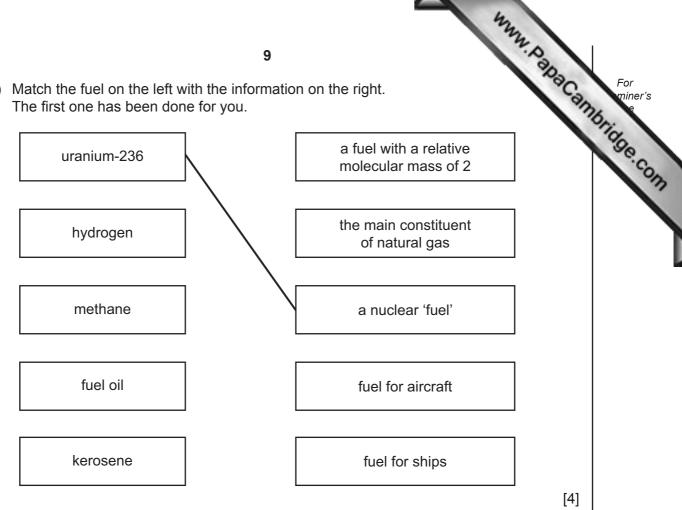
......[1]

(iii) Explain why aqueous lithium chloride is able to conduct electricity.

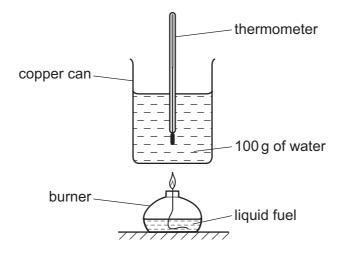
.....[1]

[Total: 13]

(a) Match the fuel on the left with the information on the right. 5 The first one has been done for you.



(b) Two students investigated some fuels to find which gave off the most energy. They tested four liquid fuels using the apparatus shown below.



(i) In each experiment, the amount of fuel burned was the same. Suggest **one** other factor that should be kept the same in each experiment.

(ii) The students used the thermometer to stir the water. Suggest why it is important to keep the water stirred.

[4]

(iii) The results are shown in the table below.

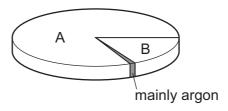
fuel	initial temperature of the water/°C	final temperature of the water/°C
ethanol	24	40
propanol	24	42
paraffin	22	33
petroleum spirit	20	40

vvnich fuel transfers the most energy to the water?	
Explain your answer.	

.....[2]

(c) Air is needed for fuels to burn.

The pie chart below shows the composition of the air.



State the name of

gas A, .....

gas B. .....[2]

- (d) Argon is a noble gas.
  - (i) State **one** use for argon.

.....[1]

(ii) To which period in the Periodic Table does argon belong?

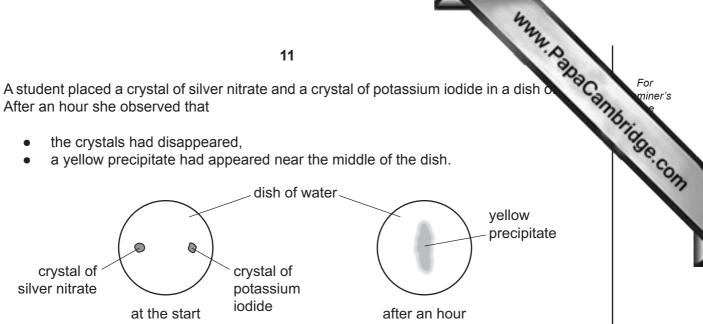
.....[1]

(iii) Describe the chemical properties of argon.

.....[1]

[Total: 13]

- A student placed a crystal of silver nitrate and a crystal of potassium iodide in a dish After an hour she observed that
  - the crystals had disappeared,
  - a yellow precipitate had appeared near the middle of the dish.



(a)	Use your knowledge of the kinetic particle theory and reactions between ions to explain these observations.
	LV.
	[4]
/I \	D. C. and C. B. P. L. and C. C. 20. Annual and L. P. C. annual and C.

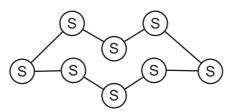
(b) Potassium iodide reacts with aqueous chlorine. Complete the equation for this reaction.

2KI + ....... 
$$\rightarrow$$
 .....KC $l$  +  $I_2$ 

[2]

[Total: 6]

The diagram shows one molecule of sulfur. 7



	12 WANNER OF THE PARTY OF THE P	
The	e diagram shows one molecule of sulfur.	For
THO	S S S S	For miner's e
(a)	How many atoms are there in <b>three</b> molecules of sulfur?	[1]
(b)	Calculate the relative molecular mass of sulfur.	
(c)	Explain how acid rain is formed when fossil fuels containing sulfur are burned.	[1]
(0)	In your answer, include	
	<ul> <li>the name of a fossil fuel which contains sulfur,</li> <li>the gas formed when sulfur burns,</li> <li>the reactions which lead to the formation of acid rain.</li> </ul>	
		[4]
(d)	Potassium sulfate can be used as a fertilizer.  The potassium in this fertilizer is an important element for plant growth.  Name <b>two</b> other <b>elements</b> , important for plant growth, which are present in meterilizers.	ost
	and	[2]
(e)	Describe a test for sulfate ions.	
	test	
	result	[2]

[Total: 10]

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	ı			1	6				MM. A.	Da Cambride
0	4 <b>He</b> Helium	20 <b>Ne</b> Neon 10	40 <b>Ar</b> Argon 18	84 <b>Kr</b> Krypton 36	131 <b>Xe</b> Xenon 54	Radon 86		175 <b>Lu</b> Lutetium 71	Lr Lawrendum 103	andri
=		19 Fluorine	35.5 <b>C1</b> Chlorine	80 <b>Br</b> Bromine	127 <b>T</b> lodine	At Astatine 85		<b>Yb</b> Ytterbium 70	Nobelium 102	13
5		16 Oxygen 8	32 <b>S</b> Sulfur 16	Selenium 34	128 <b>Te</b> Tellurium	Po Polonium 84		169 <b>Tm</b> Thulium	Md Mendelevium 101	
>		14 <b>N</b> itrogen 7	31 Phosphorus 15	75 <b>As</b> Arsenic	122 <b>Sb</b> Antimony 51	209 <b>Bi</b> Bismuth		167 <b>Er</b> Erbium 68	Fm Fermium	
≥		12 Carbon	28 <b>Si</b> Silicon	73 <b>Ge</b> Germanium 32	30 Jin	207 <b>Pb</b> Lead		165 <b>Ho</b> Holmium 67	Einsteinium	(r.t.p.).
≡		11 Boron	27 <b>A1</b> Aluminum 13	70 <b>Ga</b> Gallium 31	115 <b>In</b> Indium	204 <b>T 1</b> Thallium		162 <b>Dy</b> Dysprosium 66	Cf Californium 98	pressure
				65 <b>Zn</b> Zinc 30	Cd Cadmium	201 <b>Hg</b> Mercury 80		159 <b>Tb</b> Terbium 65	<b>BK</b> Berkelium 97	The volume of one mole of any gas is 24 dm $^3$ at room temperature and pressure (r.t.p.).
				64 <b>Cu</b> Copper	108 <b>Ag</b> Silver 47	197 <b>Au</b> Gold		Gadolinium 64	Cm Curium 96	tempera
dn				59 <b>X</b> Nickel 28	106 Pd Palladium	195 <b>Pt</b> Platinum 78		152 <b>Eu</b> Europium 63	Am Americium 95	اع at room
Group				59 <b>Co</b> Cobalt	103 <b>Rh</b> Rhodium 45	192 <b>Ir</b>		Sm Samarium 62		s is 24 dm
	T Hydrogen			56 <b>Fe</b> Iron	Ruthenium 44	190 <b>Os</b> Osmium 76		Pm Promethium 61	Neptunium 93	of any gas
		J		55 <b>Mn</b> Manganese 25	Tc Technetium 43	186 <b>Re</b> Rhenium 75		144 Nd Neodymium 60	238 <b>U</b> Uranium 92	ne mole o
				52 <b>Cr</b> Chromium 24	96 <b>Mo</b> Molybdenum 42	184 <b>W</b> Tungsten 74		741 <b>Pr</b> Praseodymium 59	Pa Protactinium 91	lume of o
				51 Vanadium 23	93 Nobium Niobium	181 <b>Ta</b> Tantalum		140 <b>Ce</b> Cerium	232 <b>Th</b> Thorium	The vo
				48 <b>Ti</b> Titanium	2r Zrconium 40		'		number	
				45 Sc Scandium 21	89 <b>×</b>	La Lanthanum 57 *	227 <b>Ac</b> Actinium 89	series iries	<ul> <li>a = relative atomic mass</li> <li>x = atomic symbol</li> <li>b = proton (atomic) number</li> </ul>	
=		9 Be Beryllium 4	24 Mg Magnesium	40 <b>Ca</b> Calcium	Strontium	137 <b>Ba</b> Barium 56	226 <b>Ra</b> Radium 88	*58-71 Lanthanoid series	а <b>Х</b> Ф	
_		7 <b>Li</b> Lithium	23 <b>Na</b> Sodium	39 K Potassium 19	Rb Rubidium 37	Caesium	Francium 87	58-71 La 30-103 A	Key	

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