



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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CHEMISTRY

0620/22

Paper 2

October/November 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 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

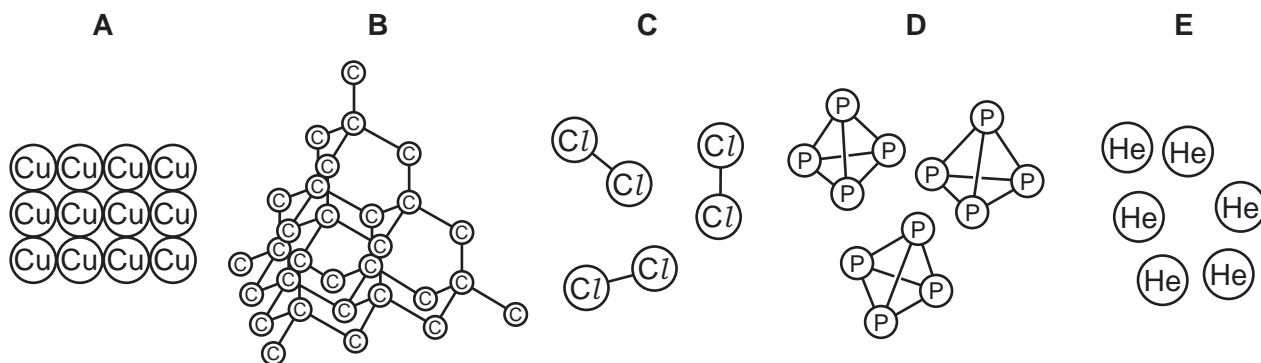
1	
2	
3	
4	
5	
6	
7	
Total	

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



1 The diagram shows the structures of five elements, **A**, **B**, **C**, **D** and **E**.

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

Which one of these elements

- (i) is in Group V of the Periodic Table, [1]
- (ii) is used to fill weather balloons, [1]
- (iii) is a diatomic gas at room temperature, [1]
- (iv) conducts electricity, [1]
- (v) is a transition element? [1]

(b) Which **two** of the elements **A**, **B**, **C**, **D** or **E** are simple molecules?

..... and [2]

(c) Which **two** of the words or phrases in the list below describe the structure of element **B**?

covalent giant ionic
metallic simple atomic simple molecular

..... and [2]

(d) What do you understand by the term *element*?

..... [1]

[Total: 10]

3

For
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2 Ammonia, NH_3 , is an alkaline gas.

(a) Describe a test for ammonia.

test

result [2]

(b) What is the pH of an aqueous solution of ammonia?
Put a ring around the correct answer.

pH1

pH3

pH5

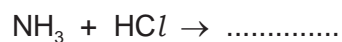
pH7

pH9

[1]

(c) Ammonia reacts with hydrochloric acid.

(i) Complete the symbol equation for this reaction.



[1]

(ii) Hydrochloric acid can be made by dissolving hydrogen chloride, HCl , in water.
Draw a diagram to show the arrangement of electrons in hydrogen chloride.
Show only the outer electrons.

Show a hydrogen electron as ●

Show a chlorine electron as x

[2]

- (d) Aqueous ammonia reacts with sulfuric acid to form a solution of ammonium sulfate.



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Use

- (i) Ammonium sulfate is a colourless salt. Describe how you could use a titration method to make a colourless solution of ammonium sulfate.

.....
.....
.....
.....
.....
..... [4]

- (ii) How can crystals of ammonium sulfate be obtained from a solution of ammonium sulfate?

.....
..... [1]

[Total: 11]

3 The table below shows the properties of some halogens.

For
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Use

halogen	colour	state at room temperature	melting point /°C
fluorine	yellow		-220
chlorine	light green	gas	
bromine	brownish-red	liquid	-7
iodine	grey-black	solid	+114

(a) (i) What is the trend in the colour of the halogens down the Group?

..... [1]

(ii) Predict the state of fluorine at room temperature.

..... [1]

(iii) Predict the melting point of chlorine.

..... [1]

(b) The reactivity of three different halogens was compared by reacting them with solutions of sodium halides.

The results are shown in the table below.

reaction mixture	observations
astatine + sodium iodide	colour of reaction mixture remains unchanged
bromine + sodium iodide	mixture turns dark brown
chlorine + sodium bromide	mixture turns brownish-red

(i) Use the results in the table to suggest the order of reactivity of astatine, bromine, chlorine and iodine.

most reactive \longrightarrow least reactive

--	--	--	--

[2]

(ii) Predict whether bromine will react with sodium chloride solution.
Explain your answer.

.....

..... [1]

- (c) Chlorine reacts with excess cold dilute sodium hydroxide. The products of the reaction are sodium chloride, sodium chlorate(I) and water.
The formula of sodium chlorate(I) is NaClO .

Complete the equation for this reaction.

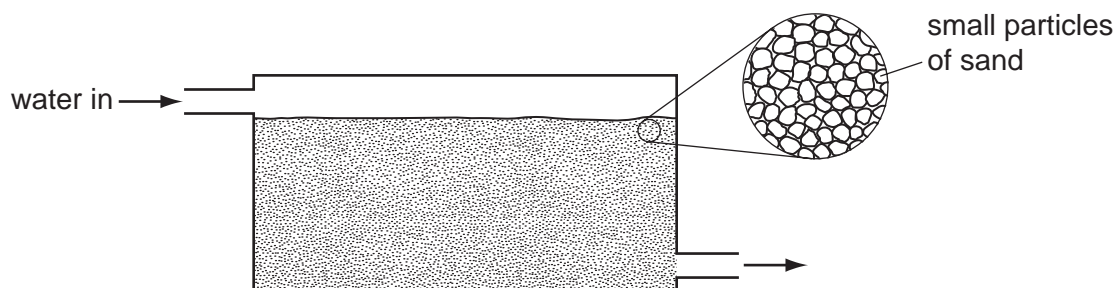


[2]

- (d) (i) Explain why chlorine is used in water purification.

..... [1]

- (ii) Impure water contains particles of minerals and remains of dead plants and animals. One stage in water purification is the removal of these particles by filtration. The diagram below shows a water filter.



Explain how this water filter works.

.....

 [2]

[Total: 11]

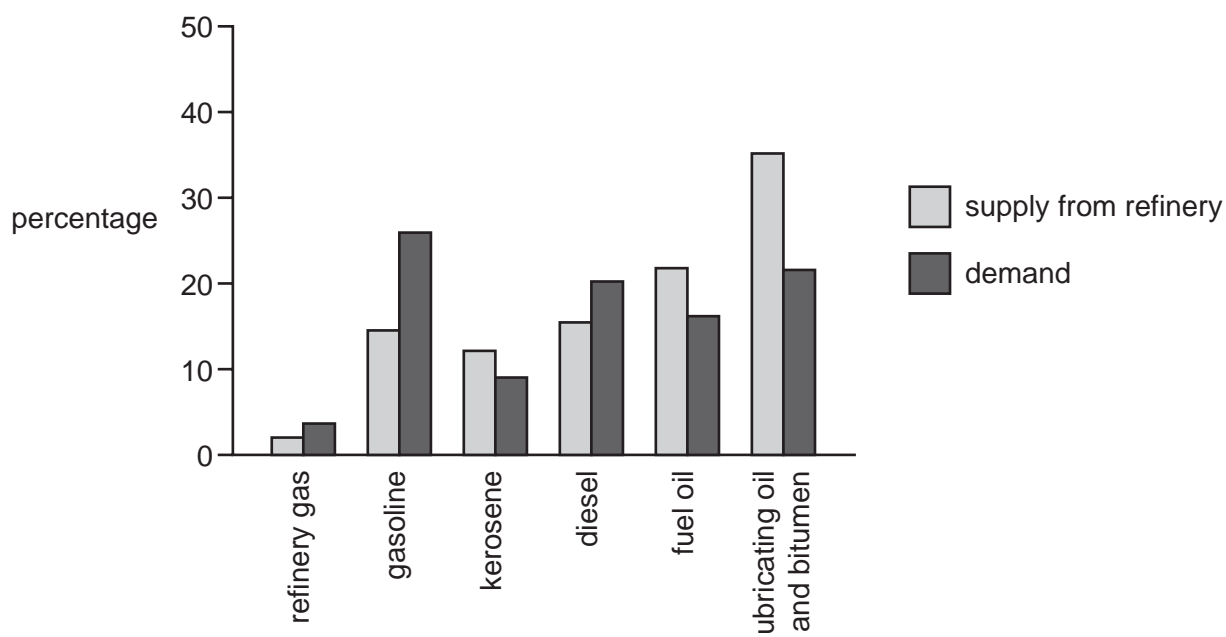
4 The process of distillation is used in an oil refinery to separate petroleum into different fractions.

(a) What do you understand by the term *petroleum fraction*?

.....
 [2]

(b) Some petroleum fractions are more useful than others. There is a greater demand for these fractions.

The diagram shows the demand from customers and the ability of an oil refinery to supply these fractions by fractional distillation alone.



(i) State the name of **two** fractions for which demand is greater than supply.

..... [2]

(ii) State **one** use for each of the following fractions.

refinery gas

bitumen [2]

(c) More gasoline can be made by cracking long-chain hydrocarbons.

State the conditions needed for cracking.

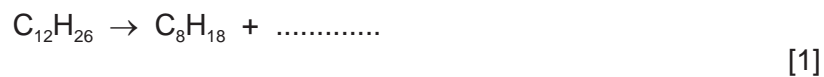
.....
 [2]

(d) Dodecane, $C_{12}H_{26}$, can be cracked to form smaller hydrocarbons.

(i) What do you understand by the term *hydrocarbon*?

..... [1]

(ii) Complete the equation for the cracking of dodecane.



(e) Ethene, C_2H_4 , can be formed by cracking.

(i) Draw the full structure of ethene showing all atoms and bonds.

[1]

(ii) Poly(ethene) can be made from ethene.
Complete the following sentences using words from the list below.

addition atoms condensation dimers
monomers polymers subtraction

The small ethene molecules which join together to form poly(ethene) are called ethene The process of joining the ethene molecules together is an example of an reaction. The long-chain molecules which are formed are called [3]

[Total: 14]

5 Aluminium is in Group III of the Periodic Table. Iron is a transition element.

- (a) Both aluminium and iron have high melting points and boiling points.
State **two** differences in the physical properties of aluminium and iron.

.....
..... [2]

- (b) State **one** use of aluminium.

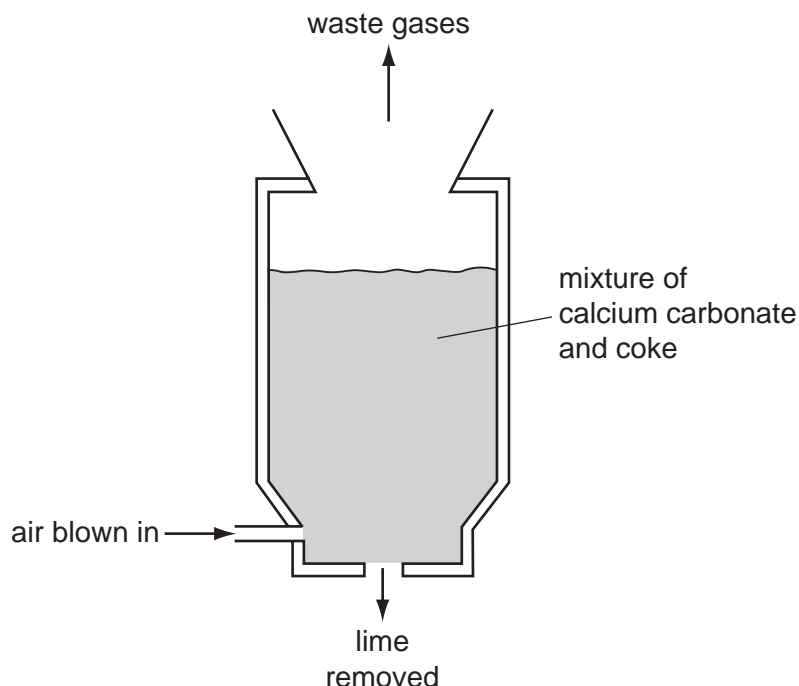
..... [1]

- (c) Sodium hydroxide is used to test for aluminium ions.
Describe what happens when you add a solution of sodium hydroxide to a solution of aluminium ions until the sodium hydroxide is in excess.

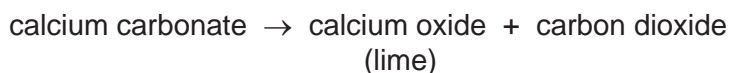
.....
.....
..... [3]

[Total: 6]

6 The diagram below shows a kiln used for manufacturing lime.



The reaction taking place in the kiln is



(a) (i) State the name of a rock which is largely calcium carbonate.

..... [1]

(ii) Explain why, at the end of the reaction, there is only lime left in the lime kiln.

..... [1]

(b) (i) Coke is mainly carbon.

Combustion of coke provides the heat for the reaction in the lime kiln.

Write a symbol equation for the complete combustion of carbon in oxygen.

..... [2]

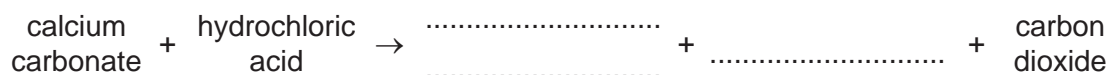
(ii) Complete these sentences using words from the list below.

- | | | | |
|---------|----------|-----------|--------------|
| air | dioxide | harmless | hydrogenated |
| limited | monoxide | poisonous | water |

When carbon burns in a supply of, carbon
..... is formed. This is a colourless gas which has no smell and is
.....

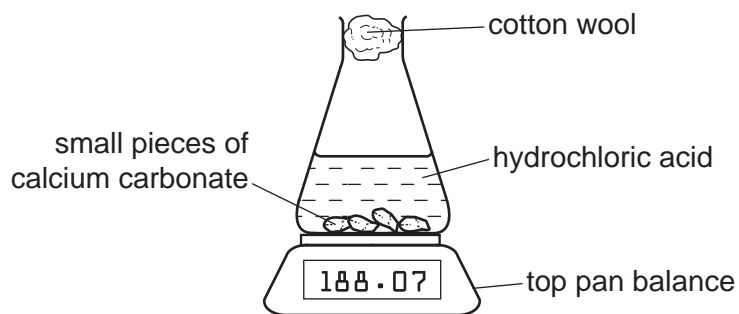
[4]

- (c) Calcium carbonate reacts with hydrochloric acid to form carbon dioxide.
Complete the word equation for this reaction.



[2]

- (d) The speed of reaction of calcium carbonate with hydrochloric acid can be found using the apparatus shown below.



- (i) Suggest how this apparatus can be used to find the speed of this reaction.

.....

 [2]

- (ii) State how the speed of this reaction changes when

the concentration of acid is increased,

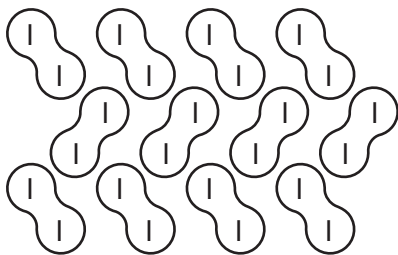
larger pieces of calcium carbonate are used,

the temperature is increased. [3]

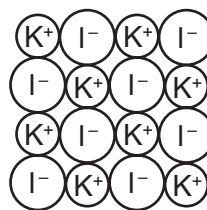
[Total: 15]

7 The structures of iodine and potassium iodide are shown below.

For
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Use



iodine



potassium iodide

(a) Iodine is a solid at room temperature. Its melting point is $+114^{\circ}\text{C}$.

(i) Describe what happens to the arrangement and movement of iodine molecules when iodine is gradually heated from 20°C to 120°C .

.....

.....

.....

.....

..... [4]

(ii) Calculate the relative molecular mass of iodine.

..... [1]

(b) (i) What type of bonding is present in potassium iodide?

..... [1]

(ii) Write the simplest formula for potassium iodide.

..... [1]

13

- (c) Complete the table below to show the solubility in water and electrical conductivity of solid iodine and solid potassium iodide.

For
Examiner's
Use

substance	solubility in water	electrical conductivity of solid
iodine		
potassium iodide		

[4]

- (d) Predict the product formed at each electrode when molten potassium iodide is electrolysed.

at the positive electrode

at the negative electrode [2]

[Total: 13]

DATA SHEET
The Periodic Table of the Elements

		Group																																																																																																																															
I	II	III	IV	V	VI	VII	0																																																																																																																										
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	13 Al Aluminium 13	14 N Nitrogen 7	15 O Oxygen 8	16 F Fluorine 9	17 Ne Neon 10	18 Ar Argon 18	19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36	37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54	55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	†	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86	226 Ra Radium 88	227 Ac Actinium 89	†	232 Th Thorium 90	238 U Uranium 92	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 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

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

a	X
b	X

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

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

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