



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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CHEMISTRY

0620/23

Paper 2

May/June 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.



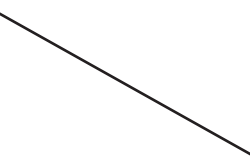
2

- 1 (a) Gases can be identified by carrying out particular tests. Some gases and tests to identify them are shown below.

For
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Match the gases on the left with the tests on the right. The first one has been done for you.

sulfur dioxide	turns limewater milky
carbon dioxide	turns potassium dichromate green
chlorine	'pops' with a lighted splint
oxygen	relights a glowing splint
hydrogen	bleaches damp litmus paper



[4]

- (b) Chlorine can be prepared by heating hydrochloric acid with manganese(IV) oxide.



- (i) Write a word equation for this reaction.

[3]

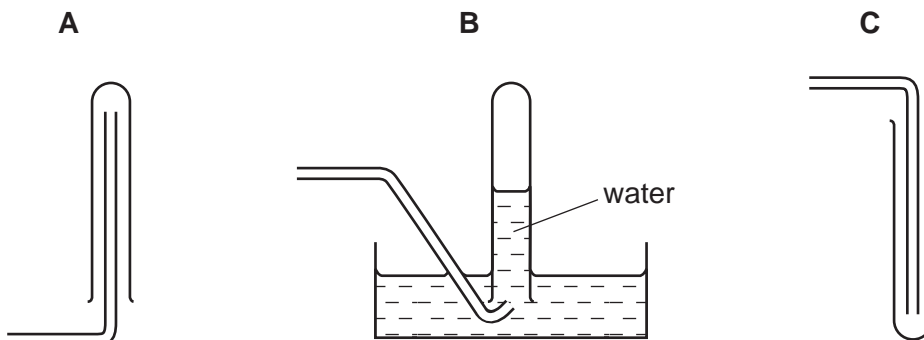
3

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Use

(ii) Chlorine is

- denser than air
- soluble in water.

Which **one** of the following diagrams, **A**, **B** or **C**, best describes how chlorine gas is collected?



Answer = [1]

(c) Hydrogen reacts with oxygen to form water.

(i) Complete the equation for this reaction.



[2]

(ii) State **one** use of

hydrogen,

water. [2]

[Total: 12]

2 Alkalis are soluble bases.

- (a) Which **one** of the following is alkaline?
Put a ring around the correct answer.

distilled water

hydrochloric acid

sodium chloride solution

sodium hydroxide solution

[1]

- (b) Suggest a pH value for a solution which is alkaline.

..... [1]

- (c) Describe how you would find the pH of a solution.

.....

.....

..... [2]

- (d) When excess fertilisers are put on the soil, the soil may become acidic.

- (i) Why is it important to farmers that the soil does not become too acidic?

..... [1]

- (ii) Calcium carbonate is used to decrease the acidity of the soil. Explain how calcium carbonate decreases soil acidity.

.....

..... [2]

[Total: 7]

3 The table below shows some properties of the halogens.

halogen	melting point/°C	boiling point/°C	colour
chlorine	-101	-35	
bromine	-7	+59	
iodine	+114	+184	greyish-black

(a) (i) Complete the spaces in the table to show the colours of chlorine and bromine. [2]

(ii) Room temperature is about 20 °C.
Use the information in the table to explain why

chlorine is a gas at room temperature,

.....

bromine is a liquid at room temperature.

..... [2]

(iii) Astatine is the halogen below iodine in the Periodic Table.
Suggest a value for the melting point of astatine.

..... [1]

(b) Chlorine reacts with an aqueous solution of potassium iodide.

(i) Complete the balanced equation for this reaction.



[2]

(ii) State the names of the products of this reaction.

..... [2]

(iii) To which period in the Periodic Table does chlorine belong?

..... [1]

(c) Complete the following sentences about the test for iodide ions using words from the list below.

hydrochloric

nitric

potassium

precipitate

silver

solution

white

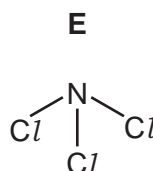
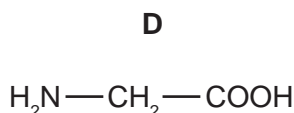
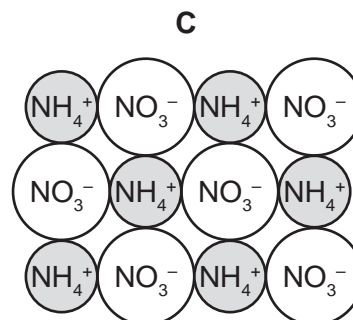
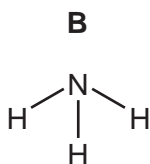
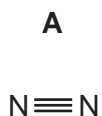
yellow

A small volume of solution containing aqueous iodide ions is put into a test-tube. Dilute
..... acid is added followed by a few drops of nitrate solution.

A coloured is formed if iodide ions are present. [4]

[Total: 14]

4 The diagram below shows the structure of some substances containing nitrogen.



- (a) (i) Which one of these substances, **A**, **B**, **C**, **D** or **E**, is an alkaline gas?
- (ii) Which one of these substances is an ionic salt?
- (iii) Which one of these substances contains a carboxylic acid functional group?

[3]

(b) Oxides of nitrogen such as nitrogen dioxide, NO_2 , are atmospheric pollutants. Give **one** source of nitrogen oxides in the air.

..... [1]

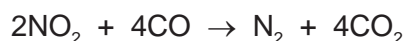
(c) State **one** harmful effect of nitrogen dioxide.

..... [1]

(d) Calculate the relative formula mass of nitrogen dioxide, NO_2 .

[1]

(e) In the presence of a catalyst, nitrogen dioxide reacts with carbon monoxide.



(i) Which substance gets oxidised during this reaction? Explain your answer.

.....

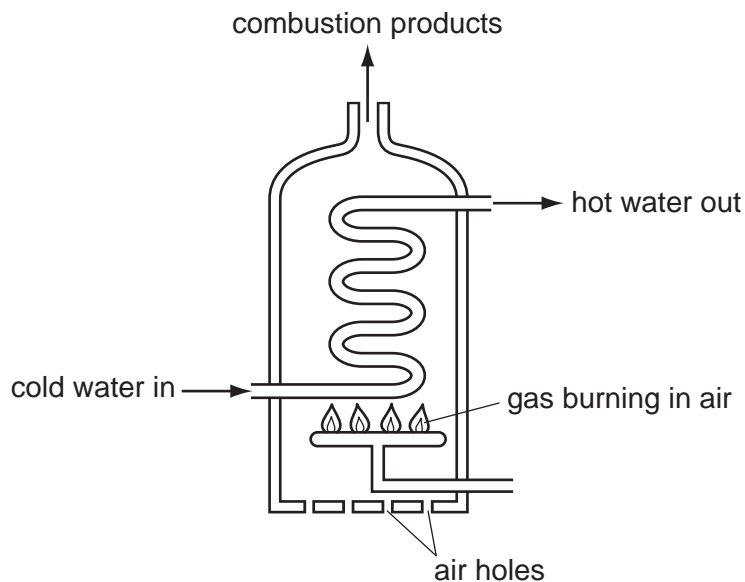
..... [2]

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(ii) What is the meaning of the term *catalyst*?

..... [1]

(iii) Carbon monoxide is formed when some of the air holes in a water heater get blocked. The diagram shows a water heater.



Explain why carbon monoxide is formed when some of the air holes in a water heater get blocked.

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

(iv) Explain why carbon monoxide is dangerous.

..... [1]

[Total: 12]

5 Iron is a shiny metallic solid. Iron is a transition element.

(a) State **three** other physical properties of a transition element.

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

(b) Iron reacts with sulfuric acid.



(i) Write a word equation for this reaction.

..... [2]

(ii) Describe, with the aid of a diagram, how you could measure the speed of this reaction.

In your answer describe:

- the apparatus you would use
- the measurements you would take.

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

(c) When iron reacts with sulfur, energy is released.

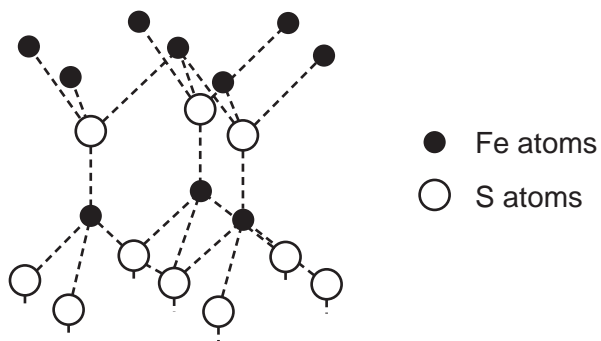
(i) What is the name given to a reaction which releases energy?

..... [1]

- (ii) The compound formed in this reaction is iron(II) sulfide.
What do you understand by the term *compound*?

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

- (iii) The diagram below shows the structure of iron(II) sulfide.



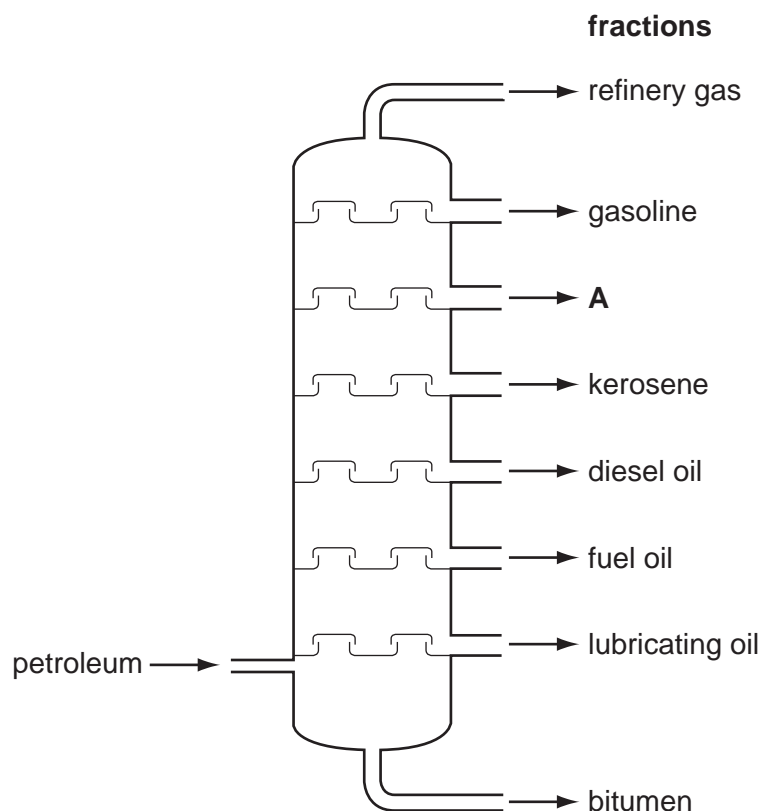
What is the simplest formula for iron(II) sulfide?

..... [1]

[Total: 12]

- 6 The diagram shows a fractionating column used to separate different hydrocarbon fractions in an oil refinery.

For
Examiner's
Use



- (a) On the diagram, draw an X to show the place in the column where the temperature is the highest. [1]

- (b) State the name of the fraction labelled **A**.

..... [1]

- (c) State a use for

the kerosene fraction,

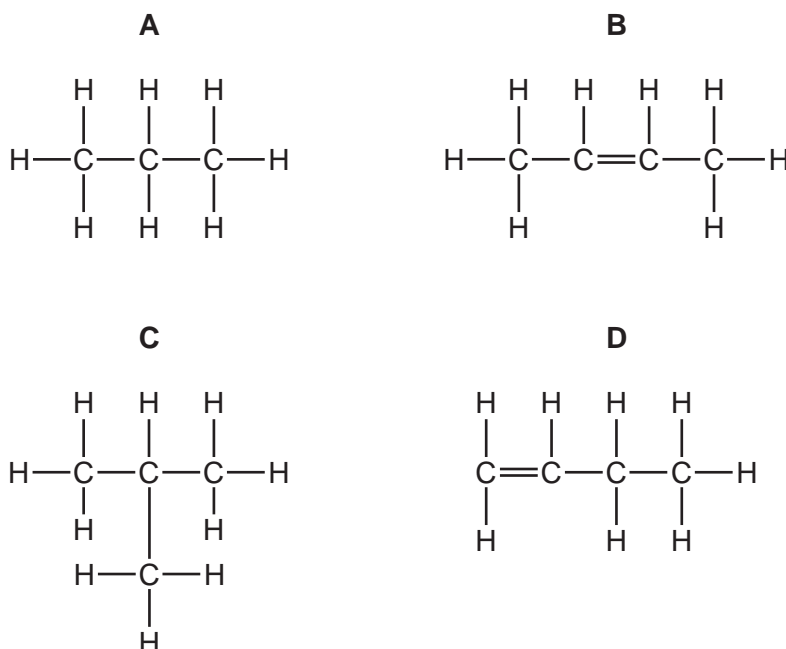
the diesel oil fraction. [2]

- (d) Complete the following sentences about fractional distillation using words from the list below.

boiling condenses cooled heated higher
lower melting mixture pressure vaporises

Petroleum is a of hydrocarbons. This mixture is and the hydrocarbons vaporise. The temperature in the fractionating column is at the top than at the bottom. As the vapours move up the column, each hydrocarbon fraction when the temperature in the column falls below the point of the hydrocarbon fraction. [5]

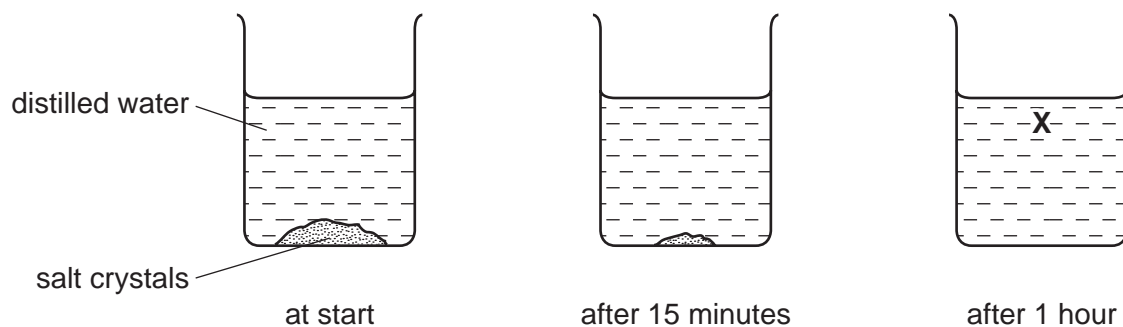
- (e) The structures of four hydrocarbons, **A**, **B**, **C** and **D**, are shown below.



- (i) Which **two** of these structures **A**, **B**, **C** or **D** have the same relative molecular mass?
..... and [1]
- (ii) Which **two** of these structures **A**, **B**, **C** or **D** will decolourise aqueous bromine?
..... and [2]

[Total: 12]

- 7 A student placed some crystals of salt at the bottom of a beaker of distilled water. She left the contents of the beaker to stand for one hour. The diagram below shows her observations.



After one hour, all the salt had disappeared but the solution at point **X** tasted salty.

- (a) Use the kinetic particle theory to explain these observations.

.....

.....

.....

.....

.....

..... [4]

- (b) Salt is sodium chloride, NaCl .

- (i) Which one of the following statements about bond formation in sodium chloride is true?

Tick **one** box.

A sodium atom shares one electron with a chlorine atom.

A sodium atom loses its outermost electron and a chlorine atom gains an electron.

A sodium atom shares two electrons with a chlorine atom.

A sodium atom gains an electron and a chlorine atom loses its outermost electrons.

[1]

13

For
Examiner's
Use

- (ii) Explain why solid sodium chloride does not conduct electricity but molten sodium chloride does conduct.

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

- (iii) State the name of the product formed at each electrode when a concentrated aqueous solution of sodium chloride is electrolysed using graphite electrodes.

at the positive electrode

at the negative electrode [2]

- (iv) What is the name of the negative electrode?
Put a ring around the correct answer.

anion **anode** **cation** **cathode** **electrolyte** [1]

- (v) Suggest why graphite is a suitable material for an electrode.

..... [1]

[Total: 11]

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	104 Rf Rutherfordium 104	105 Db Dubnium 105	106 Sg Seaborgium 106	107 Bh Bohrium 107	108 Hs Hassium 108	109 Mt Meitnerium 109	110 Ds Darmstadtium 110	111 Rg Roentgenium 111	112 Cn Copernicium 112	113 Nh Nihonium 113	114 Fl Flerovium 114	115 Mc Moscovium 115	116 Lv Livermorium 116	117 Ts Tennessine 117	118 Og Oganesson 118	119 Uu Ununennium 119	120 Uub Unbibium 120	121 Uut Ununtrium 121	122 Uuq Ununquadium 122	123 Uuq Ununquadium 123	124 Uuq Ununquadium 124	125 Uuq Ununquadium 125	126 Uuq Ununquadium 126	127 Uuq Ununquadium 127	128 Uuq Ununquadium 128	129 Uuq Ununquadium 129	130 Uuq Ununquadium 130	131 Uuq Ununquadium 131	132 Uuq Ununquadium 132	133 Uuq Ununquadium 133	134 Uuq Ununquadium 134	135 Uuq Ununquadium 135	136 Uuq Ununquadium 136	137 Uuq Ununquadium 137	138 Uuq Ununquadium 138	139 Uuq Ununquadium 139	140 Uuq Ununquadium 140	141 Uuq Ununquadium 141	142 Uuq Ununquadium 142	143 Uuq Ununquadium 143	144 Uuq Ununquadium 144	145 Uuq Ununquadium 145	146 Uuq Ununquadium 146	147 Uuq Ununquadium 147	148 Uuq Ununquadium 148	149 Uuq Ununquadium 149	150 Uuq Ununquadium 150	151 Uuq Ununquadium 151	152 Uuq Ununquadium 152	153 Uuq Ununquadium 153	154 Uuq Ununquadium 154	155 Uuq Ununquadium 155	156 Uuq Ununquadium 156	157 Uuq Ununquadium 157	158 Uuq Ununquadium 158	159 Uuq Ununquadium 159	160 Uuq Ununquadium 160	161 Uuq Ununquadium 161	162 Uuq Ununquadium 162	163 Uuq Ununquadium 163	164 Uuq Ununquadium 164	165 Uuq Ununquadium 165	166 Uuq Ununquadium 166	167 Uuq Ununquadium 167	168 Uuq Ununquadium 168	169 Uuq Ununquadium 169	170 Uuq Ununquadium 170	171 Uuq Ununquadium 171	172 Uuq Ununquadium 172	173 Uuq Ununquadium 173	174 Uuq Ununquadium 174	175 Uuq Ununquadium 175	176 Uuq Ununquadium 176	177 Uuq Ununquadium 177	178 Uuq Ununquadium 178	179 Uuq Ununquadium 179	180 Uuq Ununquadium 180	181 Uuq Ununquadium 181	182 Uuq Ununquadium 182	183 Uuq Ununquadium 183	184 Uuq Ununquadium 184	185 Uuq Ununquadium 185	186 Uuq Ununquadium 186	187 Uuq Ununquadium 187	188 Uuq Ununquadium 188	189 Uuq Ununquadium 189	190 Uuq Ununquadium 190	191 Uuq Ununquadium 191	192 Uuq Ununquadium 192	193 Uuq Ununquadium 193	194 Uuq Ununquadium 194	195 Uuq Ununquadium 195	196 Uuq Ununquadium 196	197 Uuq Ununquadium 197	198 Uuq Ununquadium 198	199 Uuq Ununquadium 199	200 Uuq Ununquadium 200	201 Uuq Ununquadium 201	202 Uuq Ununquadium 202	203 Uuq Ununquadium 203	204 Uuq Ununquadium 204	205 Uuq Ununquadium 205	206 Uuq Ununquadium 206	207 Uuq Ununquadium 207	208 Uuq Ununquadium 208	209 Uuq Ununquadium 209	210 Uuq Ununquadium 210	211 Uuq Ununquadium 211	212 Uuq Ununquadium 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295	296 Uuq Ununquadium 296	297 Uuq Ununquadium 297	298 Uuq Ununquadium 298	299 Uuq Ununquadium 299	300 Uuq Ununquadium 300

*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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