



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--



**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	
<b>Total</b>	

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



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

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.



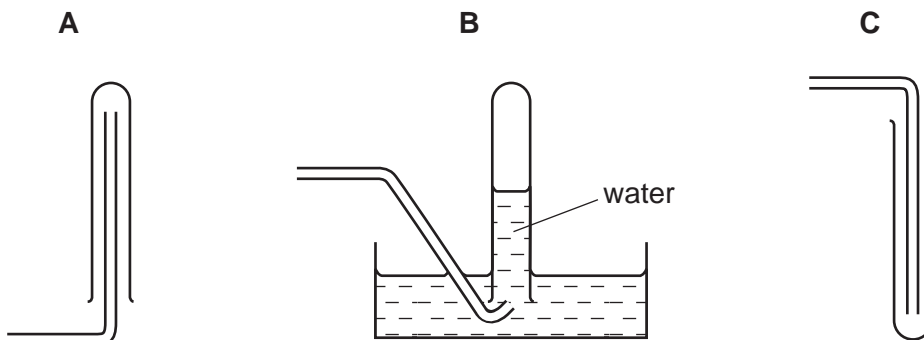
- (i) Write a word equation for this reaction.

[3]

(ii) Chlorine is

- denser than air
- soluble in water.

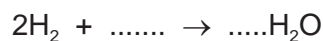
Which **one** of the following diagrams, **A**, **B** or **C**, best describes how chlorine gas is collected?



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.

- |                                 |                                  |
|---------------------------------|----------------------------------|
| <b>distilled water</b>          | <b>hydrochloric acid</b>         |
| <b>sodium chloride solution</b> | <b>sodium hydroxide solution</b> |

[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**

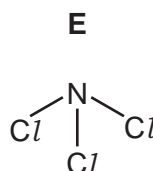
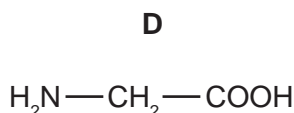
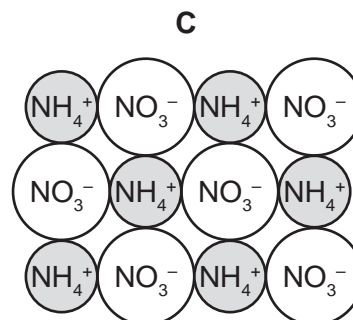
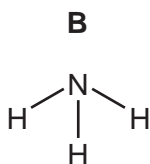
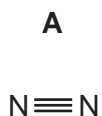
**yellow**

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,  $\text{NO}_2$ , are atmospheric pollutants. Give **one** source of nitrogen oxides in the air.

..... [1]

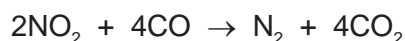
(c) State **one** harmful effect of nitrogen dioxide.

..... [1]

(d) Calculate the relative formula mass of nitrogen dioxide,  $\text{NO}_2$ .

[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.

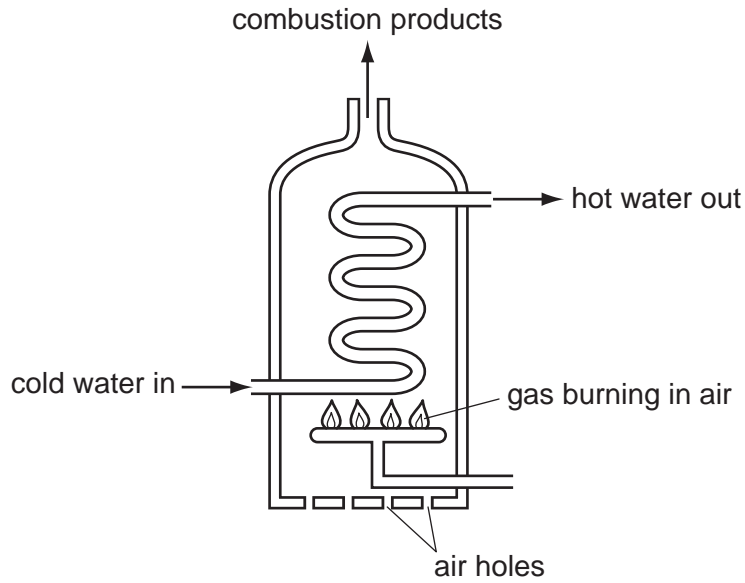
.....

..... [2]

(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]

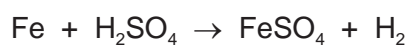
[Total: 12]

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?

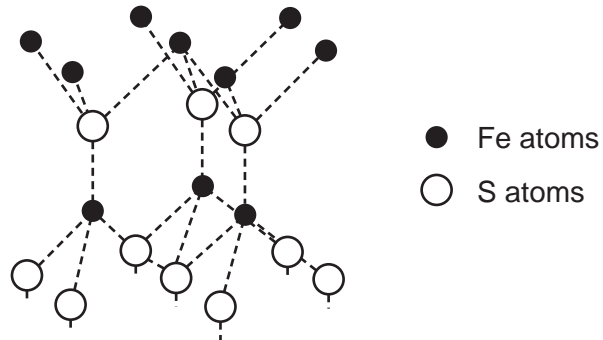
..... [1]



- (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.

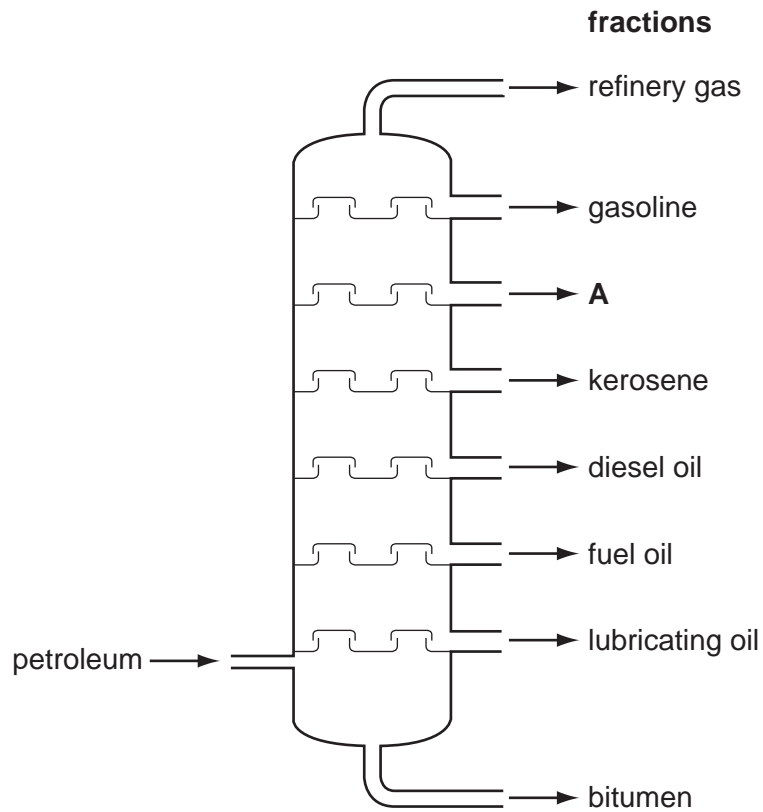


What is the simplest formula for iron(II) sulfide?

..... [1]

[Total: 12]

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



(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]

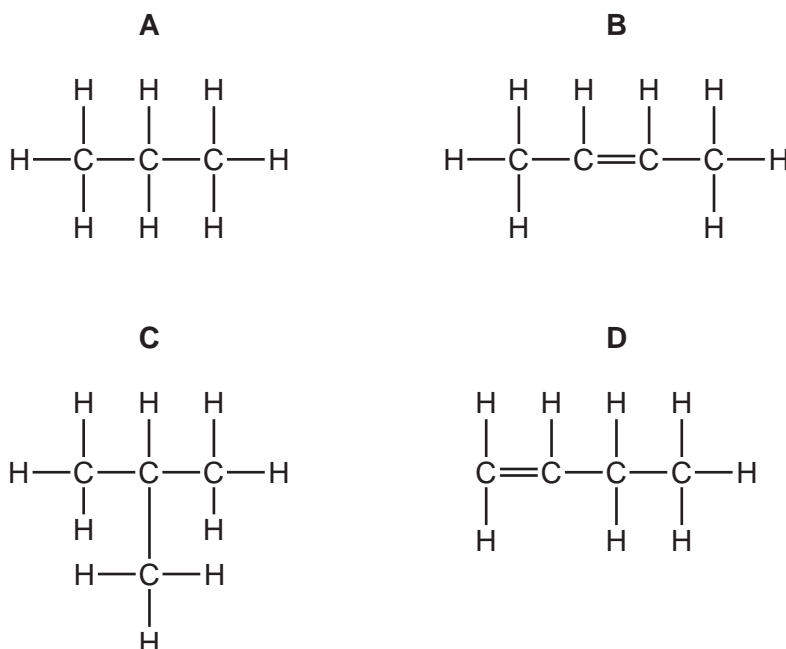
(c) State a use for  
the kerosene fraction, .....  
the diesel oil fraction. .... [2]

- (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]

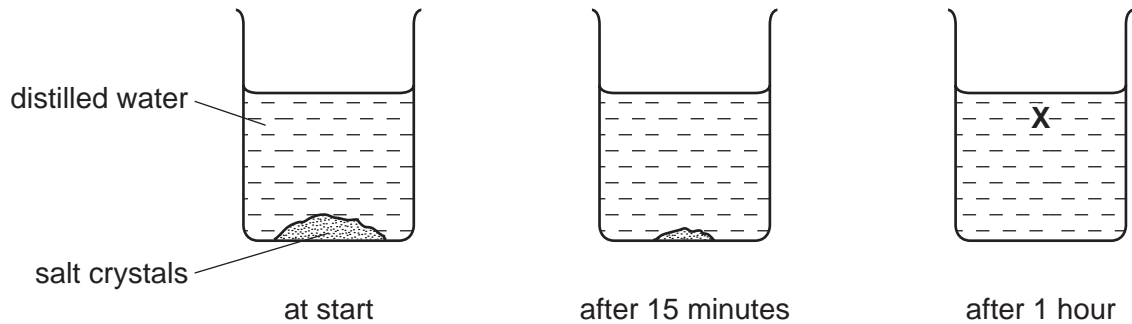
- (e) The structures of four hydrocarbons, **A**, **B**, **C** and **D**, are shown below.



- (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,  $\text{NaCl}$ .

- (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]

(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 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10	27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulfur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18	4 <b>He</b> Helium 2
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36	85 <b>At</b> Astatine 85	86 <b>Rn</b> Radon 86
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36	131 <b>Xe</b> Xenon 54	
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	91 <b>Ti</b> Titanium 22	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54		
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	148 <b>Pm</b> Promethium 61	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	159 <b>Tb</b> Terbium 65	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71		
226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89	140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	148 <b>Pm</b> Promethium 61	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	159 <b>Tb</b> Terbium 65	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71	
87 <b>Fr</b> Francium		232 <b>Th</b> Thorium 90	238 <b>U</b> Uranium 92	238 <b>Np</b> Neptunium 93	238 <b>Am</b> Americium 95	238 <b>Cm</b> Curium 96	238 <b>Bk</b> Berkelium 97	238 <b>Cf</b> Californium 98	238 <b>Es</b> Einsteinium 99	238 <b>Fm</b> Fermium 100	238 <b>Md</b> Mendelevium 101	238 <b>No</b> Nobelium 102	238 <b>Lr</b> Lawrencium 103		

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

Key

a	X
b	
†	

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

The volume of one mole of any gas is 24 dm<sup>3</sup> 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.