UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

7086809263

CHEMISTRY **0620/22**

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.

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.

$$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$$

(i) Write a word equation for this reaction.

[3]

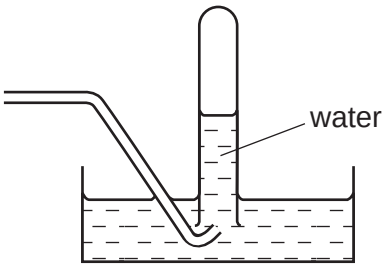
(ii) Chlorine is

- denser than air
- soluble in water.

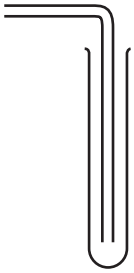
Which **one** of the following diagrams, **A**, **B** or **C**, best describes how chlorine gas is collected?

A

B



C



Answer = ... [1]

(c) Hydrogen reacts with oxygen to form water.

(i) Complete the equation for this reaction.

$$2H_2 + ... \rightarrow .....H_2O$$

[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.

$$Cl_2 + ...KI \rightarrow 2KCl + ...$$

[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**

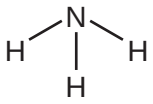
A small volume of solution containing aqueous iodide ions is put into a test-tube. Dilute ..... acid is added followed by a few drops of ..... nitrate solution. A ..... coloured ..... is formed if iodide ions are present. [4]

[Total: 14]

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

A

B



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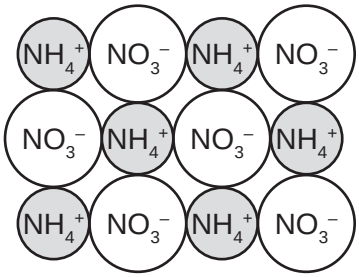
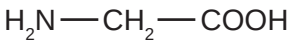
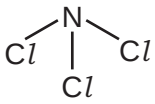


D



E



(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.

$$2NO_2 + 4CO \rightarrow N_2 + 4CO_2$$

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

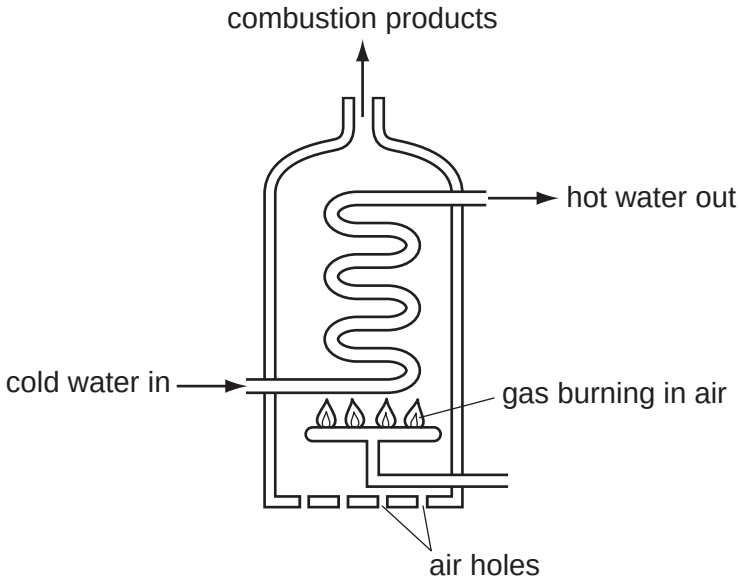
.....

..... [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.

$$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$$

(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?

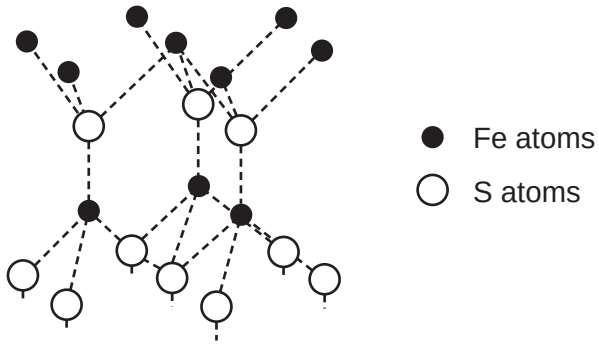
..... [1]

(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.

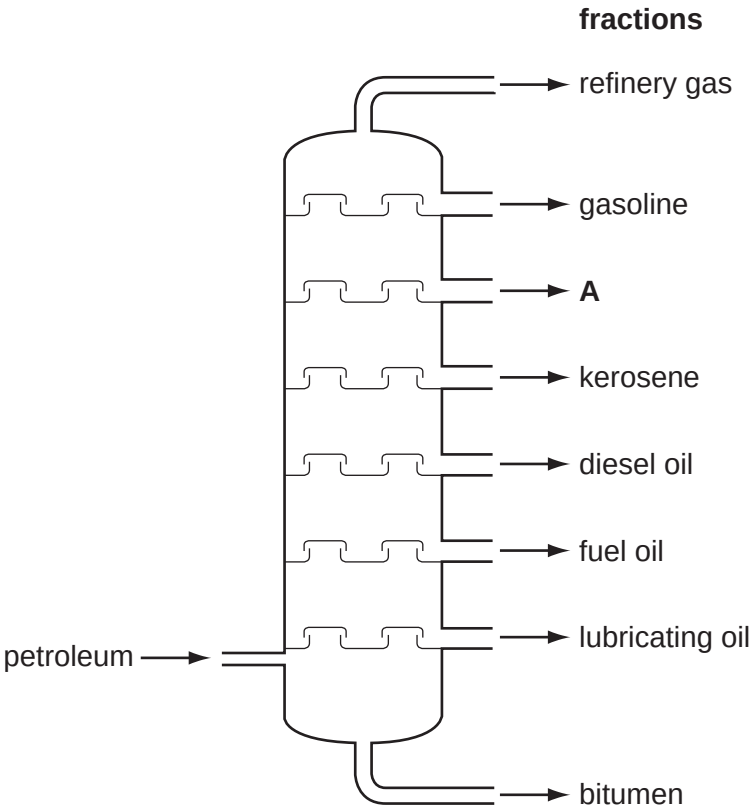


What is the simplest formula for iron(II) sulfide?

..... [1]

[Total: 12]

6 The diagram shows a fractionating column used to separate different hydrocarbon fr
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 below.

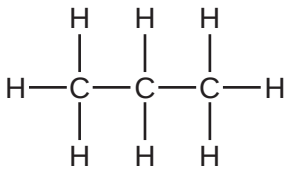
boiling **condenses** **cooled** **heated** **higher**

lower **melting** **mixture** **pressure** **vaporises**

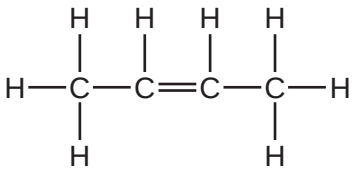
Petroleum is a ..... of hydrocarbons. This mixture is ..... and the hydrocarbons vaporise. The temperature in the fractionating column is ..... at the top than at the bottom. As the vapours move up the column, each hydrocarbon fraction ..... when the temperature in the column falls below the ..... point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

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

A



B



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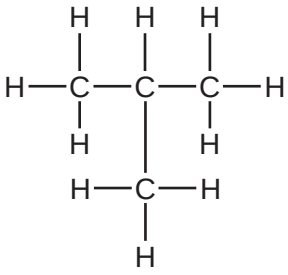
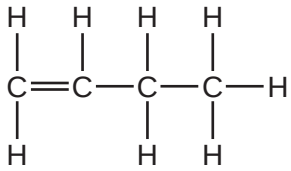


D



(i) Which **two** of these structures **A**, **B**, **C** or **D** have the same relative molecular mass?

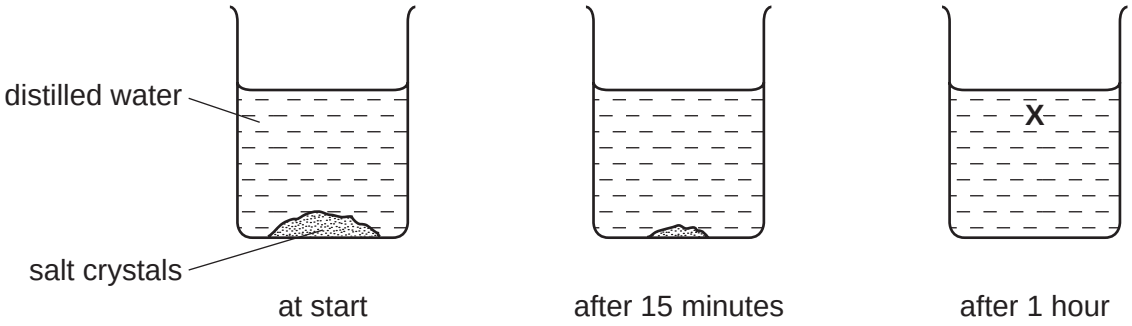
..... and ..... [1]

(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
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, NaC*l*.

(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]

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DATA SHEET
The Periodic Table of the Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
																4 He Helium 2
						1 H Hydrogen 1					11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
	7 Li Lithium 3	9 Be Beryllium 4									27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
	23 Na Sodium 11	24 Mg Magnesium 12									70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	112 Cd Cadmium 48	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
	85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
	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	Po Polonium 84	At Astatine 85	Rn Radon 86
	Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	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
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

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

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

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).