



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

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	

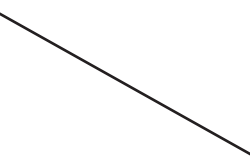
This document consists of **14** printed pages and **2** blank pages.



- 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.



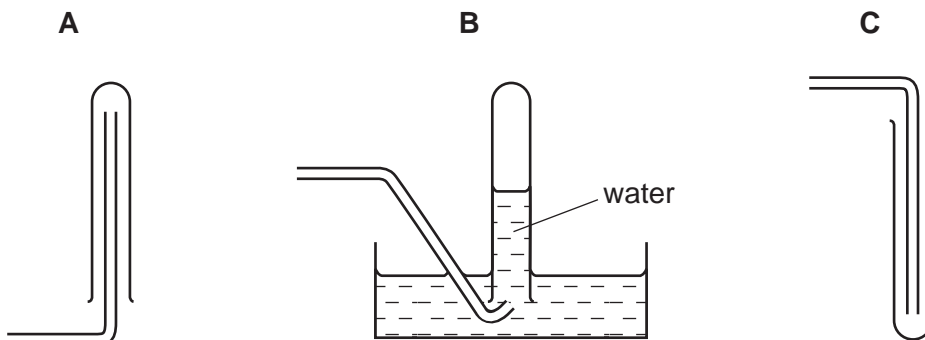
- (i) Write a word equation for this reaction.

[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.

- | | |
|---------------------------------|----------------------------------|
| 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

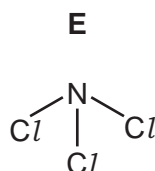
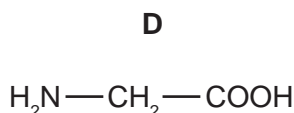
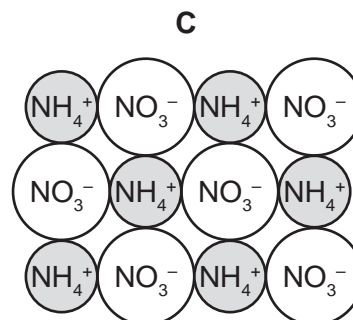
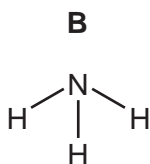
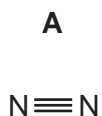
yellow

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]

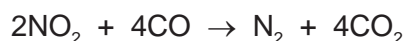
(c) State **one** harmful effect of nitrogen dioxide.

..... [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.

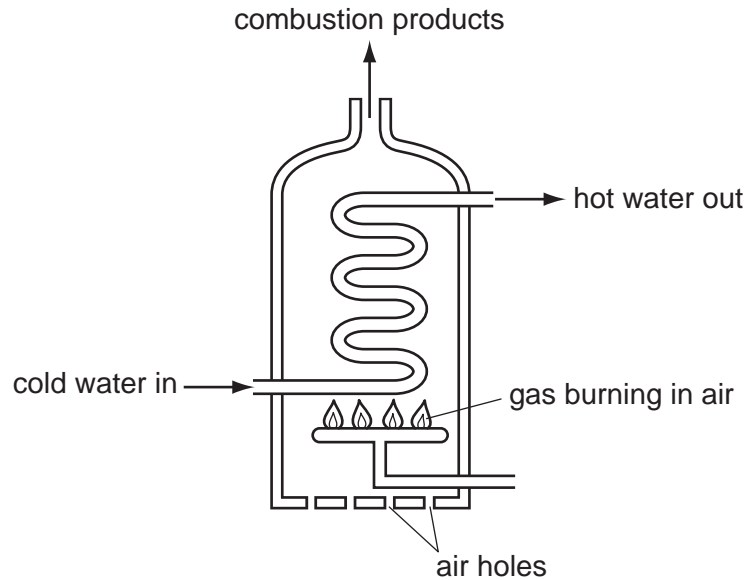
.....

..... [2]

(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.

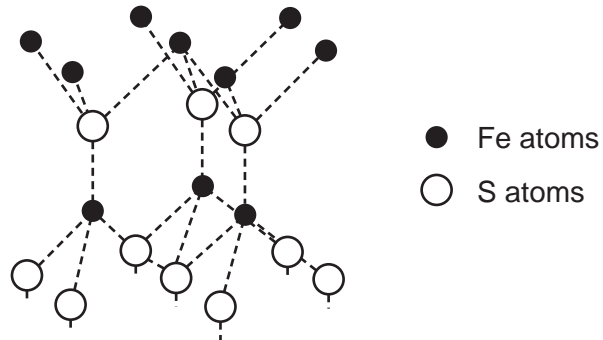
(i) What is the name given to a reaction which releases energy?

..... [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.

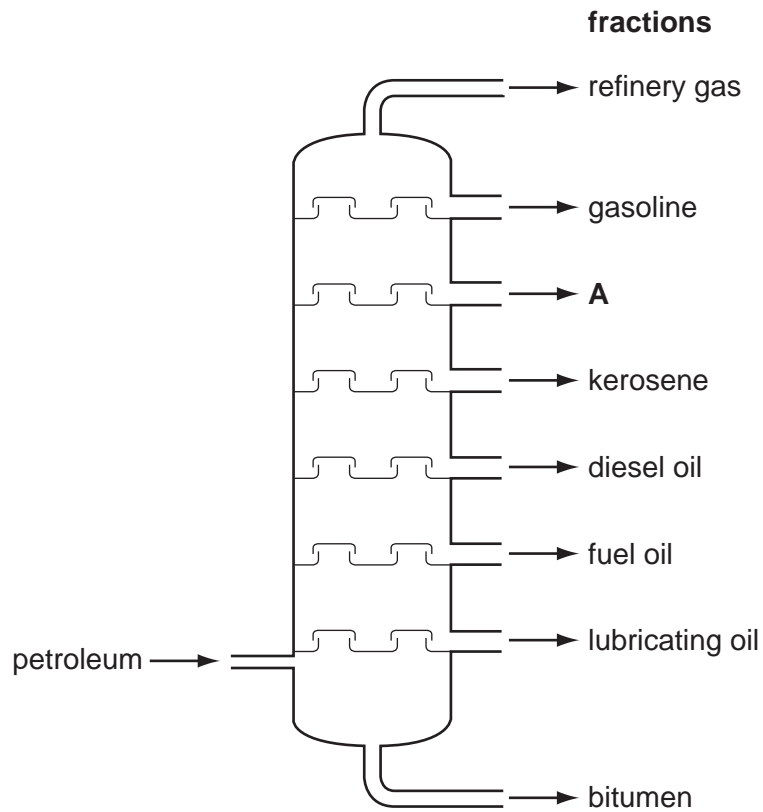


What is the simplest formula for iron(II) sulfide?

..... [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]

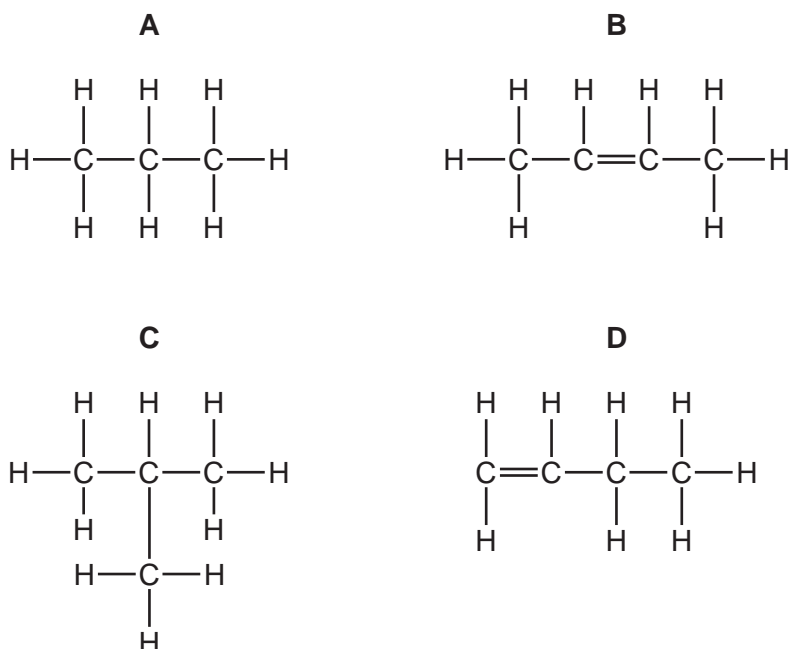
- (c) State a use for
the kerosene fraction,
the diesel oil fraction. [2]

- (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]

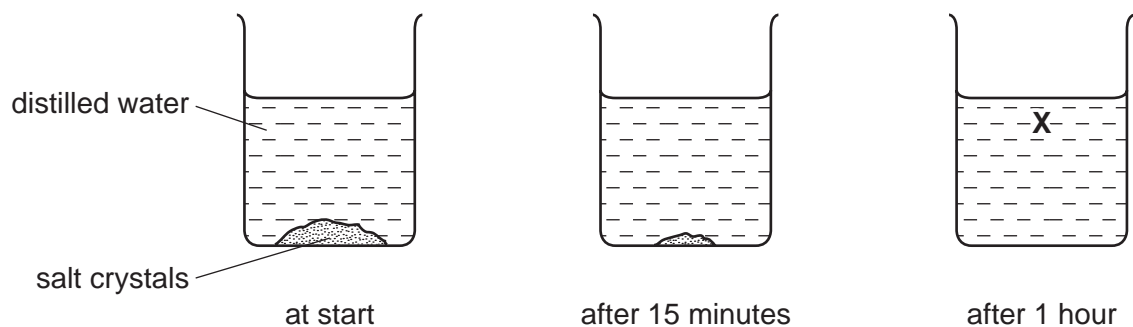
- (e) The structures of four hydrocarbons, **A**, **B**, **C** and **D**, are shown below.



- (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, 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 Li Lithium 3	9 Be Beryllium 4													1 H Hydrogen 1													2 He Helium 2	4 Ne Neon 10	10 Ar Argon 18	18 Kr Krypton 36	131 Xe Xenon 54	86 Rn Radon 86																																																																				
23 Na Sodium 11	24 Mg Magnesium 12													5 B Boron 5	6 C Carbon 6	7 N Nitrogen 7	8 O Oxygen 8	9 F Fluorine 9	10 Ne Neon 10	14 N Nitrogen 7	12 C Carbon 6	11 B Boron 5	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	31 P Phosphorus 15	32 S Sulfur 16	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36	51 Sb Antimony 51	50 Sn Tin 50	49 In Indium 49	48 Cd Cadmium 48	47 Ag Silver 47	46 Pd Palladium 46	45 Rh Rhodium 45	44 Ru Ruthenium 44	43 Tc Technetium 43	42 Mo Molybdenum 42	41 Nb Niobium 41	40 Zr Zirconium 40	39 Y Yttrium 39	38 Sr Strontium 38	37 Rb Rubidium 37	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	165 Ho Holmium 67	166 Er Erbium 68	167 Tm Thulium 69	168 Yb Ytterbium 70	169 Lu Lutetium 71	175 La Lanthanum 71	176 Ce Cerium 58	177 Pr Praseodymium 59	178 Nd Neodymium 60	179 Pm Promethium 61	180 Sm Samarium 62	181 Eu Europium 63	182 Gd Gadolinium 64	183 Tb Terbium 65	184 Dy Dysprosium 66	185 Ho Holmium 67	186 Er Erbium 68	187 Tm Thulium 69	188 Yb Ytterbium 70	189 Lu Lutetium 71	232 Th Thorium 90	231 Pa Protactinium 91	230 U Uranium 92	238 Np Neptunium 93	237 Pu Plutonium 94	236 Am Americium 95	235 Cm Curium 96	234 Bk Berkelium 97	233 Cf Californium 98	232 Es Einsteinium 99	231 Fm Fermium 100	230 Md Mendelevium 101	229 No Nobelium 102	228 Lr Lawrencium 103
87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89 †																																																																																																		
*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 dm³ at room temperature and pressure (r.t.p.).

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