



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTER
NUMBER

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CANDIDATE
NUMBER

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* 9 3 2 2 8 6 4 9 5 7 2 *

CHEMISTRY (US)

0439/23

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 Center 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 burning 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.



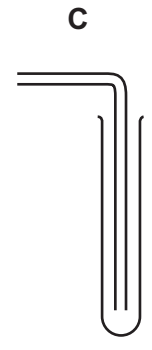
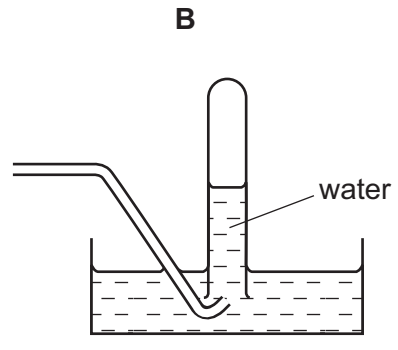
(i) Write a word equation for this reaction.

[3]

(ii) Chlorine is

- denser than air
- soluble in water.

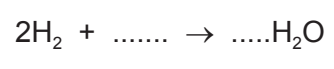
Which **one** of the following diagrams, **A**, **B** or **C**, best describes how chlorine gas is collected?



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 circle 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 fertilizers 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	color
chlorine	-101	-35	
bromine	-7	+59	
iodine	+114	+184	grayish-black

(a) (i) Complete the spaces in the table to show the colors 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

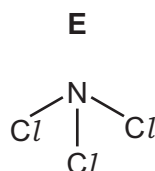
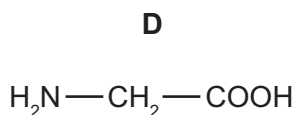
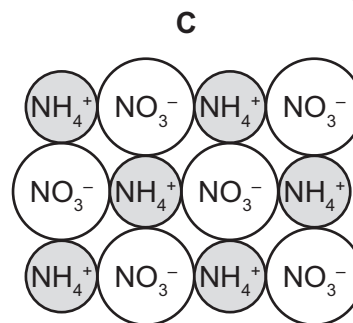
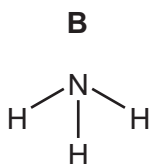
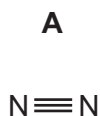
yellow

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 colored 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]

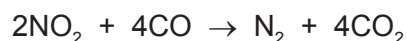
(c) State **one** harmful effect of nitrogen dioxide.

..... [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 oxidized during this reaction? Explain your answer.

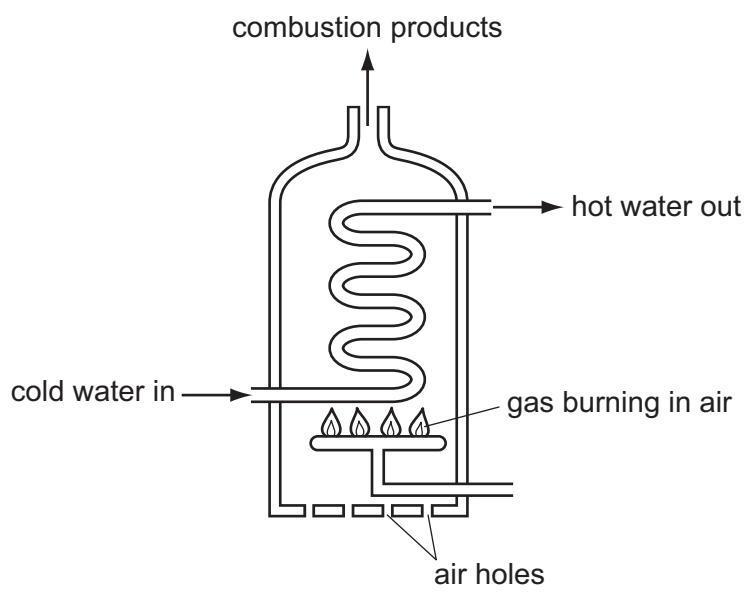
.....

..... [2]

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

.....

(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]

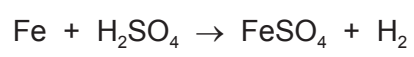
[Total: 12]

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.

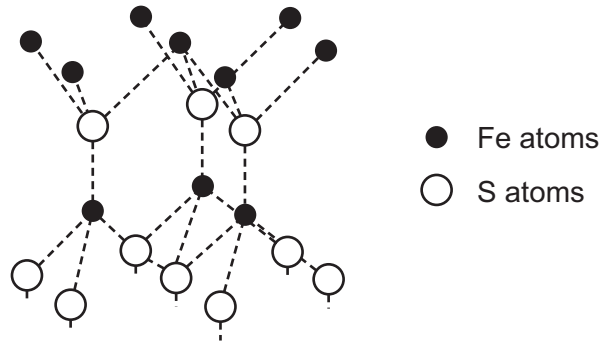
(i) What is the name given to a reaction which releases energy?

..... [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.

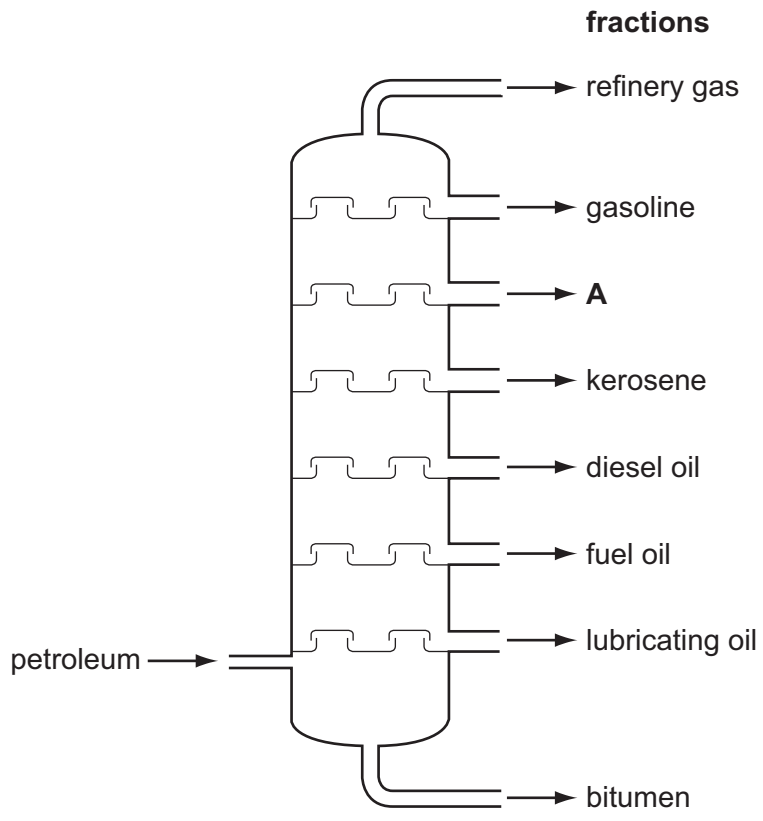


What is the simplest formula for iron(II) sulfide?

..... [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]
.....

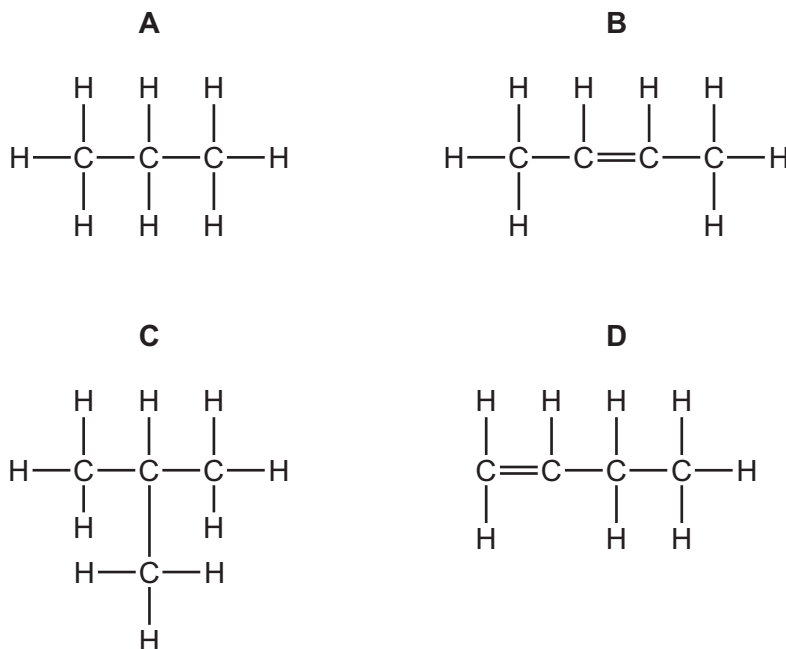
(c) State a use for
the kerosene fraction,
the diesel oil fraction. [2]

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

boiling **condenses** **cooled** **heated** **higher**
lower **melting** **mixture** **pressure** **vaporizes**

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

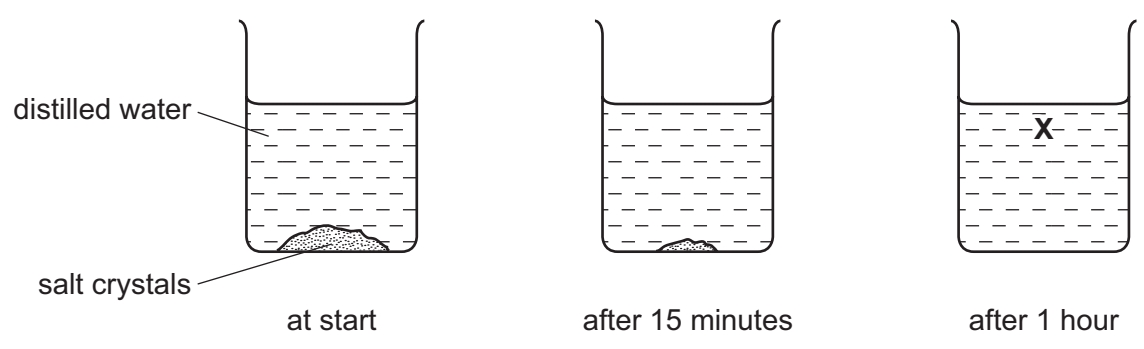
- (e) The structures of four hydrocarbons, **A**, **B**, **C** and **D**, are shown below.



- (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 decolorize 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?
Check **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 electrolyzed using graphite electrodes.

at the positive electrode
at the negative electrode [2]

(iv) What is the name of the negative electrode?
Put a circle 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	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10																											
23 Na Sodium 11	24 Mg Magnesium 12	27 Al Aluminum 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18																												
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	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36																		
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 Ru Ruthenium 44	101 Rh Rhodium 45	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	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	209 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86																			
87 Fr Francium	88 Ra Radium	89 Ac Actinium																																	
		*58-71 Lanthanoid series										†90-103 Actinoid series																							
		<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 50px;">a</td> <td style="width: 50px;">X</td> </tr> <tr> <td style="width: 50px;">Key</td> <td style="width: 50px;">b</td> </tr> </table>										a	X	Key	b	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 50px;">a = relative atomic mass</td> <td style="width: 50px;">x = atomic symbol</td> </tr> <tr> <td style="width: 50px;">b = proton (atomic) number</td> <td style="width: 50px;"></td> </tr> </table>										a = relative atomic mass	x = atomic symbol	b = proton (atomic) number							
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The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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