



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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CENTER
NUMBER

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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.



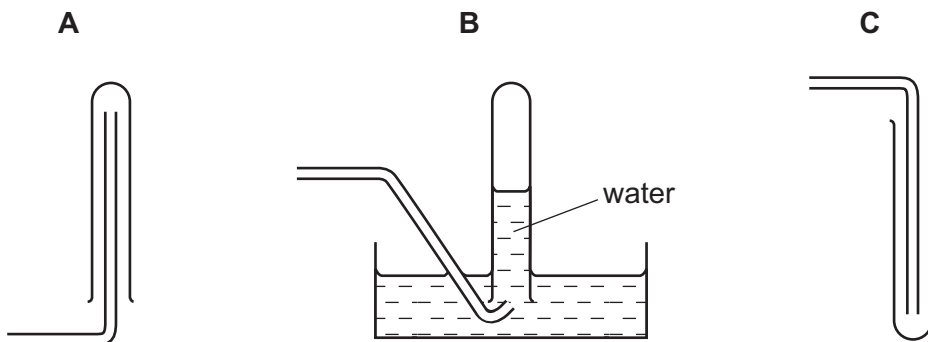
- (i) Write a word equation for this reaction.

[3]

(ii) Chlorine is

- denser than air
- soluble in water.

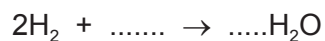
Which **one** of the following diagrams, **A**, **B** or **C**, best describes how chlorine gas is collected?



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

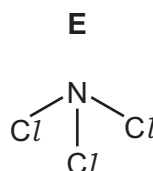
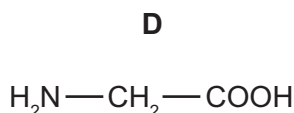
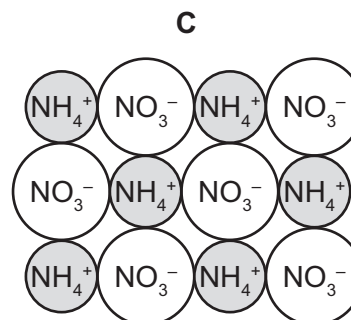
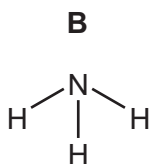
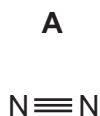
A small volume of solution containing aqueous iodide ions is put into a test-tube. Dilute

..... 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]

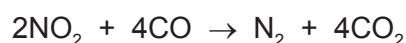
- (c) State **one** harmful effect of nitrogen dioxide.

..... [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.

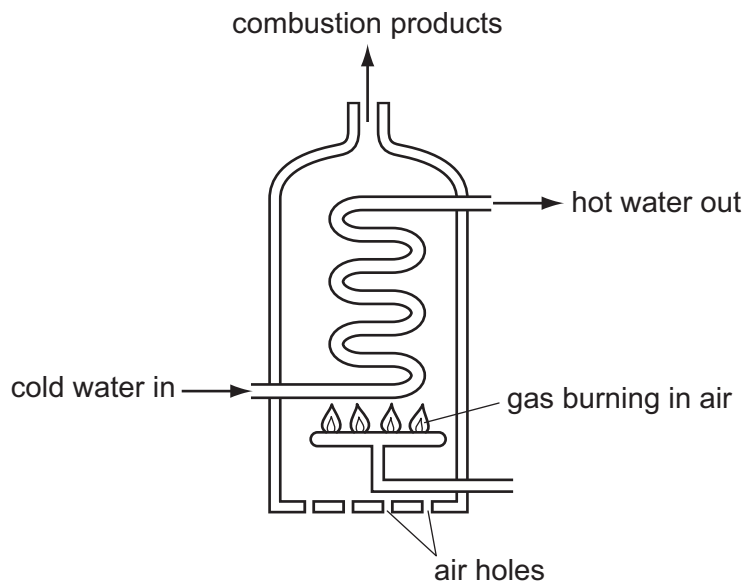
.....

..... [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]

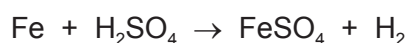
[Total: 12]

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.

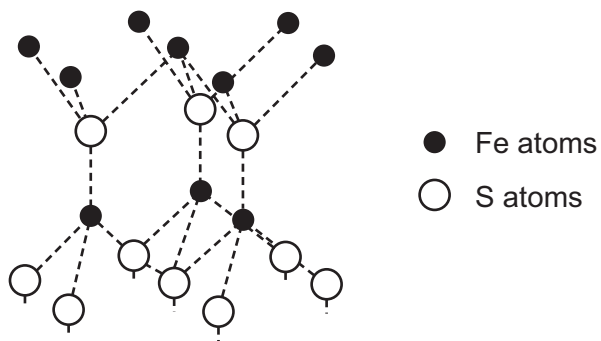
(i) What is the name given to a reaction which releases energy?

..... [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.

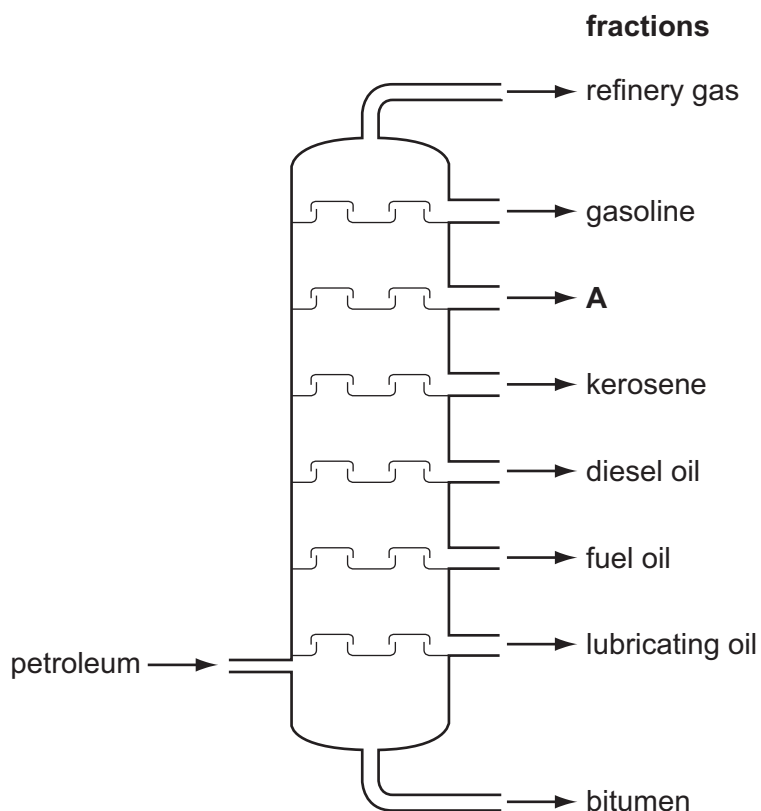


What is the simplest formula for iron(II) sulfide?

..... [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,

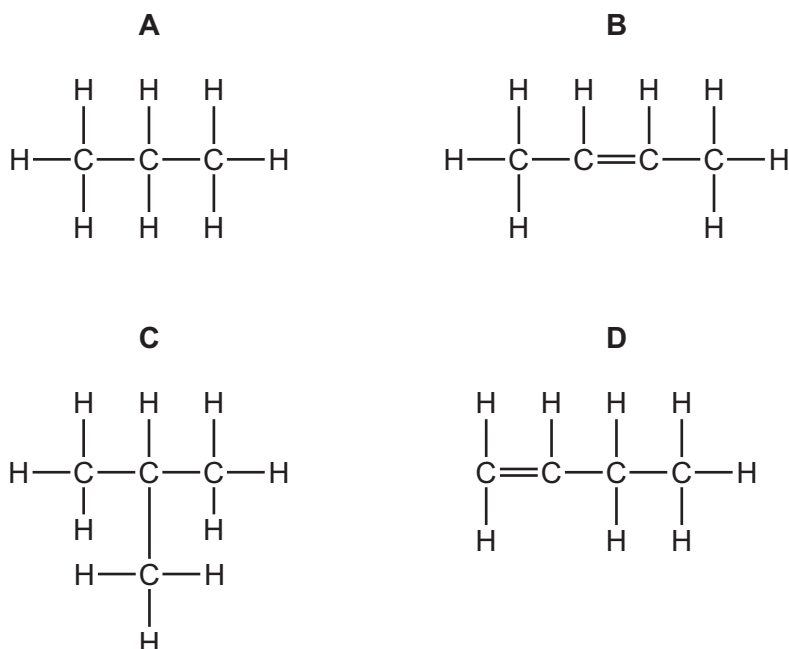
the diesel oil fraction. [2]

- (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]

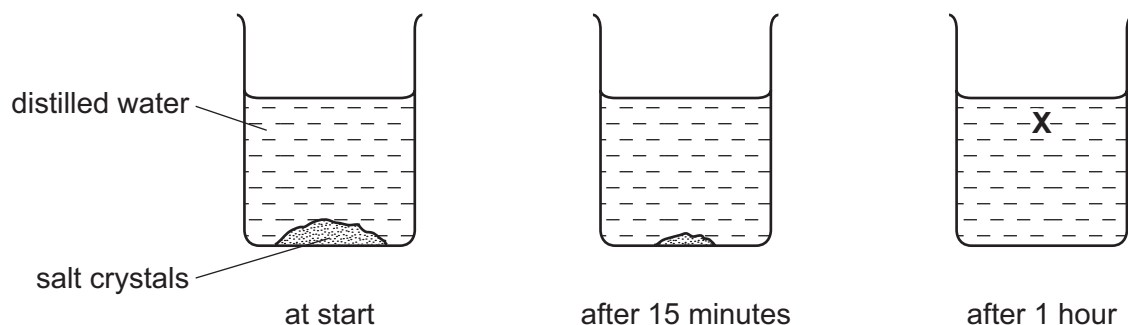
- (e) The structures of four hydrocarbons, **A**, **B**, **C** and **D**, are shown below.



- (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]

Group

a **X**

b b

Key

a = relative atomic mass **X** = atomic symbol

b = proton (atomic) number

*58-71 Lanthanoid series
90-103 Actinoid series

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