

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2003

**CHEMISTRY (MODULAR) SPECIFICATION A 3423/F
FOUNDATION TIER**

Monday 9 June 2003 9.00 am to 10.30 am

F



In addition to this paper you will require:
the Data Sheet (enclosed).
You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 90.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

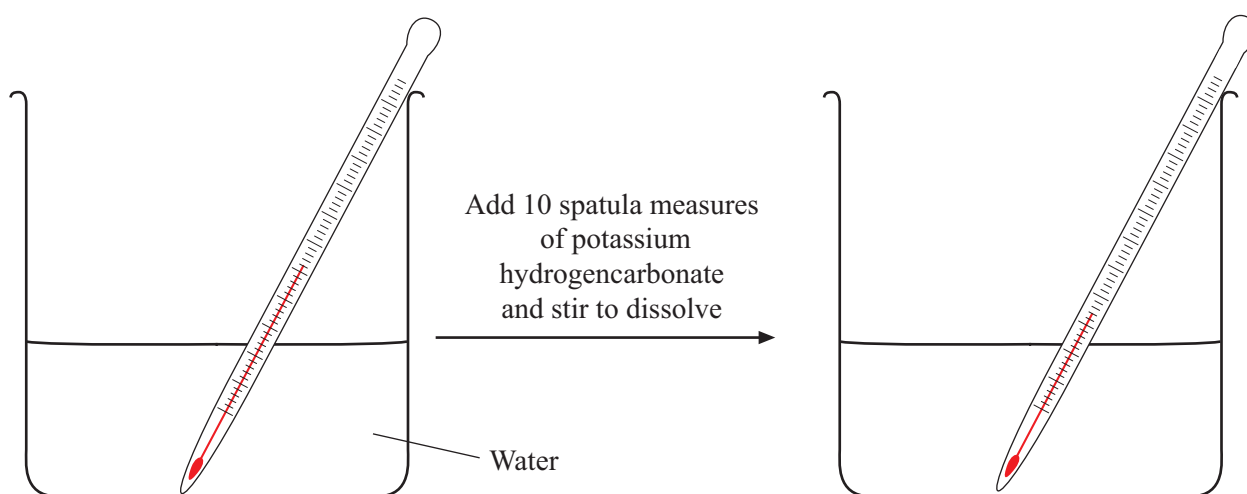
For Examiner's Use			
Number	Mark	Number	Mark
1		13	
2		14	
3		15	
4		16	
5		17	
6		18	
7		19	
8		20	
9			
10			
11			
12			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

PATTERNS OF CHEMICAL CHANGE

- 1 (a) Potassium hydrogencarbonate has the formula KHCO_3 .
How many different elements are there in potassium hydrogencarbonate?

.....
(1 mark)

- (b) An experiment about dissolving solids was set up, using potassium hydrogencarbonate and adding it to a beaker containing some water.



Thermometer reading = 16 °C

Thermometer reading = 12 °C

Complete each sentence by choosing the correct words from the box. Each word may be used once or not at all.

endothermic	exothermic	gained
insoluble	lost	soluble

Potassium hydrogencarbonate isbecause it dissolves in water.

The change in temperature shows that energy must be from

the surroundings so it is an reaction.

(3 marks)

- 2 The equation for the industrial process used to manufacture ammonia is:



- (a) What is the name of this industrial process?

.....
(1 mark)

- (b) What is the name of gas X?

.....
(1 mark)

- (c) Where does the nitrogen used in the process come from?

.....
(1 mark)

- (d) A catalyst of iron is used in the process.
What effect does the iron have on the reaction?

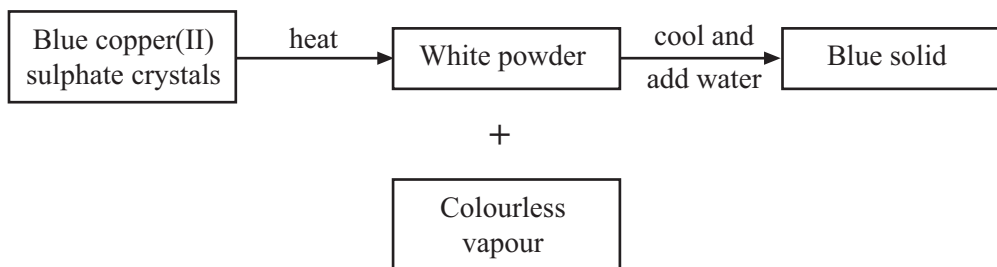
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(1 mark)

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4

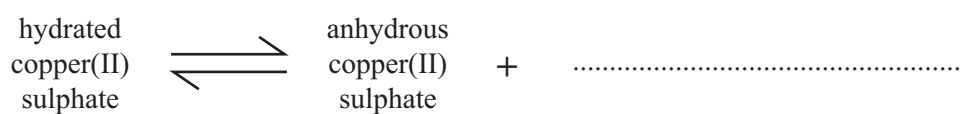
TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 3 (a) The diagram shows the results of an experiment with copper(II) sulphate crystals.



- (i) Complete the word equation for these changes.



(1 mark)

- (ii) What is meant by \rightleftharpoons in the word equation?

.....

(1 mark)

- (iii) What is the name of the white powder?

.....
 (1 mark)

- (b) A jar of copper(II) sulphate crystals has this symbol on it.



State what the symbol tells you about copper(II) sulphate.

.....

(1 mark)

STRUCTURES AND BONDING

4 (a) The incomplete table gives information about the three main particles in atoms.

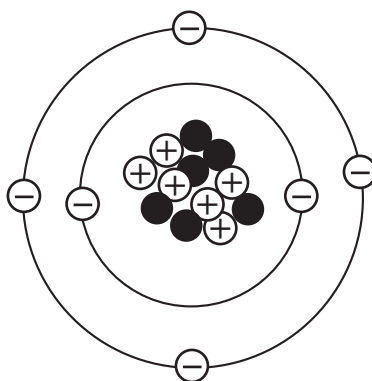
Name	Relative mass	Charge	Symbol
neutron	1	0	●
proton	<input type="text"/>	+1	⊕
electron	almost 0	-1	⊖

(i) Put the relative mass of a proton into the box in the table. (1 mark)

(ii) Protons and neutrons are in the centre of the atom. What is the name for this part of the atom?

.....
(1 mark)

(b) The diagram shows the structure of an atom.



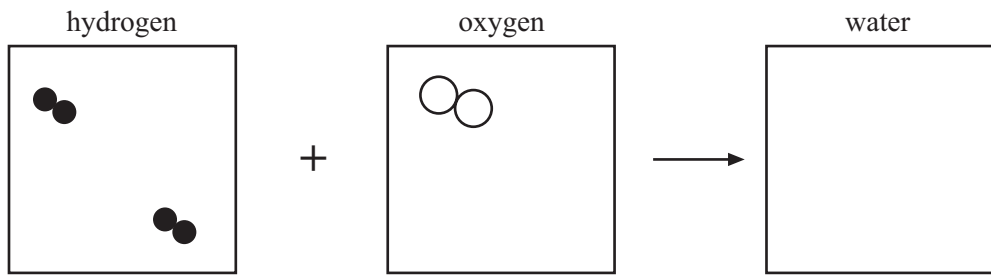
(i) What is the mass number of this atom?
(1 mark)

(ii) In which Group of the periodic table would you find this element?
How did you decide on your answer?

.....
.....
.....
(2 marks)

Turn over ▶

- 5 (a) Complete the diagram to show the arrangement of atoms in a molecule of water.



(1 mark)

- (b) What physical property of water shows it is made of small molecules?

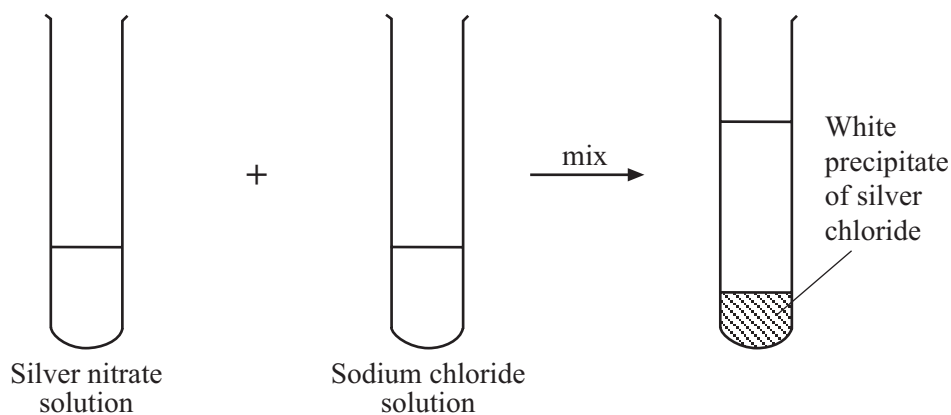
.....
(1 mark)

- (c) Complete the word equation.

sodium + water → sodium hydroxide +

(1 mark)

- 6 The diagram shows an experiment on mixing two solutions.



- (a) Complete the chemical equation for the reaction.



(1 mark)

- (b) What happens to the silver chloride if it is left in sunlight?

.....
(1 mark)

- (c) Name a process that uses the effect of light on silver compounds like silver chloride.

.....
(1 mark)

3

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

7 Use the periodic table on the Data Sheet to help you answer this question.

(a) Name the **least** reactive alkali metal shown.

.....
(1 mark)

(b) Name the noble gas which is in the same *period* as magnesium in the periodic table.

.....
(1 mark)

(c) Give the chemical formula of the compound formed when aluminium reacts with fluorine.

.....
(1 mark)

(d) Explain why ionic bonding takes place when magnesium reacts with oxygen.

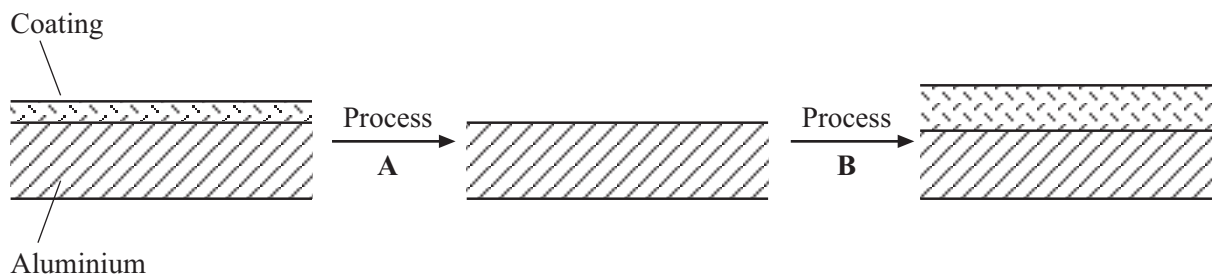
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(2 marks)

5

CHEMISTRY IN ACTION

- 8 Aluminium can be made more resistant to corrosion by a process called anodising.

The diagram shows a cross-section through a piece of aluminium during the process of anodising.



Complete each sentence by choosing the correct words from the box. Each word may be used once or not at all.

chloride	electrolysed	heated
hydrochloric	hydroxide	oxide
reactive	sulphuric	transition

Aluminium is a metal but is protected from corroding by a coating of aluminium If the coating needs to be thicker, it is first removed in Process **A**, using sodium solution.

Then in Process **B**, the aluminium is in dilute acid.

(5 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 9 Compound X was tested in a laboratory. The report shows the results of the tests.

Laboratory Report on Compound X	
Tests	Results
1. Appearance	Green powder
2. Added to water	Did not dissolve
3. Heated	Powder turned black
4. Added to dilute hydrochloric acid	Fizzed and gave off a gas that turned limewater milky/cloudy
5. Flame test	Green-blue colour
CONCLUSION: X is copper (II) carbonate	

- (a) Which test (1, 2, 3, 4 or 5) shows that a carbonate is present?

(1 mark)

- (b) Name the black powder.

.....

(1 mark)

- (c) Describe how you would perform a flame test.

.....
.....
.....

(2 marks)

—
4

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

- 10** *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Some compounds react with water to produce acidic or alkaline solutions.

Explain the work of Arrhenius **and** of Brønsted-Lowry in developing the ideas about acids and bases.

.....

.....

.....

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.....

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.....

.....

(4 marks)

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4

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 11 (a) Which one of the *ions* below is a cause of hard water?

Put a ring round your choice.



(1 mark)

- (b) Two samples of water come from different parts of the country. Describe how you would test them to find out which one was the harder water.

.....

.....

.....

.....

.....

(2 marks)

- (c) Give **one** method of softening hard water.

.....

.....

(1 mark)

—
4

- 12 Complete each sentence by choosing the correct words from the box. Each word may be used once or not at all.

carbohydrate	cracking	distillation
fractions	fuels	high
hydrocarbon	low	volatile

Crude oil is a mixture of many different molecules.

At the refinery, the crude oil is first separated into The larger molecules have boiling points and are not very The breaking down of these larger molecules into smaller molecules is called

(5 marks)

5

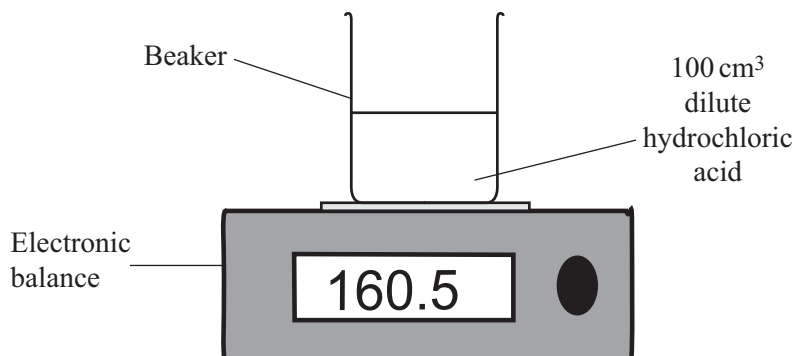
TURN OVER FOR THE NEXT QUESTION

Turn over ▶

PATTERNS OF CHEMICAL CHANGE

- 13** A student investigated what conditions altered the rate of reaction between 2.0 g of magnesium carbonate and 100 cm³ of dilute hydrochloric acid (an excess).

The diagram shows the apparatus used.



Details of the four experiments are given below.

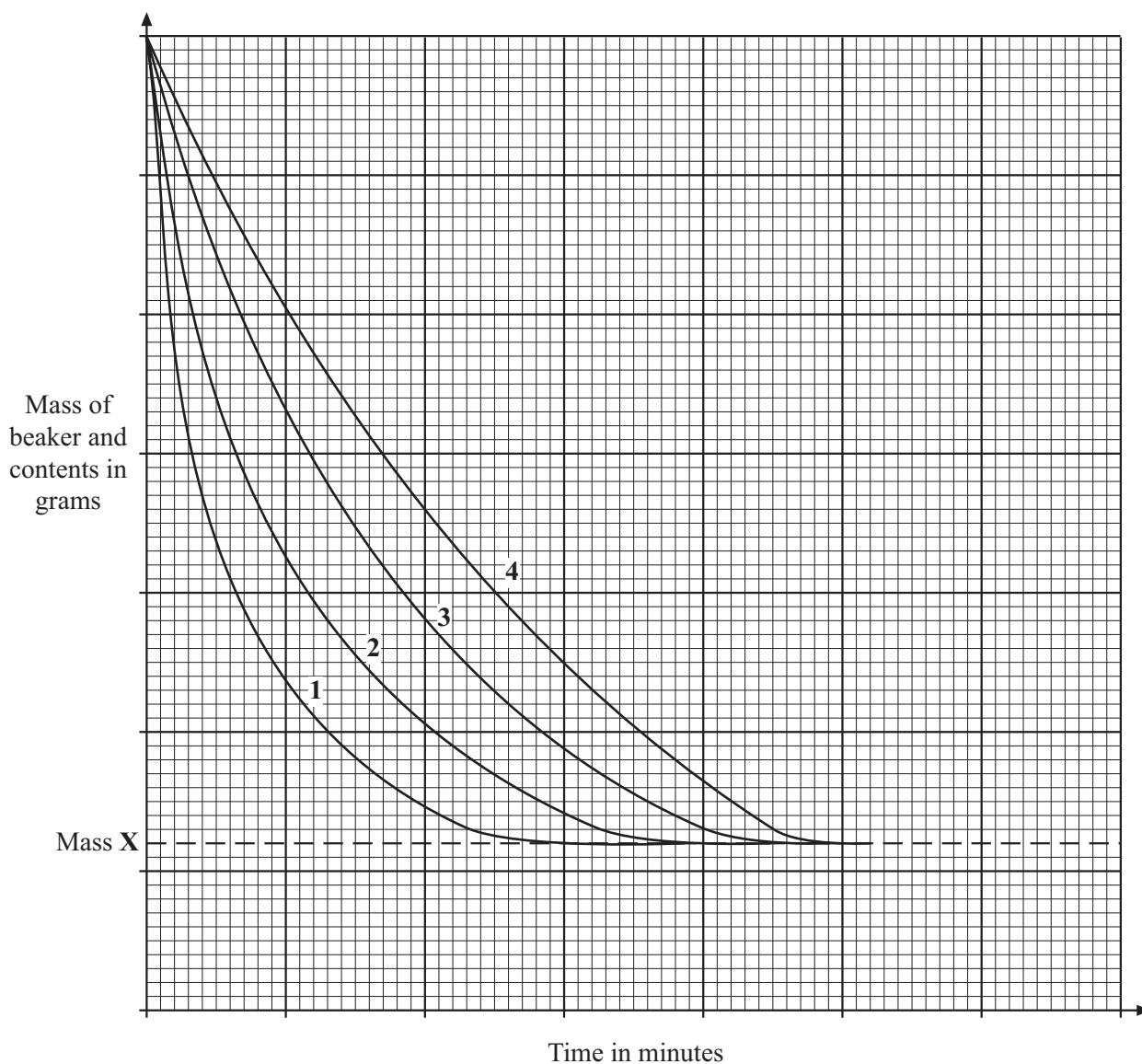
Experiment	Form of magnesium carbonate	Concentration of acid in moles per dm ³	Temperature of acid
A	lump	2	20 °C
B	lump	2	15 °C
C	powder	4	25 °C
D	powder	2	20 °C

- (a) The student recorded the loss in mass of the beaker and its contents every 10 seconds. Explain why there was a loss in mass in each experiment.

.....

(1 mark)

(b) The results of the four experiments were plotted on graph paper.



Match up the graph plots with the correct experiments (A, B, C or D).

Line 1 is experiment

Line 2 is experiment

Line 3 is experiment

Line 4 is experiment

(2 marks)

(c) Explain why the reaction stopped at mass X in each experiment.

.....
.....

(1 mark)

- 14 (a) Nitrogen-based fertilisers are used to increase crop yields.
Calculate the percentage of nitrogen in the fertiliser ammonium sulphate, $(\text{NH}_4)_2 \text{SO}_4$.

(Relative atomic masses: H = 1; N = 14; O = 16; S = 32)

.....

.....

.....

.....

(2 marks)

- (b) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Explain why the amount of fertiliser used is increasing, and describe the damage that fertilisers can cause to life in rivers and lakes.

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

6

STRUCTURES AND BONDING

- 15 (a) The symbols for two *isotopes* of oxygen are:



- (i) Explain why they can be described as *isotopes* of oxygen.

.....

.....

(1 mark)

- (ii) The arrangement of electrons in energy levels (shells) for an oxygen atom is 2,6. Give the electron arrangement of an oxide ion.

.....

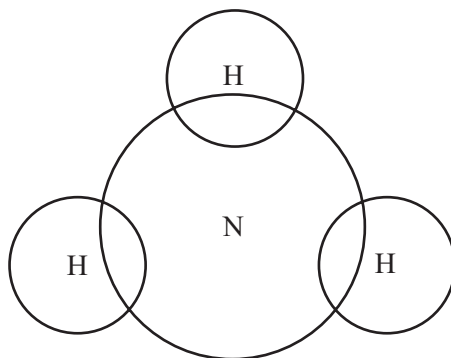
(1 mark)

- (iii) Give the chemical formula of potassium oxide.

.....

(1 mark)

- (b) Using dot and cross symbols, complete the diagram to show how the outer electrons are arranged in a molecule of ammonia, NH_3 .



(2 marks)

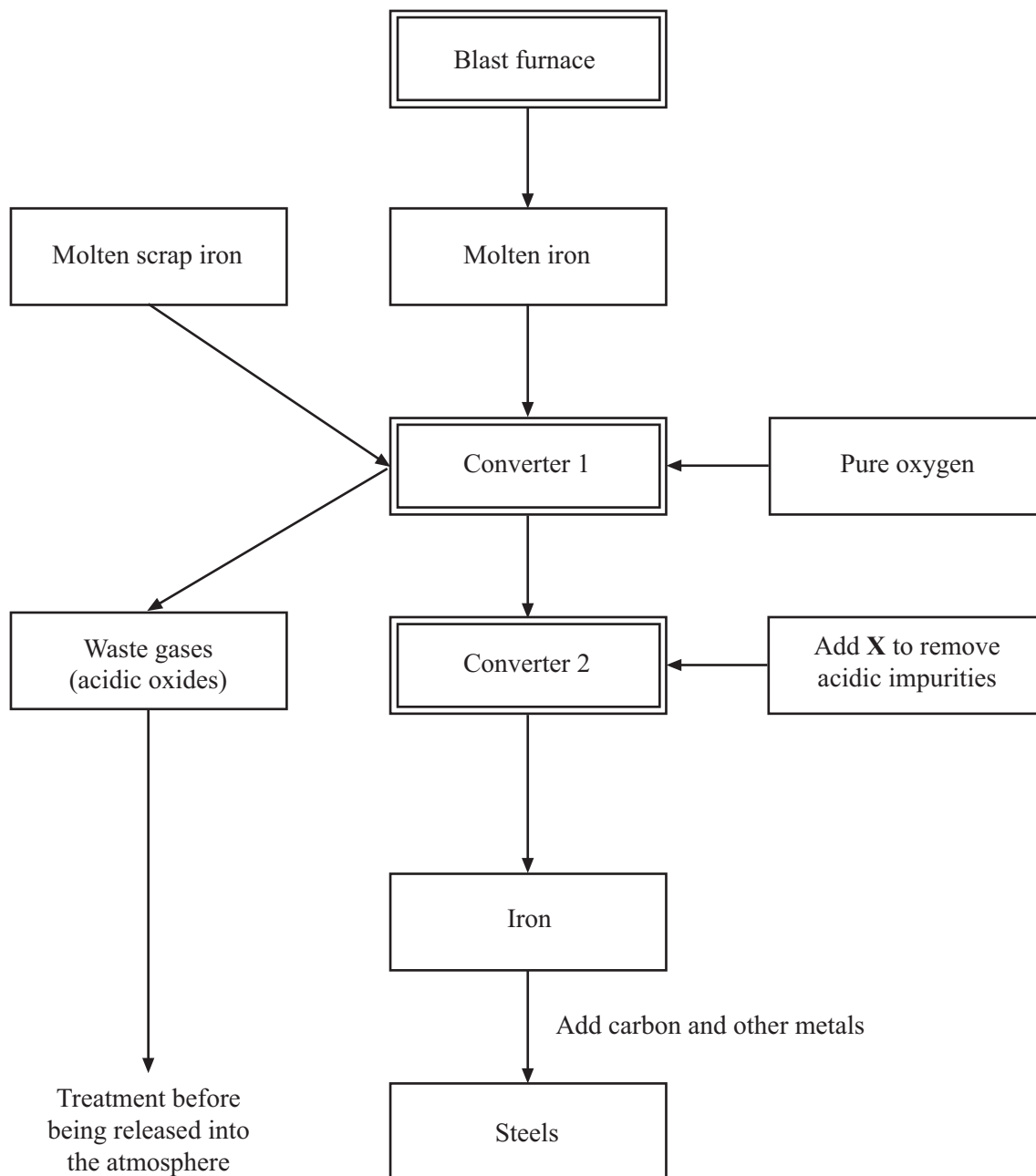
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Turn over ►

CHEMISTRY IN ACTION

- 16 The iron produced from the blast furnace can be converted into steels for specific uses.

The flow diagram for the process is given below.



- (a) Solid iron from the blast furnace is of little practical use.
Explain why.

.....
.....
.....
.....

(2 marks)

- (b) Identify the stage in the process where the recycling of resources is involved.

.....

(1 mark)

- (c) Name the chemical process taking place in Converter 1.

.....

(1 mark)

- (d) Sulphur dioxide is one of the acidic oxides produced in Converter 1. Explain why sulphur dioxide needs to be removed before the remaining waste gases are released into the atmosphere.

.....
.....
.....

(2 marks)

- (e) Name substance X.

.....

(1 mark)

- (f) Name **one** metal added to pure iron to produce steels.

.....

(1 mark)

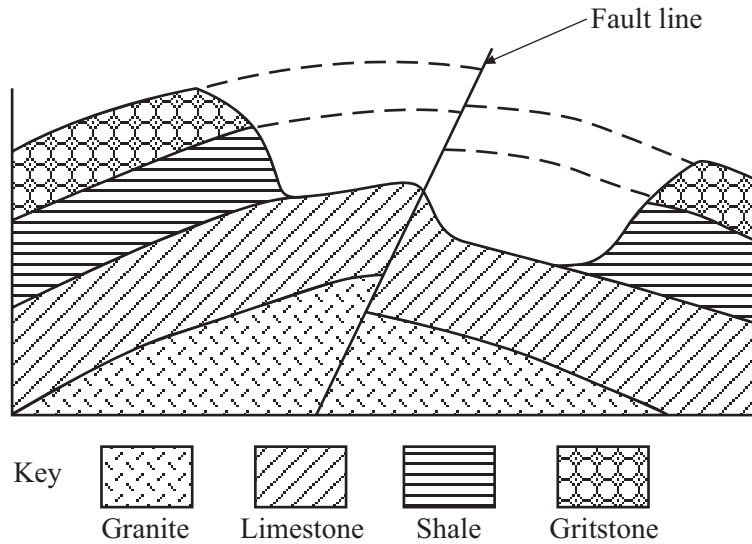
TURN OVER FOR THE NEXT QUESTION

8

Turn over ▶

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

17 The diagram shows the different layers of rock in a section of the Earth's crust.



(a) Give the name of the youngest sedimentary rock in the diagram.

..... (1 mark)

(b) Give **one** piece of evidence that a rock is sedimentary.

..... (1 mark)

(c) What is a fault line?
What does the fault line tell you about this part of the Earth's crust?

.....
.....
.....
..... (2 marks)

- 18 This question is about the metals given in the box. Each metal may be used once, more than once or not at all.

aluminium	copper	gold
iron	silver	sodium

- (a) Give the name of the metal with the lowest density.

.....
(1 mark)

- (b) Give the names of **two** metals which are found uncombined with other elements in the Earth's crust.

..... and
(1 mark)

- (c) Give the name of **one** metal that can only be extracted from its compounds by electrolysis. Explain why this metal cannot be extracted using carbon.

.....
.....
.....
(2 marks)

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4

- 19 This question is about a white solid that is dissolved in water. The solution has the following properties:

- pH = 4.7
- slow evolution of gas when a piece of magnesium ribbon is added to it.

- (a) Which ion is produced in the solution when the solid dissolves?

.....
(1 mark)

- (b) What can be deduced about the white solid from the information provided? Explain your answer.

.....
.....
.....
(2 marks)

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3

Turn over ►

- 20 The table gives information about three fuels that can be burned to heat a house.

Fuel	Heat produced (in kJ per gram)	Cost per gram in pence (p)	Products of burning	
			Soot from flame?	Solid left?
A	59	6	✓	✗
B	40	7	✗	✗
C	42	5	✓	✓

- (a) Use the data to calculate which fuel produces most heat per penny.
Show clearly how you worked out your answer.

.....

 (2 marks)

- (b) When burned, which fuel is the cleanest?
Explain your answer.

.....

 (2 marks)

- (c) Write the word equation for the **incomplete** combustion of methane.

methane + oxygen → +
 (2 marks)

END OF QUESTIONS