

OXFORD

INTERNATIONAL
AQA EXAMINATIONS

INTERNATIONAL GCSE

COMBINED SCIENCE DOUBLE AWARD

9204/CC PAPER 2 – CHEMISTRY CORE TIER

Specimen material

1 hour 45 minutes

Materials

For this paper you must have:

- a ruler with millimetre measurements
- a calculator
- the Periodic table (enclosed).

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number Candidate number

Surname

Forename(s)

Candidate signature _____

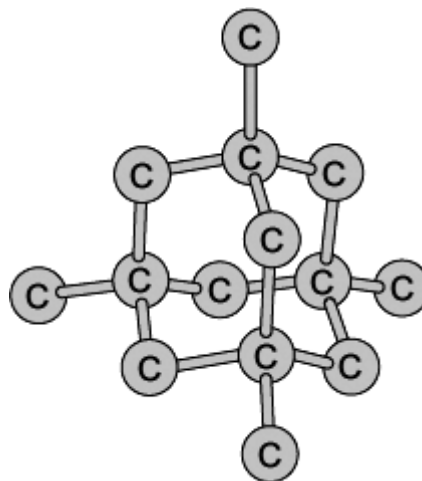
9204/CC

Answer **all** questions in the spaces provided.

1

This question is about the structures and properties of substances.

A model of part of the structure of diamond is shown below.



0 1 . 1

Diamond is made of one element.

Tick the name of this element.

[1 mark]

Calcium

Carbon

Chromium

Cobalt

0 1 . **2** Diamond is hard.

Tick **two** statements which explain why.

[2 marks]

It is made of layers.

It has weak covalent bonds.

Each atom is joined to four other atoms.

It has a giant structure.

It has strong ionic bonds.

0 1 . **3** Which two statements about metals and alloys are true?

Tick **two** boxes.

[2 marks]

Alloys are mixtures containing metals.

Metals are poor conductors of heat.

Metals can be hammered into shape.

Steel is an alloy of aluminium.

0 1 . **4** Complete **Table 4**.

[4 marks]

Name of substance	Melting point in °C	Does the substance conduct electricity as a solid?	Does the substance conduct electricity as a liquid?	Type of structure
Zinc	420	Yes	Yes	
Ethanol	-114			Small molecules
Silicon dioxide	1600	No	No	
Sodium chloride	801			Ionic lattice

Turn over ►

2

This question is about carbon and gases in the air.

0 2 . 1

Carbon atoms have protons, neutrons and electrons.

Complete **Table 1** by writing the relative mass of a neutron and an electron.

[2 marks]

Table 1

Name of particle	Relative mass
proton	1
neutron	
electron	

0 2 . 2

What is the total number of protons and neutrons in an atom called?

Tick **one** box.

[1 mark]

The atomic number

The mass number

One mole of the atom

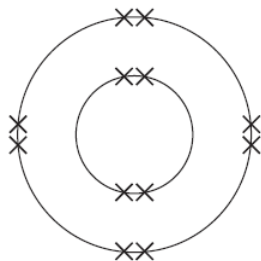
0 2 . 3

An atom of carbon has six electrons.

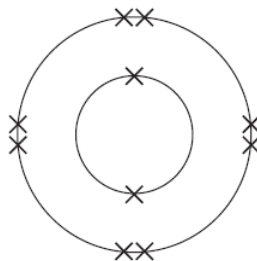
Which structure, **A**, **B** or **C**, represents the electronic structure of the carbon atom?

[1 mark]

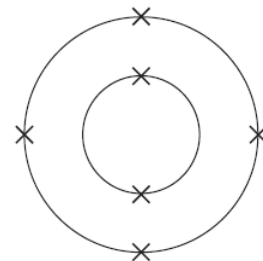
Structure A



Structure B



Structure C



The carbon atom is structure .

Carbon reacts with oxygen to produce carbon dioxide (CO₂).

0 2 . 4

How many different elements are in one molecule of carbon dioxide?

[1 mark]

0 2 . 5

What is the total number of atoms in one molecule of carbon dioxide?

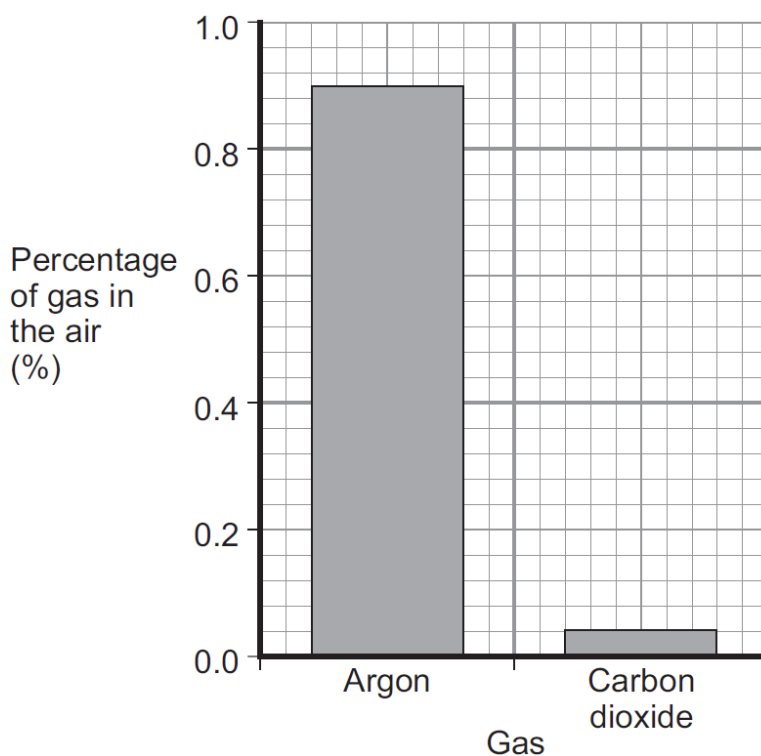
[1 mark]

Carbon dioxide is one of the gases in the air.

0 2 . 6

Figure 1 shows the percentage of argon and the percentage of carbon dioxide in the air.

Figure 1



What is the percentage of argon in the air?

[1 mark]

0	2	.	7
---	---	---	---

What is the percentage of carbon dioxide in the air?

[1 mark]

Turn over for the next question

3 This question is about salts.

0 3 . 1 Sodium chloride is produced by reacting sodium with chlorine.

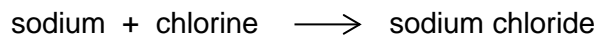
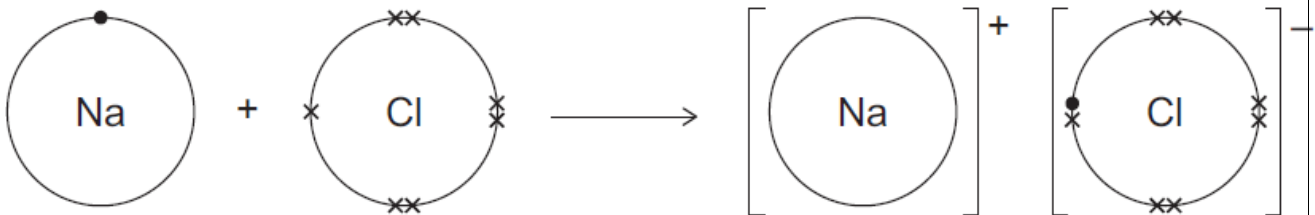


Figure 2 shows what happens to atoms of sodium and chlorine in this reaction.

The dots (•) and crosses (×) represent electrons.

Only the outer electrons are shown.

Figure 2



Describe, in terms of electrons, what happens when a sodium atom reacts with a chlorine atom to produce sodium chloride.

[3 marks]

0 3 . 2 Lack of iodine can affect the learning ability of children.

One idea is that salt (sodium chloride) should have iodine added.

Iodine consists of simple molecules.

What is a property of substances that have simple molecules?

Tick **one** box.

[1 mark]

Have no overall electric charge

Have high boiling points

Have giant covalent structures

A student produced the salt ammonium nitrate by adding an acid to ammonia solution.

0 3 . 3 Name the acid used.

[1 mark]

0 3 . 4 Use the correct answer from the box to complete the sentence.

[1 mark]

an acid an alkali a salt

Ammonia solution (ammonium hydroxide) is _____

0 3 . 5 The student added a few drops of a solution which changed colour when the reaction was complete.

Complete the sentence.

[1 mark]

The solution added is an _____

Farmers buy solid ammonium nitrate in poly(ethene) sacks.

0 3 . **6** How is solid ammonium nitrate made from a solution of ammonium nitrate?

Tick **one** box.

[1 mark]

Crystallisation

Decomposition

Electrolysis

0 3 . **7** The properties of poly(ethene) depend on the reaction conditions when it is made.

State **one** reaction condition that can be changed when making poly(ethene).

[1 mark]

4

A student wanted to make a mixture of calcium oxide and copper sulfate, which is used to treat fungal infections on plants.

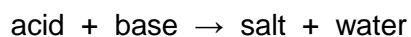
The student knew that calcium oxide could be made by heating limestone.

Limestone contains calcium carbonate.

0 4 . **1** Write the word equation for this reaction.

[1 mark]

The student knew that copper sulfate (CuSO_4) could be made by the following general reaction:



0 4 . **2** What type of reaction is this?

[1 mark]

0 4 . **3** The base used is copper oxide.

Name and give the chemical formula of the acid used.

[2 marks]

Name _____

Chemical formula _____

The student wrote about how the copper sulfate was made.

“Some of the acid was warmed. Copper oxide was added. The mixture was stirred. More copper oxide was added until no more would react. The mixture was then filtered.”

0 4 . 4 Why was the acid warmed?

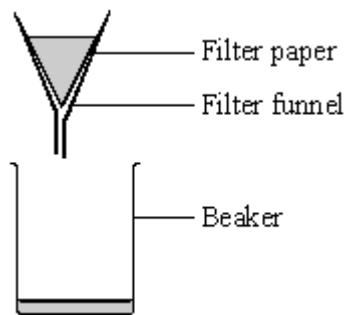
[1 mark]

0 4 . 5 Explain why copper oxide was added until no more would react.

[2 marks]

0 4 . 6 The filtration apparatus is shown in **Figure 3**.

Figure 3

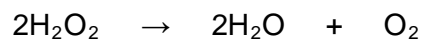


Describe and explain what happens as the mixture is filtered.

[2 marks]

Turn over for the next question

5 The symbol equation for the decomposition of hydrogen peroxide is:



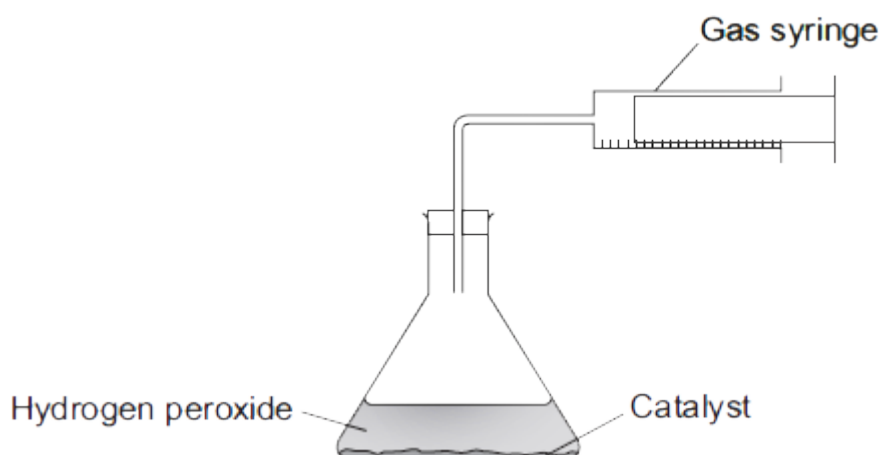
0 5 . 1 This reaction is *exothermic*.

What is an *exothermic* reaction?

[1 mark]

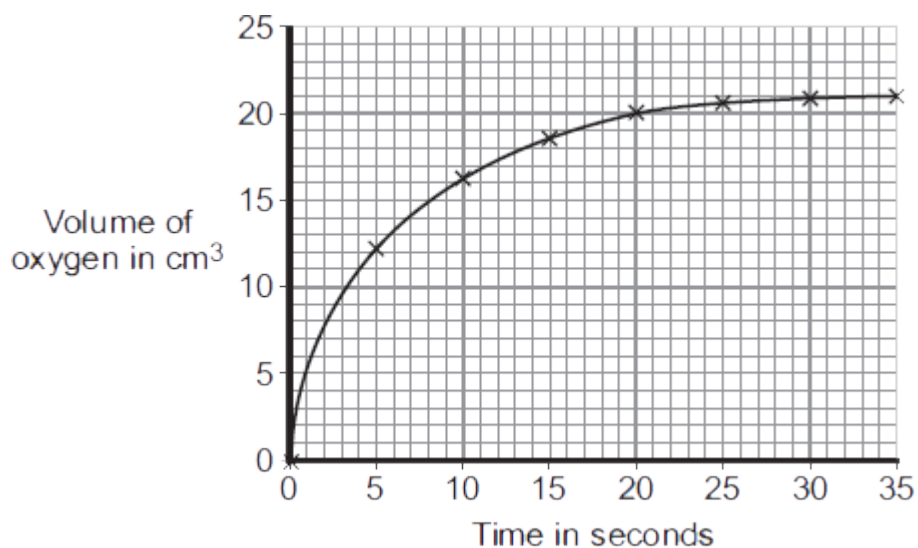
A student measured the volume of oxygen produced by 50 cm³ of hydrogen peroxide, using the apparatus in **Figure 4**.

Figure 4



The graph in **Figure 5** shows the results.

Figure 5



0 5 . 2

Use the graph to describe the changes in the rate of the reaction from 0 to 35 seconds.

[3 marks]

0 5 . 3

What was the total volume of oxygen gas collected?

[1 mark]

Total volume of oxygen = _____ cm³

0 5 . 4

An increase in the temperature of the hydrogen peroxide increases the rate of the reaction.

Explain why, using your knowledge of particles.

[3 marks]

0 5 . 5

Sketch a curve on the graph in **Figure 5** to show the results of the same experiment carried out at a higher temperature.

[2 marks]

6 The periodic table may help you answer these questions.

Many chemists have contributed to the development of the periodic table.

John Newlands was one of the first chemists who attempted to classify elements based on atomic weight. In 1866 he suggested that there was a repeating pattern of elements with similar properties every eighth element.

Part of Newlands' periodic table is shown below.

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr	Di, Mo	Ro, Ru

Many chemists in 1866 did not accept Newland's periodic table.

0 6 . 1

Give **one** piece of evidence which supports Newlands' ideas.

[1 mark]

0 6 . 2

Suggest **two** reasons why many chemists in 1866 did not accept Newlands' ideas.

[2 marks]

1

2

Chlorine, bromine and iodine are Group 7 elements.

A student investigated the reactivity of these elements.

The student added:

- aqueous chlorine to potassium bromide and potassium iodide solutions
- aqueous bromine to potassium chloride and potassium iodide solutions
- aqueous iodine to potassium chloride and potassium bromide solutions.

The student's results are shown in **Table 2**.

Table 2

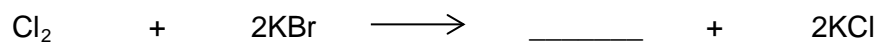
Solution	Potassium chloride	Potassium bromide	Potassium iodide
Chlorine		Solution turned orange-brown	Solution turned brown
Bromine	No reaction		Solution turned brown
Iodine	No reaction	No reaction	

0 6 . **3** How do these results show the trend in reactivity in Group 7?

[2 marks]

0 6 . **4** Complete the equation below, which represents the reaction between chlorine and potassium bromide.

[1 mark]

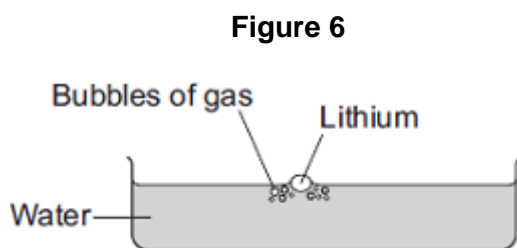


0 6 . **5** State why chlorine, bromine and iodine are in Group 7, in terms of electronic structure.

[1 mark]

Lithium is in Group 1 of the periodic table.

Lithium reacts with water to produce a gas and an alkaline solution as shown in **Figure 6**.



0 6 . **6** Name the gas produced.

[1 mark]

0 6 . **7** Which ion causes the solution to be alkaline?

[1 mark]

0 6 . **8** Potassium is also in Group 1 of the periodic table.

Potassium reacts with water in a similar way to lithium.

Suggest **one** difference you would see between the reactions of potassium and lithium with water.

[1 mark]

7

There are two main types of diesel fuel used for cars:

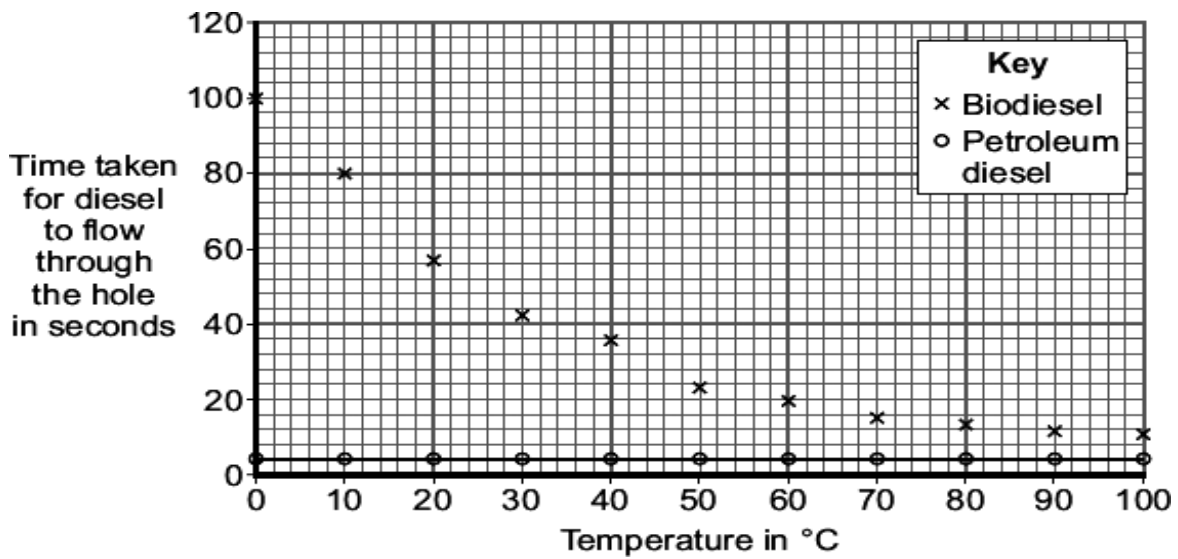
- biodiesel, made from vegetable oils
- petroleum diesel, made from crude oil.

A scientist compared the viscosity of biodiesel with petroleum diesel at different temperatures.

The scientist measured the time for the same volume of each diesel fuel to flow through a small hole in a cup.

The scientist's results are plotted on the graph in **Figure 7**.

Figure 7



0 7 . **1** Draw a line of best fit for the biodiesel results.

[1 mark]

0 7 . **2** What conclusions can the scientist make about the viscosity of biodiesel compared with the viscosity of petroleum diesel at different temperatures?

[2 marks]

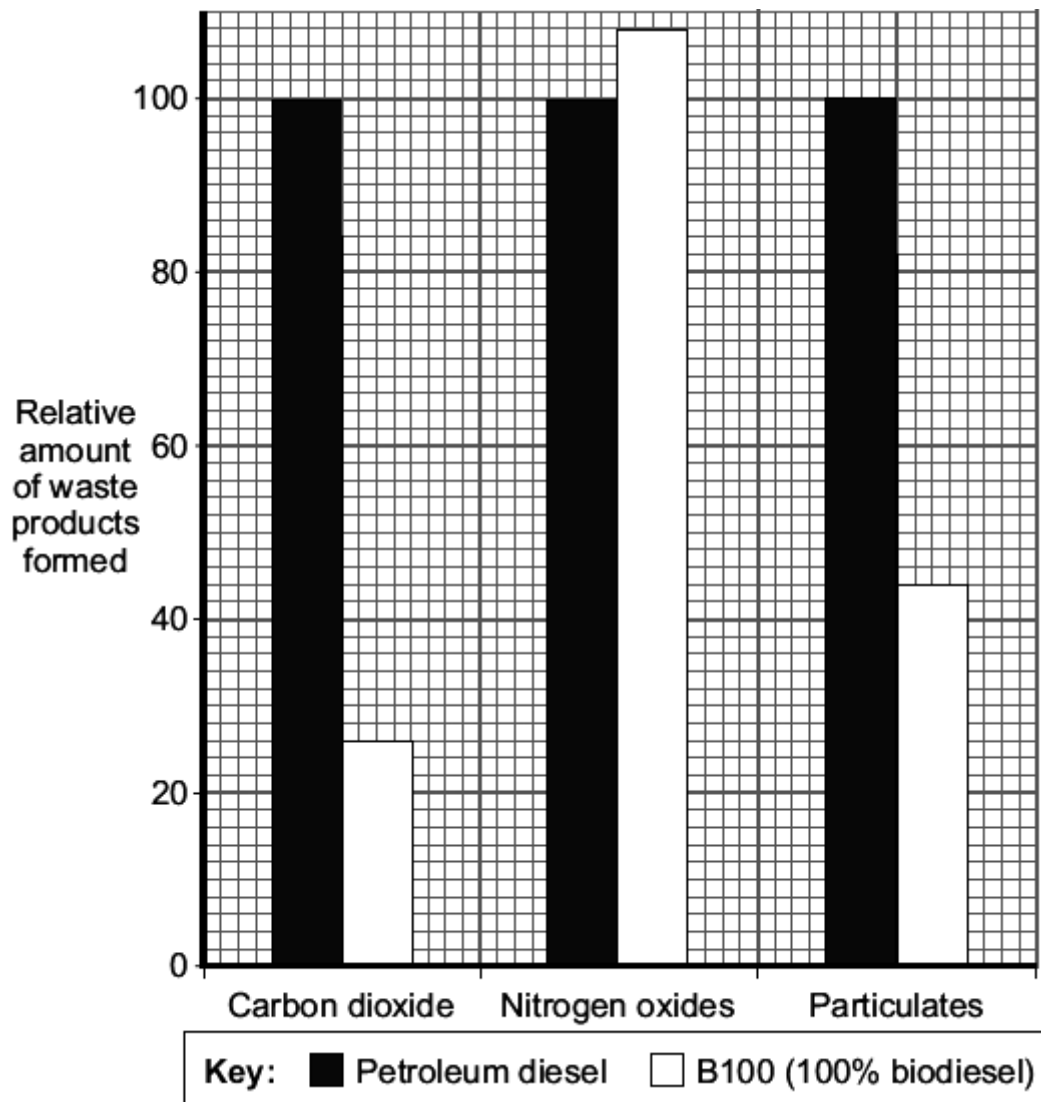
0 7 . **3** Biodiesel may be less suitable than petroleum diesel as a fuel for cars.

Use these results to suggest **one** reason why.

[1 mark]

The bar chart in **Figure 8** compares the relative amounts of waste products made when two different types of diesel fuel burnt in a car engine.

Figure 8



07 . 4

What is the percentage reduction in particulates when using B100 instead of petroleum diesel?.

[1 mark]

Turn over ►

A carbon neutral fuel does **not** add extra carbon dioxide to the atmosphere.

0 7 . **5**

Is biodiesel a carbon neutral fuel?

Use the bar chart and your knowledge to explain your answer.

[2 marks]

0 7 . **6**

Give a reason why using biofuels may lead to food shortages in some countries.

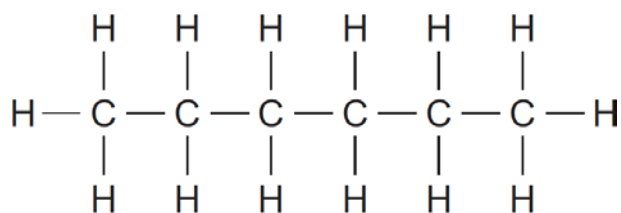
[1 mark]

Turn over for the next question

8 This question is about hydrocarbons.

Hexane has the displayed structure shown in **Figure 9**.

Figure 9



0 8 . **1** Complete the formula of hexane.

[1 mark]



0 8 . **2** What type of covalent bonds does hexane have?

Tick **one** box.

[1 mark]

Double and single bonds

Only double bonds

Only single bonds

Butene is an alkene.

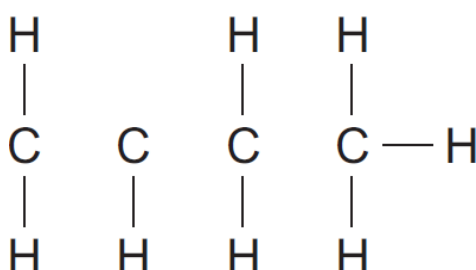
0 8 . **3** Complete the general formula for alkenes.

[1 mark]



0 8 . **4** Complete the displayed formula for butene.

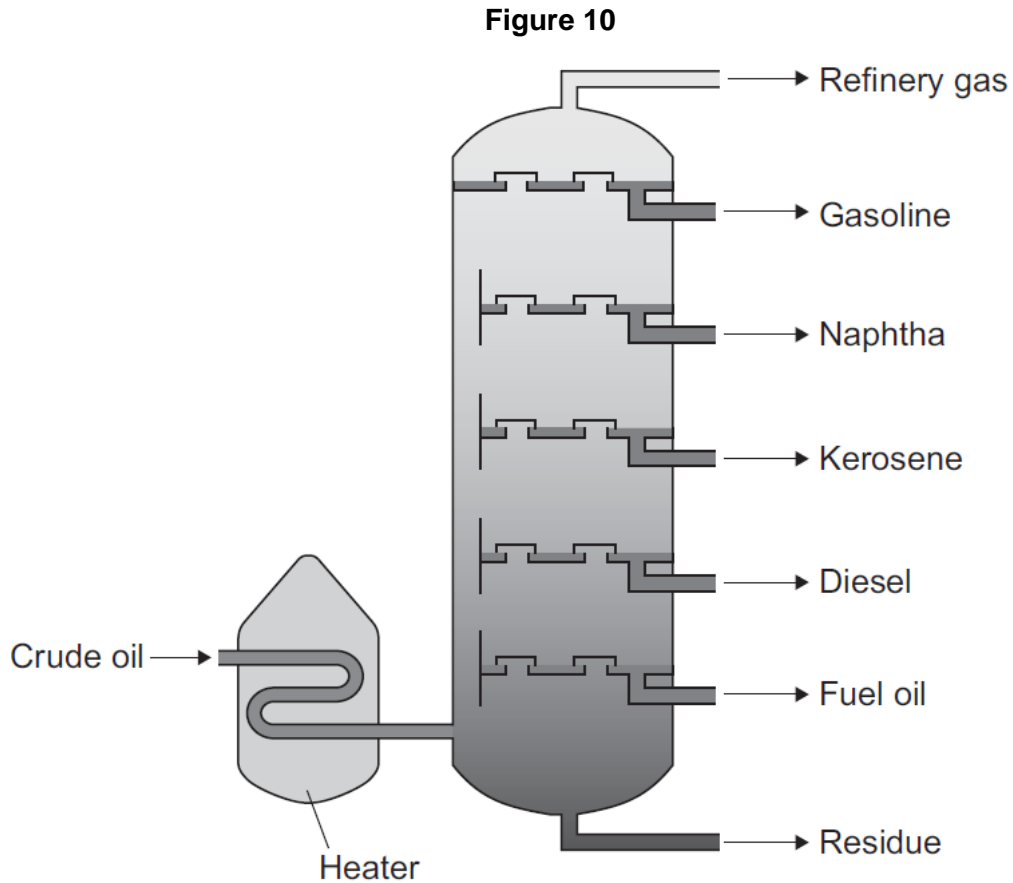
[1 mark]



0 8 . 5 Crude oil contains many hydrocarbons.

These hydrocarbons are separated into fractions by fractional distillation.

Figure 10 shows a fractionating column.



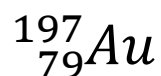
Crude oil is heated to vaporise it, and pumped into the bottom of the fractionating column.

Describe how the hydrocarbons in crude oil are separated into fractions in the fractionating column.

[3 marks]

9 This question is about gold (Au).

An atom of gold is represented as:



0 9 . **1** How many neutrons are in this atom of gold?

[1 mark]

0 9 . **2** Gold ions are used as a catalyst.

How does a gold atom (Au) become a gold ion (Au³⁺)?

[2 marks]

0 9 . **3** A gold catalyst can be used when carbon monoxide reacts with oxygen to make carbon dioxide.

Complete and balance the equation for this reaction.

[2 marks]



0 9 . **4** Explain why carbon dioxide has a very low boiling point.

[3 marks]

0 9 . **5** Gold is used as a catalyst in industrial processes.

Gold is rare and increasingly expensive.

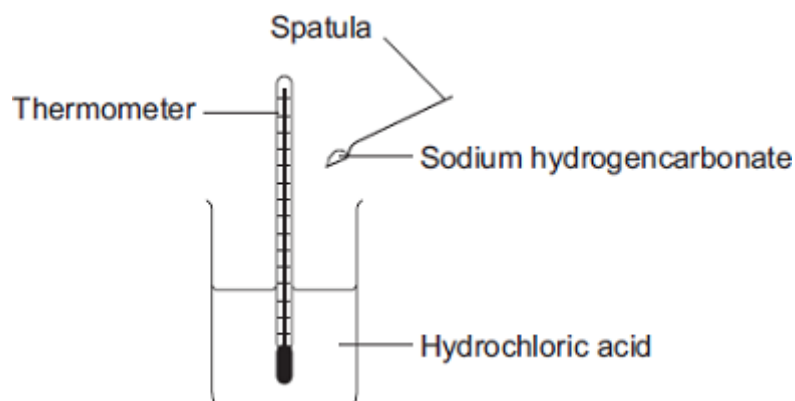
Suggest **two** reasons why gold is still used in industrial processes.

[2 marks]

Turn over for the next question

10

Some students did an experiment to find the temperature change when hydrochloric acid reacts with sodium hydrogencarbonate.



The results are shown in **Table 3**.

Table 3

Number of spatula measures of sodium hydrogencarbonate	Start temperature in °C	Final temperature in °C	Change in temperature in °C
2	20	16	4
4	20	14	6
6	19	11	8
8	20	10	10
10	19	9	10
12	20	10	10

1 0 . **1** Describe the trends shown in the students' results.

[3 marks]

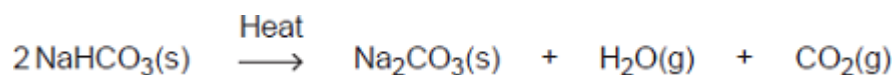
1 0 . **2** State **one** variable that must be kept the same for the investigation. **[1 mark]**

1 0 . **3** State the type of energy transfer for this reaction. **[1 mark]**

Sodium hydrogencarbonate is used as baking powder for making cakes.

When the cake mixture is baked the sodium hydrogencarbonate decomposes.

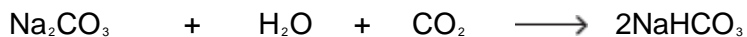
The equation for the reaction is:



1 0 . **4** The cake mixture rises when baked. Use the equation to suggest why. **[1 mark]**

Question 10 continues on the next page

- 1 0 . 5 The same reaction can be reversed to produce sodium hydrogencarbonate from sodium carbonate.



Do the reactants need to be heated?

Give a reason for your answer.

[1 mark]

- 1 0 . 6 Calculate the relative formula mass of sodium hydrogencarbonate (NaHCO_3).

Relative atomic masses (A_r): H=1; C=12; O=16; Na=23

[2 marks]

Relative formula mass (M_r)= _____

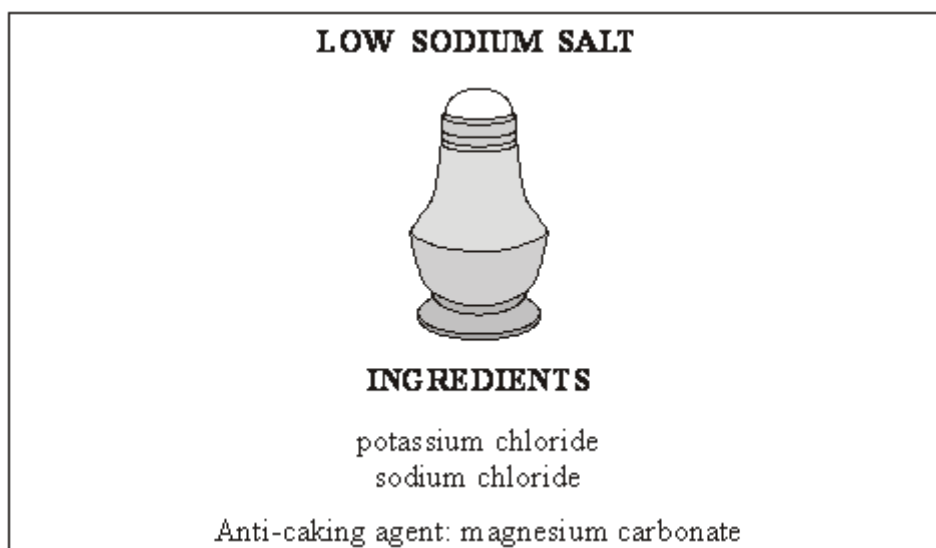
- 1 0 . 7 Calculate the percentage by mass of carbon in sodium hydrogencarbonate.

[1 mark]

Percentage of carbon = _____ %

11

The label is from a packet of Low Sodium Salt.



A student tested some Low Sodium Salt to show that it contains carbonate ions and chloride ions.

1 1 . 1

Describe how you would test for carbonate ions.

Describe what you would see.

[2 marks]

1 1 . 2

Flame tests can be used to identify potassium ions and sodium ions.

Suggest why it is difficult to identify **both** of these ions in Low Sodium Salt using a flame test.

[1 mark]

Read the following information and then answer the questions.

Salt – friend or foe?

Sodium chloride (salt) is an essential mineral for our health. It is used to flavour and preserve foods.

Too much sodium in our diet may increase the risk of high blood pressure and heart disease.

Heart disease is a major cause of death in many countries. Some people also claim that too much sodium is poisonous and can cause cancer, while others say that more evidence is needed.

Many processed foods contain salt, so it is easy to exceed the recommended daily upper limit of about 5 g of salt per person. A 'healthier' amount should be about 3 g. Many people consume over 10 g of salt each day.

One way to reduce sodium in our diet is to use Low Sodium Salt. This has two thirds of the sodium chloride replaced by potassium chloride.

1 1 . 3

Suggest why removing all sodium chloride from food would be impractical.

[1 mark]

1 1 . 4

Describe the advantages and disadvantages of reducing the amount of sodium chloride in all foods.

[6 marks]

END OF QUESTIONS

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