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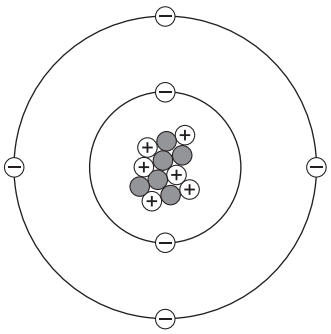
Do not write outside the box

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

1 The picture shows a diamond ring.

1 (a) Diamond is a form of carbon. The diagram represents a carbon atom.



Complete the table to show the name and charge of each type of particle in the carbon atom.

Name of particle	Charge
proton	
neutron	0
	–1

(2 marks)

1 (b) Use the Chemistry Data Sheet to help you to answer these questions.

1 (b) (i) Draw a ring around the correct answer to complete the sentence.

Gold and carbon are

- compounds.
- elements.
- mixtures.

(1 mark)

1 (b) (ii) Complete the sentence.

Gold and carbon have different properties because gold is a metal and carbon is a ..... .

(1 mark)

1 (c) Draw a ring around the correct answer to complete each sentence.

Pure gold is not used to make the ring because pure gold is too

- hard.
- reactive.
- soft.

The gold ring is made by mixing pure gold with other metals to form

- a compound.
- an atom.
- an alloy.

(2 marks)

Question 1 continues on the next page

1 (d) The data in the table shows some information about the three metals in the gold ring.

Name of metal	Atomic number	Percentage (%) of metal
gold	79	
silver	47	16
copper	29	9

Draw **one** line from each question to its correct answer.

Question	Answer
What is the percentage of gold in this ring?	29
How many electrons are there in a copper atom?	61
How many neutrons are in an atom of silver with a mass number of 108?	75
	79

(3 marks)

9

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

2 Cans for food and drinks are made from steel or aluminium.
The main metal in steel is iron.

2 (a) Reacting iron oxide with carbon produces iron.

Draw a ring around the correct answer to complete the sentence.

The reaction to produce iron from iron oxide is

decomposition.
oxidation.
reduction.

(1 mark)

2 (b) Aluminium cannot be produced by reacting aluminium oxide with carbon.

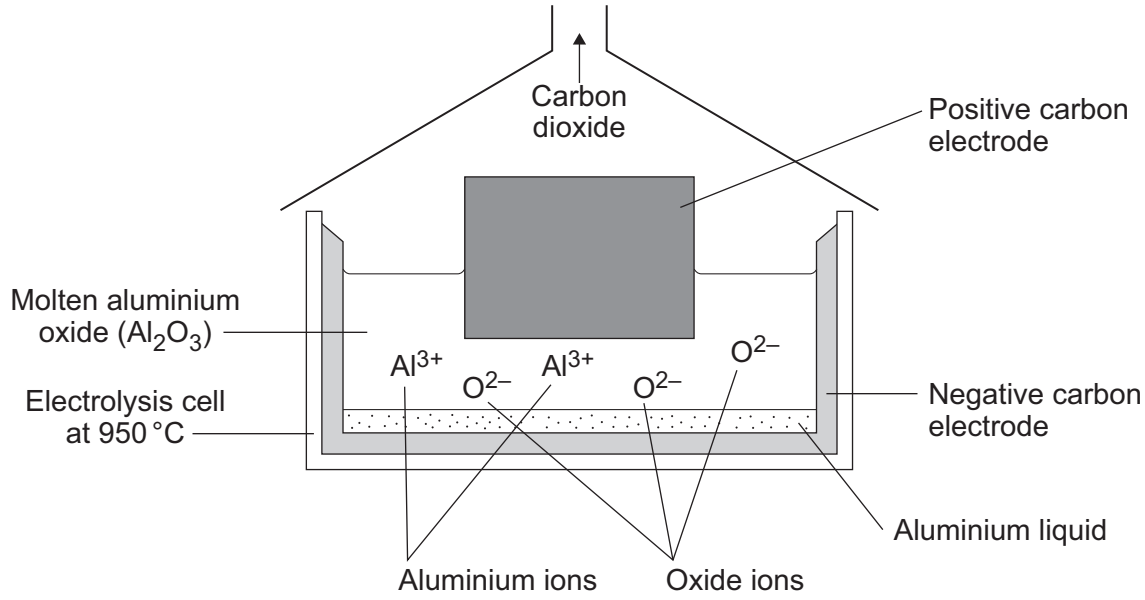
Why does aluminium oxide **not** react with carbon?

Tick (✓) the correct answer.

Answer	Tick (✓)
aluminium is less reactive than carbon	
carbon is less reactive than aluminium	
oxygen is more reactive than carbon	

(1 mark)

2 (c) Aluminium can be produced by electrolysis.



Why do the aluminium ions collect at the negative electrode?

.....

.....

.....

.....

(2 marks)

2 (d) Some statements about aluminium are given below.

Tick (✓) **two** statements that are correct reasons why aluminium is used to make cans.

Statement	Tick (✓)
aluminium conducts electricity	
aluminium is not a transition metal	
aluminium has a low density	
aluminium is resistant to corrosion	

(2 marks)

2 (e) Recycling aluminium cans uses less fossil fuels than producing aluminium from its ore.

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of recycling aluminium to make aluminium cans.

Statement	Advantage Tick (✓)	Disadvantage Tick (✓)
aluminium is the most common metal in the Earth's crust		
less carbon dioxide is produced		
more aluminium ore needs to be mined		
used aluminium cans have to be collected and transported		

(2 marks)

8

3 (a) Crude oil is a mixture of compounds.
These compounds are made up of hydrogen and carbon atoms only.

3 (a) (i) Draw a ring around the correct answer to complete the sentence.

Compounds made up of carbon and hydrogen atoms only are called

alcohols.

hydrocarbons.

vegetable oils.

(1 mark)

3 (a) (ii) The table shows five of these compounds.

Compound	State at room temperature (20 °C)	Boiling point in °C
ethane, C_2H_6	gas	–89
butane, C_4H_{10}	gas	0
hexane, C_6H_{14}	liquid	+69
pentadecane, $C_{15}H_{32}$	liquid	+270
heptadecane, $C_{17}H_{36}$	solid	+302

Tick (✓) **two** correct statements about the five compounds.

Statement	Tick (✓)
ethane has the smallest molecules	
hexane and pentadecane are liquid at 100 °C	
heptadecane has the highest boiling point	
butane boils at 100 °C	

(2 marks)

3 (a) (iii) Draw a ring around the correct answer to complete each sentence.

Fractional distillation is used to separate the compounds in crude oil.

The first step in fractional distillation is

cracking

displacing

evaporating

the crude oil.

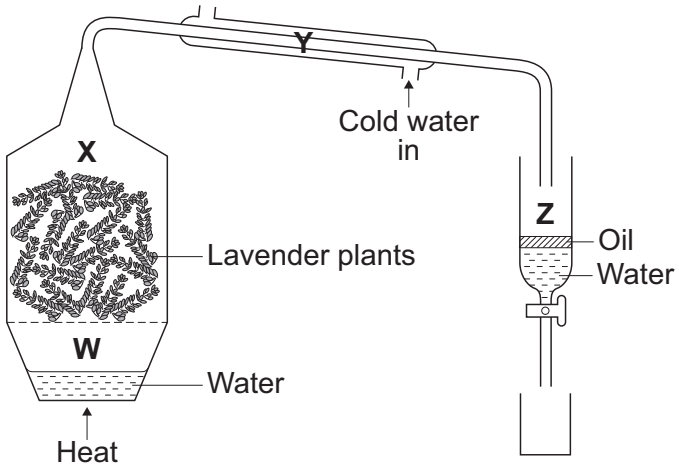
During fractional distillation the compounds

burn
condense
decompose

at different temperatures.

(2 marks)

3 (b) Steam distillation is used to separate oils from plants.
The diagram shows some apparatus that can be used to separate oil from lavender plants. Four parts of the apparatus are labelled **W**, **X**, **Y** and **Z**.



3 (b) (i) In which part, **W**, **X**, **Y** or **Z**, of the apparatus:

is steam produced ☐

are steam and oil condensed? ☐

(2 marks)

3 (b) (ii) Use the correct word from the box to complete the sentence.

dissolves	**floats**	**sinks**

When the oil separates from the water, the oil ..... .

(1 mark)

3 (b) (iii) Describe how part **Z** of the apparatus can be used to remove the water from the oil.

.....

.....

.....

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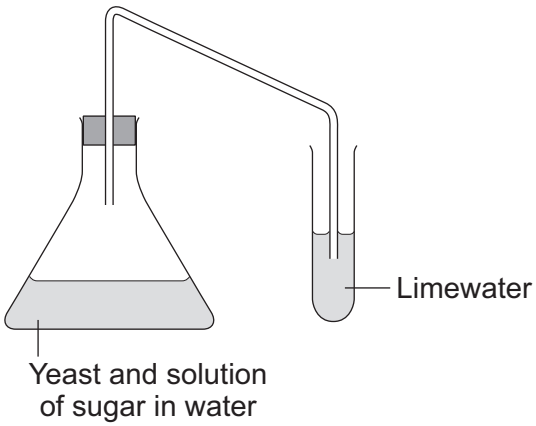
(2 marks)

10

4 Two fuels that can be used for cars are:

- petrol from crude oil
- ethanol made from sugar in plants.

4 (a) A student used the apparatus shown to investigate the reaction to make ethanol from sugar.



4 (a) (i) Draw a ring around the correct answer to complete the sentence.

This reaction to make ethanol from sugar is

combustion.
decomposition.
fermentation.

(1 mark)

4 (a) (ii) Complete the sentences.

The limewater turns ..... .

This happens because ..... .

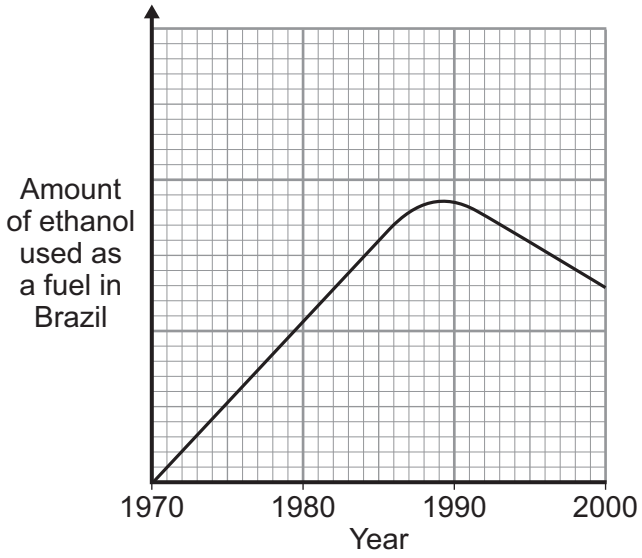
(2 marks)

4 (b) In 1970, the Brazilian Government stated that all petrol must contain more than 25 % ethanol.

The reasons for this statement in 1970 were:

- Brazil did not have many oilfields
- Brazil has a climate suitable for growing sugar cane.

The graph shows the amount of ethanol used as a fuel in Brazil from 1970 to 2000.



4 (b) (i) Use the graph to describe the changes in the amount of ethanol used as a fuel in Brazil from 1970 to 2000.

.....

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.....

(2 marks)

4 (b) (ii) In 2011, the Brazilian Government decided to reduce the amount of ethanol in petrol to 18 %.

Suggest **one** reason for their decision.

.....

.....

(1 mark)

6

5 Cement is made by heating a mixture of clay and limestone in a kiln.

5 (a) Many kilns are heated by burning natural gas (methane) in air.

A chemical equation for the burning of methane is:

$$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$$

Describe this reaction in words.

Give the names of the molecules **and** the numbers of each molecule in this chemical equation.

.....

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.....

(2 marks)

5 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Limestone contains calcium carbonate.
There is a large deposit of limestone under an area of natural beauty.
A company wants to quarry this limestone and build a kiln near to the quarry to make cement.

Area of natural beauty

A quarry

Explosives will be used to extract the limestone out of the ground.

Heavy machinery will be used to lift and crush the limestone.

Lorries will be used to transport the limestone to the kiln to make cement.

The lorries and the heavy machinery will use diesel fuel.

Quarrying limestone and making cement will have an impact on everything near the area.

Describe the positive and the negative impacts of quarrying limestone and making cement.

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(6 marks)

8

Turn over for the next question

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

6 A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol	
Alkane	**Formula**
hexane	C_6H_{14}
heptane	
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$

Air	
Gas	**Percentage (%)**
nitrogen	78
oxygen	21
carbon dioxide	0.035
Small amounts of other gases and water vapour	

6 (a) Use the information above to answer these questions.

6 (a) (i) Give the formula for heptane.

.....

(1 mark)

6 (a) (ii) Complete the general formula of alkanes.
n = number of carbon atoms

$$C_nH$$

(1 mark)

6 (b) Alkanes in petrol burn in air.
The equations represent two reactions of hexane burning in air.

Reaction 1 $2C_6H_{14} + 19O_2 \rightarrow 12CO_2 + 14H_2O$

Reaction 2 $2C_6H_{14} + 13O_2 \rightarrow 12CO + 14H_2O$

Reaction 2 produces a different carbon compound to **Reaction 1**.

6 (b) (i) Name the carbon compound produced in **Reaction 2**.

.....

(1 mark)

6 (b) (ii) Give a reason why the carbon compounds produced are different.

.....

.....

(1 mark)

Question 6 continues on the next page

6 (c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

6 (c) (i) What is the percentage of the other gases in the table?

.....

(1 mark)

6 (c) (ii) What is the name of the compound that makes up most of the other gases?

.....

(1 mark)

6 (c) (iii) Give a reason why sulfur dioxide is produced in a petrol engine.

.....

.....

(1 mark)

6 (c) (iv) State how nitrogen oxides are produced in a petrol engine.

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(2 marks)

6 (d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

.....

.....

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.....

(2 marks)

11

Turn over for the next question

7 There are about 500 000 earthquakes every year. On 12 January 2010 there was an earthquake near Port-au-Prince in Haiti. Many buildings were destroyed causing the deaths of thousands of people. The earthquake did not come as a surprise to scientists who predicted the earthquake a week earlier. The Government and people ignored the prediction.

The Richter scale is used to compare the size of earthquakes.

Richter scale value	Effect of earthquake
Less than 2	People do not feel the earthquake.
2 – 4	People feel the earthquake but the earthquake rarely causes damage to buildings.
4 – 5	People feel the earthquake and the earthquake causes minor damage to a few buildings.
5 – 6	Shaking of the ground and major damage to some buildings.
6 – 8	Violent shaking of the ground and many buildings destroyed.
8 – 10	Very violent shaking of the ground and most buildings destroyed.

7 (a) Use the information above to answer these questions.

7 (a) (i) Suggest the Richter scale value for the earthquake that happened near Port-au-Prince in Haiti.

.....

(1 mark)

7 (a) (ii) Governments and people often ignore scientists' predictions of an earthquake.

Suggest **three** reasons why.

1 .....

.....

.....

2 .....

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3 .....

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(3 marks)

7 (b) During the twentieth century many scientists proposed ideas about the cause of earthquakes and about the Earth's crust.
In 1912 Alfred Wegener proposed his idea of '*continental drift*'.
In 1930 Arthur Holmes suggested his idea of '*mantle dynamics*'.

7 (b) (i) What did Wegener mean by *'continental drift'*?

.....

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.....

.....

(2 marks)

7 (b) (ii) Holmes' idea of '*mantle dynamics*' provided an explanation for Wegener's idea of *'continental drift'.*

Suggest what *'mantle dynamics'* is and state what causes *'mantle dynamics'*.

.....

.....

.....

.....

.....

(2 marks)

8

END OF QUESTIONS

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Iron

1 Iron occurs in the Earth's crust as an ore.

iron ore

The ore is mainly iron oxide, Fe_2O_3.

(a) Give the name of the element combined with iron in iron oxide.

(1)

.....

(b) When iron oxide is heated with carbon, the products are iron and carbon dioxide.

(i) Complete the word equation for this reaction.

(2)

iron oxide + ... → iron + ...

(ii) What happens to the iron oxide during this reaction?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** the iron oxide burns

☒ **B** the iron oxide is neutralised

☒ **C** the iron oxide is oxidised

☒ **D** the iron oxide is reduced

(c) Iron corrodes when it is left in moist air.

This list shows iron and three other metals in reactivity series order, with the most reactive metal at the top.

most reactive	magnesium
	iron
	lead
least reactive	silver

Explain which metal in the list will corrode faster than iron.

(2)

.....

.....

.....

.....

(d) Stainless steel is an alloy containing iron and chromium.

(i) State the meaning of the term **alloy**.

(1)

.....

.....

(ii) Cutlery is made of stainless steel.

Give a reason why cutlery is not made of pure iron.

(1)

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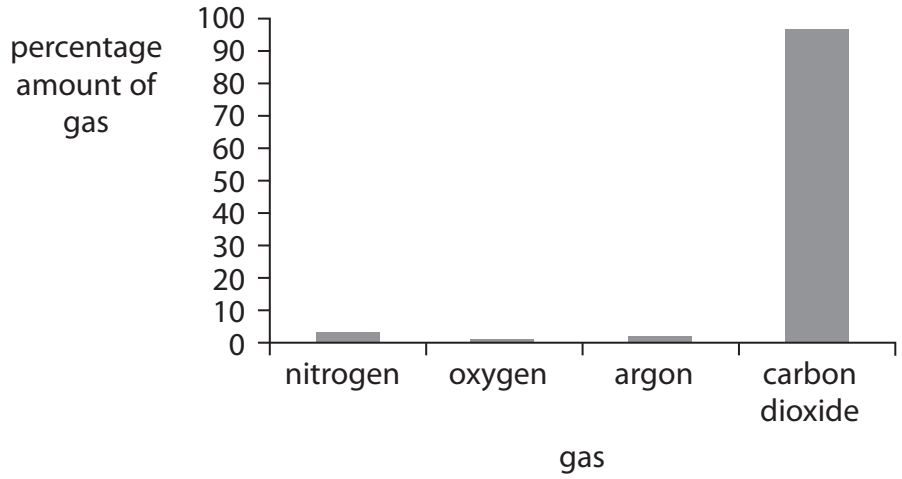
(Total for Question 1 = 8 marks)

The Earth's atmosphere

2 The amounts of some gases in the Earth's early atmosphere are shown on the bar chart.



(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The earth's earliest atmosphere was formed by

(1)

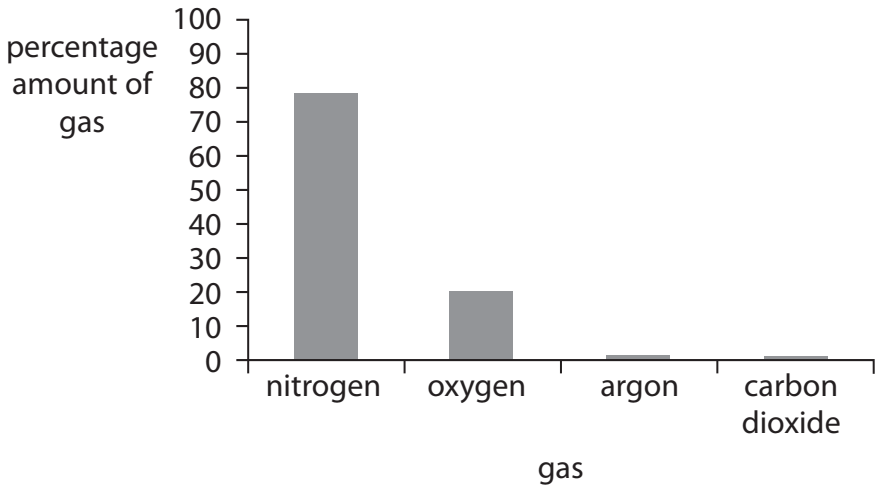
☒ **A** animals breathing

☒ **B** trees burning

☒ **C** plants photosynthesising

☒ **D** volcanoes erupting

(b) The amounts of some gases in the atmosphere on Earth today are shown on this bar chart.



Which gas has decreased by the largest amount from the Earth's early atmosphere to the atmosphere of the Earth today?

Use this bar chart and the bar chart in (a).

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** argon

☒ **B** carbon dioxide

☒ **C** nitrogen

☒ **D** oxygen

(c) There was also a large amount of water vapour in the Earth's early atmosphere. There is a much smaller amount of water vapour in the atmosphere on Earth today.

Explain how the amount of water in the Earth's atmosphere decreased.

(2)

(d) Methane burns in air.

$$\text{methane} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$$

This causes small changes in the amounts of some gases in today's atmosphere.

Explain why burning methane changes the amounts of gases in the atmosphere.

(2)

(e) Apart from burning fossil fuels, state **two** other activities that affect the amounts of gases in the atmosphere.

(2)

(Total for Question 2 = 8 marks)

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Hydrochloric acid

3 (a) Dilute hydrochloric acid can be used to make salts.
The salts produced are chlorides.

Some copper compounds react with dilute hydrochloric acid to produce copper chloride.

Which of the following compounds will **not** neutralise dilute hydrochloric acid to produce copper chloride?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** copper carbonate

☒ **B** copper hydroxide

☒ **C** copper oxide

☒ **D** copper sulfate

(b) Use words from the box to complete the word equation for the reaction of magnesium carbonate to produce magnesium chloride.

(2)

carbon dioxide	hydrochloric acid	nitric acid
oxygen	sulphuric acid	

magnesium carbonate + ... → magnesium chloride + ... + water

(c) Indigestion tablets neutralise excess hydrochloric acid in the stomach.
Two tablets, A and B, were tested.

The table shows the cost of each tablet and the volume of hydrochloric acid neutralised by each tablet.

tablet	cost of one tablet / p	volume of hydrochloric acid neutralised by one tablet / cm^3
A	2.5	30.6
B	1.2	10.2

Explain which tablet, A or B, is the best value for money.

(2)

.....

.....

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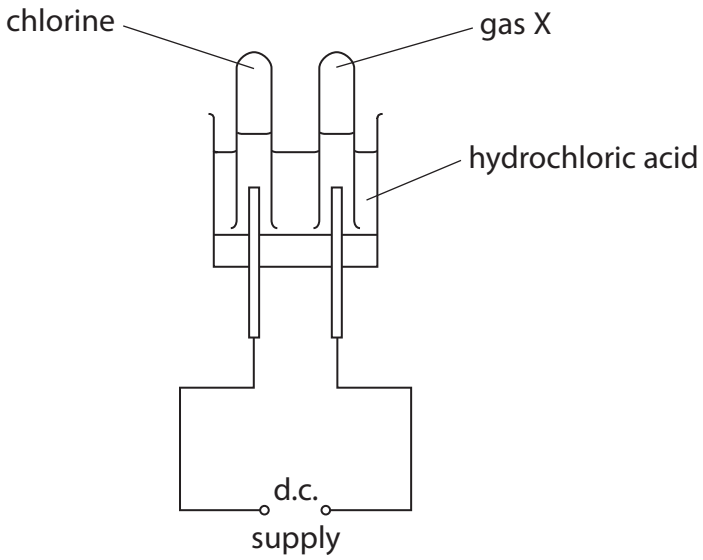
.....

(d) Hydrochloric acid was electrolysed using the apparatus shown.



(i) Chlorine gas was collected in one of the test tubes.

Describe a test to show the gas is chlorine.

(2)

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(ii) Gas X was collected in the other test tube.
When gas X was mixed with air and ignited, it burned with a squeaky pop.

Give the name of gas X.

(1)

.....

(e) In industry, large amounts of chlorine are produced.

Explain why it could be dangerous to produce large amounts of chlorine in a factory.

(2)

.....

.....

(Total for Question 3 = 10 marks)

Fuels

4 Different car engines are designed to use different fuels.
These fuels include diesel, ethanol, hydrogen, LPG (liquefied petroleum gas) and petrol.

(a) LPG contains the compound propane.

(i) Complete the structure of a molecule of propane, C_3H_8, showing all bonds.

(1)

C——C——C

(ii) Propane burns completely to produce carbon dioxide and water.

Describe how you would use limewater to show that carbon dioxide is produced.

(2)

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.....

.....

.....

(iii) Incomplete combustion occurs when propane burns with insufficient oxygen available for complete combustion.

Explain a problem caused by the products of this incomplete combustion.

(2)

.....

.....

.....

.....

(b) Biofuels can be used as alternatives to non-renewable, fossil fuels.

(i) Which of the following can be produced as a biofuel?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** ethanol

☒ **B** hydrogen

☒ **C** LPG

☒ **D** petrol

(ii) Explain how a biofuel is different from a fossil fuel.

(2)

.....

.....

.....

.....

(c) The table shows information about two fuels, A and B, used in car engines.

fuel	physical state	cost of 1 kg / £	energy produced by complete combustion of 1 kg / MJ	availability at fuel station
A	gas	2.13	142	limited
B	liquid	1.95	47	good

Explain which fuel, A or B, would be best for powering a car.

(2)

.....

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.....

(Total for Question 4 = 10 marks)

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Calcium carbonate

5 (a) Limestone is a rock which often contains fossils.

What type of rock is limestone?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** igneous
- ☒ **B** lava
- ☒ **C** metamorphic
- ☒ **D** sedimentary

(b) Limestone is an important raw material.

Which of these is made using limestone as a raw material?

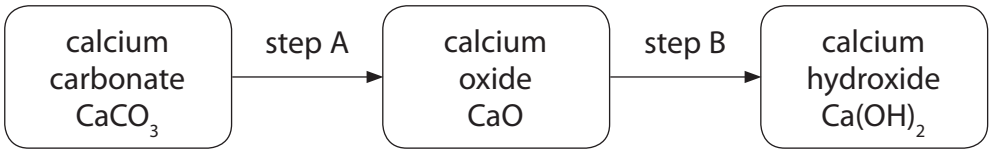
Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** bleach solution
- ☒ **B** cement
- ☒ **C** fertilisers
- ☒ **D** soap

(c) Limestone contains calcium carbonate.

Calcium carbonate can be converted into calcium oxide.
Calcium oxide can then be converted into calcium hydroxide.



(i) A lump of calcium carbonate is heated to convert it into calcium oxide in step A.

Explain why the mass of calcium oxide formed is less than the original mass of calcium carbonate.

(2)

.....

.....

.....

.....

(ii) Write the word equation for the reaction in step B.

(2)

.....

*(d) Even though limestone is an important raw material in the chemical industry, many people are against plans to open new limestone quarries.

Discuss the advantages and disadvantages, to the local community and its surroundings, of opening a new limestone quarry.

(6)

(Total for Question 5 = 12 marks)

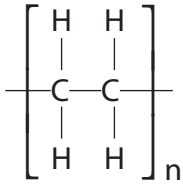
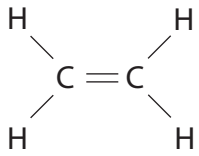
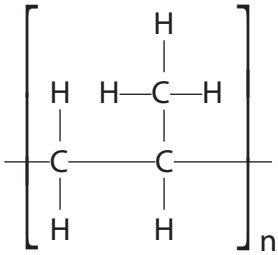
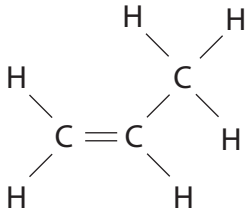
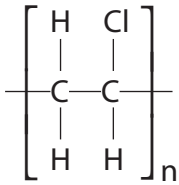
Polymers

6 Polymer molecules are made by joining large numbers of small molecules (monomers) together.

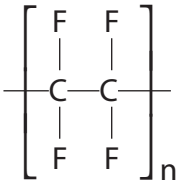
(a) The table shows some information about three polymers and the monomers used to make them.

Complete the table.

(3)

name of polymer	structure of polymer molecule	name of the monomer used to make the polymer molecule	structure of monomer molecule
poly(ethene)		.....	
.....		propene	
poly(chloroethene)		chloroethene	.....

(b) The structure of the polymer poly(tetrafluoroethene), PTFE, is



State why this polymer is **not** a hydrocarbon.

(1)

.....

.....

(c) Poly(chloroethene), PVC, is used to make gutters and drainpipes.

One property of poly(chloroethene) is that it is easy to shape.

Describe other properties of poly(chloroethene) that make it suitable for gutters and drainpipes.

(2)

.....

.....

.....

.....

*(d) Waste is often disposed of by putting it in landfill sites, by burning or by recycling.

Discuss the advantages and disadvantages of each disposal method, and explain which disposal method should be used for plastic bottles.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Answer ALL questions

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Temperature changes

1 (a) When a small amount of solid ammonium chloride is shaken with water, a colourless solution forms.

(i) What type of change has occurred?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** dissolving

☐ **B** displacement

☐ **C** neutralisation

☐ **D** precipitation

(ii) When this change takes place there is a decrease in temperature.

Describe how you could measure this change in temperature.

(2)

.....

.....

.....

.....

(iii) Some chemical reactions cause a decrease in temperature.

Give the name of the type of chemical reaction that causes a decrease in temperature.

(1)

.....

(b) Marble is a form of calcium carbonate.
When marble chips are added to cold, dilute hydrochloric acid, the mixture fizzes.

The word equation for the reaction is

calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water

(i) Give the name of the product that causes the mixture to fizz.

(1)

.....

(ii) The experiment is repeated using warm, instead of cold, acid.

State the difference you would **see** when the marble chips react with warm, instead of cold, acid.

(1)

.....

.....

(iii) Explain what must be done to the marble chips so that the reaction with the warm, dilute hydrochloric acid is even faster.

(2)

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

Salts

2 The table shows some salts that are soluble and some that are insoluble in water.

soluble salts	insoluble salts
copper chloride lead nitrate sodium carbonate	barium sulfate lead carbonate

(a) An insoluble salt can be prepared by mixing two salt solutions.

Choose **two** salts from the table that can be reacted together to form lead carbonate.

(2)

..... and .....

(b) Barium chloride solution reacts with copper sulfate solution.

$$\text{barium chloride} + \text{copper sulfate} \rightarrow \text{barium sulfate} + \text{copper chloride}$$

Explain what is **seen** when solutions of barium chloride and copper sulfate are mixed.

(2)

.....

.....

.....

.....

(c) A 'barium meal' may be given to a patient before an X-ray is taken.
A 'barium meal' is a suspension of barium sulfate in water.

Give **one** reason why barium sulfate is used in this way.

(1)

.....

.....

(d) Complete the sentences by putting a cross (☒) in the box next to your answer.

(i) The table shows that copper chloride is soluble in water.

This suggests that the structure of copper chloride is

(1)

☒ **A** simple molecular, covalent

☒ **B** giant molecular, covalent

☒ **C** ionic

☒ **D** metallic

(ii) Sodium carbonate is an ionic compound.

The most likely melting point of sodium carbonate is

(1)

☒ **A** –85 °C

☒ **B** 17 °C

☒ **C** 146 °C

☒ **D** 851 °C

(e) Sodium carbonate contains sodium ions, Na^+, and carbonate ions, CO_3^{2-}.

Give the formula for sodium carbonate.

(1)

.....

(Total for Question 2 = 8 marks)

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Mixtures

3 (a) Water and oil do not mix.

(i) What term is used to describe two liquids that do not mix?

Put a cross (☒) in the box next to your answer.

(1)

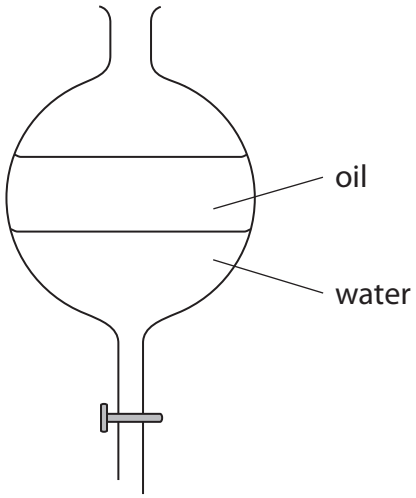
☒ **A** ionic

☒ **B** inflammable

☒ **C** immiscible

☒ **D** insoluble

(ii) The water and oil mixture can be separated using a separating funnel.



Describe how the separating funnel is used to separate samples of water and oil from the mixture.

(2)

.....

.....

.....

.....

(b) Wax and sand are both solids at room temperature.
The wax has a melting point of 64 °C.
The sand has a melting point of 1610 °C.

(i) State what will happen to the wax when it is heated using a Bunsen burner.

(1)

.....

(ii) When the sand is heated using a Bunsen burner there is no visible change.

Explain why.

(2)

.....

.....

.....

.....

(iii) The wax has a low melting point because there are only weak forces between the molecules in the wax.

What type of structure does wax have?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** simple molecular, covalent

☒ **B** giant molecular, covalent

☒ **C** ionic

☒ **D** metallic

(c) A written note was found at a crime scene.
Forensic scientists used chromatography to investigate the dyes in the ink used to write the note.

They put spots of four substances on chromatography paper.

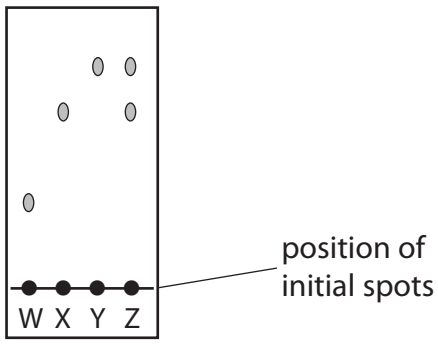
W was pure red dye

X was pure blue dye

Y was pure yellow dye

Z was the ink used on the note

The result of the chromatography is shown.



(i) State how you can tell that dyes W, X and Y are pure.

(1)

.....

.....

.....

(ii) Explain what you can deduce about the ink Z used on the note.

(2)

.....

.....

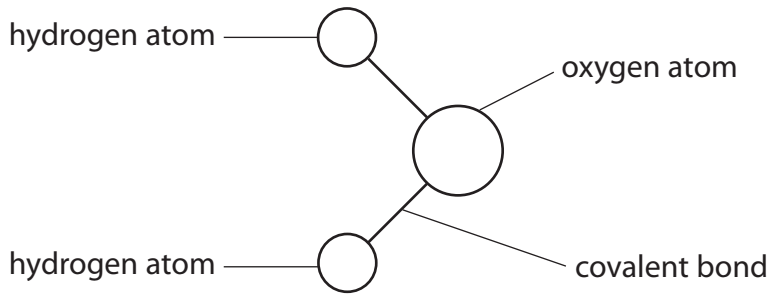
.....

.....

(Total for Question 3 = 10 marks)

Water

4 The diagram shows a model of a water molecule.



(a) Explain, in terms of electrons, how a covalent bond is formed between an oxygen atom and a hydrogen atom.

(2)

.....

.....

.....

.....

(b) Calculate the relative formula mass of water, H_2O.
(Relative atomic masses: H = 1.0, O = 16)

(2)

.....

.....

answer = ...

(c) Hydrogen burns in oxygen to form water.

(i) Write the balanced equation for this reaction.

(3)

.....

(ii) In an experiment the mass of water obtained was 2.0 g.
The theoretical yield for this experiment was calculated to be 4.0 g.

Calculate the percentage yield.

(2)

.....

.....

percentage yield = ... %

(iii) Suggest **one** reason why less than 4.0 g of water was obtained in this experiment.

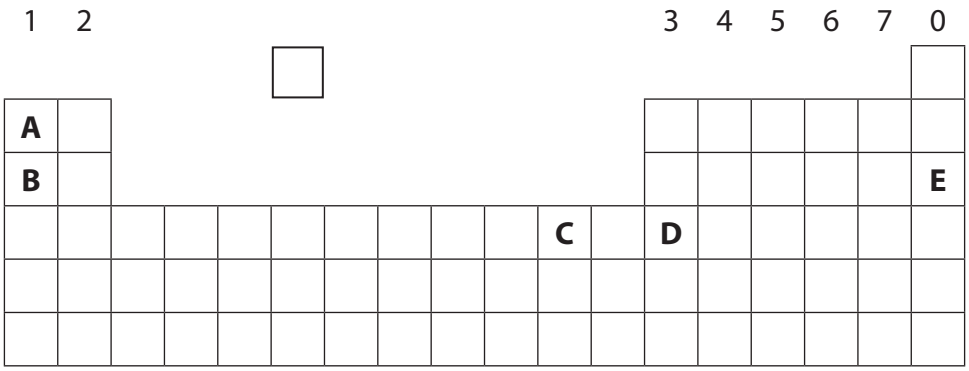
(1)

.....

(Total for Question 4 = 10 marks)

Atoms

5 The positions of five elements, **A**, **B**, **C**, **D** and **E**, are shown in the periodic table. These letters are not the atomic symbols of these elements.



(a) Which element, **A**, **B**, **C**, **D** or **E**, is a transition metal?

(1)

.....

(b) State why elements **A** and **B** have similar reactions.

(1)

.....

.....

(c) When Mendeleev produced his periodic table, the element labelled **D** had not been discovered.
He predicted the properties of the element and left a space for it in his table.

Explain how Mendeleev was able to predict the properties of element **D**.

(2)

.....

.....

.....

.....

(d) An atom of element **C** contains 29 protons.

Explain how you can use this information to calculate the number of protons in an atom of element **D**.

(2)

*(e) An atom has an atomic number of 9 and a mass number of 19.

Describe the numbers and positions of electrons, protons and neutrons in this atom.

(6)

(Total for Question 5 = 12 marks)

Metals and their compounds

6 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

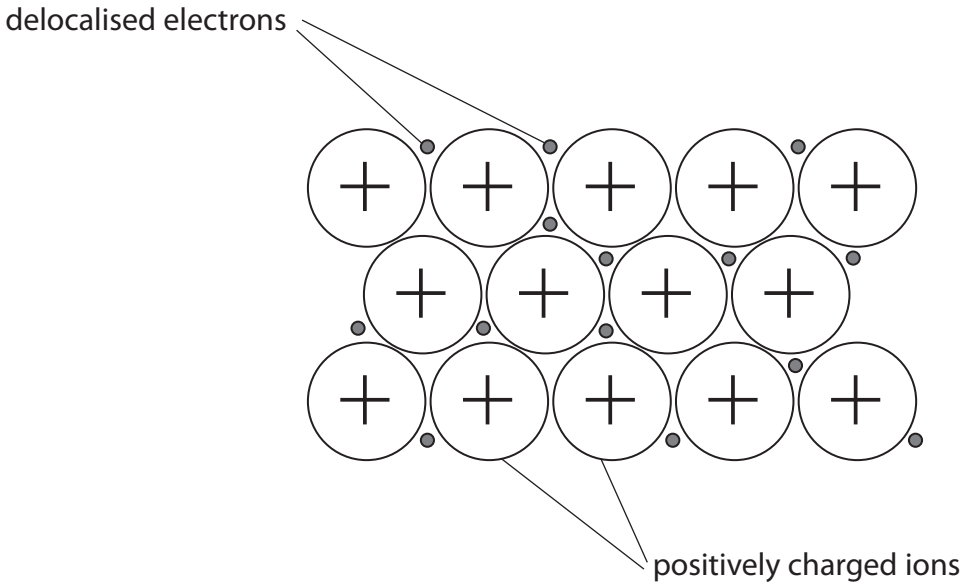
Sodium is an alkali metal.

In the periodic table, sodium is in group

(1)

- ☒ **A** 0
- ☒ **B** 1
- ☒ **C** 4
- ☒ **D** 7

(b) The diagram shows the structure of a metal.



Explain how metals conduct electricity.

(2)

(c) A sodium chloride crystal contains sodium cations and chloride anions.

(i) State the colour produced by sodium compounds in a flame test.

(1)

(ii) Describe how silver nitrate solution can be used to show that solid sodium chloride contains chloride ions.

(2)

*(iii) Sodium reacts with chlorine to form sodium chloride.

Describe how the reaction can be carried out, explaining what happens when a sodium atom reacts with a chlorine atom.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

Answer **all** the questions.

1 Cars on motorways use the right hand lane for overtaking. The left hand lanes are used for slower vehicles.

From 2007, car pool lanes will be introduced on some motorways.
Only cars with two or more people in them will be allowed to drive in the right hand lane.

(a) (i) Finish the sentence by choosing the **best** word from this list.

less

more

the same

Car pool lanes should mean that the number of cars on motorways will be

…… . [1]

(ii) Why should people be encouraged to take passengers in their cars?

Put a tick (✓) in the box next to the **best** answer.

There will be fewer buses on the motorway. ☐

Less fossil fuel will be burned. ☐

It will stop lorries using the motorway. ☐

More people will ride bicycles. ☐ [1]

(iii) Why will people want to use the car pool lane?

Put ticks (✓) in the boxes next to the **two best** answers.

There is someone to talk to.	☐
It is cheaper per person.	☐
They like to be in the right hand lane.	☐
They won't be stuck in traffic jams.	☐

[2]

(b) Polluting gases from car engines include:

- carbon dioxide
- carbon monoxide
- nitrogen oxides

Which of these will be reduced if there are fewer cars on motorways?

Put a (ring) around the correct answer.

all of them **carbon dioxide only** **none of them** [1]

(c) Pollution from cars is reduced by using catalytic converters.

Catalytic converters change carbon monoxide to carbon dioxide and change nitrogen oxides to nitrogen.

How do the amounts of gases produced by a car change when a catalytic converter is used?

Put ticks (✓) in the correct boxes in the table.

	decreases	**increases**	**stays the same**
carbon dioxide			
carbon monoxide			
nitrogen oxides			

[2]

(d) Petrol is made up of compounds of carbon and hydrogen **only**.

(i) What is the name given to these compounds?

Put a (ring) around the correct answer.

carbohydrates **hydrocarbons** **polymers** [1]

(ii) When petrol burns, the **carbon** atoms react with oxygen to make carbon dioxide.

Finish the diagram to show the reaction.

carbon oxygen carbon dioxide [1]

[Total: 9]

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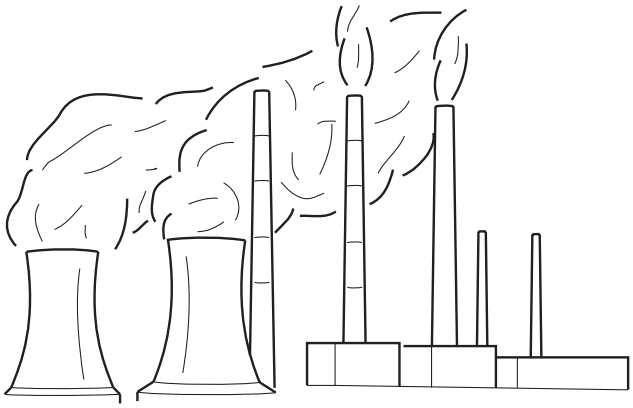
Question 2 starts on page 6.

PLEASE DO NOT WRITE ON THIS PAGE

2 This question is about pollution from power stations.



One of the pollutants from power stations is sulfur dioxide.

Sulfur dioxide levels are measured at different distances from a power station. The table shows the results on one day.

distance from power station in metres	**concentration of sulfur dioxide in µg / m^3**
0	64
500	50
1000	14
1500	8
2000	3

(a) Levels of sulfur dioxide higher than 50 µg / m^3 are considered harmful to humans.

Where was the air harmful?

Put ticks (✓) in the boxes next to the **two** correct answers.

At the power station. ☐

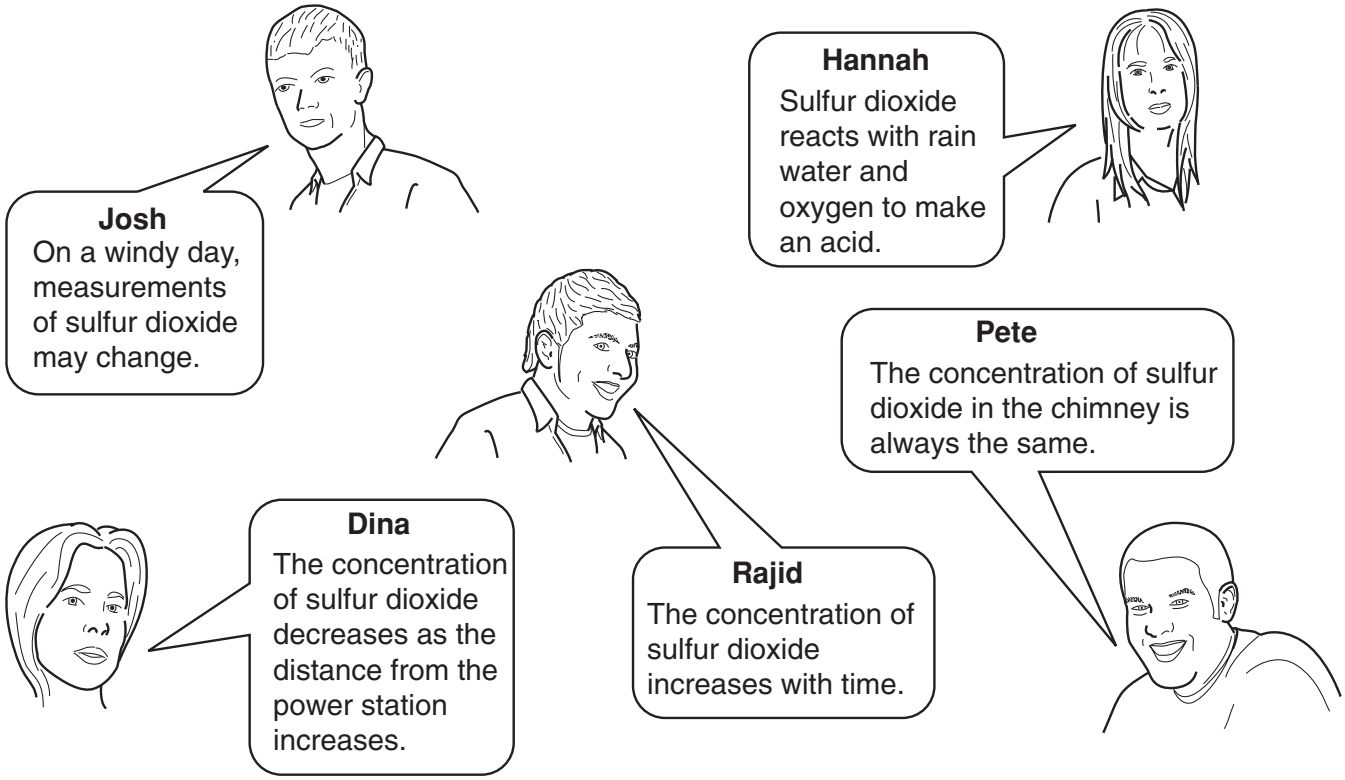
Less than 500 metres from the power station. ☐

More than 500 metres from the power station. ☐

Between 500 metres and 1000 metres from the power station. ☐

[2]

(b) Here is what five students said about the data in the table.



(i) Which **one** person has described the correlation in the table?

..... [1]

(ii) On another day, the concentrations of sulfur dioxide are lower.

Which **two** people have suggested explanations for this change?

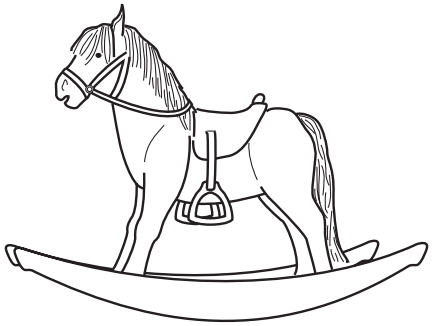
..... [2]

(iii) Who has explained how sulfur dioxide is removed from the air?

..... [1]

[Total: 6]

3 Julie and Sam are designing a new rocking horse for a toy company.



The rocking horse will be used by children between three and eight years old.
They should be able to move it around.
It must be strong enough to sit on.
It must not be dangerous.
It must be cheap to buy.

They test a number of materials.

The table gives the results of these tests.

material	strength	density	flexibility	cost
iron	very strong	high	low	medium
polypropylene	strong	low	high	low
wood	strong	medium	medium	high

They choose to make the rocking horses with polypropylene.

(a) Use the table to answer these questions.

(i) Which **two** properties of polypropylene make it better than iron or wood for making the rocking horse?

Put ticks (✓) in the boxes next to the **two** correct answers.

strength ☐

density ☐

flexibility ☐

cost ☐

[2]

(ii) Which property of polypropylene is the **main** disadvantage for making the rocking horse?

Put a tick (✓) in the box next to the correct answer.

strength	☐
density	☐
flexibility	☐
cost	☐

[1]

(b) Julie says it would be better for the environment if the rocking horses were made of wood. Which of the following explains this?

Put a tick (✓) in the box next to the **best** answer.

Wood is a natural material.	☐
Wood has to be carved into shape.	☐
Wood is strong.	☐
Wood is a renewable material.	☐

[1]

(c) Sam says there are **three** different ways of getting rid of the polypropylene rocking horse at the end of its life. These will also affect the environment.

Finish the sentences. Choose words from this list.

burned
disposed
energy
landfill
products
recycled
rot
rust

The polypropylene rocking horse can be dumped in …… where it will not …… .

It can be put in an incinerator and …… .

It can be …… to make new products. [3]

[Total: 7]

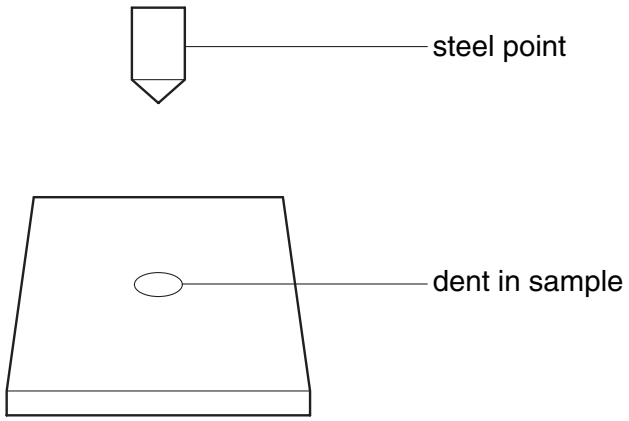
[Turn over

4 A scientist measures the hardness of two different materials, X and Y.

A machine presses a steel point into samples of each material.

The machine uses the same force each time.

A hardness number is calculated from the size of the dent in the sample: the higher the number the harder the material.



(a) Each type of material is tested several times. The results are shown in the table.

	hardness number						
material	**sample 1**	**sample 2**	**sample 3**	**sample 4**	**sample 5**	**sample 6**	**mean**
X	8	10	9	8	7	12	9
Y	18	20	16	7	21	20	19

The mean hardness has been calculated for each material.

One result has not been used to calculate the mean for **material Y** because it is an outlier.

(i) Which result is the outlier?

Put a (ring) around the correct sample number.

1 **2** **3** **4** **5** **6** [1]

(ii) Here are four suggestions why this test gave the wrong result.

A	Samples of X and Y had been mixed up.
B	The steel point had been pressed with a larger force.
C	The steel point had been pressed with a smaller force.
D	The steel point had not been pressed into the sample.

Write down the letters of the **two** best suggestions.

answer …… and …… [2]

(b) All the test results for material X are reliable, but there are small differences between their values.

Why are these values different?

Put a tick (✓) in the box next to the correct answer.

Samples of X and Y had been mixed up. ☐

Samples of X may vary. ☐

It is not a fair test. ☐

The steel point had not been pressed into the samples. ☐

[1]

(c) Complete the table below to show the range of hardness number for material X.

	range
range for X	

[1]

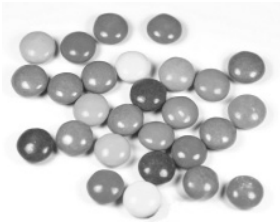
[Total: 5]

5 Read this article.

There will be no more blue Smarties

The manufacturer is removing all artificial colours from Smarties. There is no natural alternative to the blue chemical used now.

The blue will be replaced by a white Smartie.



A recent study showed a possible harmful effect on the nervous system due to artificial colours and chemicals.

The blue colouring may cause hyperactivity and skin rashes. It is also listed as a cancer risk by the US Environmental Protection Agency.

A scientist said 'It is great news for children's health. We would now like to see the Government announce a total ban on the blue colouring.'

(a) Why are blue Smarties no longer being made?

Put a tick (✓) in the box next to the **best** answer.

Eating a blue Smartie will give all children a rash. ☐

All children who eat blue Smarties will develop health problems. ☐

The blue colouring may make some children hyperactive. ☐

All artificial additives will harm children. ☐ [1]

(b) Why would the scientist like to see the Government ban the blue colour?

Put a tick (✓) in the box next to the **best** answer.

To stop blue Smarties from being made. ☐

The blue colour is used in other foods. ☐

So the risk can be measured. ☐

To make Smarties cheaper. ☐

To reduce the risk to children's health. ☐ [1]

(c) Here are three statements about food additives.

Put ticks (✓) in the correct boxes to show whether each statement is **true** or **false**.

	true	**false**
Additives with an E number have passed a safety test.		
Preservatives slow down the growth of microbes.		
All natural additives are harmless.		

[2]

[Total: 4]

6 This is a question about farming.

(a) Here are five sentences explaining why a wheat field becomes less fertile each year. They are in the wrong order.

A	Wheat uses these nitrogen compounds to make proteins in the plant.
B	There are nitrogen compounds in water in the soil.
C	Wheat is harvested and taken from the field.
D	Wheat plants take in nitrogen compounds through their roots.
E	The concentration of nitrogen compounds in the soil falls.

Fill in the boxes to show the right order. The last one has been done for you.

				E

[3]

(b) Here are three statements about the advantages and disadvantages of intensive farming.

For each one write **A** if it is an advantage or **D** if it is a disadvantage.

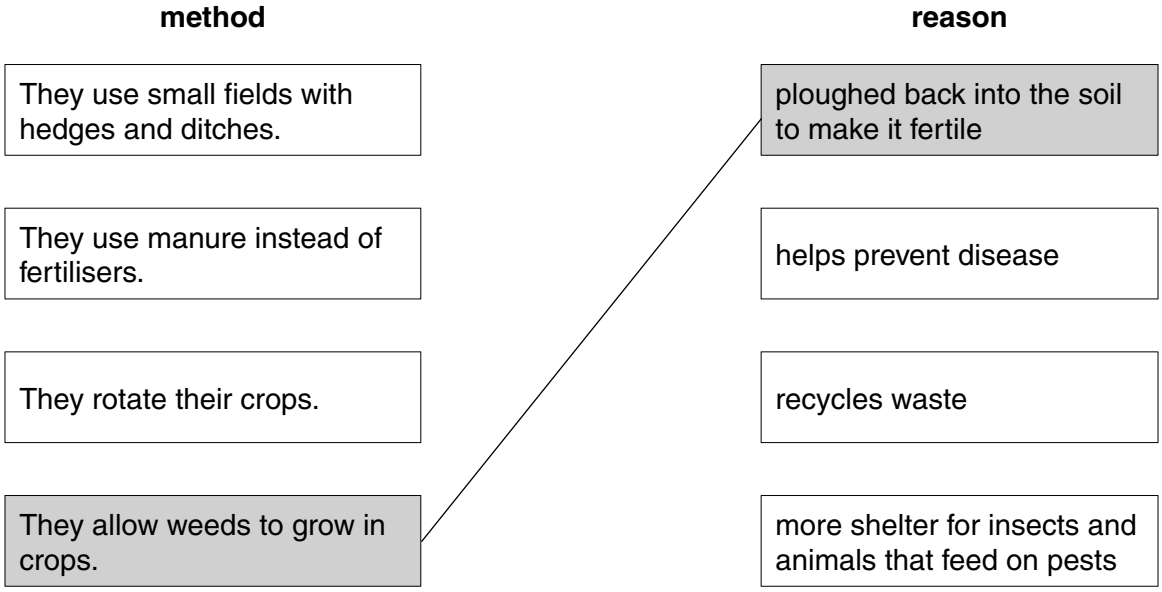
statement	A (advantage) or D (disadvantage)
Food is cheaper.	
Less land is needed.	
Soil structure may be damaged.	

[2]

(c) The lists below show different organic farming methods and the reasons for their use.

Draw a straight line from each **method** to the correct **reason**.

One has been done for you.



[2]

[Total: 7]

7 The Government is worried about the increase in childhood obesity.
The number of 2 to 11 year olds who are obese has risen steadily over the past 10 years.

(a) Here are some sentences about obesity.

Finish the sentences using words from this list.

diabetes

exercise

insulin

measles

protein

Obesity is caused by eating too much food and not getting enough …… .

Obesity increases the risk of heart disease and …… . [2]

(b) Politicians want to pass laws to help reduce childhood obesity.

Here are some actions they could take.

Which **two** actions may help reduce obesity?

Put ticks (✓) in the boxes next to the **two** correct answers.

Banning salads from school lunches. ☐

Banning fizzy drinks machines from schools. ☐

Banning junk food advertising. ☐

Banning the sale of bottled water in schools. ☐

[2]

[Total: 4]

END OF QUESTION PAPER

Answer **all** the questions.

1 Elements in Group 7 are called the halogens. The table gives some information about the physical properties of three of the halogens.

halogen	proton number	melting point in °C	boiling point in °C	state at 25 °C	colour
chlorine	17	–101	–35		pale green
bromine	35	–7	59	liquid	deep red
iodine	53	114	184	solid	dark grey

(a) The halogens show trends in physical properties with increasing proton number.

Use information from the table to help you answer these questions.

(i) Finish the sentence about the trend in melting point.

As the proton number …… the melting point …… . [1]

(ii) What is the state of chlorine at 25 °C?

Put a (ring) around the correct answer.

gas **liquid** **solid**

[1]

(iii) **Astatine** is a halogen. The proton number of astatine is 85.

The halogens get darker in colour as the proton number increases.

Predict the colour of **astatine**.

Put a (ring) around the correct answer.

yellow **orange** **black**

[1]

(b) The halogens also show a trend in reactivity.

This can be shown by the displacement reactions when halogens are added to solutions of halides.

A student made the following observations.

- When chlorine is added to potassium bromide solution, red bromine appears.
- When bromine is added to potassium iodide solution, brown iodine appears.
- When bromine is added to potassium chloride solution, there is no displacement.

(i) What is the correct order of reactivity for these halogens?

Put a tick (✓) in the box next to the correct answer.

decreasing reactivity →

bromine	chlorine	iodine	☐
chlorine	bromine	iodine	☐
iodine	bromine	chlorine	☐

[1]

(ii) Fluorine is a halogen with proton number 9.

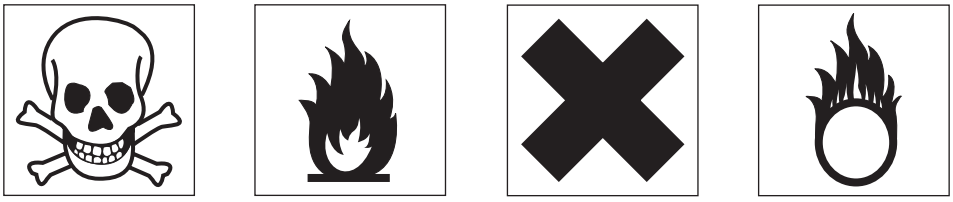
Which statement describes the displacement reactions of fluorine?

Put a tick (✓) in the box next to the correct answer.

Fluorine displaces chlorine, bromine and iodine.	☐
Fluorine displaces iodine but not chlorine or bromine.	☐
Fluorine displaces chlorine and bromine but not iodine.	☐
Fluorine displaces bromine and iodine but not chlorine.	☐

[1]

(c) Hazard symbols are used to show the dangers involved in handling some chemicals.



A **B** **C** **D**

Iodine is **harmful**. Which hazard symbol, **A**, **B**, **C** or **D**, should be placed on a container of iodine?

answer ..... [1]

[Total: 6]

[Turn over

2 This diagram shows part of the Periodic Table.

						He
Li	Be		C			Ne
Na	Mg				Cl	Ar
K	Ca				Br	

(a) (i) Which three elements shown in the diagram are in the same **group**?

Put a tick (✓) in the box next to the correct answer.

Be	C	He	☐
Na	Mg	Ar	☐
He	Be	Ar	☐
Li	Na	K	☐

[1]

(ii) Which three elements shown in the diagram are in the same **period**?

Put a tick (✓) in the box next to the correct answer.

Na	Mg	Ar	☐
Li	Na	Ca	☐
He	Ne	Ar	☐
Na	Ca	Br	☐

[1]

(b) One element in the diagram has the symbol Be. This element is in Group 2.

Write down the following information about the element with the symbol **Be**.

Use the Periodic Table on the back page to help you.

name .....

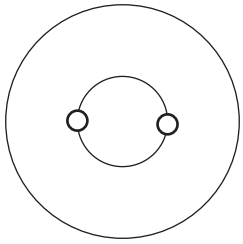
proton number .....

relative atomic mass ..... [3]

(c) Finish the diagram to show the arrangement of electrons in an atom of the element **carbon**.

Use a circle ○ to show the position of each electron.

The positions of two electrons have already been drawn to help you.



[1]

(d) The elements sodium and chlorine react to form the compound sodium chloride.

(i) Sodium chloride is made of sodium ions, Na^+, and chloride ions, Cl^-.

Which statement describes evidence that sodium chloride is made of ions?

Put a tick (✓) in the box next to the correct answer.

Sodium chloride is a solid. ☐

Sodium chloride is made of crystals. ☐

Sodium chloride has a high melting point. ☐

Molten sodium chloride conducts electricity. ☐

[1]

(ii) The table shows the arrangement of electrons in sodium atoms and chlorine atoms.

Complete the table to show the arrangement of electrons in sodium ions and chloride ions.

sodium atom Na	**sodium ion Na^+**	**chlorine atom Cl**	**chloride ion Cl^-**
2.8.1		2.8.7	

[2]

[Total: 9]

3 The table gives information about ions dissolved in sea water.

ion	symbol	percentage by mass of the total dissolved solids (%)
chloride	Cl^-	55
sodium	Na^+	30
sulfate	SO_4^{2-}	8
magnesium	Mg^{2+}	4
calcium	Ca^{2+}	1
potassium	K^+	1
carbonate	CO_3^{2-}	0.5
bromide	Br^-	0.2

These ions enter the sea water when crystals of ionic compounds in rocks dissolve.

Each of these ionic compounds is made up of one type of positive ion and one type of negative ion shown in the table.

(a) One compound that dissolved from the rocks into the water is magnesium sulfate.

Suggest the name of one **other** ionic compound that dissolved from the rocks into the water.

Use information from the table to help you.

..... [1]

(b) What holds together the ions in the crystals of ionic compounds?

Put a tick (✓) in the box next to the correct answer.

sharing of pairs of electrons ☐

attraction between ions of opposite charge ☐

attraction between ions of the same charge ☐

[1]

(c) Sea water conducts electricity.

Which **two** statements give the best explanation for this?

Put ticks (✓) in the boxes next to the **two** correct answers.

Ions are able to move around in the sea water.	☐
Electrons can pass from ion to ion in the sea water.	☐
The sea water contains more ions with positive charges than ions with negative charges.	☐
The sea water contains ions that have positive charges and ions that have negative charges.	☐

[2]

(d) When a sample of sea water is evaporated to dryness, a white solid is left. This is a mixture of several ionic compounds.

Look at the **percentage by mass of the total dissolved solids** column in the table.

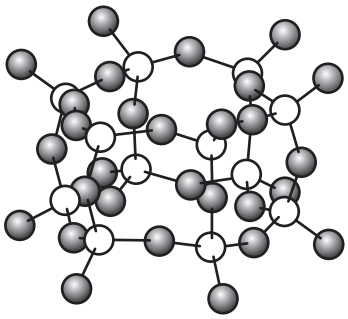
Use the information to name the ionic compound that makes up **most** of the white solid.

..... [1]

[Total: 5]

4 All of the materials in the world are made up of elements.

(a) Much of the elements oxygen and silicon are in the compound silicon dioxide.



key

○ Si atom

● O atom

Here are some sentences about **silicon dioxide**.

Finish these sentences by putting a tick (✓) in the box next to the correct word in each pair.

Silicon dioxide is a giant

ionic	
covalent	

structure.

It is very

soft	
hard	

and has

low	
high	

melting and boiling points.

Silicon dioxide is

soluble	
insoluble	

in water and

does	
does not	

conduct electricity.

[4]

(b) The compounds in living organisms are made **mainly** of four elements. Two of these elements are **carbon** and **hydrogen**.

Which are the other **two** elements?

Put a (ring) around each of the **two** correct answers.

calcium **nitrogen** **oxygen** **sodium**

[1]

[Total: 5]

[Turn over

5 The ore haematite contains iron oxide. Iron is extracted from this ore by reaction with carbon.

$$\text{iron oxide} + \text{carbon} \longrightarrow \text{iron} + \text{carbon dioxide}$$

(a) Oxidation **and** reduction take place in this reaction.

What is the name of the substance that has been **oxidised**?

..... [1]

(b) Which **two** of the metals below are also extracted by reaction with carbon?

Put a (ring) around each of the **two** correct answers.

copper **potassium** **sodium** **zinc**

[2]

(c) The ore bauxite contains aluminium oxide.

Carbon is **not** used to extract aluminium from this ore.

(i) Why is carbon **not** used to extract aluminium from bauxite?

Put a tick (✓) in the box next to the correct answer.

The reaction is too fast.	☐
Aluminium is more reactive than carbon.	☐
Carbon is more reactive than aluminium.	☐
The reaction would use too much carbon.	☐

[1]

(ii) Suggest **one** method that can be used to extract large quantities of aluminium from bauxite.

..... [1]

[Total: 5]

6 An acid and an alkali react to form a salt and water.

$$\text{acid} + \text{alkali} \longrightarrow \text{salt} + \text{water}$$

(a) What type of reaction is this?

Put a (ring) around the correct answer.

decomposition **neutralisation** **oxidation** **polymerisation**

[1]

(b) Draw straight lines to join up the boxes to show which **acid** reacts with which **alkali** to make each **salt**.

acid	**alkali**	**salt**
sulfuric acid	potassium hydroxide	sodium sulfate
hydrochloric acid	ammonium hydroxide	potassium chloride
nitric acid	sodium hydroxide	magnesium nitrate
phosphoric acid	magnesium hydroxide	

[3]

(c) Acids also react with metals.

$$\text{acid} + \text{metal} \longrightarrow \text{salt} + \text{hydrogen}$$

A piece of zinc is added to 20 cm^3 of dilute hydrochloric acid.

Bubbles of hydrogen gas appear.

What is the formula of **hydrogen gas**?

Put a (ring) around the correct answer.

H **2H** **H_2**

[1]

[Total: 5]

7 Magnesium sulfate is one of the chemicals in detergent powder.

Mary makes some magnesium sulfate using this reaction.

magnesium carbonate + sulfuric acid → magnesium sulfate + water + carbon dioxide

$$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$$

She measures out 100 cm^3 of dilute sulfuric acid and adds solid magnesium carbonate until no more bubbles appear.

(a) Some solid magnesium carbonate is left in the solution.

What technique can Mary use to remove the solid from the solution?

..... [1]

(b) Mary works out the theoretical yield to be 12.0 g.

(i) To make this calculation Mary uses the relative formula mass of magnesium carbonate and magnesium sulfate.

She uses these relative atomic masses: C = 12; Mg = 24; O = 16; S = 32.

Use this information to work out these relative formula masses.

relative formula mass of magnesium carbonate, $MgCO_3$ = ...

relative formula mass of magnesium sulfate, $MgSO_4$ = ...
[2]

(ii) The theoretical yield for Mary's experiment is 12.0 g.

Mary dries and weighs the magnesium sulfate she makes. This is her actual yield.

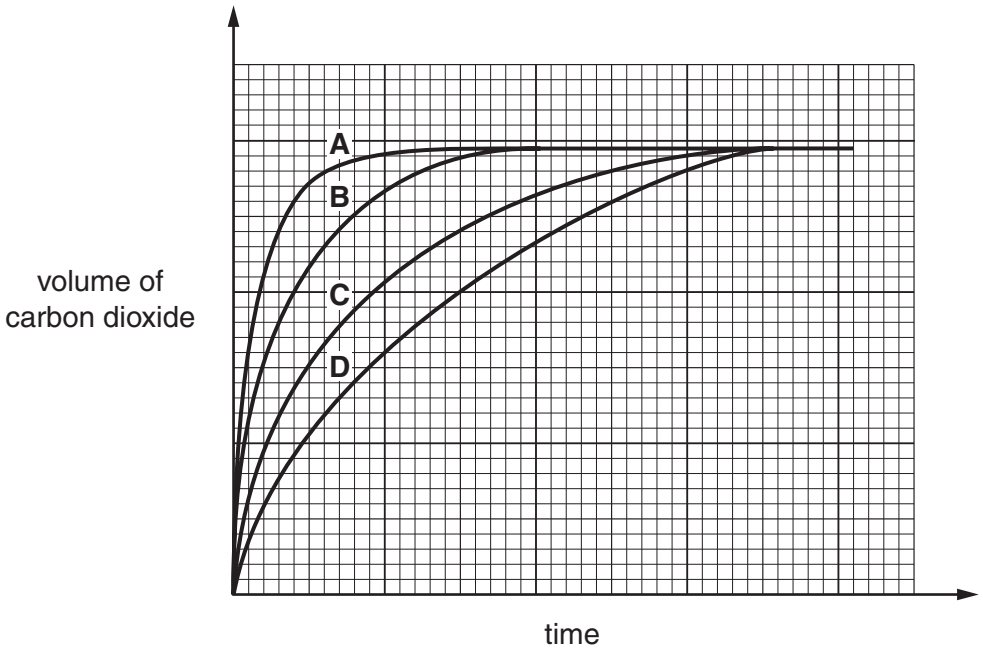
Actual yield = 10.8 g.

Work out the percentage yield for Mary's experiment.

percentage yield = ... [1]

(c) Mary investigates the rate of this reaction using the same sulfuric acid solution with different sized lumps of magnesium carbonate.

She measures the volume of carbon dioxide given off at time intervals and plots her results on a grid.



(i) How do these graphs show that Mary used the same mass of magnesium carbonate for each experiment?

Put a tick (✓) in the box next to the correct answer.

Each line is a curve. ☐

Each line begins at the origin. ☐

Each line finishes at the same time. ☐

Each line finishes at the same volume. ☐

[1]

(ii) Which line, **A**, **B**, **C** or **D**, shows results from:

the fastest rate of reaction?

answer .....

the largest lumps of magnesium carbonate?

answer .....[1]

[Turn over

(iii) What **other** change to Mary's experiment would make the reaction faster?

Put a tick (✓) in the box next to the correct answer.

decreasing the concentration of the acid	☐
increasing the temperature of the acid	☐
decreasing the mass of magnesium carbonate	☐

[1]

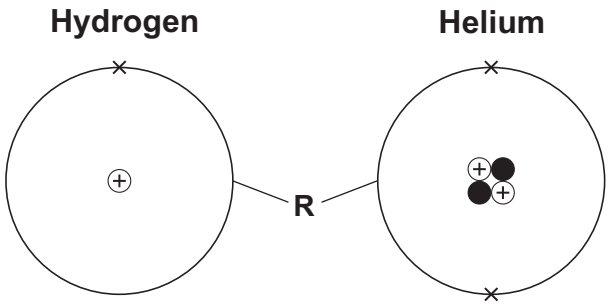
[Total: 7]

END OF QUESTION PAPER

Do not write outside the box

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

1 The Sun is mainly hydrogen and helium.
The diagrams show an atom of hydrogen and an atom of helium.



1 (a) Draw a ring around the correct answer to complete each sentence.

1 (a) (i) The centre of each atom is called the

molecule.

nucleus.

shell.

(1 mark)

1 (a) (ii) The circle (labelled **R**) around the centre of each atom is called

a bond.

an electrical charge.

an energy level (shell).

(1 mark)

1 (b) Use the diagrams on page 2 to help you to answer these questions.

Draw **one** line from each question to its correct answer.

Question	Answer
How many protons are there in the hydrogen atom?	1
How many electrons are there in the helium atom?	2
What is the mass number of the helium atom?	3
	4

(3 marks)

1 (c) The Sun is 73% hydrogen and 25% helium. The rest is other elements.

What is the percentage of other elements in the Sun? ..... %

(1 mark)

1 (d) One of the other elements in the Sun is neon.
Neon is in the same group of the periodic table as helium.

Use the Chemistry Data Sheet to help you to answer these questions.

1 (d) (i) How many protons are there in a neon atom?

.....

(1 mark)

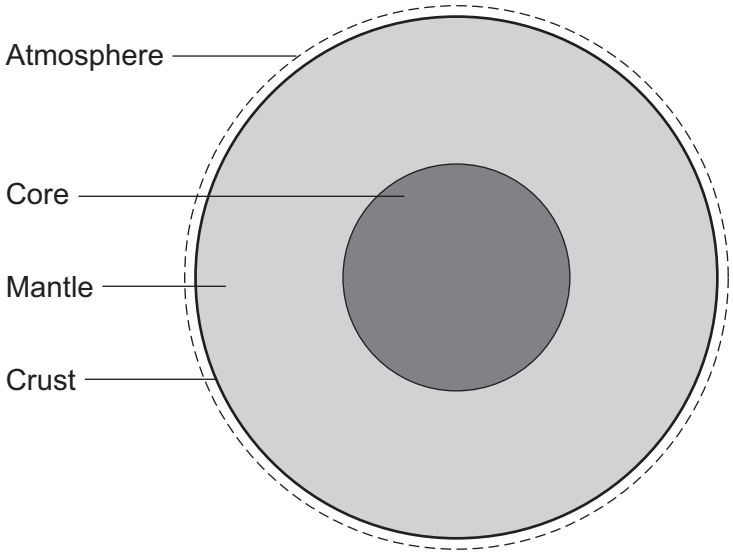
1 (d) (ii) Which group of the periodic table are helium and neon in?

.....

(1 mark)

8

2 The diagram shows the layers in and around the Earth.



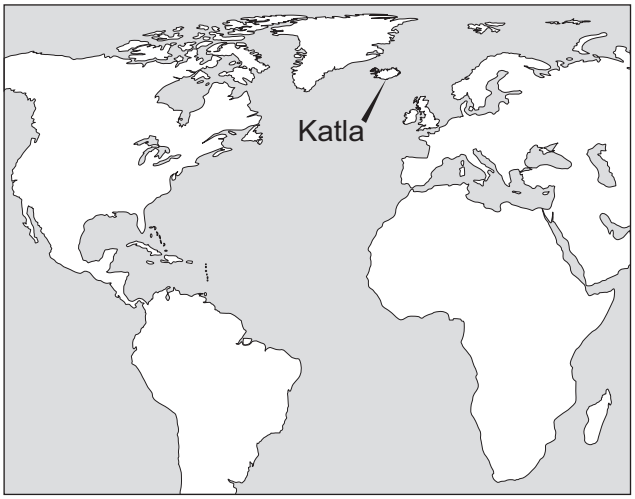
2 (a) Use the diagram above to help you to answer this question.

Draw **one** line from each statement to its correct layer.

Statement	Layer
There are mountain ranges.	atmosphere
There are convection currents that cause earthquakes.	core
There is a mixture of gases.	crust
	mantle

(3 marks)

2 (b) Iceland has many volcanoes.
Scientists are monitoring a volcano in Iceland, called Katla.



There has been an increase in the number of small earthquakes (tremors) around Katla.

2 (b) (i) Draw a ring around the correct answer to complete the sentence.

Iceland has volcanoes because it

- has low temperatures.
- is an island.
- is on a tectonic plate boundary.

(1 mark)

2 (b) (ii) People do not know when Katla will next erupt.

Tick (✓) the correct reason why.

Reason	Tick (✓)
Small earthquakes (tremors) near the volcano are happening more often.	
The last two eruptions happened a long time ago in October 1918 and in May 1860.	
Scientists cannot accurately predict when volcanic eruptions will occur.	

(1 mark)

Question 2 continues on the next page

2 (c) Previous eruptions of Katla produced large amounts of solid ash particles and sulfur dioxide.

Use the correct answer to complete each sentence.

acid rain	**earthquakes**	**global dimming**	**global warming**

An environmental impact caused by solid ash particles is ..... .

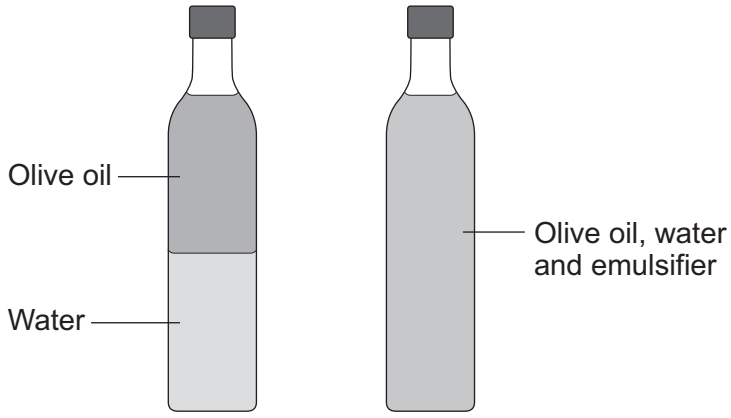
An environmental impact caused by sulfur dioxide is ..... .

(2 marks)

7

3 Olive oil has a high content of healthy, unsaturated fats.

3 (a) Olive oil and water do not mix.
A salad dressing is made by shaking olive oil and water with an emulsifier.



3 (a) (i) Complete the sentence.

The salad dressing of olive oil, water and emulsifier is a mixture

called an ..... .

(1 mark)

3 (a) (ii) Give **one** benefit of using emulsifiers in food.

.....

.....

(1 mark)

3 (b) Olive oil has a boiling point of 300 °C.

3 (b) (i) Complete the sentence.

The boiling point of olive oil compared to the boiling point of water

is ..... .

(1 mark)

3 (b) (ii) Apart from colour, state **two** ways in which a food cooked in olive oil will be different to a food cooked in water.

.....

.....

.....

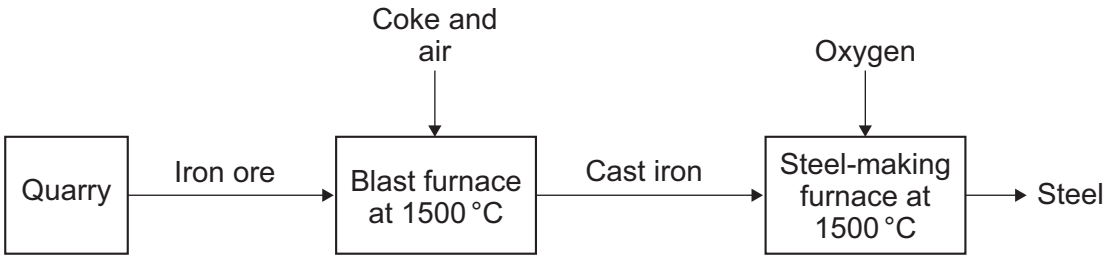
.....

(2 marks)

5

4 The iron produced from iron ore in a blast furnace is called cast iron.

Cast iron is converted into steel in a furnace.



Iron ore contains iron oxide.
Coke contains carbon.

4 (a) Quarrying iron ore will have an impact on everything near to the quarry.

4 (a) (i) Describe **one** positive impact and **one** negative impact of quarrying iron ore.

positive impact .....

.....

negative impact.....

.....

(2 marks)

4 (a) (ii) Draw a ring around the correct answer to complete the sentence.

Ores contain enough metal to make extraction of the metal

carbon neutral.

economical.

reversible.

(1 mark)

4 (b) Many chemical reactions take place in a blast furnace.
Use the flow diagram to help you to answer this question.

Suggest how the blast furnace is heated.

.....

.....

(1 mark)

4 (c) A chemical reaction for the extraction of iron is:

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

4 (c) (i) Complete the word equation for this chemical reaction.

..... + carbon monoxide → iron + ...

(2 marks)

4 (c) (ii) Draw a ring around the correct answer to complete the sentence.

Iron is extracted from its ore by

- decomposition.
- oxidation.
- reduction.

(1 mark)

4 (d) Cast iron contains about 4% carbon.
Cast iron is converted into low-carbon steels.

4 (d) (i) Low-carbon steel is produced by blowing oxygen into molten cast iron.

Suggest how oxygen removes most of the carbon.

.....

.....

.....

.....

(2 marks)

4 (d) (ii) Draw a ring around the correct answer to complete the sentence.

Metals, such as nickel, are added to low-carbon steels to make the steel

- corrode easily.
- easy to shape.
- much harder.

(1 mark)

Question 4 continues on the next page

4 (e) Recycling steel uses less energy than producing steel from iron ore.

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of recycling steel.

Statement	Advantage Tick (✓)	Disadvantage Tick (✓)
Iron is the second most common metal in the Earth's crust.		
Less carbon dioxide is produced.		
More iron ore needs to be mined.		
There are different types of steel which must be sorted.		

(2 marks)

12

5 This question is about compounds produced from crude oil.

The table below shows four of these compounds.

Compound	Melting point in °C	Boiling point in °C
methane (CH_4)	–183	–164
ethene (C_2H_4)	–169	–104
decane ($C_{10}H_{22}$)	–30	+174
icosane ($C_{20}H_{42}$)	+37	+343

5 (a) Tick (✓) **two** correct statements about the four compounds.

Statement	Tick (✓)
Methane has the lowest melting point and icosane has the highest boiling point.	
Ethene and methane are alkanes.	
Methane and decane are gases at room temperature (20 °C).	
Decane and icosane are liquid at 100 °C.	

(2 marks)

5 (b) Petrol contains a mixture of compounds, including octane (C_8H_{18}).

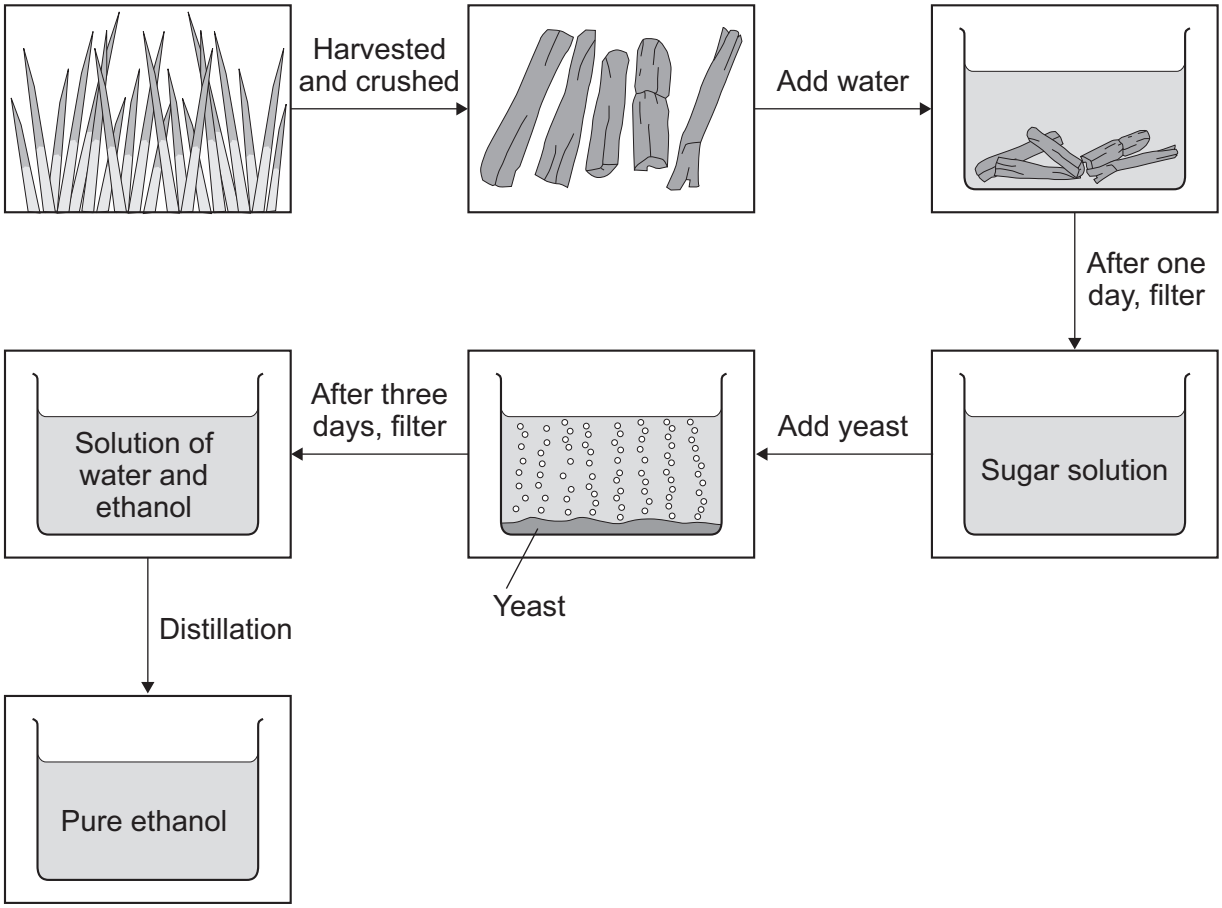
Complete the word equation for the complete combustion of octane.

octane + oxygen → ..... + ...

(2 marks)

Question 5 continues on the next page

5 (c) Most petrol used in cars contains about 5% ethanol (C_2H_5OH).
Ethanol can be produced from sugar cane.



5 (c) (i) Draw a ring around the correct answer to complete the sentence.

The reaction to produce ethanol from sugar solution is

combustion.

displacement.

fermentation.

(1 mark)

5 (c) (ii) Some people say that increasing the production of ethanol from sugar cane will be **good** for the environment.

Suggest **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

5 (c) (iii) Other people say that increasing the production of ethanol from sugar cane will be **bad** for the environment.

Suggest **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

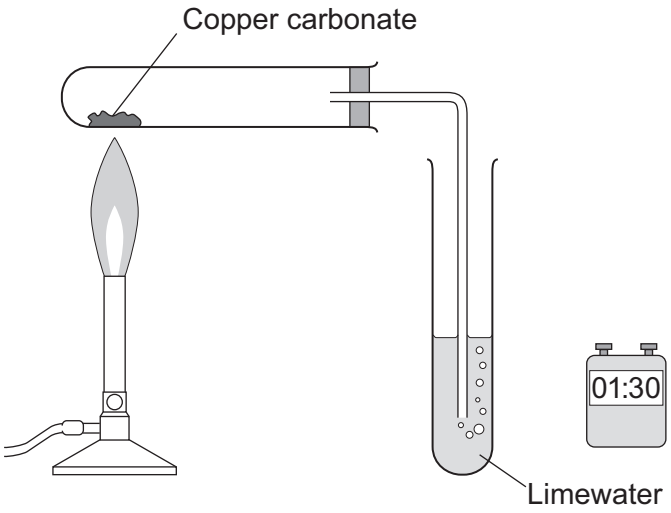
(2 marks)

9

Turn over for the next question

6 Carbon dioxide is produced when copper carbonate is heated.

A student investigated heating copper carbonate.
The student used the apparatus to measure how long it took for carbon dioxide to be produced.
The student also noted what happened during each minute for three minutes.



6 (a) The student used changes to the limewater to measure how long it took for carbon dioxide to be produced.

Describe how.

.....

.....

.....

.....

(2 marks)

6 (b) The student wrote down her observations.

Time interval in minutes	Observations
Between 0 and 1	A slow release of gas bubbles. The limewater did not change. The solid in the test tube was green.
Between 1 and 2	A fast release of gas bubbles. The limewater changed at 1 minute 10 seconds.
Between 2 and 3	No release of gas bubbles. The solid in the test tube was black.

6 (b) (i) Suggest the reason for the student's observations between 0 and 1 minute.

.....

.....

.....

.....

.....

(2 marks)

6 (b) (ii) Explain the student's observations between 1 and 2 minutes.

.....

.....

.....

.....

(2 marks)

6 (b) (iii) Explain the student's observations between 2 and 3 minutes.

.....

.....

.....

.....

(2 marks)

8

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

7 This question is about oil reserves.

7 (a) Diesel is separated from crude oil by fractional distillation.

Describe the steps involved in the fractional distillation of crude oil.

.....

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(3 marks)

7 (b) Diesel is a mixture of lots of different *alkanes.*

What are *alkanes*?

.....

.....

.....

.....

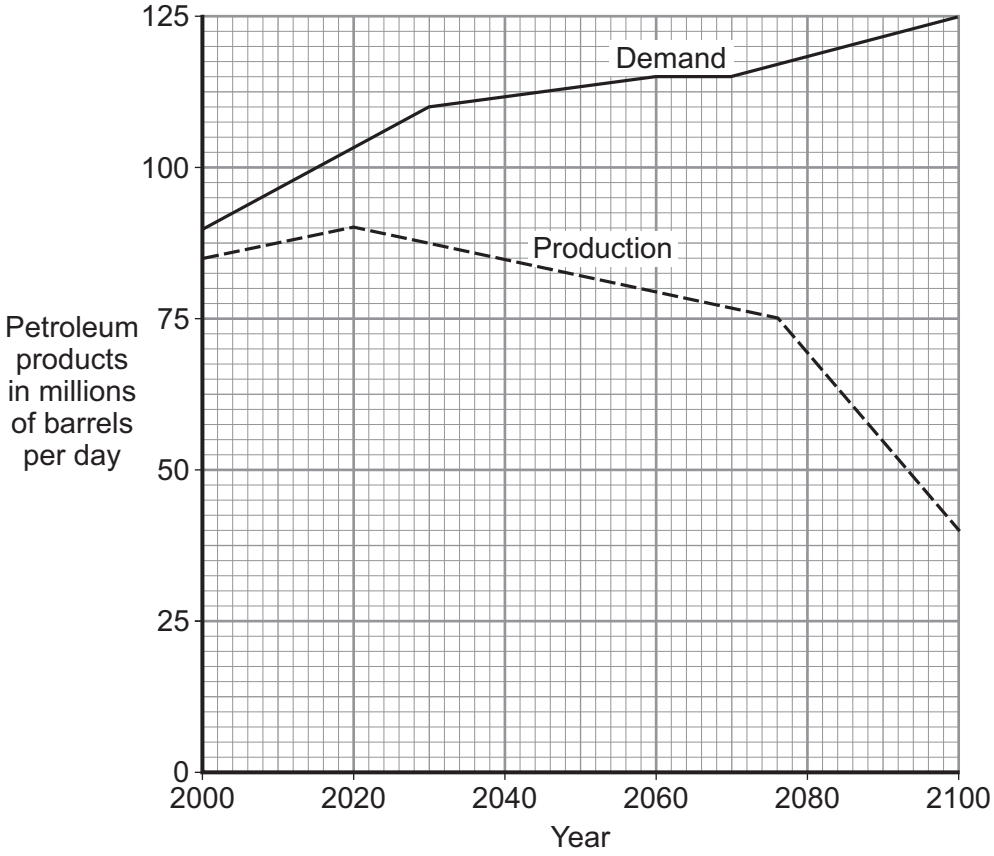
.....

(2 marks)

Question 7 continues on the next page

7 (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Petroleum products, such as petrol, are produced from crude oil.
The graph shows the possible future production of petroleum products from crude oil and the expected demand for petroleum products.



Canada's oil sands hold about 20% of the world's known crude oil reserves.

The oil sands contain between 10 to 15% of crude oil. This crude oil is mainly bitumen.

In Canada the oil sands are found in the ground underneath a very large area of forest. The trees are removed. Then large diggers and trucks remove 30 metres depth of soil and rock to reach the oil sands. The oil sands are quarried. Boiling water is mixed with the quarried oil sands to separate the bitumen from the sand. Methane (natural gas) is burned to heat the water.

The mixture can be separated because bitumen floats on water and the sand sinks to the bottom of the water. The bitumen is cracked and the products are separated by fractional distillation.

Use the information on page 18 and your knowledge and understanding to suggest the advantages and disadvantages of extracting petroleum products from oil sands.

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(6 marks)

11

END OF QUESTIONS