OCR
RECOGNISING ACHIEVEMENT

SPECIMEN H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE **A171/02**

CHEMISTRY A

Unit A171: Modules C1, C2, C3 (Higher Tier)

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:
None

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks for each question is given in brackets **[ ]** at the end of the question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

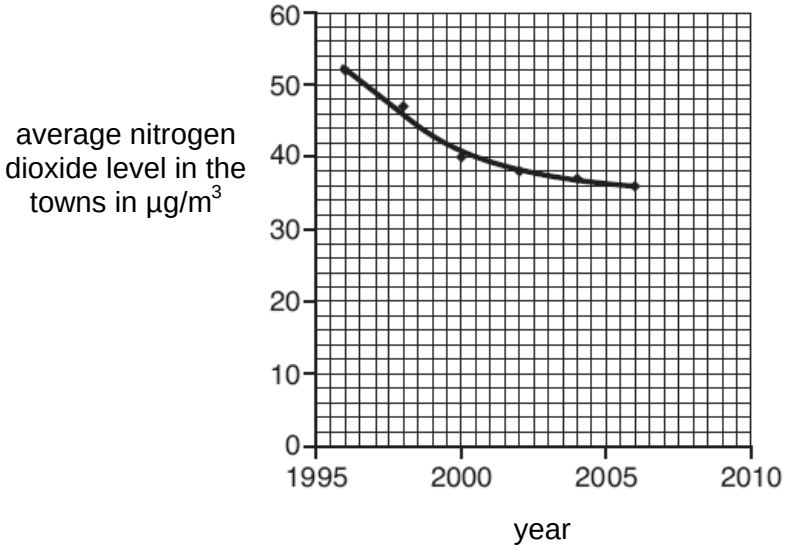
For Examiner's Use		
	Max	**Mark**
1	**10**	
2	**6**	
3	**4**	
4	**9**	
5	**6**	
6	**4**	
7	**9**	
8	**4**	
9	**8**	
TOTAL	**60**	

Answer **all** the questions.

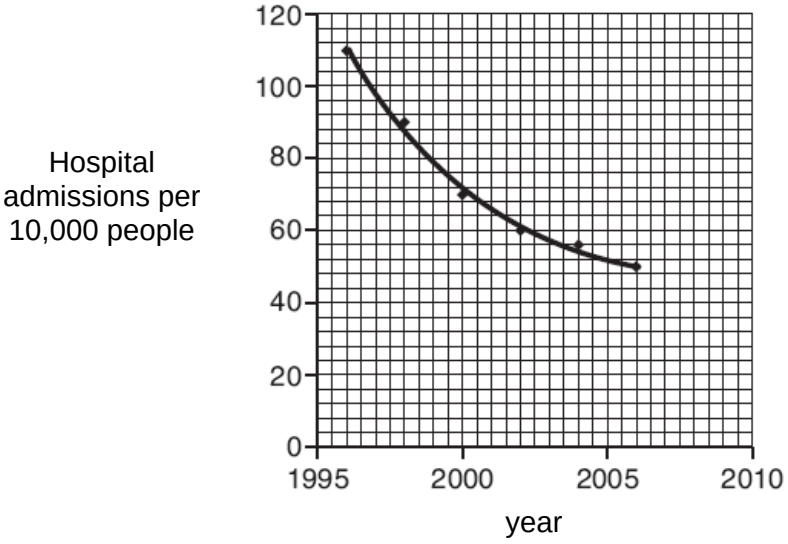
1 This question is about air pollution.

(a) The graphs show nitrogen dioxide pollution in the air and the number of hospital admissions for asthma between 1996 and 2006.

average nitrogen dioxide levels in UK towns



hospital admissions for asthma



(i) What was the number of hospital admissions per 10 000 people when the average nitrogen dioxide level in towns reached 40 µg / m^3?

answer = ... **[1]**

(ii) Between 1997 and 2006 the number of hospital admissions for asthma halved.

What was the change in average nitrogen dioxide levels in that time?

answer = ... µg / m^3 **[1]**

(iii) Use the graphs to explain the difference between correlation and cause.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

(b) Between 1996 and 2006 the number of miles driven by motor vehicles in the UK increased by 50 %.

During this time, the amount of pollution by nitrogen dioxide decreased.

Here are five ways that pollution from vehicle exhausts could have been reduced.

1 manufacturing cars with more efficient engines

2 using low sulfur fuels

3 installing catalytic converters in cars

4 introducing congestion charges in cities

5 encouraging people to travel by public transport

Which of these ways would account for the **decrease** in nitrogen dioxide pollution even though the distance driven by vehicles **increased**?

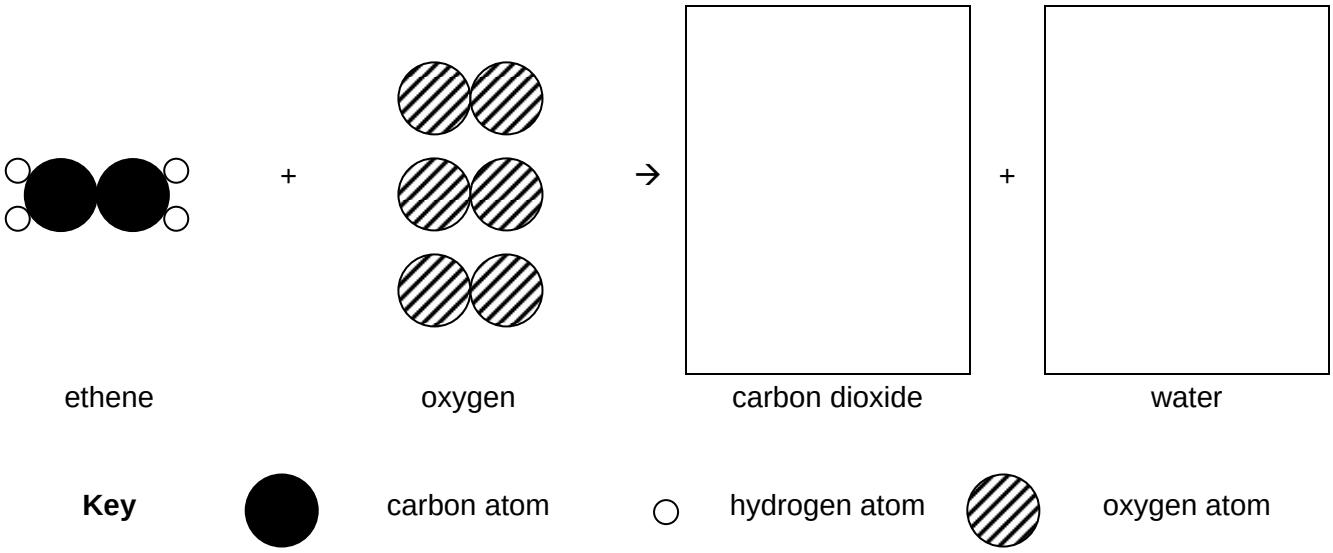
Write down the numbers of the **two** correct answers.

..... and..... **[2]**

[Total: 10]

2 **(a)** Ethene is a hydrocarbon. Ethene burns to make carbon dioxide and water.

Complete the diagram to show this reaction.



[3]

(b) A scientist analyses the products of combustion of ethene.

He collects all the products of the reaction.

His results are shown in the table.

product	**mass in g**
carbon dioxide	82.0
water vapour	70.2
carbon monoxide	52.0
carbon	2.0
total	**206.2**

(i) What is the percentage by mass of carbon monoxide?

percentage by mass = ... % **[1]**

(ii) What can be concluded from these results about the conditions in which combustion occurred?

Explain your answer.

.....

.....

..... **[2]**

[Total: 6]

3 The Earth's early atmosphere was formed by volcanic activity.

It consisted of water vapour and carbon dioxide, but no oxygen.

Explain how the amounts of carbon dioxide, water vapour and oxygen have changed from the Earth's early atmosphere to today's atmosphere.

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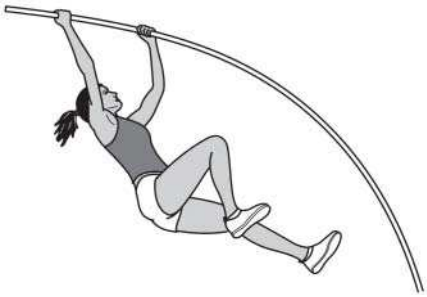
..... **[4]**

[Total: 4]

4 The table shows how the Olympic record height for the pole vault event has increased over the last 60 years.

It also shows the material used to make the pole.



year that record was broken	Olympic record in metres	material used to make the pole
1948	4.45	bamboo
1952	4.55	bamboo
1960	4.70	bamboo
1964	5.10	polymer and glass fibre
1968	5.40	polymer and glass fibre
1972	5.50	polymer and glass fibre
1980	5.80	polymer and glass fibre
1988	5.90	polymer and glass fibre
2004	5.95	polymer and glass fibre
2008	5.96	polymer and glass fibre

(a) Here are four statements about the pole vault Olympic record height.

Use the evidence in the table to evaluate each statement.

Put a tick (✓) in the correct box next to each statement to show whether it is **true** or **false**.

	true	**false**
The Olympic record increased at least 0.5 m every 20 years.	☐	☐
The biggest increase in the Olympic record was when the material used to make the poles changed.	☐	☐
The Olympic record increased more between 1988 and 2008 than between 1948 and 1960.	☐	☐
The average increase in the Olympic record over the period of the table is about 0.1 m every 4 years.	☐	☐

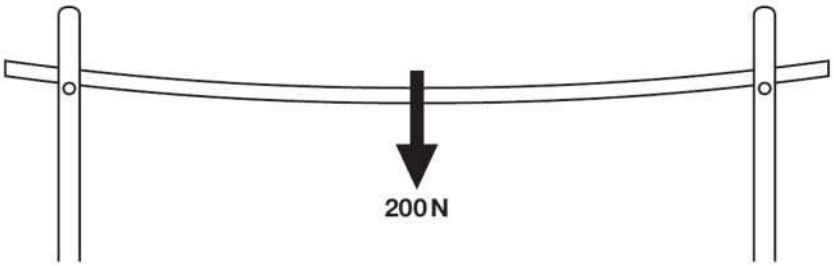
[2]

(b) Anna and Nick are investigating the properties of vaulting poles.

They know that flexibility (how far the pole bends) is an important property.

They support a pole at both ends as shown in the diagram.

They hang a 200 N weight from the centre of the pole and measure how far the pole bends.



(i) They repeat this measurement five times.

Suggest reasons why.

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..... **[2]**

Here are their results.

test number	**1**	**2**	**3**	**4**	**5**
how far the pole bends in cm	11.4	10.9	11.5	11.0	11.2

(ii) Suggest why the results of the five tests are different.

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..... **[2]**

(c) Anna and Nick use the same test on a different vaulting pole.

Here are the results for the second pole.

test number	**1**	**2**	**3**	**4**	**5**
how far the pole bends in cm	12.4	12.9	11.9	11.8	12.5

(i) Work out the best estimate of how far each pole bends.

first pole = ... cm

second pole = ... cm

[1]

(ii) Anna looks at the best estimates for both poles and concludes that the two poles have different flexibility.

Comment on whether Anna is correct to come to this conclusion? Justify your answer.

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..... **[2]**

[Total: 9]

5 Read the newspaper article.

> **Skincare creams use nanotechnology**
>
> Nanoparticles are put in face creams and sunscreens.
>
> These creams are easy to apply and invisible on the skin.
>
> Some scientists are worried about the effects of nanoparticles on the body.
>
> At the moment it is impossible for consumers to tell if the creams contain nanoparticles.

Use your knowledge of nanoparticles to explain why some scientists may be worried about the effects of using these particles in creams.

Suggest what actions should be taken to reduce the concerns of experts and consumers.

The quality of written communication will be assessed in your answer to this question.

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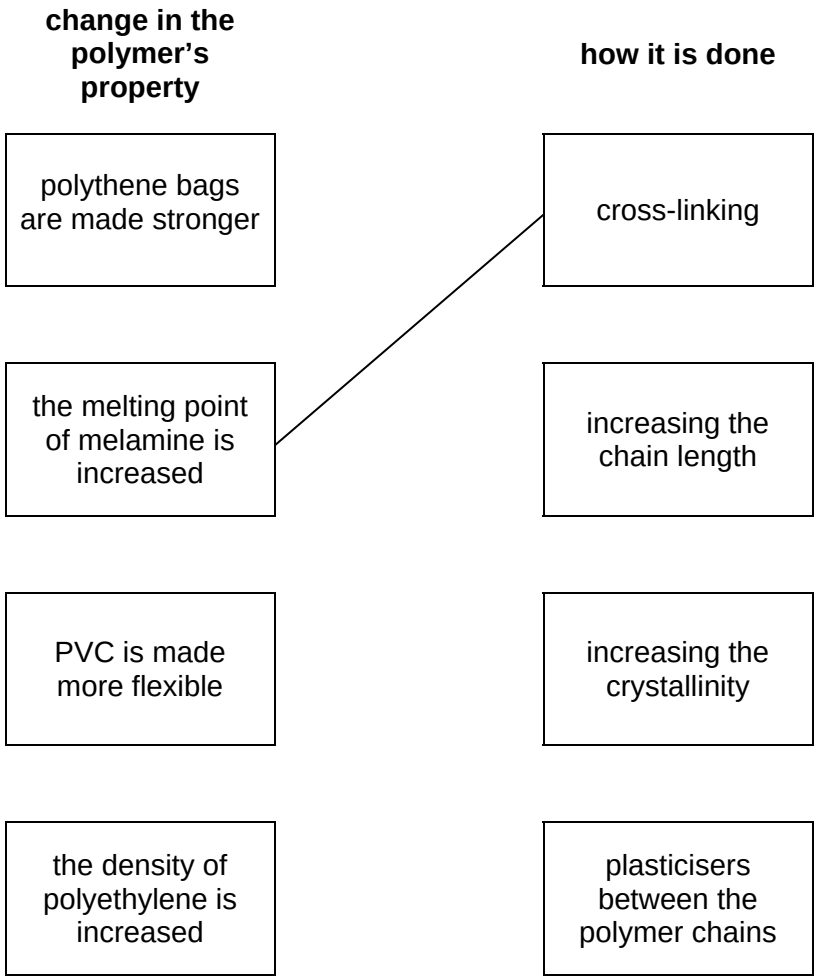
..... **[6]**

[Total: 6]

6 This question is about changing the properties of a polymer by changing its molecules.

(a) Draw straight lines to link each **change in the polymer's property** to **how it is done**.

One has been done for you.



[2]

(b) ‘Vulcanised’ rubber is made by heating natural rubber with sulfur.

The sulfur atoms form cross-links between the polymer chains.

The more cross-links between the polymer chains, the higher the melting point of the ‘vulcanised’ rubber, and the harder it becomes.

Why does the **amount of cross-linking** have these effects?

Put a tick (✓) in the correct box next to each possible reason, to show whether the reason is **true** or **false**.

	true	**false**
There are larger forces between the polymer chains.	☐	☐
There are smaller forces within the polymer chains.	☐	☐
The polymer chains are increased in length.	☐	☐
The polymer chains are forced further apart.	☐	☐
It becomes more difficult for the polymer chains to break away from one another.	☐	☐
The polymer chains become tangled.	☐	☐
The polymer chains can slide past one another more easily.	☐	☐

[2]

[Total: 4]

7 A website gives information about salt in the diet.

The maximum amount of salt a person should eat in a day is:		
1 to 3 years old	–	2 g salt per day
4 to 6 years old	–	3 g salt per day
7 to 10 years old	–	5 g salt per day
11 years old and over	–	6 g salt per day

(a) (i) Describe carefully the relationship between age and the daily maximum amount of salt.

.....

..... **[1]**

(ii) Tom thinks that the daily maximum intake of salt should be linked to a person's body mass rather than to their age.

Explain why a person's body mass may be more important than their age when deciding how much salt they can safely eat in a day.

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..... **[2]**

(b) Many food companies add salt to improve the taste of their food. Salt is also a food preservative.

Food companies are being told to reduce the amount of salt in their products.

Explain why

- food companies **may not want** to lower the amount of salt in their food
- food companies **should be made** to lower the amount of salt in their foods.

The quality of written communication will be assessed in your answer to this question.

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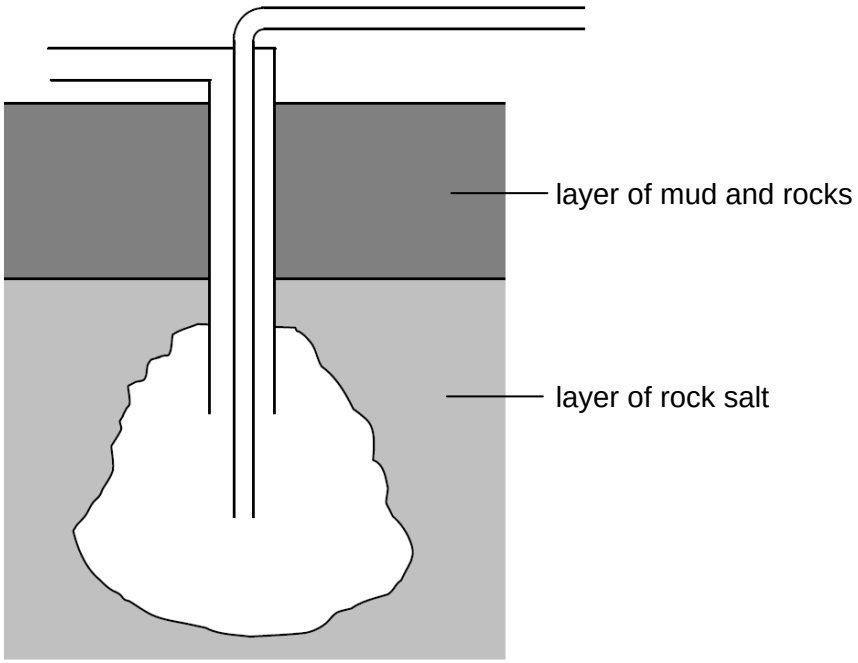
[Total: 9]

8 Salt is found underneath the ground in some parts of the UK.

It can be obtained by solution mining.



(a) The diagram shows part of the process for solution mining of salt.

Here are some statements about solution mining of salt.

Not all of the statements are correct, and they are in the wrong order.

A Water dissolves the salt.

B Water is pumped down the inner and outer pipes.

C Water is pumped down the outer pipe.

D Salt solution is pumped to the chemical plant when required.

E Salt solution is stored above the ground.

F Rock salt is dug out of the cavern.

G Pressure pushes salt solution up to the surface.

Choose the correct steps and then fill in the boxes to show the right order.

One has been done for you.

				D

[2]

(b) Describe ways that solution mining can affect the environment near the mine.

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..... **[2]**

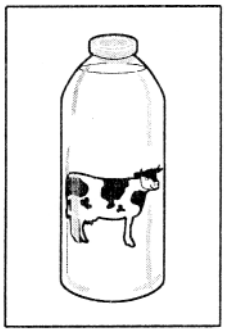
[Total: 4]

9 Some people have milk delivered to their houses. The milk is contained in glass bottles.

When the glass bottles are empty they are collected, cleaned and re-used.

Other people buy milk in plastic bottles from the supermarkets.

When the milk has been used the plastic bottles are thrown away.



glass bottle

plastic bottle

The table gives information about the energy used to make glass bottles and plastic bottles. It also gives information about the energy used in washing, filling and delivering the bottles.

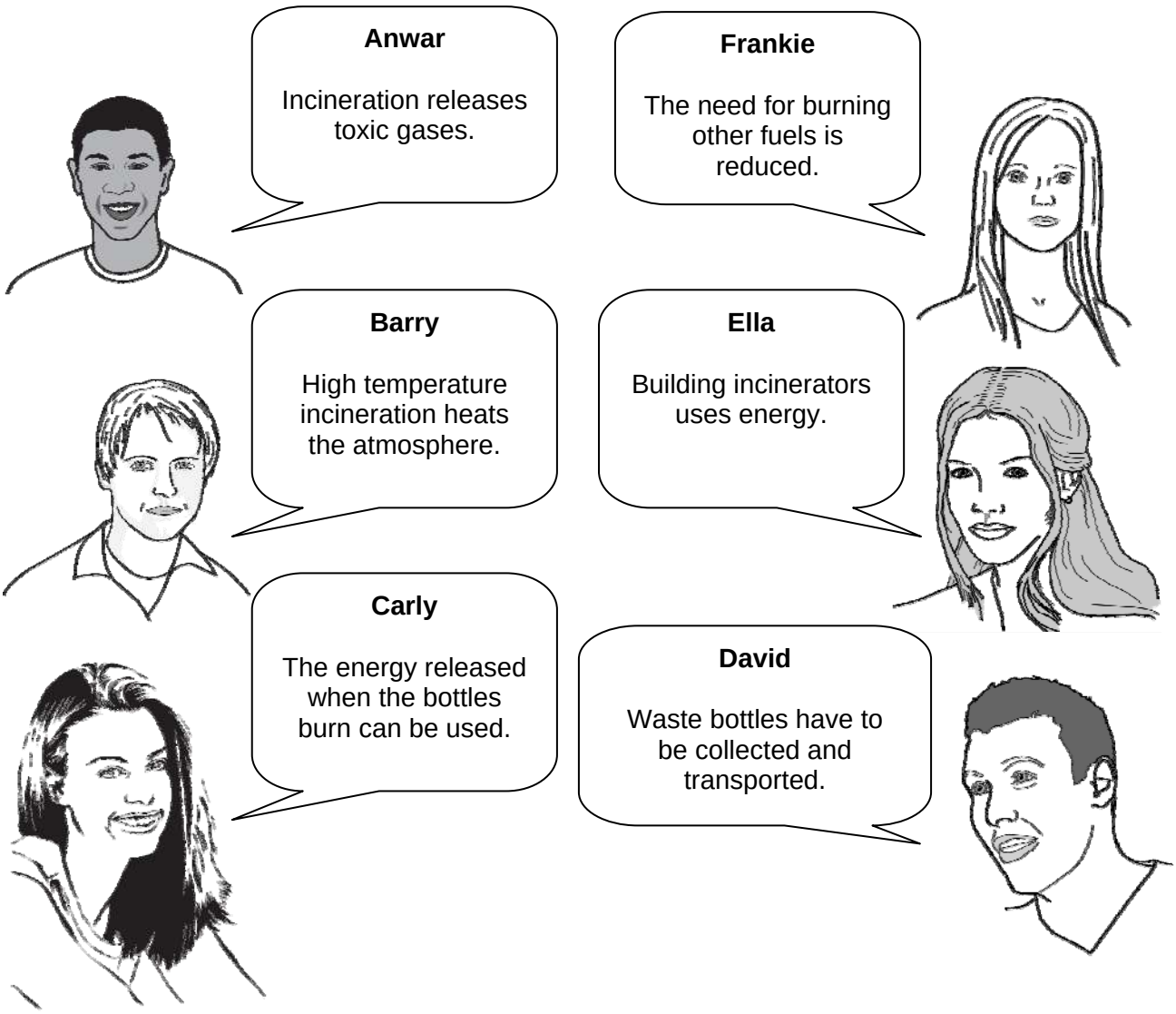
	energy used in MJ	
	re-usable glass bottle	**non-reusable plastic bottle**
manufacturing the bottle	7.2	4.7
washing, filling and delivering the bottle	2.5	2.2

(a) How many times must a glass bottle be re-used for there to be an energy saving compared to using non-returnable plastic bottles?

You must show your working.

number of times = ... **[2]**

(b) Some students are talking about the disposal of plastic bottles by incineration.



Which two students, **when taken together**, are arguing that incineration might have less environmental impact than landfill?

..... and ..... **[2]**

(c) The method of disposal of the bottle is one feature considered in its Life Cycle Assessment (LCA).

Write down **two** other features that should be considered in a Life Cycle Assessment, and for each feature suggest how it may be different for the two types of bottle.

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..... **[4]**

[Total: 8]

[Paper Total: 60]

END OF QUESTION PAPER

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