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A321/02

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**TWENTY FIRST CENTURY SCIENCE**  
**CHEMISTRY A**

Unit 1 Modules C1 C2 C3 (Higher Tier)

**THURSDAY 5 JUNE 2008**

Morning

Time: 40 minutes

\* C U P / T 4 4 4 1 7 \*

Candidates answer on the question paper.

**Additional materials (enclosed):**

None

Calculators may be used.

**Additional materials:** Pencil  
 Ruler (cm/mm)



Candidate  
 Forename

Candidate  
 Surname

Centre  
 Number

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Candidate  
 Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.

**FOR EXAMINER'S USE**

Qu.	Max.	Mark
1	7	
2	9	
3	9	
4	4	
5	5	
6	3	
7	5	
<b>TOTAL</b>	<b>42</b>	

This document consists of **20** printed pages.

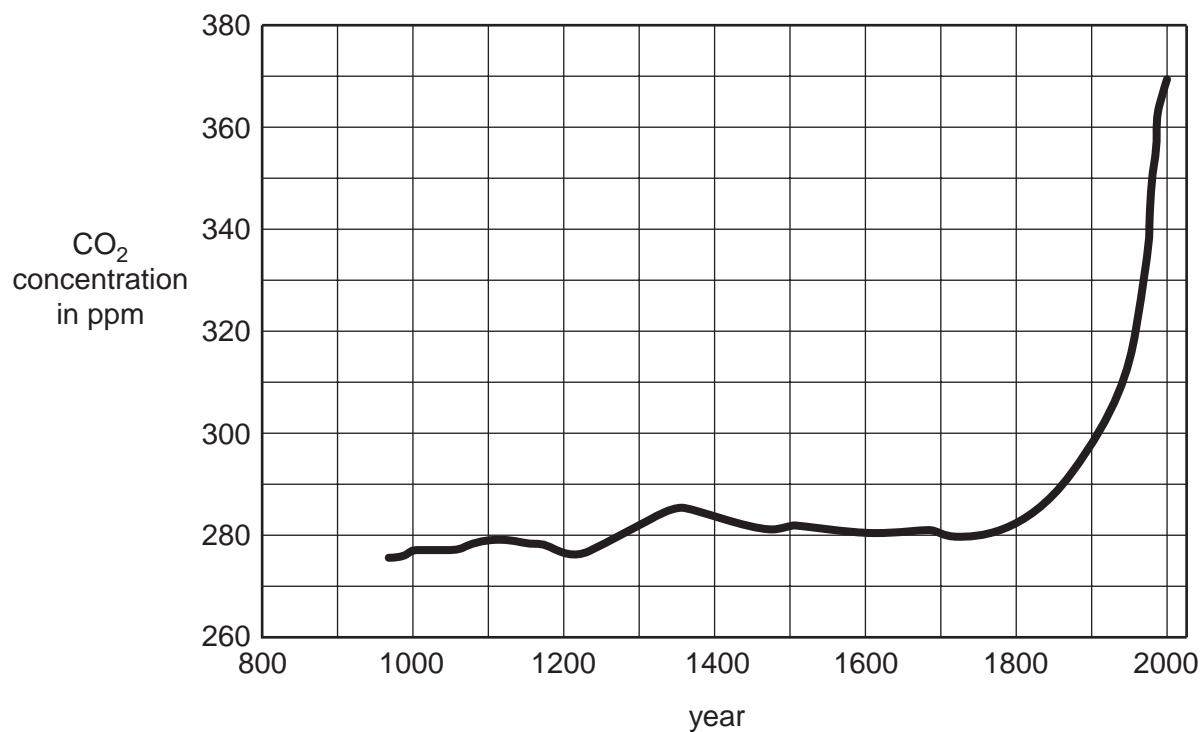
Answer **all** the questions.

1 Bubbles of air stay trapped in the ice in Antarctica for thousands of years.

Scientists find out about the history of our atmosphere by drilling down into the ice and testing the air in the bubbles.



The graph shows how the concentration of carbon dioxide in our atmosphere has changed over the last thousand years.



(a) (i) Put an X on the graph to show when the concentration of carbon dioxide was increasing at the fastest rate. [1]

(ii) Which of the following are correct statements about the amount of carbon dioxide in our atmosphere in the year 2000 compared to the year 1000?

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

There has been an increase of about 100 ppm.

The amount of carbon dioxide is over 5 times greater.

There has been an increase of about 30%.

[2]

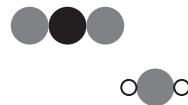
(b) One way that carbon dioxide enters the atmosphere is by burning fossil fuels such as methane in power stations.

Methane reacts with oxygen when it burns to make carbon dioxide and water.

**before the reaction**



**after the reaction**



+ missing molecule

(i) Which molecule below is the missing molecule?

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



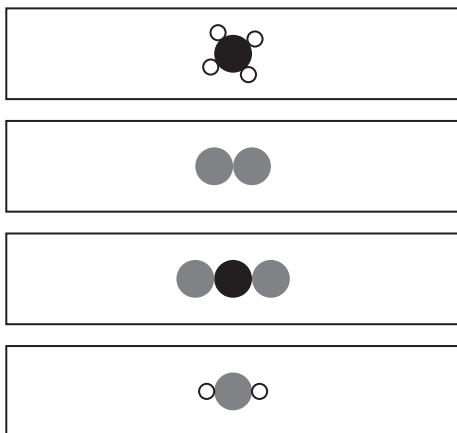







[1]

(ii) Draw a straight line from each **molecule** to its correct **name**.

**molecule****name**

methane

oxygen

carbon monoxide

water

carbon dioxide

[3]

[Total: 7]

2 London City Council are encouraging people to use buses instead of cars to get to work.

The Council says this would improve air quality.



(a) A bus produces more air pollution than a car.

Which two statements **when put together** explain why travelling by bus improves air quality?

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

Each bus carries many people.

Many people need to arrive at work at the same time.

Many people travelling to work in cars make more total air pollutants.

Each bus makes many more journeys per day than each car.

[1]

(b) Buses cause problems because their engines produce pollutants.

This is a list of pollutants and some of the problems that they cause.

Put ticks (✓) in the correct boxes to show the **problems caused** by each **pollutant**.

The first one has been done for you.

pollutant	problems caused		
	acid rain	breathing problems / asthma	makes layer of dirt on buildings
sulfur dioxide	✓	✓	
nitrogen oxides			
carbon particulates (tiny bits of solid in the air)			

[2]

(c) The particulates are mainly small particles of carbon. What is the main source of these particles?

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

from incomplete combustion of the fuel

from reactions between the gases in the air

they are impurities in the fuel

from reactions in the catalytic converter

[1]

(d) New buses are fitted with exhaust filters that remove particulates.

Scientists test the pollutants that the buses produce before and after the filters are fitted.

The table shows how the pollutants change.

	sulfur dioxide	nitrogen oxides	particulates
change after filter is fitted	stays the same	increase	decrease

This is what the scientists say about the results.



**Eve**

These results show that filters are a great success because they cut down on particulates, which are harmful pollutants.

**Joe**

After the filters are fitted, the levels of particulates are lower, but the amounts of both the other pollutants are higher.

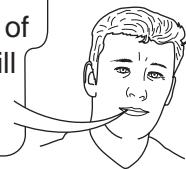


**Liz**

I am disappointed in the results – the filters increase some of the harmful pollutants.

**Sab**

The filters remove some of the pollutants, so they will improve air quality when they are used.



Some of the statements made about the results are true, some are false and some scientists do not have enough evidence for the statements they have made.

Put ticks (✓) in the correct boxes to show whether each statement is **true**, **false** or there is **not enough evidence** to make the statement.

	true	false	not enough evidence
Eve			
Joe			
Liz			
Sab			

[3]

(e) Some cities use electric trams rather than buses.

Which of the statements about electric trams are **true** and which are **false**?

Put a tick (✓) in the correct box for each statement.

	true	false
If all cities use electric trams instead of buses there will be less air pollution in the cities.		
If all cities use electric trams there will be no air pollution anywhere.		
Electric trams do not give out carbon monoxide.		
No fossil fuels are burned to run electric trams.		

[2]

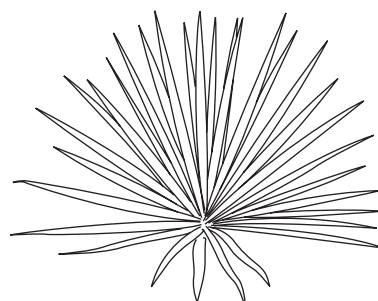
[Total: 9]

3 In Africa, ropes for use on boats are made from natural plant materials.

Some plants used to make rope include hemp, ramie, coir and sisal.



hemp



sisal

property of rope	hemp	ramie	coir	sisal
density in g/cm <sup>3</sup>	1.48	1.50	1.25	1.33
tensile strength in N/mm <sup>2</sup>	550–900	500	220	600–700
stiffness in kN/mm <sup>2</sup>	50	44	6	38
stretch before breaking in %	1.6	2	15–25	3
moisture absorption in %	7	12–17	10	11

(a) (i) Which ropes show no **real difference** between their tensile strengths?

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

**coir      hemp      ramie      sisal**

[1]

(ii) What is the best explanation for this?

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

The values are very close together.

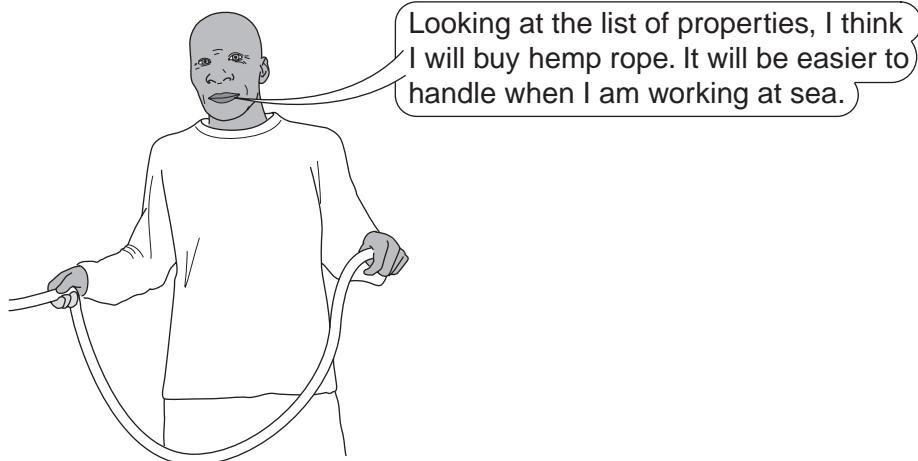
Measuring the tensile strength several times will give different results.

It is important to take into account the stretch before breaking when measuring tensile strength.

The ranges for the values overlap.

[1]

(iii) The fisherman chooses a rope.



Which two statements **when put together** explain why hemp ropes are easier to handle at sea?

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

Hemp ropes are stiffer than the other ropes.

Hemp ropes do not absorb water as much as the other ropes.

It is easier to handle light ropes.

The rope needs to be wrapped around a holder on the boat.

The ropes need to be very hardwearing.

[2]

10

(b) Flax is another plant that can be used to make ropes.

A scientist tests samples of flax to find out its tensile strength.

These are the results.

sample	tensile strength in N/mm <sup>2</sup>
1	800
2	1500
3	900
4	1000
5	1100

(i) Why did the scientist repeat the test several times?

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

to use up all the sample

to make it a fair test

to practise the technique

to check the reliability

to calculate a best estimate

[2]

(ii) The scientist decides to quote the data as a range.

He enters the data in a table like this:

<b>flax</b>	
<b>tensile strength in N/mm<sup>2</sup></b>	800–1500

Why is it more useful to show the tensile strength of flax as a range rather than an average?

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

Flax is a natural material, so its strength is very variable.

The range is too wide for a calculated average to be useful.

The tensile strength of the rope depends on its diameter.

The strength is higher than all the other natural fibres.

[1]

(c) In the UK, most ropes for use on boats are made from synthetic polymers such as poly(propene) rather than natural fibres.

The following statements about poly(propene) come from the Life Cycle Assessment for its use to make ropes.

Which of the statements show **advantages** of using poly(propene) to make ropes, and which are **disadvantages**?

Put a tick (✓) in the correct box for each statement.

	<b>advantage</b>	<b>disadvantage</b>
Poly(propene) is made from crude oil.		
Poly(propene) ropes do not rot, so they last for a very long time.		
Poly(propene) ropes do not rot when they are thrown away.		
Poly(propene) can be broken down and used to make new polymers.		

[2]

[Total: 9]

## 12

4 Eve investigates the properties of five types of polymer. She looks at nylon, poly(ethene), bakelite, PVC and melamine.

These are her results.

polymer	flexibility	effect of heat
nylon	flexible	starts to melt at 213 °C
poly(ethene)	flexible	starts to melt at 110 °C
bakelite	hard and brittle	starts to burn before it melts
PVC	flexible	starts to melt at 334 °C
melamine	hard and brittle	starts to burn before it melts

(a) (i) Which of the polymers has the weakest forces between its molecules?

Put a **ring** around the correct answer.

nylon      poly(ethene)      bakelite      PVC      melamine

[1]

(ii) Which of the polymers have **cross links** between their molecules?

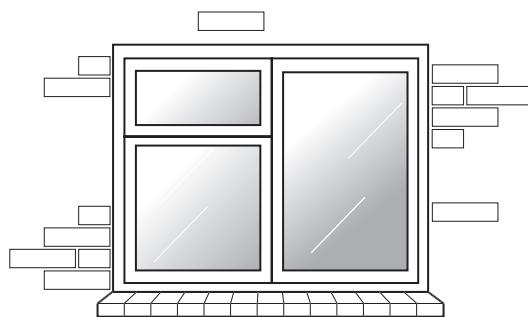
Put a **ring** around each of the **two** correct answers.

nylon      poly(ethene)      bakelite      PVC      melamine

[1]

(b) Manufacturers sometimes use PVC to make consumer goods.

Plasticised PVC is used for waterproof boots. Unplasticised PVC is used to make window frames.



unplasticised PVC (uPVC)



plasticised PVC

How does plasticized PVC compare to unplasticised PVC?

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

**Plasticised PVC ...**

... is stronger.

... is more flexible.

... has a lower tensile strength.

... stretches less before breaking.

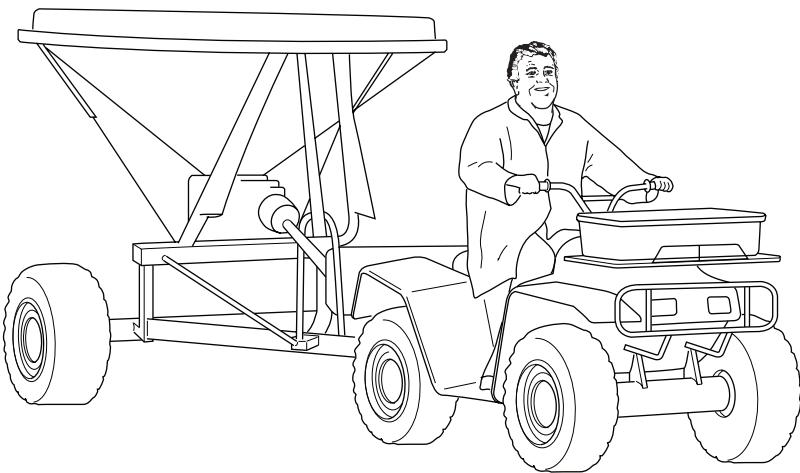
... has polymer chains closer together.

... has polymer chains further apart.

[2]

[Total: 4]

5 Joe is a farmer. He uses intensive farming methods to grow wheat crops on his farm.



(a) Joe adds chemical fertiliser to the soil.

Which of the following statements **when put together** explain why Joe needs to do this?

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

Wheat roots take up soil nutrients which are needed for growth.

Wheat is planted in very big fields.

Pesticides are used to kill pests on the wheat plants.

Ripe wheat is harvested and removed completely from the field.

[2]

15

(b) Some other local farms use organic farming methods.

Which of the following statements are **true for intensive farming**, which are **true for organic farming** and which are **true for both**?

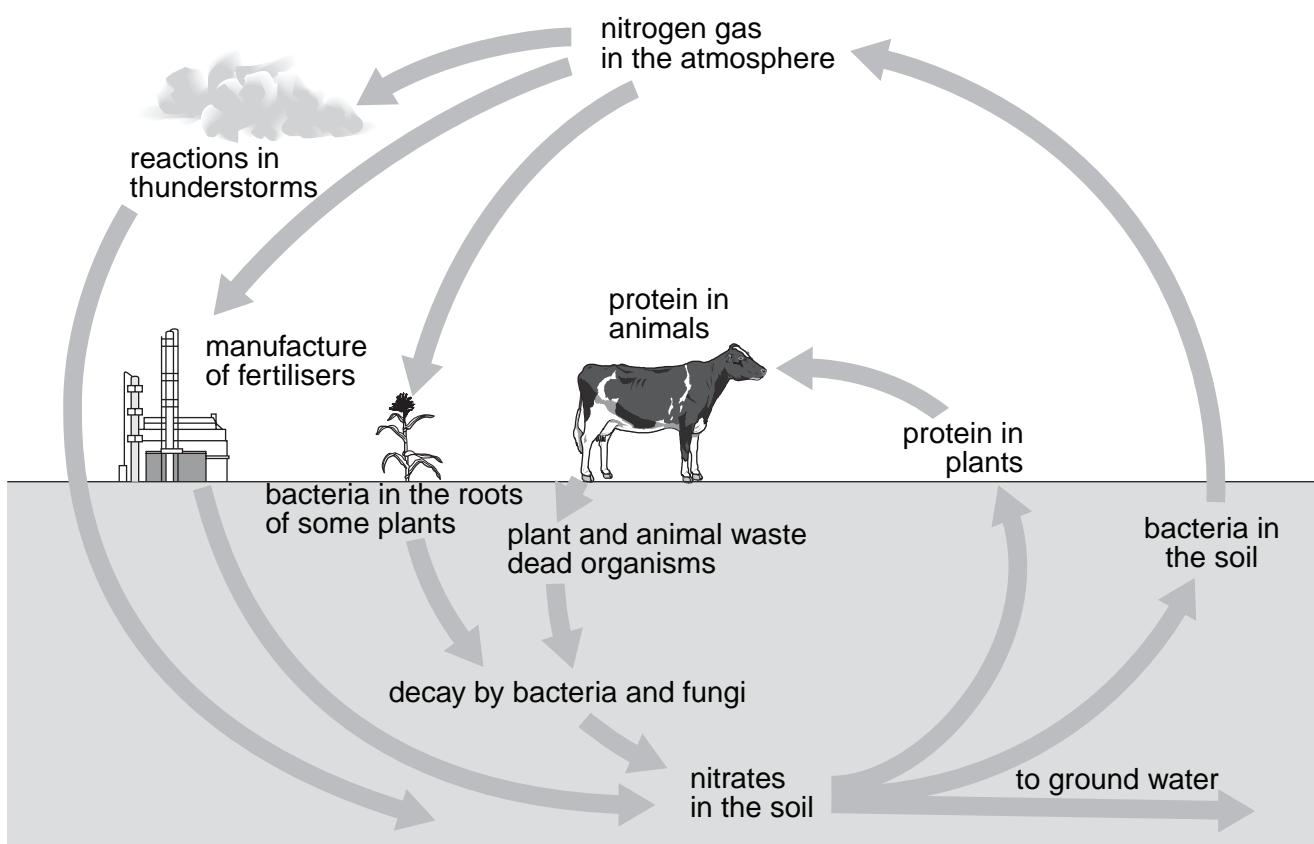
Put a tick (✓) in the correct box for each statement.

	true for intensive farming	true for organic farming	true for both
fields produce less wheat per acre			
food produced is larger and more likely to be free from damage			
more land is available for roads and housing			
food may contain harmful chemicals			
nutrients washed into streams may cause algae to grow in local rivers			

[3]

[Total: 5]

6 This diagram shows the nitrogen cycle.



The following sentences describe chemical changes involving nitrogen.

- A Nitrogen compounds are used to form proteins.
- B Nitrogen compounds break down to form nitrogen gas.
- C Proteins react to form other nitrogen compounds.
- D Nitrogen gas reacts to form nitrogen compounds.

17

Which sentence shows the chemical change that happens at each of the following parts of the nitrogen cycle?

Write the correct letter, **A**, **B**, **C** or **D**, in each box.

You may use each letter once, more than once or not at all.

reactions in the fertiliser factory

reactions caused by bacteria in plant roots

reactions that happen when animal waste rots

reactions caused by bacteria in the soil

[3]

[Total: 3]

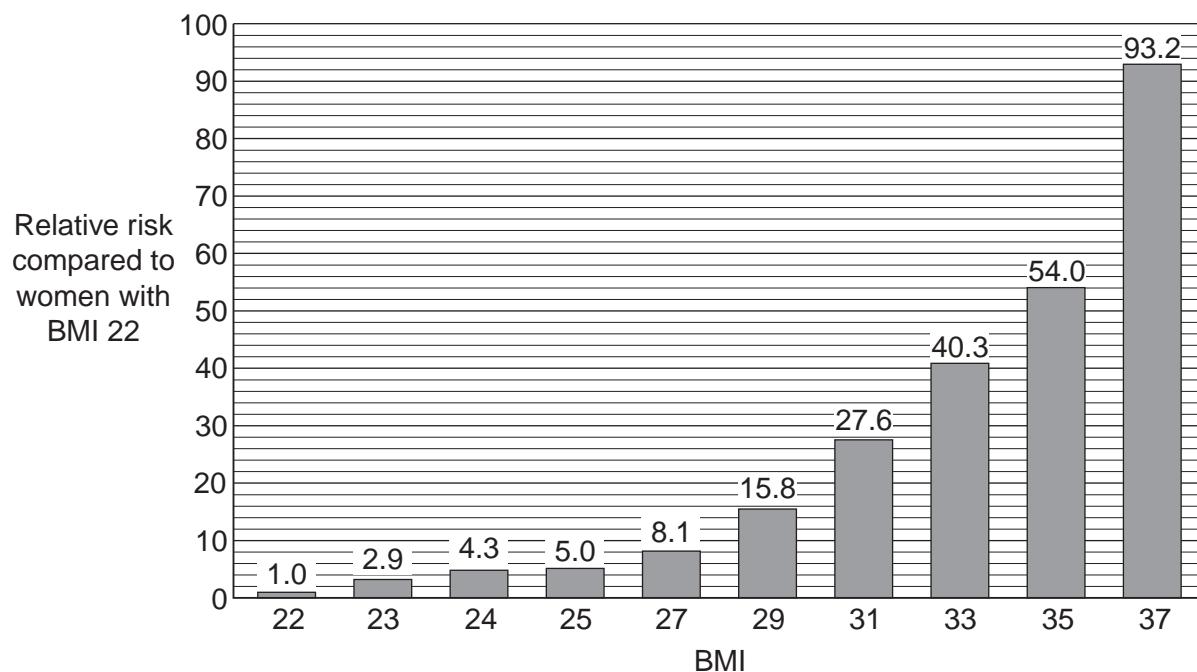
7 Body Mass Index (BMI) is a measure of whether or not a person is overweight. People with a BMI greater than 30 are obese (very overweight).

Scientists have carried out research to find out how a person's BMI affects the likelihood that they will have type 2 diabetes.

They studied women aged between 30 and 35.

The recommended BMI for women in this age range is 22.

They produced a graph to show the **relative risk** of these women having diabetes **compared to women with a BMI of 22**.



(a) Which of the following statements can be made using **only** the information on the graph?

Put a tick (✓) in each correct box.

Women with a BMI of 25 are about 5 times more likely to have type 2 diabetes than women with a BMI of 22.

93.2% of women with a BMI of 37 will have type 2 diabetes.

Reducing your BMI may reduce your risk of contracting type 2 diabetes.

Women are more likely to get type 2 diabetes when they are 35 years old rather than 30 years old.

[2]

19

(b) Ann is 35 and has a BMI of 34. She does not have diabetes, but her mother and grandmother do.

She sees the graph and talks to her friend.



Her friend makes the following statements to try to make her feel better.

Which of the statements are **true**, and which are **false**?

Put a tick (✓) in the correct box for each statement.

	true	false
Your mother and grandmother having diabetes does not affect your risk of getting the disease.		
You are very active, so you are at less risk from diabetes.		
As you get older, you are less likely to get diabetes.		
The graph shows a correlation between groups of people.		
Individual women may not get diabetes even if they have a very high BMI.		

[3]

[Total: 5]

**END OF QUESTION PAPER**

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