OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A212/02

SCIENCE A

Unit 2: Modules B2 C2 P2
(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)

Wednesday 17 June 2009
Morning

Duration: 40 minutes

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.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **42**.
- This document consists of **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1

Helen and Sam are testing carrier bags made from cotton, nylon and poly(ethene).
They are finding the maximum weight the bags will carry.
Each bag is identical in size with the same shape of handle.
Weights are added to the bags until the bags break.
Five bags of each material are tested.

(a) Why do Helen and Sam test five bags of each material?

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

To make sure the test is fair. ☐

They are learning to measure correctly. ☐

The more they test, the more accurate they are. ☐

To make sure the results are reliable. ☐ **[1]**

(b) The readings from these tests are shown in the table.

	weight to break bag in newtons					
test / material	**1**	**2**	**3**	**4**	**5**	**mean**
cotton	235	248	228	232	242	237
nylon	375	385	372	95	388	380
poly(ethene)	64	68	69	71	68	

(i) Sam says that one of the readings in the table is an outlier.

Put a (ring) around the outlier in the table. **[1]**

(ii) Work out the mean value of the weight a poly(ethene) carrier bag will hold.

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

(iii) Here are some statements about the weight needed to break each bag.

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

There is very little difference in the mean weight for each type of bag. ☐

The ranges of readings for the cotton and poly(ethene) bags do not overlap. ☐

There is a significant difference in the mean weight for the nylon and poly(ethene) bags. ☐

The mean value of the nylon bag is inside the range of the poly(ethene) bag. ☐

[1]

(c) The Life Cycle Assessments (LCA) of cotton and nylon bags are different. Which of these comparisons **explain** the difference in the LCA?

Put ticks (✓) in the boxes next to the **three** comparisons.

cotton	**nylon**	
made from plants	made from crude oil	
made for over 5000 years	made since 1950s	
usually replaced after 2 years	usually replaced after 10 years	
soft	shiny and harder	
made into threads	made in different shapes and styles	
biodegradable	non-biodegradable	

[2]

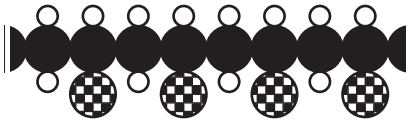
[Total: 6]

2 Below are representations of five molecules.

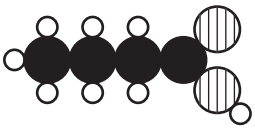
A

B

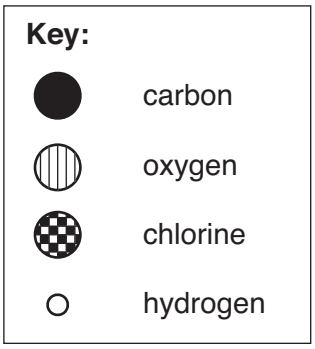
C



D



E



(a) Which molecule, **A**, **B**, **C**, **D** or **E**, is a hydrocarbon?

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

(b) One representation shows a small molecule that can be polymerised to make another of the molecules.

Write the letters of these molecules in the spaces below.

..... **polymerisation** ⟶ ..... **[1]**

(c) Finish each sentence by choosing the best word from this list.

chemicals

different

higher

lower

molecules

products

unchanged

In a chemical reaction, reactants change to ..... .

The number of atoms of each element before and after the

reaction is ..... . **[2]**

[Total: 4]

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Question 3 starts on page 6.

3 The material for car tyres is made by heating natural rubber with sulfur.
The sulfur atoms form crosslinks between the polymer chains.

(a) The more crosslinks made between polymer chains, the higher the melting point of the rubber.
Why does the melting point increase?

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

larger forces between particles ☐

smaller forces between particles ☐

larger forces between the rubber and the air ☐

larger forces inside the particles ☐

[1]

(b) The more crosslinks made between polymer chains, the harder the rubber.
Which two of the following statements, when **put together**, explain why this happens?

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

Crosslinks increase the length of the chain. ☐

Polymer chains become tangled. ☐

Polymer chains can easily slide past each other. ☐

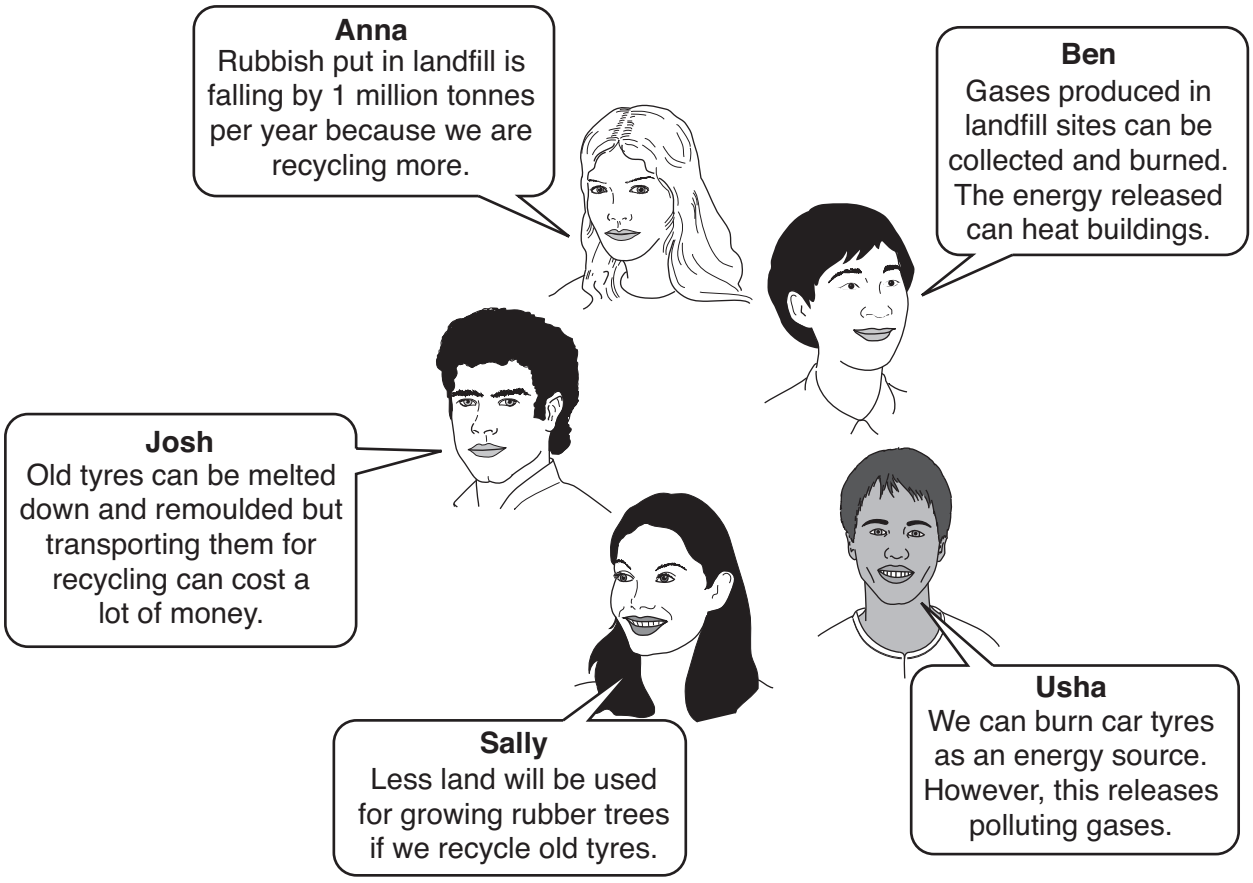
Crosslinks hold the polymer chains together. ☐

Crosslinks make the chains move further apart. ☐

Polymer chains cannot break away from each other. ☐

[1]

(c) Students in a science class are discussing the disposal of used tyres.
Read what they say.



(i) Which **two** students are suggesting ways to reduce the use of crude oil as a fuel?

answer ..... and ..... **[1]**

(ii) Who is explaining why the best method of disposal may depend on where you live?

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

[Total: 4]

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4 Read this article from a newspaper.

The hole in the ozone layer is bigger than ever

The hole in the ozone layer is bigger than any other on record, a satellite image has revealed.

The ozone layer in the atmosphere shields Earth from the Sun's harmful ultraviolet rays. The layer gets thinner over the South Pole every winter. This is mostly because human-made chemicals destroy ozone in the upper atmosphere.

However, there is good news. Concentrations of the chemicals which destroy ozone have been decreasing since 1995. Scientists estimate the hole in the ozone layer will be gone by 2065.

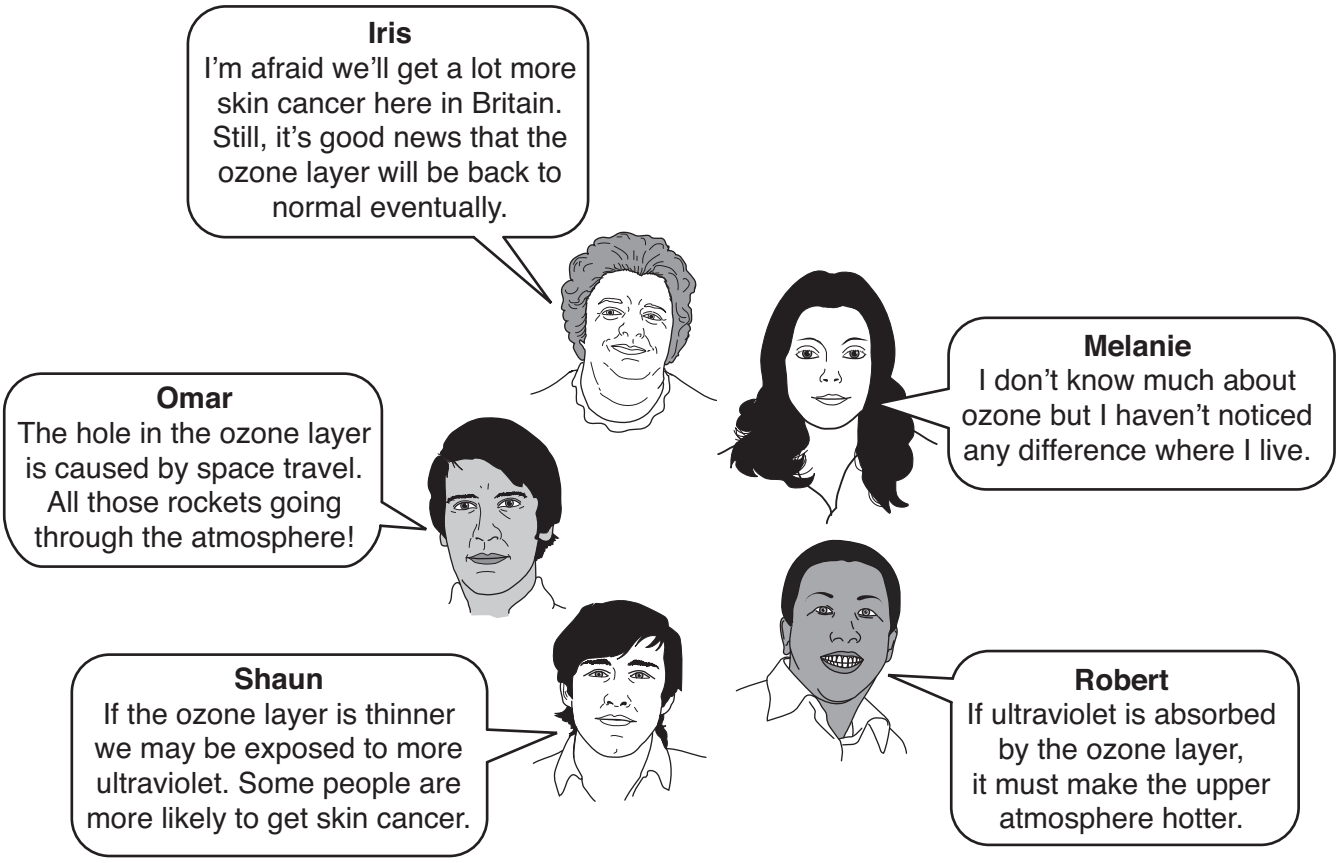
(a) The ozone layer shields us from harmful ultraviolet.
Which **two** of the following statements explain why ultraviolet is harmful?

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

Ionising radiation can damage living cells.	☐
Radiation heats any material that absorbs it.	☐
The Sun's radiation allows photosynthesis to happen.	☐
Ultraviolet radiation is absorbed by ozone.	☐
Ultraviolet radiation is ionising radiation.	☐

[2]

(b) Some British people in the street were interviewed by local radio to find out what they thought about the hole in the ozone layer.



(i) Which of these people describes a **correlation**?

Put a tick (✓) in the box next to the **one** correct name.

Iris ☐

Melanie ☐

Omar ☐

Robert ☐

Shaun ☐

[1]

(ii) Which of these people talk about one factor **causing** another?

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

Iris ☐

Melanie ☐

Omar ☐

Robert ☐

Shaun ☐

[2]

(iii) Which one of these people is making an **incorrect** statement?

Put a tick (✓) in the box next to the **one** correct name.

Iris ☐

Melanie ☐

Omar ☐

Robert ☐

Shaun ☐

[1]

(iv) Which of these people talk about effects caused by the fact that ultraviolet is an ionising radiation?

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

Iris ☐

Melanie ☐

Omar ☐

Robert ☐

Shaun ☐

[1]

[Total: 7]

5 In June 2007, Britain had more rainfall than usual, and there were many floods. Experts did not agree why this happened.

Professor Morgan

It is impossible to say if global warming is responsible for specific events. But you can see patterns.

We are getting much heavier bursts of rain from the Atlantic Ocean. The atmosphere is warmer and able to hold more moisture. That points to global warming.

Professor Rankin

Global warming explanations are nonsense. Britain's weather depends on what happens over the Atlantic Ocean and Europe. This month, winds brought in lots of rain from the Atlantic.

In Britain, more and more countryside is being built on. Land covered with concrete cannot soak up the extra rain. This makes the rivers overflow. Building houses in flat areas beside rivers leads to disaster, whatever the climate.

(a) Which of these statements are supported by Professor Morgan, Professor Rankin, by both or by neither of them.

Put a tick (✓) in the **one** correct box after each statement.

statement	Professor Morgan	Professor Rankin	both scientists	neither scientist
Global warming definitely caused the floods in June 2007.				
The wet summer proves that global warming is taking place.				
The floodwater in June 2007 had its origin in the Atlantic Ocean.				
There is a correlation between the amount of flooding and the amount of house building.				

[3]

(b) Professor Morgan continues his research.

Here are some possible pieces of evidence that he might obtain about wet weather and flooding in the future.

Put a tick (✓) in the **one** correct box after each possible piece of evidence.

possible piece of evidence	suggests Professor Morgan is right	suggests Professor Morgan is wrong	neither
A positive correlation is found between the average temperature of the atmosphere and the average summer rainfall in Britain over many years.			
Global warming continues, but over many years the average rainfall in Britain does not change.			

[2]

(c) Several factors may affect the future temperature of the Earth's atmosphere.

Put a tick (✓) in the box next to **each** change that would result in **more** global warming.

planting two trees for every tree that is cut down ☐

microscopic plants grow faster in the warmer seas ☐

more water evaporates from the seas into the atmosphere ☐

the warmer atmosphere makes plants photosynthesise faster ☐

rotting plants increase the amount of methane in the atmosphere ☐

[2]

[Total: 7]

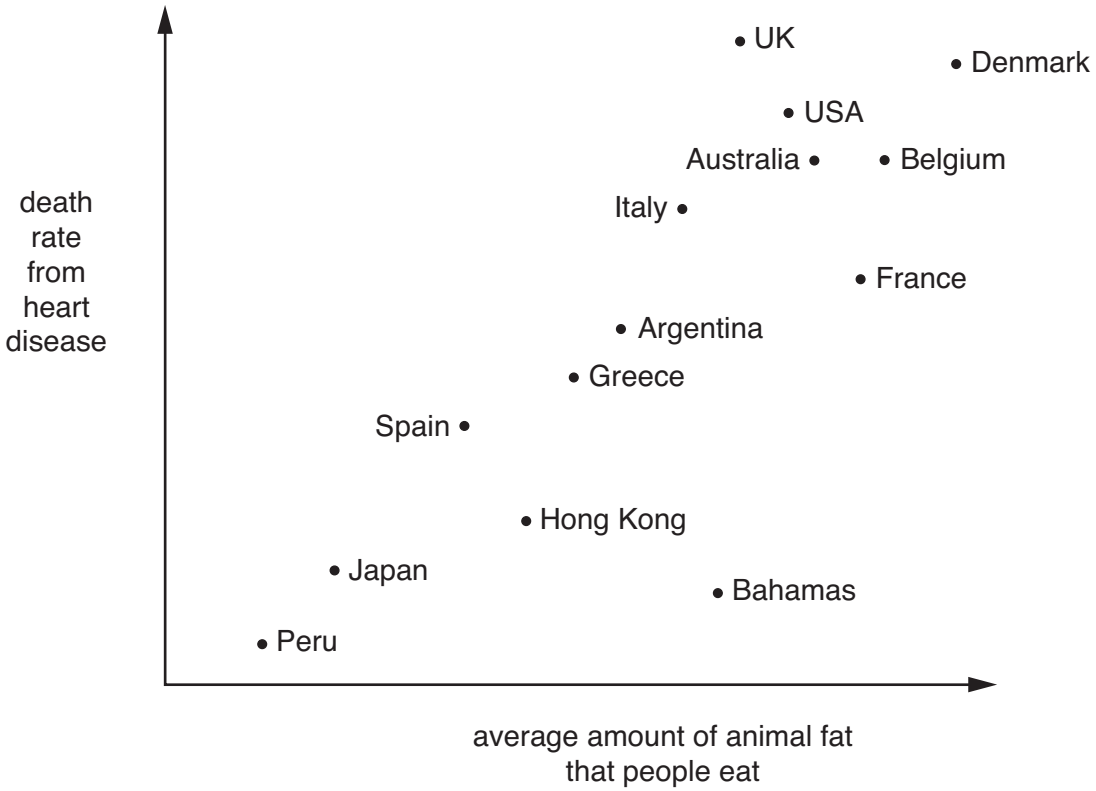
6 This question is about heart disease.

(a) In a heart attack some heart muscle dies.
The heart muscle dies because its blood supply is blocked.

(i) Name the type of blood vessel which carries blood to the heart muscle.

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

The graph shows the relationship between eating animal fat and deaths from heart disease.



(ii) Which country has the lowest recorded death rate due to heart disease.

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

(iii) What correlation does the graph show?

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

People in different countries eat different amounts of animal fat. ☐

The more animal fat that people eat, the greater their chance of dying of heart disease. ☐

The amount of animal fat that people eat has no effect on their chance of dying of heart disease. ☐

The less animal fat that people eat, the greater their chance of dying of heart disease. ☐ **[1]**

(iv) The data in the graph does **not** show that eating animal fat **causes** heart disease.
What is the best explanation for this?

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

Some countries do not fit the pattern. ☐

Some other factor causes heart disease and this factor correlates with the amount of animal fat eaten. ☐

The data does not show how eating animal fat leads to heart disease. ☐

The data doesn't show how much vegetable fat is eaten. ☐

[1]

(v) The graph shows that people in the UK and the Bahamas eat, on average, the same amount of animal fat.
However, people in the UK are far more likely to die of heart disease.
Two of the statements below, when put together, could explain why.

Put a (ring) around the **one** correct statement in each box.

1	The most important risk factors for heart disease are microorganisms and lifestyle.
2	The most important risk factors for heart disease are genetic and lifestyle.
3	The most important risk factors for heart disease are genetic and microorganisms.

1	Infections from microorganisms are more common in the Bahamas compared with in UK.
2	People in the Bahamas have completely different genes compared to people living in the UK.
3	People in the Bahamas are generally less stressed than people living in the UK.

[2]

(b) Read about two studies published in scientific journals that link genes to heart disease.

Heart disease genetic link found

Two teams of scientists have linked a faulty gene with an increased risk of heart disease.

In North America, a study of 23 000 people found that 25% of people had two copies of the faulty gene. These people have a 30 to 40% higher risk of heart disease compared to people who carry no copies.

In Iceland, a study of 17 000 people found that 20% of people had two copies of the faulty gene. These people had a 60% increased risk of heart disease compared to people who carry no copies.

Why do other scientists have confidence in these studies?

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

the results are different	☐
both studies involve large numbers of people	☐
both studies show that genes cause heart disease	☐
scientific journals are always peer reviewed	☐
all scientific work is published in journals	☐

[2]

[Total: 8]

7 Read the information about *C. difficile*.

The bacterium *C. difficile* is thought to have been responsible for the deaths of 3800 hospital patients in 2004–5.
C. difficile can live in the intestines and cause diarrhoea.
C. difficile is an example of a "super bug".
"Super bugs" are resistant to antibiotics.

(a) (i) Bacteria become resistant to antibiotics when a random change to a gene occurs.
What name do scientists give to these random changes?

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

(ii) Use **one** straight line to link the correct **advice about reducing antibiotic resistance** with the correct **reason for the advice**.
Draw only **one** line.

advice about reducing antibiotic resistance	**reason for the advice**
Always take antibiotics for infections caused by microorganisms.	Antibiotics kill non-resistant bacteria.
Only use antibiotics when necessary.	Antibiotics are only effective against non-resistant viruses.
Use antibiotics for all bacterial infections.	Antibiotics kill all bacteria and fungi.
Only use antibiotics against resistant bacteria.	Resistant bacteria only have a survival advantage when antibiotics are used.

[1]

(b) Microorganisms reproduce rapidly in suitable conditions.

Some bacteria can reproduce so rapidly that the population doubles every 20 minutes.

If a single bacterium infected someone and reproduced every 20 minutes, how many minutes would it take for the population of bacteria to be greater than 100?

Put a (ring) around the correct answer.

60 **100** **140** **180** **220** **260** **[1]**

[Total: 3]

8 There were worldwide influenza epidemics in 1918, 1958 and 1968.

Many scientists think there will be another epidemic soon. Vaccinations can prevent this.

(a) Put a tick (✓) in the box next to the statement that completes the sentences.

Since influenza is highly infectious, to prevent an epidemic …

… a low percentage of the population must be vaccinated.	
… a high percentage of the population must be vaccinated.	
… 100 percent of the population must be vaccinated.	

This …

… reduces the chance of a virus infecting a susceptible individual.	
… increases the chance of a virus infecting a susceptible individual.	
… reduces the chance of the virus infecting an immune individual.	

[1]

(b) Put a tick (✓) in the box next to the **two** statements which best explain why new vaccines against influenza have to be developed frequently.

Influenza viruses change very quickly.	
Influenza viruses pass easily from person to person.	
Immune systems cannot make antibodies against influenza viruses.	
The antibodies made against influenza viruses are not very effective.	
A different antibody is needed to recognise each different type of microorganism.	
Immune systems cannot remember how to make antibodies against influenza viruses.	

[1]

(c) A group of scientists is researching the effectiveness of a new drug in treating the symptoms of influenza.

They plan to test the new drug using 200 volunteers.

From these volunteers, only 100 will be given the drug.

All 200 volunteers will then be exposed to mild (harmless) forms of influenza viruses and asked to keep a diary of how they feel.

Here are some suggestions that are made to the scientists to change their plan.

Put a tick (✓) in the box next to each suggestion that will **improve** their plan.

Give the new drug to all 200 volunteers.	☐
Use 100 volunteers instead of 200.	☐
Choose the 100 to receive the new drug by tossing a coin.	☐
Let the volunteers choose if they want the new drug or not.	☐
Give a placebo to the 100 not receiving the new drug.	☐
Don't let the scientists know which patients have taken the new drug.	☐
Don't tell the volunteers whether or not they have taken the new drug.	☐

[1]

[Total: 3]

END OF QUESTION PAPER

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