UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

21ST CENTURY SCIENCE **0608/03**

Paper 3 **For Examination from 2009**

SPECIMEN PAPER

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **21** printed pages and **3** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

1 A coal-fired power station releases fumes into the air from the top of a tall chimney.

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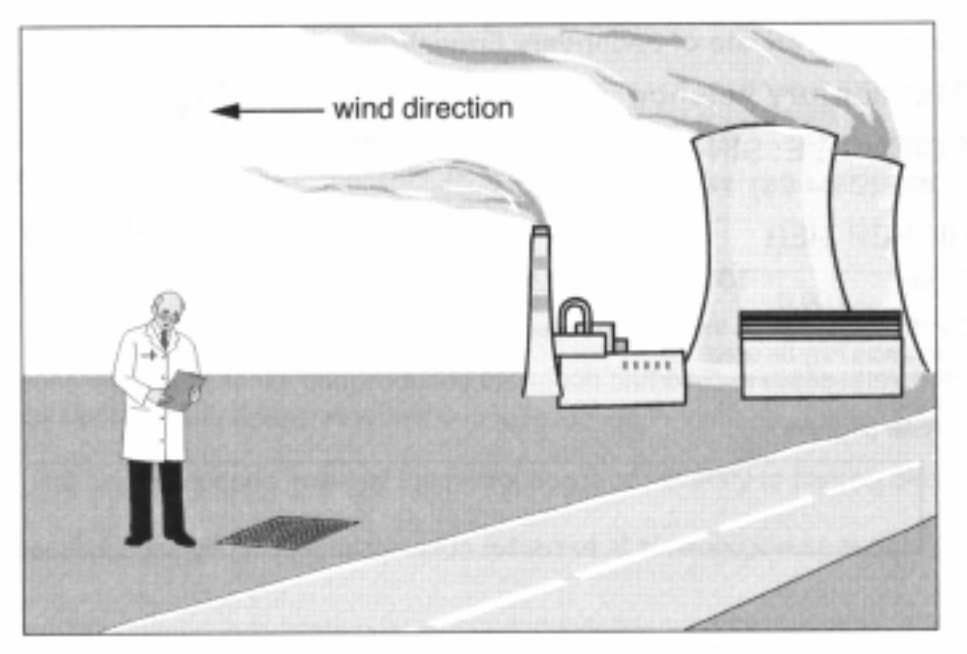

These fumes contain the gas sulfur dioxide.
Sulfur dioxide reacts in the air to make acid rain.

(a) (i) Which solid element present in the coal forms the gas sulfur dioxide as the gas burns?

Put a ring around the correct answer

carbon **hydrogen** **nitrogen** **sulfur** [1]

(ii) Which **two** substances in the air react with sulfur dioxide to make acid rain?

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

argon	☐
carbon dioxide	☐
nitrogen	☐
oxygen	☐
water	☐

[2]

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(b) A scientist investigates the effect of sulfur dioxide released from the power station on plants. He counts the number of species of plant growing in 1 m^2 of roadside verge at different distances from the power station. At each location he makes this measurement five times and takes an average.

He makes his measurements in the direction that the wind blows fumes from the power station.

His results are shown in the table.

Distance from power station/km	5	10	15	20	25	30	35	40	45	50
Average number of plant species in 1m^2	4	3	4	6	8	10	12	12	15	14

The scientist also makes a set of measurements 10 km in the opposite direction from the power plant. This shows an average of 15 species of plants in 1m^2.

(i) Why did the scientist take one set of measurements in the **direction opposite** to that in which the wind blows from the power plant?

.....

..... [1]

(ii) The scientist's results suggest that there is a correlation between the distance from the power station and the number of plant species.

Complete the sentence to describe this correlation.

Choose words from this list.

increases **stays the same** **decreases**

As the distance from the power station increases the number of plant

species ..... [1]

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(c) The scientist takes a further set of measurements at the side of the road immediately outside the power station.

measurement number	1	2	3	4	5	mean value
number of plant species in $1m^2$	9	10	8	9	8	9

(i) Suggest why the scientist made a number of measurements and worked out the average instead of making just one measurement.

.....

..... [1]

(ii) What is the range for this set of results?

range = ... to ..... [1]

[Total: 7]

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2 Poly(ethene) is made from small molecules obtained from crude oil.

(a) Crude oil is a mixture of chemicals.

Which one of these statements indicates that crude oil is a mixture?

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

It is a thick, dark coloured liquid which is less dense than water.	☐
It was made from the remains of animals that lived long ago.	☐
It can be separated into useful materials for the chemical industry.	☐
It is found deep underground.	☐

[1]

(b) Poly(ethene) is made by joining together small molecules to make long molecules.

Put a (ring) around the name given to this process.

decomposition **oxidation** **photosynthesis** **polymerisation** [1]

(c) Poly(ethene) is used to make a variety of products.

Two of these are supermarket carrier bags and underground pipes for natural gas.

(i) A Life Cycle Assessment (LCA) for either of these products includes the following statements.

A How long the product lasts.

B The energy used to extract the raw material.

C The energy used to make the product from poly(ethene).

D The energy needed to make poly(ethene) from the raw material.

Which two of these statements, **A**, **B**, **C** and **D**, will be **different** for an LCA for carrier bags and an LCA for natural gas pipes?

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

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(ii) Underground gas pipes were once made from iron.

Poly(ethene) has replaced iron because it is more flexible and does not rust.

Give another example of a new material that has replaced an old material for the manufacture of an article, and explain its advantage.

Name of article .....

Old material .....

New material .....

Advantage of new material .....

..... [3]

[Total: 7]

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3 In some countries a 'slash and burn' method of agriculture is used. Areas of tropical rain forest are cleared by cutting down and burning the trees. Crops are then grown on the cleared land.

(a) At first the crops grow well on the cleared land, but after a few years they grow poorly.

They do not have enough nitrogen.

(i) Plants need nitrogen to make protein.

Which other **two** elements are present in protein.

Put a (ring) around each correct answer.

argon **calcium** **carbon** **fluorine** **hydrogen** **potassium** [2]

(ii) Suggest why the crops do not have enough nitrogen.

.....

.....

..... [2]

(iii) Describe one effect slash and burn agriculture may have on local climate.

.....

..... [1]

(b) In many other countries slash and burn agriculture is not used.

Farmers add artificial fertilisers to their soil, and grow crops on the same land for many years.

Why do the crops grow well on this land even after many years.

.....

..... [1]

[Total: 7]

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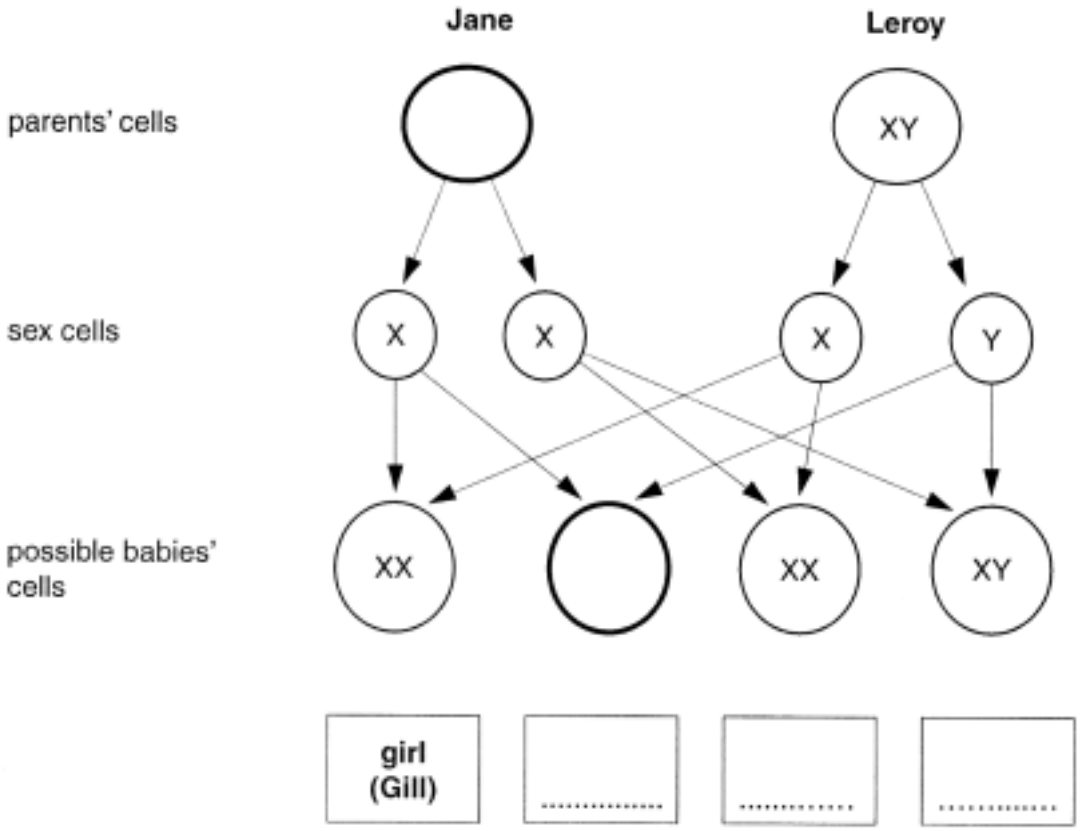
4 **(a)** Jane and Leroy have a baby girl called Gill.

Gill is a girl because each of her cells has two X chromosomes.

The diagram shows how Gill inherited these sex chromosomes from Jane and Leroy.



(i) On the diagram, write the correct pairs of sex chromosomes in each of the two blank circles. [2]

(ii) Finish the diagram by writing **boy** or **girl** in each of the three boxes to show the gender of the other possible babies that could have been produced by Jane and Leroy. [2]

(b) Read the following passage about thalassemia.

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> Thalassemia is a genetic **condition**. People who have thalassemia cannot make enough of the **protein** called haemoglobin. The condition is caused by a recessive allele. This means that only people who have two affected **alleles** have the condition. It also means that people can be **carriers**.

Finish these sentences. Choose from the words written in **bold** in the passage.

You may only use each word once.

A gene codes instructions for a type of chemical called a .....

Different versions of a gene are called .....

People whose cells all have one affected allele but who do not have the condition are called ..... [3]

[Total: 7]

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5 This question is about heart disease.

(a) Describe how changes in the heart can lead to a heart attack.

.....

.....

..... [2]

(b) Scientists carry out an investigation to see if there is a link between gum disease and heart disease.

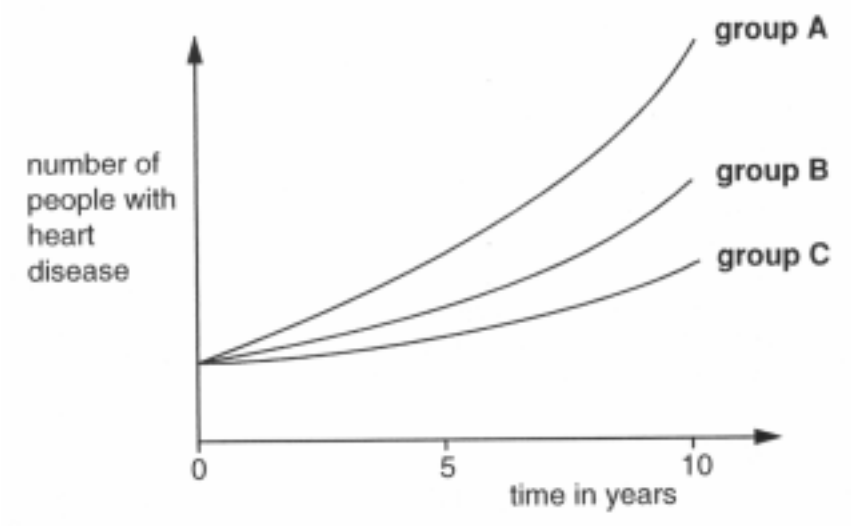
They look at a sample of people and split them into three groups.

Group A has high levels of gum disease.

Group B has average levels of gum disease.

Group C has little gum disease.

They plot the number of people from each group that suffer from heart disease.



Describe the patterns of results shown by the graph.

.....

.....

..... [2]

(c) Two scientists make comments about the investigation.

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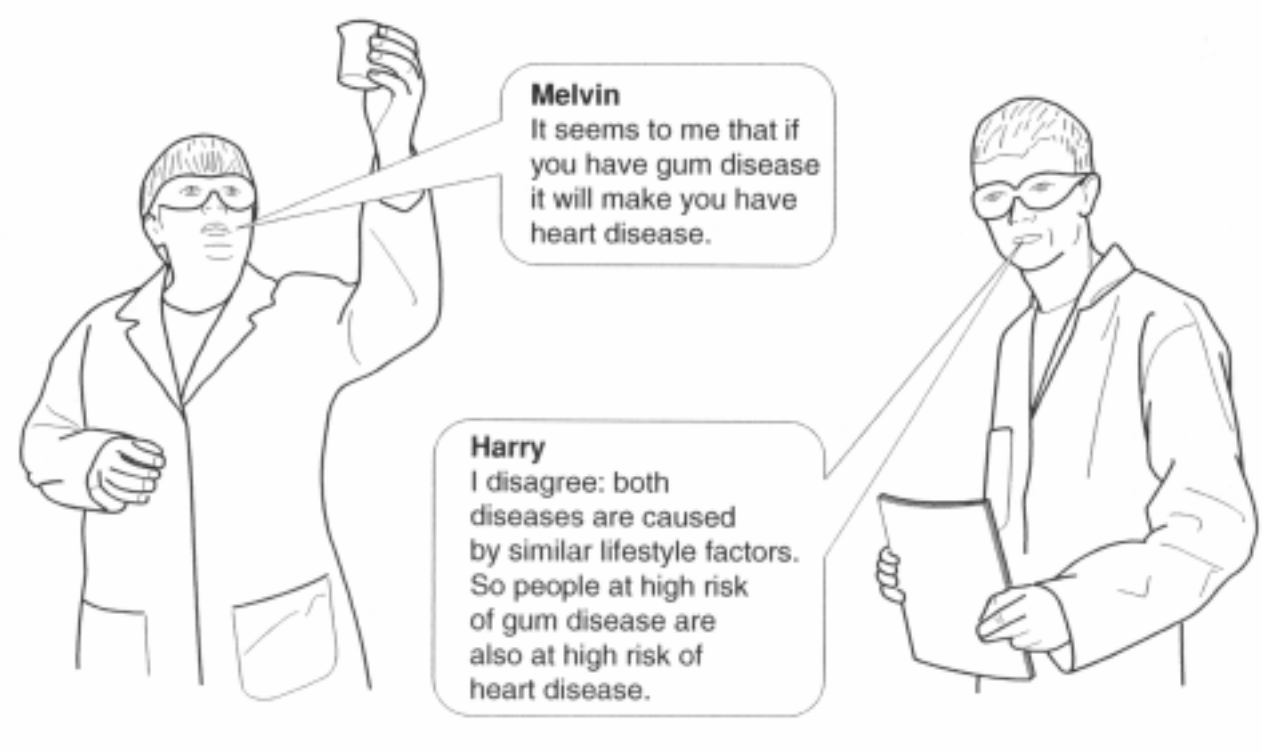

(i) One of these statements matches Melvin's comment.

Write **Melvin** in the box next to this statement.

One of these statements matches Harry's comment.

Write **Harry** in the box next to this statement.

There is a correlation between heart disease and gum disease.	
Having gum disease causes heart disease.	
Having heart disease causes gum disease.	
There is no link between gum disease and heart disease	

[2]

(ii) Certain lifestyle factors make a person more likely to get heart disease.

Write down one of these lifestyle factors.

.....[1]

[Total: 7]

6 The drawings show some species of animal that have become extinct.

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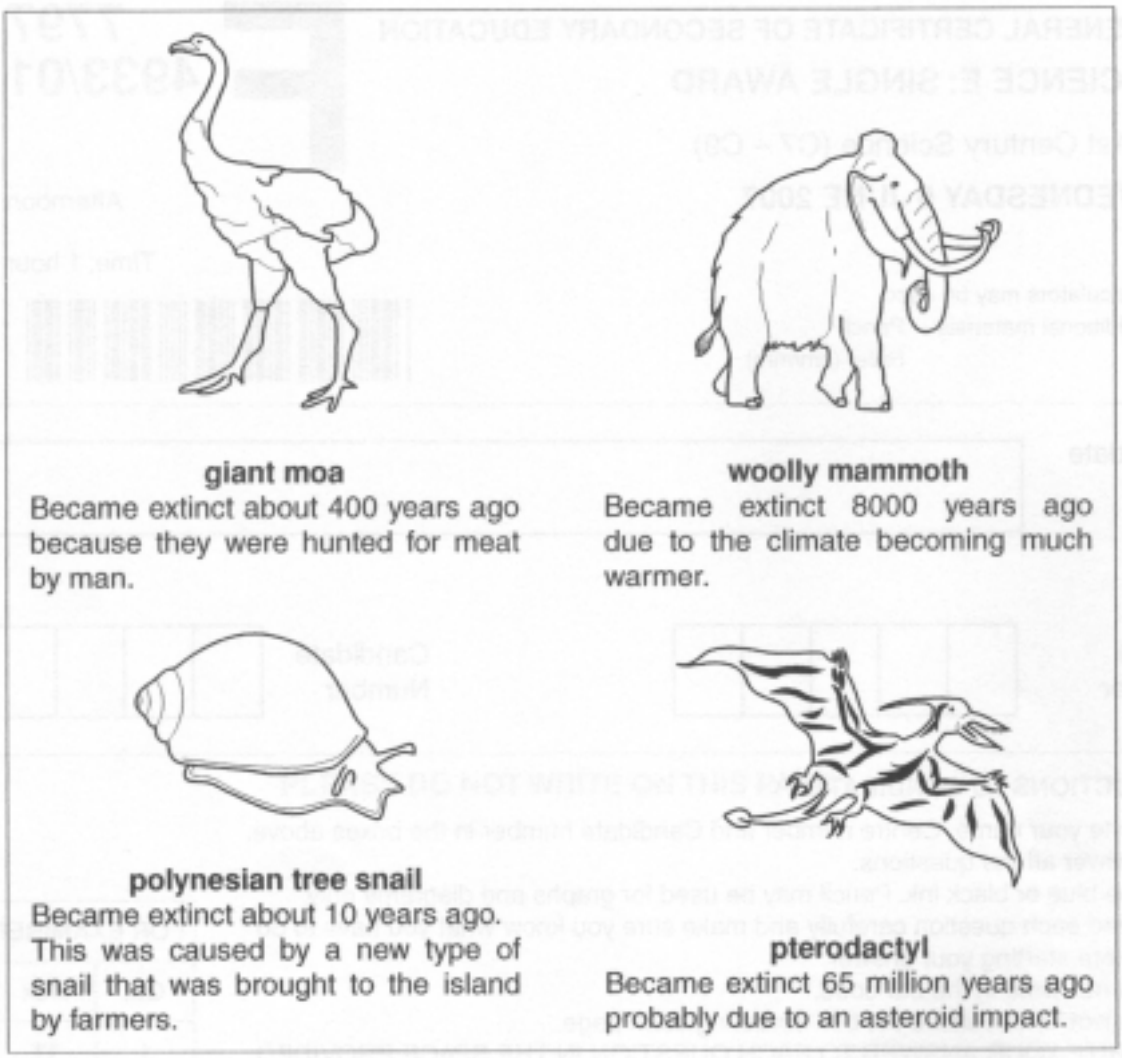

giant moa
Became extinct about 400 years ago because they were hunted for meat by man.

woolly mammoth
Became extinct 8000 years ago due to the climate becoming much warmer.

polynesian tree snail
Became extinct about 10 years ago. This was caused by a new type of snail that was brought to the island by farmers.

pterodactyl
Became extinct 65 million years ago probably due to an asteroid impact.

(a) In the table write the names of the four animals shown in the drawings to show the order in which they became extinct.

first to become extinct	
last to become extinct	

[2]

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(b) Write down the names of **two** animals shown in the drawings whose extinction was caused by human activity.

..... and ..... [1]

(c) The arrival of a new sort of snail caused the extinction of the Polynesian tree snail.

Suggest how the new sort of snail may have caused this extinction.

.....

.....

.....

..... [2]

(d) In 1859 Charles Darwin put forward a set of ideas to explain why new species of plants and animals appear. He called these ideas natural selection.

What name is given to a set of ideas such as natural selection?

Put a (ring) around each correct answer.

conclusion **data** **facts** **theory** [1]

[Total: 6]

7 Not everyone agrees about the age of the Earth. Read this story of how ideas changed and then answer the question.

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How old is the Earth?

James Ussher was Archbishop of Armagh.

In 1645, he followed family histories in the Bible back in time.

He calculated that the Universe was created in the year 4004 BC, on October 23.

By the late 1700s, it was known that rocks eroded.

James Hutton, a Scottish farmer, noticed that Hadrian's Wall had not been eroded very much.

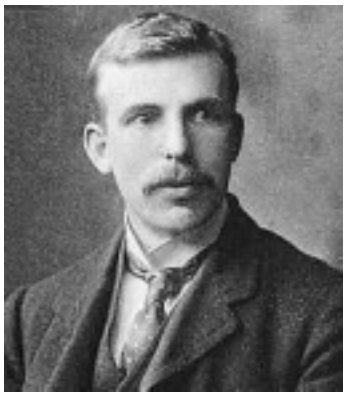
It was made from stone and had been there for over 1000 years.

He said the Earth must be older than Ussher suggested.

By 1897, many people were studying science.

William Thompson suggested that the Earth had once been a ball of molten rock.
He said that it was cooling down gradually by conduction and radiation.

He worked out that it must be between 24 million and 400 million years old.



Radioactivity was discovered in 1896.
In 1905, Ernest Rutherford used radioactive decay of minerals to work out the age of the Earth. He said it was 500 million years old.

Today scientists estimate the age of the Earth as being much older.

The information in the story describes how estimates about the age of the Earth have changed.

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Use your ideas about how science theories are developed to explain how this happened.

.....

.....

.....

.....

..... [3]

[Total: 3]

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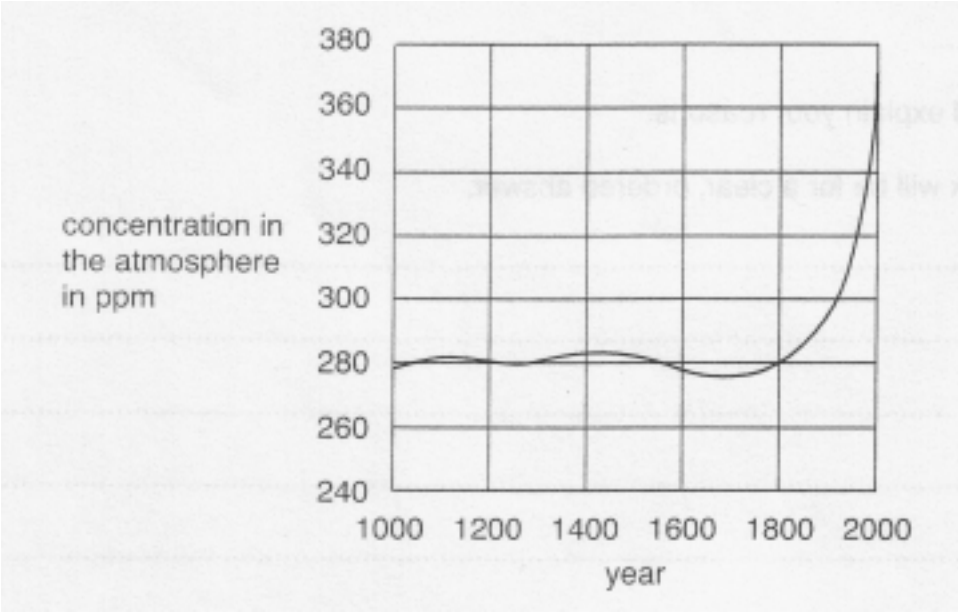
8 This question is about changes in the world climate.

(a) The graph shows how levels of carbon dioxide in the atmosphere have changed during 1000 years.



(i) Complete these sentences to describe the graph.
Choose the **best** words from the list.

decreased **increased** **remained steady**

Between 1000 and 1700, the level of carbon dioxide .....

Between 1200 and 2000, the level of carbon dioxide ..... [2]

(ii) Explain why the carbon dioxide levels have changed since 1700.
Use your ideas about the carbon cycle in your answer.

.....

.....

..... [2]

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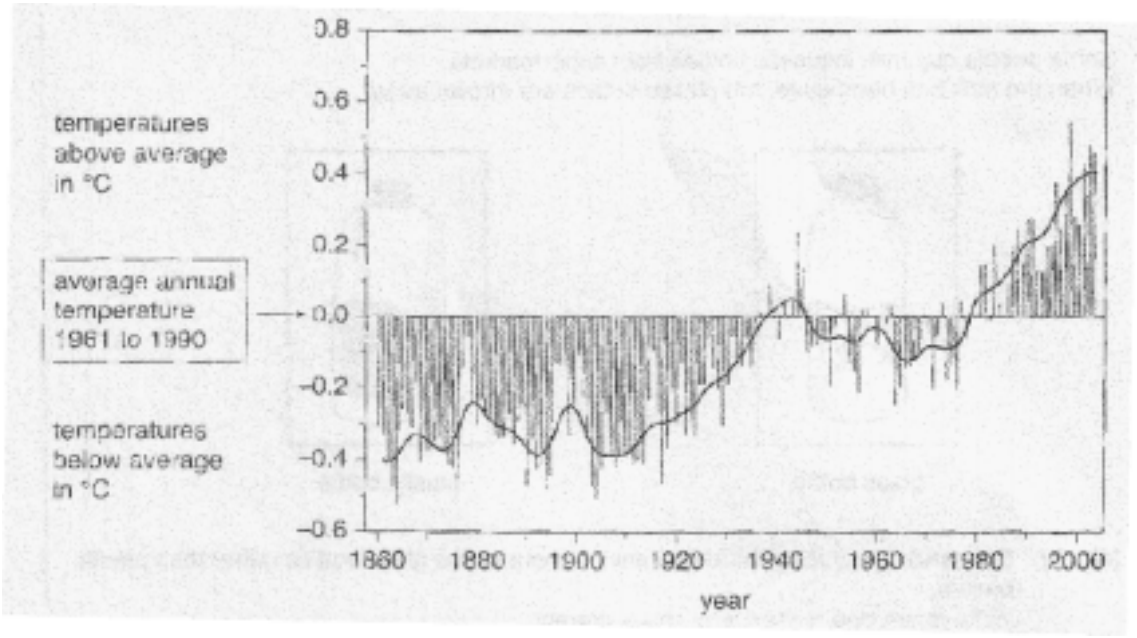
(b) The graph shows how the average global temperature has changed from 1860 to 2003.



Complete these sentences to describe the graph.
Choose the **best** words from the list,

decreased **increased** **not changed** **varied**

Overall, the average temperature between 1860 and 2003 has .....

From one year to the next, the average temperature has ..... [2]

(c) Many scientists believe that the increase in temperature is due to the increase in carbon dioxide in the atmosphere.

Discuss whether you think the two graphs in part (a) and part (b) support that idea.

Use ideas about correlation in your answer.

.....

.....

.....

..... [3]

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(d) Scientists predict that, as the average global temperature increase, sea levels will rise.

(i) Suggest **one** reason why sea levels will rise as the temperature rises.

.....

..... [1]

(ii) Suggest **one** effect rising sea levels will have on some countries.

.....

..... [1]

[Total: 11]

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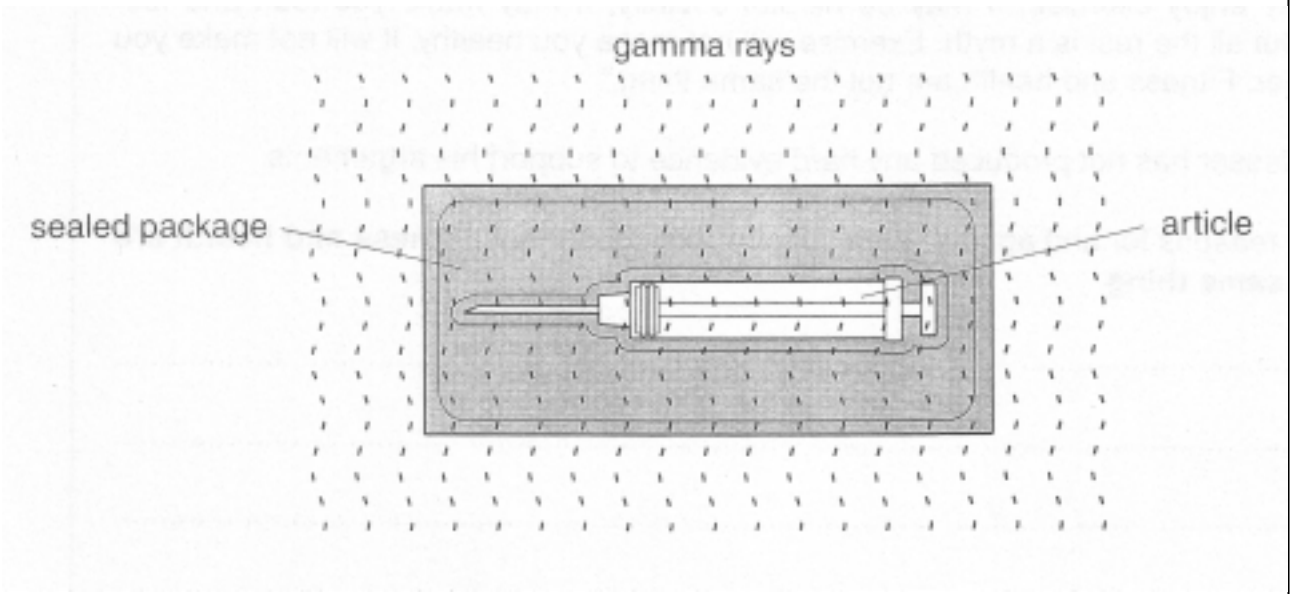
9 Many medical products are sterilised using gamma radiation. The radiation passes through packaging to sterilise the product inside.



(a) Radioactive materials emit three different types of radiation. One type is gamma radiation.

Name the other **two** types.

1. .....

2. ..... [2]

(b) What property of gamma rays makes them suitable for sterilising medical products?

.....

..... [1]

(c) The sterilising process takes place in a box made of reinforced concrete, two metres thick.

Explain why the concrete box is necessary.

.....

..... [1]

For Examiner's Use

(d) A radioactive source commonly used is cobalt-60.

This has a half-life of 5.26 years..

Explain what is meant by saying that cobalt-60 has a **half-life** of 5.26 years.

.....

.....

..... [2]

[Total: 6]

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