UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

21ST CENTURY SCIENCE **0608/04**

Paper 4 **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

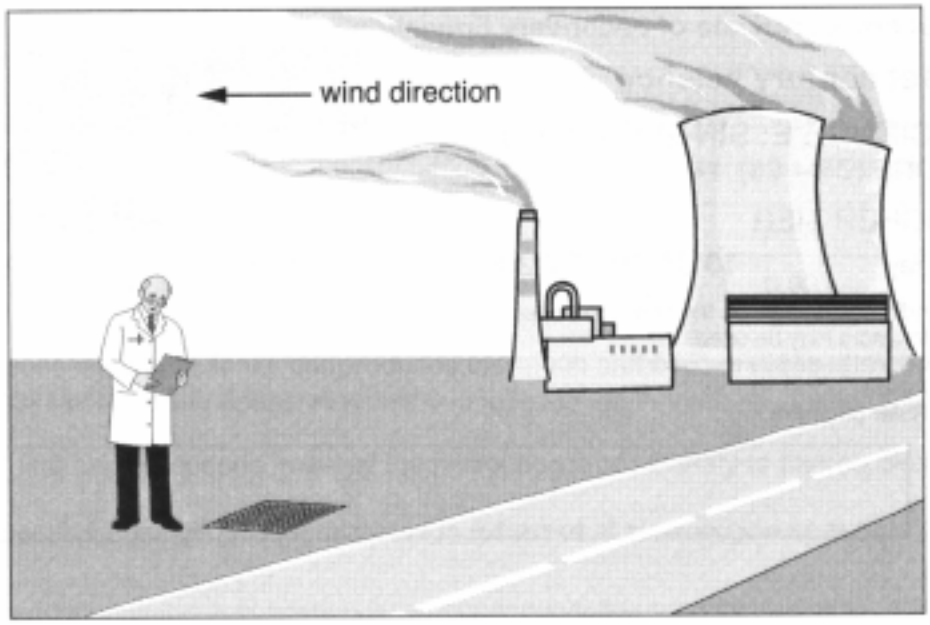
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **17** printed pages and **1** blank page.

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



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

(a) A scientist investigates the effect of sulfur dioxide released from the power station on plants. He counts the number of plant species 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 thinks that sulfur dioxide is the cause of the reduction in plant s close to the power plant.

What further evidence would support this causal link?

.....

..... [1]

(b) 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 took a number of measurements and worked out the average instead of making just one measurement.

.....

..... [1]

(ii) He found that there are more plant species immediately outside the power plant than there are 5 km away.

Suggest an explanation for this.

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..... [2]

(iii) The scientist takes a second set of measurement immediately outside the power plant on a different day.

measurement number	1	2	3	4	5	mean value
number of plant species in $1m^2$	9	11	9	11	10	10

He decides that there is not a significant difference between the sets of results taken on these two days.

Explain how the results show this.

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..... [2]

[Total: 7]

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

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

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

The outcomes of Life Cycle Assessments (LCA) for these two products are different.

Explain why.

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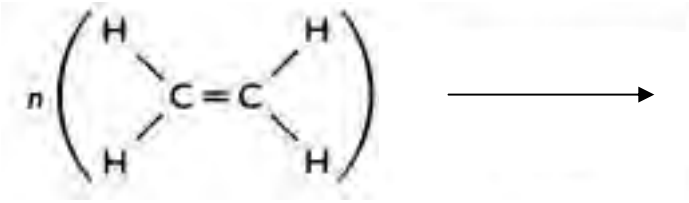
(b) Complete this equation to show the formation of poly(ethene) from ethene.



[2]

(c) 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]

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

Suggest why the crops do not have enough nitrogen.

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..... [2]

(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.

(i) Artificial fertilisers provide plants with nitrogen.

Name two other essential elements provided by artificial fertilisers.

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

(ii) Suggest why farmers who use slash and burn agriculture do not use artificial fertilisers instead.

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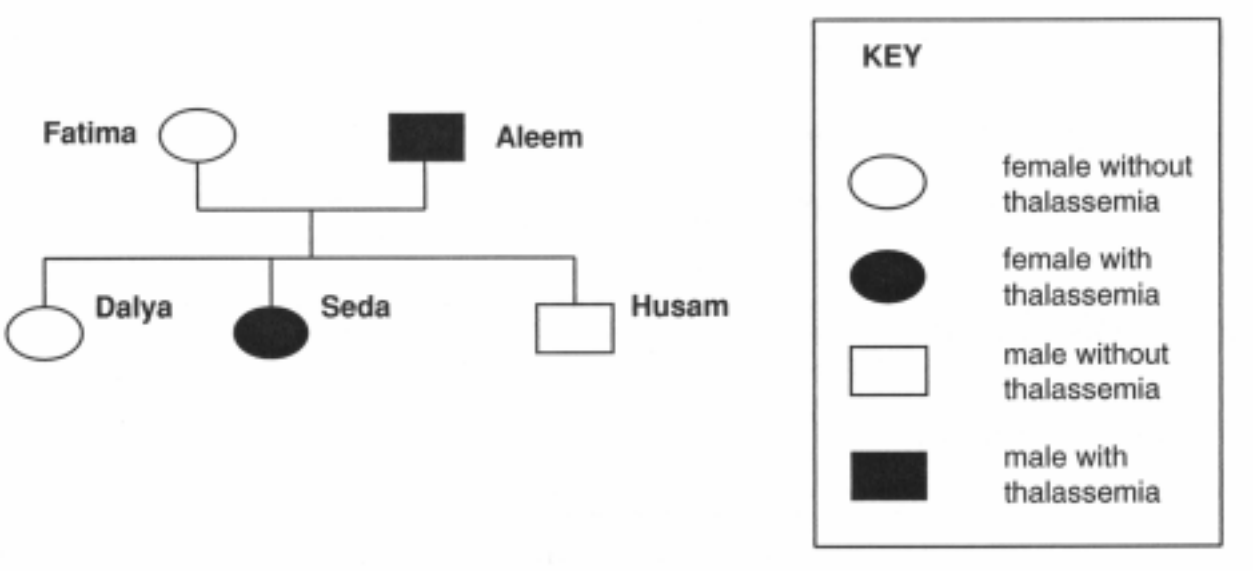
..... [2]

[Total: 6]

4 Thalassemia is a genetic condition. People who have thalassemia cannot make end… 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.

(a) Dalya is looking at her family tree.



(i) Dalya is a carrier for thalassemia.

Explain how you can tell this from her family tree.

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..... [2]

(ii) Dalya is married to Theodor, who is also a carrier for thalassemia.

What is the chance of Dalya and Theodor having a child with thalassemia?

Show by means of a suitable diagram how you work out your answer.

[2]

(b) Thalassemia is far more common in Cyprus than in many other countries.
To try to reduce the number of people with the condition a rule was introduced.
Before two people can be married they have to be tested to see if they are carriers f
thalassemia.

After the rule had been used for a few years there were very few carriers of thalassemia in Cyprus. Explain why.

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..... [2]

[Total: 7]

5 This question is about heart disease.

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

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.....

..... [2]

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

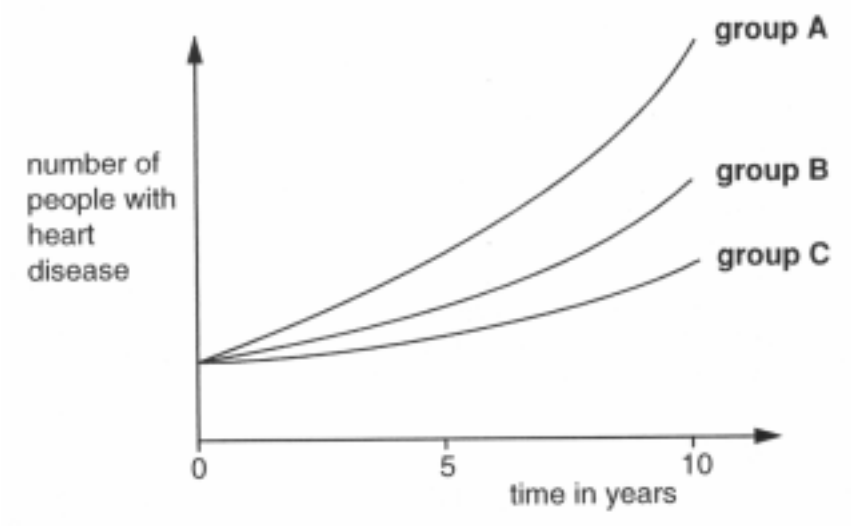
They look at a sample of people and split them into three groups.

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 pattern of results shown by the graph.

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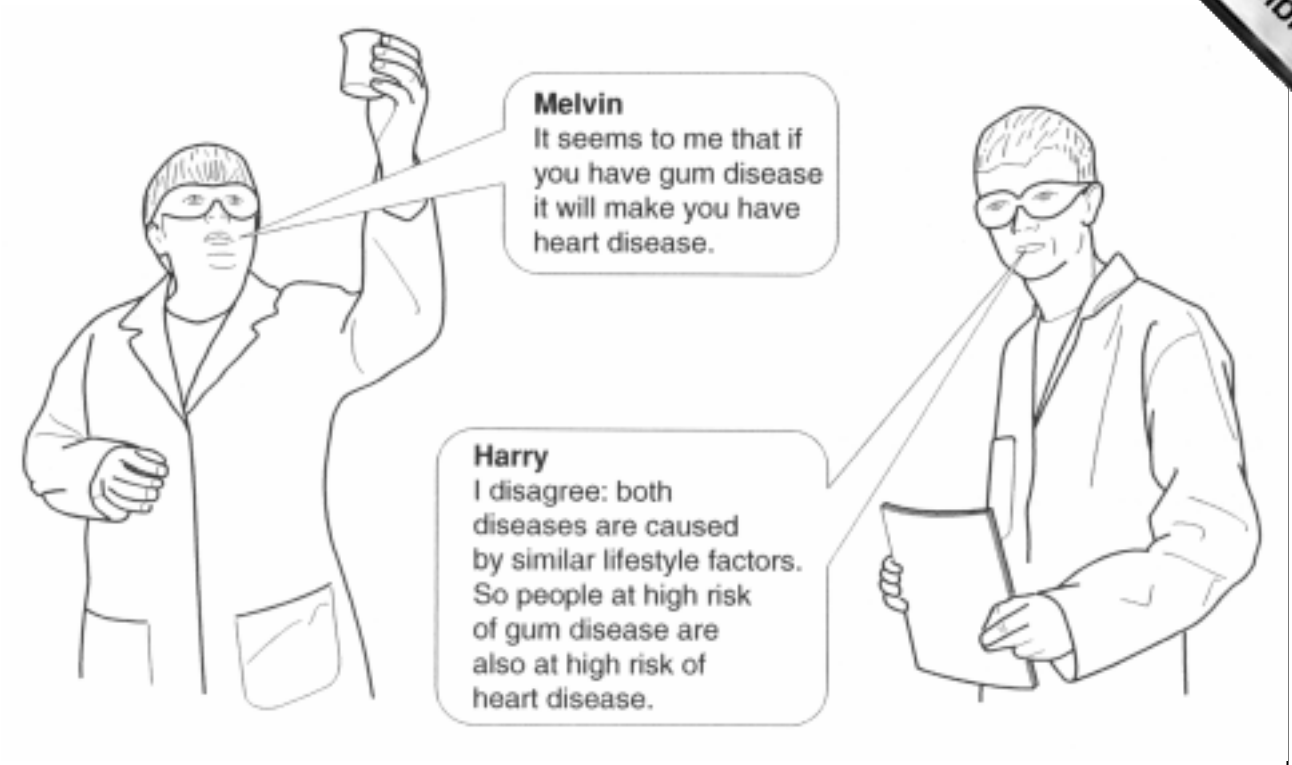
(c) Two scientists make comments about the investigation.



(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 Read this passage about chimpanzees

It is generally agreed that humans and chimps shared a relative about six million years ago. Since then they have evolved differently.

Scientists have looked at both chimp and human DNA.

Over the last six million years changes to the DNA occurred when it was copied.

Some of these changes have led to the differences between chimps and humans.

(a) In each of the boxes write words that match ideas used in the passage.

Choose words from this list.

common ancestor **competitor** **hominid** **mutation**

natural selection **radiation** **selective breeding**

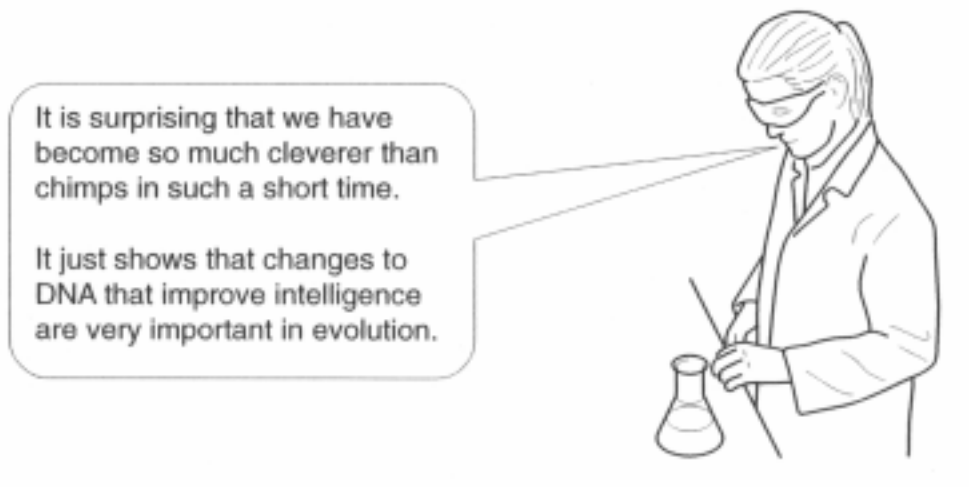
a change happening to DNA when it is copied	
a relative shared by man and chimp	
a theory that explains how humans and chimps could have evolved	

[3]

(b) Scientists have now found that humans are evolving much slower than chimps.

They think that this is because it takes about twice as long for a human to be o enough to mate compared with a chimp.

A scientist said:



Explain why changes that increase intelligence are favoured by evolution.

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..... [2]

(c) Look at these sentences about chimps and humans.

Write the letter E for an explanation or D for data in each box to show which sentences describe an explanation and which describe data.

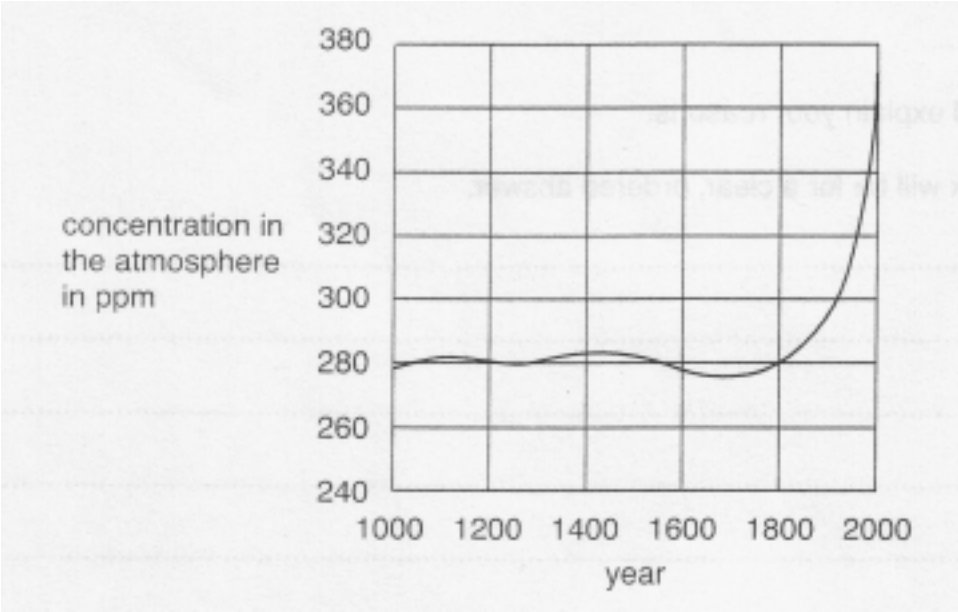
chimp DNA and human DNA is 99.4% the same	
chimps and humans were produced by evolution	
chimps can mate at an earlier age than humans	

[2]

[Total: 7]

7 This question is about changes in the world climate.

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



Use your ideas about the carbon cycle to describe **and** explain how the carbon dioxide levels have changed since 1700.

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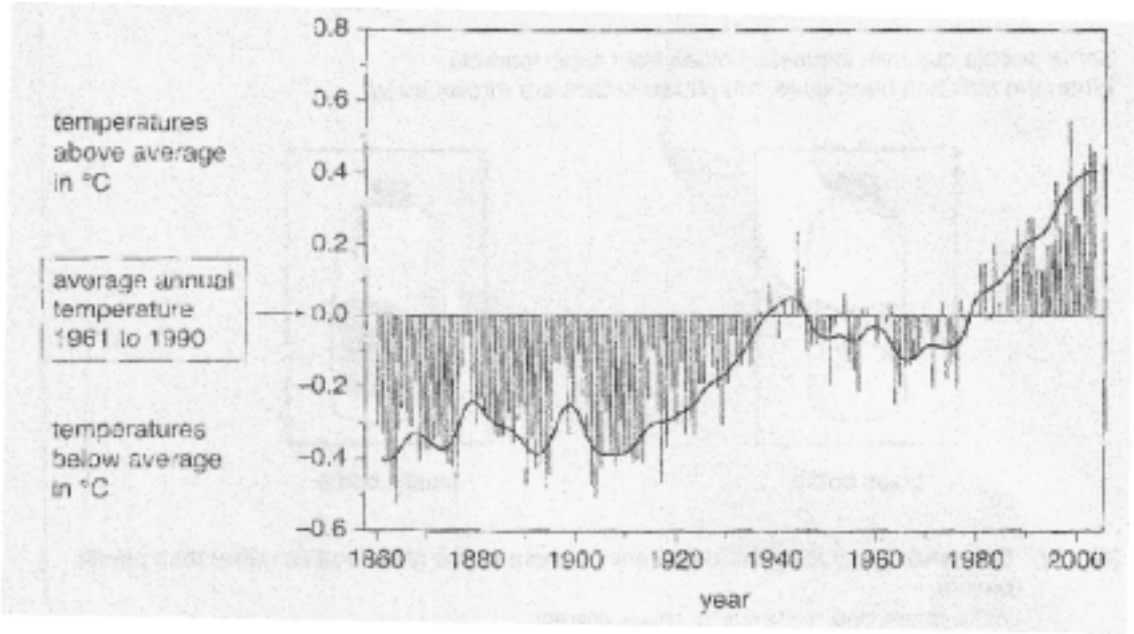
..... [3]

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



Write down three facts about changes in the average global temperature since 1

For iner's

1. .....

2. .....

3. ..... [3]

(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.

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..... [3]

(d) Scientists predict that, as the average global temperature increase, the sea levels across the world will be affected.

Explain why sea levels might change and suggest one effect this change may have on some countries.

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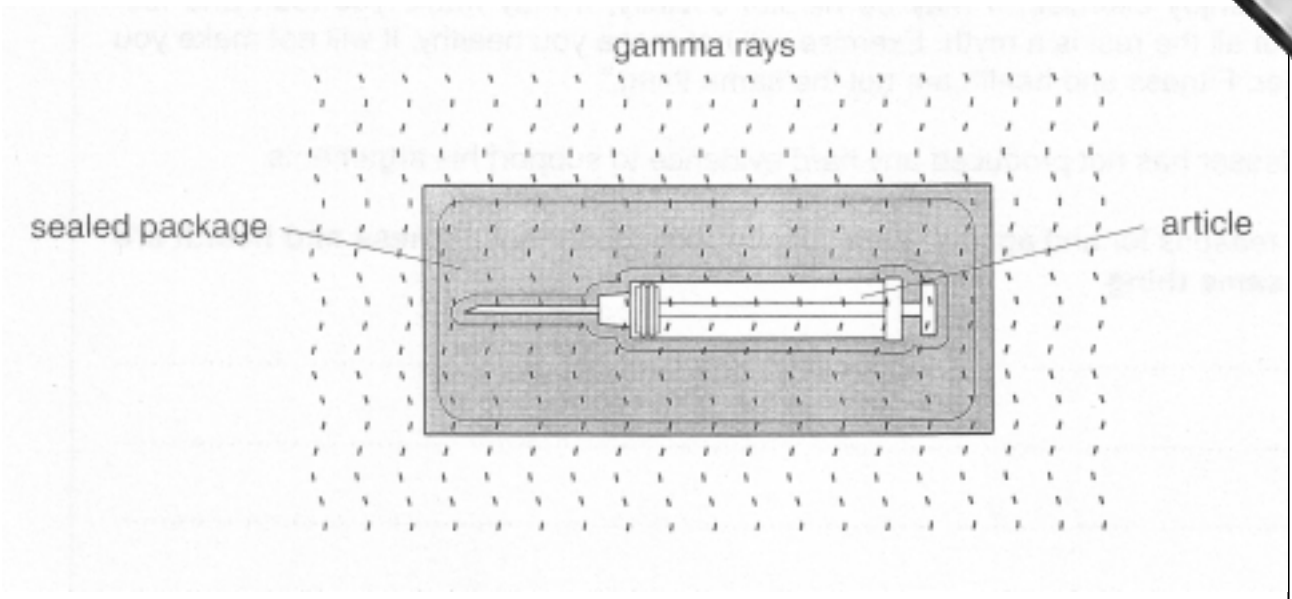
..... [2]

[Total: 11]

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



(a) Explain why gamma rays are more suitable for sterilising medical products than alpha or beta particles?

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..... [2]

(b) **(i)** 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.

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..... [2]

(ii) Another radioactive source, iron-59 also emits gamma radiation. It has a hal
45 days.

Use your ideas about half-life to suggest why iron-59 would be less suitable as the
course of gamma radiation for sterilisation.

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..... [2]

[Total: 6]

9 Not everyone agrees about the age of the Earth. Read this story of how ideas chang… then answer the question.

For …iner's

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.

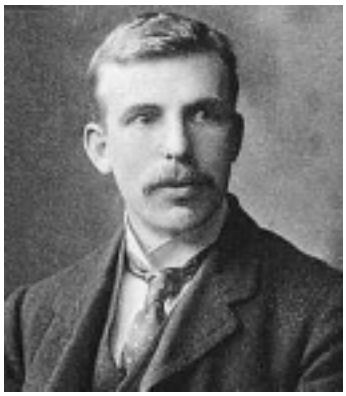
It was made from stone and had been there for over 1000 years.

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 changed.

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

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..... [3]

[Total: 3]

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