UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1706611984

TWENTY FIRST CENTURY SCIENCE **5131/02**

Paper 2 **October/November 2010**

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.
DO **NOT** WRITE IN ANY BARCODES.

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 **16** printed pages and **4** blank pages.

For Examiner's Use

1 Sickle cell anaemia is a genetic condition caused by a recessive allele.

(a) (i) What is the main symptom of sickle cell anaemia?

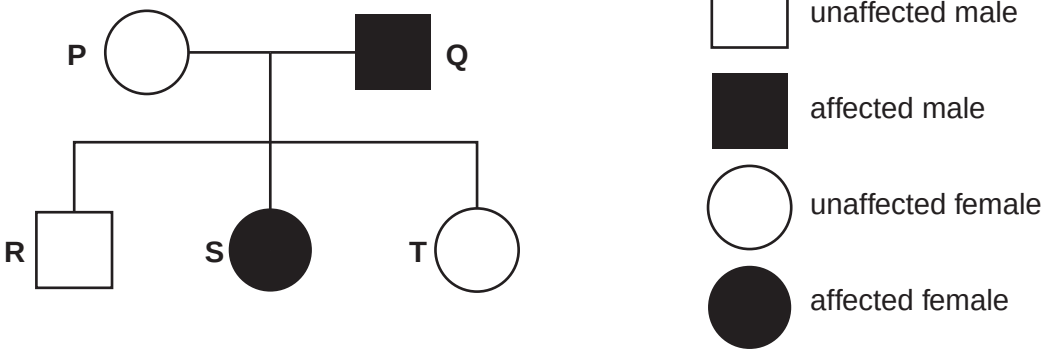
.....[1]

(ii) Explain why people with sickle cell anaemia have this symptom.

.....

.....[1]

(b) The diagram of a family tree shows the inheritance of sickle cell anaemia.



T marries a man, **M**, who has sickle cell anaemia.

What is the probability that their first child will have sickle cell anaemia?

Complete the diagram below to show how you worked out your answer.
Use **a** for the recessive allele for sickle cell anaemia and **A** for the dominant allele.

	Mother (**T**)	
	A	**a**
Father (**M**)		

Probability = ... [3]

(c) People can have a genetic test for the recessive allele that causes sickle cell anaemia. This testing has ethical implications.

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(i) Suggest **one** reason why someone might want to be tested.

.....

..... [1]

(ii) Suggest **one** reason why someone might **not** want to be tested.

.....

.....

..... [1]

[Total: 7]

2 Scientists are always developing new drugs. This can take many years of research and testing.

For Examiner's Use

(a) Give **two** reasons why all new drugs must be tested before they can be given to the general public.

1. .....

.....

2. .....

.....[2]

(b) Look at the statements **A**, **B**, **C** and **D**.

They describe the four stages of testing used in drug development.

They are in the wrong order.

A tests on humans with the illness

B tests on animals

C tests on human cells in the laboratory

D tests on healthy human volunteers

Write a letter, **A**, **B**, **C** or **D**, in each box to put the statements in the correct order.

[1]

(c) A double-blind human trial can be used to test a new medical treatment.

Describe how a double-blind human trial is carried out.

.....

.....

.....

.....

.....

.....[3]

[Total: 6]

For Examiner's Use

3 **(a)** **(i)** The first living things evolved from simple molecules.

What could these simple molecules do which made evolution possible?

.....[1]

(ii) Fossils provide scientists with evidence for evolution taking place.

Suggest another way in which scientists have obtained evidence for evolution.

.....

.....[1]

(b) Read the sentences about Lamarck. Lamarck was a French scientist who suggested an explanation for evolution before Charles Darwin.

1. He observed that all living things were different from each other.

2. He suggested that the characteristics of living things changed during their lifetime.

3. He believed that a giraffe stretches up to reach leaves high in the trees and this causes their necks to become longer.

4. He suggested that the giraffe passes the characteristic of a long neck to its offspring.

(i) Which of the sentences, **1**, **2**, **3** and **4**, agree with Charles Darwin's ideas about evolution due to natural selection?

..... [1]

(ii) Describe Darwin's theory of evolution.

.....

.....

.....

.....

.....[3]

(iii) Suggest why some people were reluctant to accept Darwin's explanation for evolution when he first proposed it.

.....

.....

.....[1]

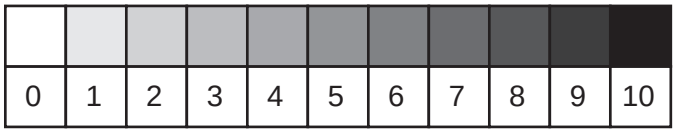
[Total: 7]

4 When diesel fuel is burned in a vehicle engine, very small particles of carbon, called particulates, are released into the air.

Scientists compare the level of air pollution by particulates next to a quiet country road and in the centre of a city.

They use apparatus that passes air through a paper filter. The particulates turn the paper from white to grey.

The scientists then match the grey colour of the filter with one on a card printed with shades of grey between 0 (white) and 10 (black).



Their results are shown in the table.

	shade of grey						
	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	mean
city centre	6	5	4	9	5	5	
country road	2	1	1	3	2	3	2

(a) (i) To increase the reliability of their best estimates for the level of air pollution by particulates, the scientists take several measurements at each location.

How does this make their best estimates more reliable?

.....

.....

.....

..... [2]

(ii) The scientists' measurements are not all the same at each location.

Suggest **one** reason why the measurements in each set of results are not identical.

.....

..... [1]

(iii) The scientists get a best estimate for the level of air pollution by particulates next to the country road. They do this by calculating the mean (average) of the results.

Work out a best estimate for the level of air pollution by particulates in the city centre.

best estimate = ...[2]

(b) (i) The scientists conclude that there is a **real difference** between the level of air pollution by particulates next to the country road and in the city centre.

How do the results show this?

.....

.....[1]

(ii) Particulates do not stay in the air forever.

What happens to these particulates?

.....

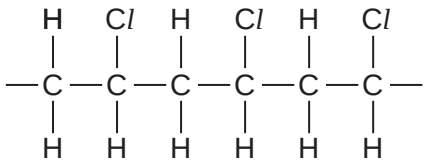
.....[1]

[Total: 7]

5 PVC is made by the polymerisation of the monomer chloroethene, C_2H_3Cl, also known as vinyl chloride.

For Examiner's Use

Part of a chain of the polymer PVC is shown below.



(a) Explain what is meant by the term *polymerisation*.

.....

.....

.....[2]

(b) Draw a diagram to show the structure of chloroethene (vinyl chloride).

[1]

(c) A chemical can be added to PVC to make it more flexible. Flexible PVC sheeting can be made to look like leather. This 'artificial leather' is used to make shoes, handbags and briefcases.

(i) What type of chemical is added to PVC to make it more flexible?

.....[1]

(ii) Suggest how adding this chemical makes the PVC more flexible.

Use ideas about the forces between molecules in your answer.

.....

.....

.....[1]

(d) PVC is also used to make rigid window frames.

For Examiner's Use

The outcome for a Life Cycle Assessment for PVC 'artificial leather' is different from the outcome for a Life Cycle Assessment for PVC window frames.

Suggest and explain **one** difference in the Life Cycle Assessments for these two uses of the same material.

.....

.....

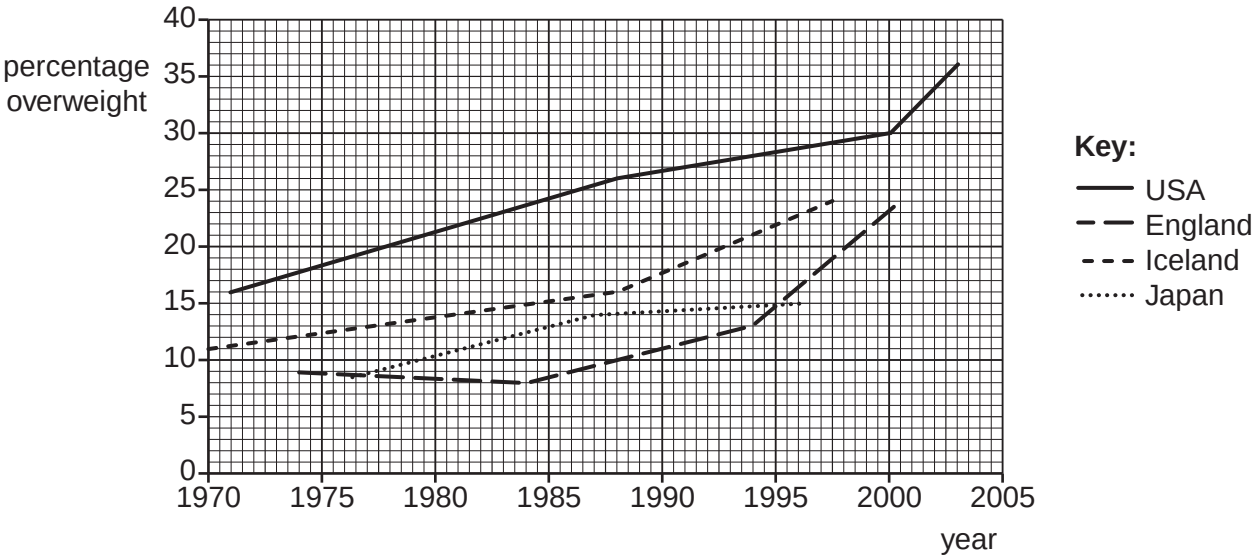
.....

.....[2]

[Total: 7]

6 Childhood obesity is a problem in many countries. The graph shows how childhood obesity increased in four countries over a period of time.

For Examiner's Use



(a) (i) Describe what is meant by a *balanced diet*.

.....

.....

.....

.....[2]

(ii) Suggest what food types in the diet of children in these four countries may be helping to cause their obesity.

.....

.....

.....

.....[2]

(b) In these four countries the number of adults who have heart disease is increasing.

The link between obesity and heart disease is well established.

Despite this fact many adults remain obese.

Suggest two reasons why these people are willing to accept this increased risk of getting heart disease.

1. .....

.....

2. .....

.....[2]

[Total: 6]

For Examiner's Use

7 In 1912, Alfred Wegener presented his idea of continental drift.

For Examiner's Use

(a) (i) What is meant by *continental drift*?

.....

..... [1]

(ii) Wegener had evidence to support his theory.

Write down two facts that supported Wegener's theory.

1. .....

.....

2. .....

..... [2]

(iii) Most scientists did not believe Wegener's theory in 1912.

Explain why these scientists did not accept Wegener's theory.

.....

..... [1]

(b) Wegener's theory is now accepted. The Earth's crust is made up of tectonic plates.

Scientists use the theory to understand where earthquakes are likely to happen.

(i) Where are earthquakes most likely to happen?

..... [1]

(ii) Understanding where earthquakes happen allows governments to prepare for them before they happen.

Suggest and explain two actions that governments could take to reduce the damage caused by earthquakes.

1. .....

.....

2. .....

..... [2]

[Total: 7]

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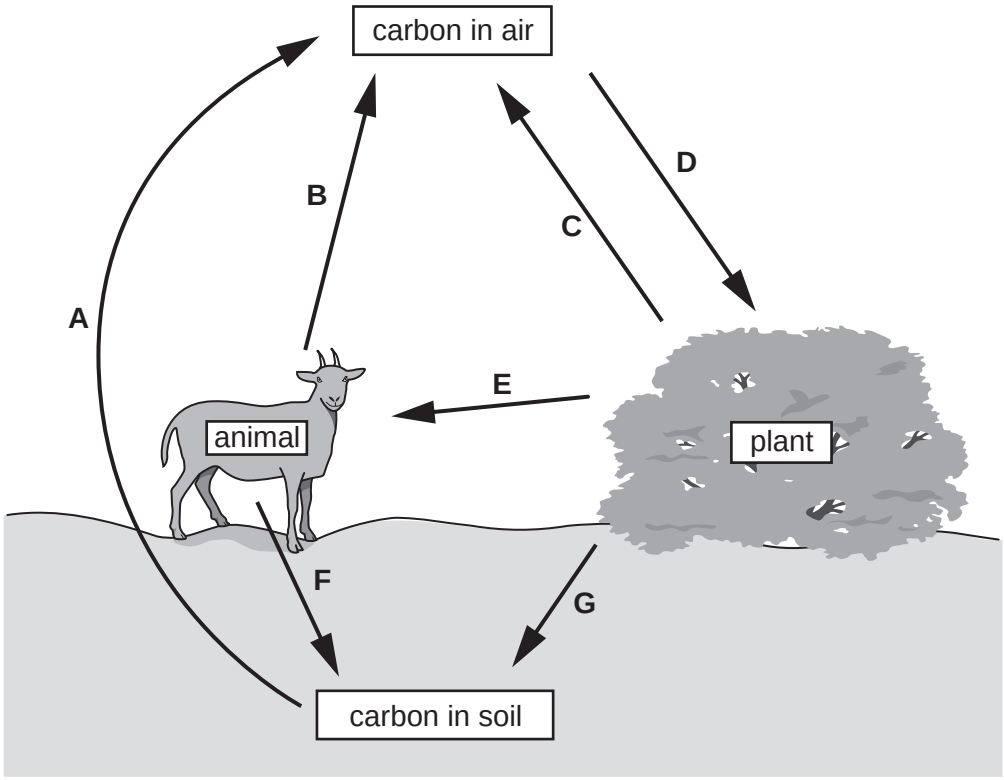
QUESTION 8 IS ON PAGE 14

8 This question is about carbon dioxide in the Earth's atmosphere.

The diagram shows part of the carbon cycle, with processes labelled with the letters **A** to **G**.



(a) Use the letters **A** to **G** from the diagram to answer the following questions.

(i) Which process is photosynthesis?

.....[1]

(ii) Which processes are respiration?

.....[1]

(b) Use the letters **A** to **D** from the diagram to explain why the amount of carbon dioxide in the atmosphere stayed constant for thousands of years.

.....

.....

.....

.....[2]

For Examiner's Use

(c) Most scientists agree that

- the amount of carbon dioxide in the atmosphere is increasing,
- the average global temperature is increasing.

However, some of these scientists do not believe that human activities are causing global warming.

Explain why some scientists accept that global warming is taking place, but are not convinced that human activities are the cause.

Use ideas of **correlation** and **cause** in your answer.

.....

.....

.....

.....

..... [2]

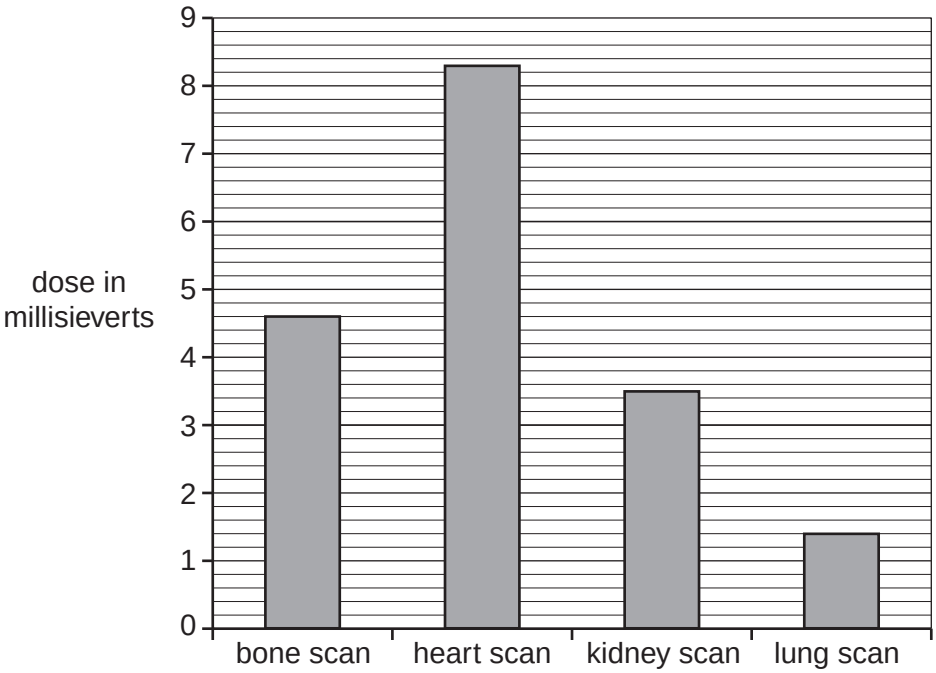
[Total: 6]

For Examiner's Use

9 This question is about the risk to patients and staff in hospitals due to radioactive materials.

For Examiner's Use

(a) The bar chart shows the typical dose that a patient gets from different treatments.



(i) Write down the dose received in a bone scan

..... millisieverts [1]

(ii) Each of these treatments involves injecting a radioactive chemical into the body.

A heart scan and a lung scan give the patient quite different doses of radiation.

Suggest two reasons for this.

Your answer should consider the type and amount of radioactive chemical used and the time it is in the body.

1. .....

2. ..... [2]

(b) Explain why the patient may be willing to have the heart scan, even though radiation may be dangerous.

Use ideas about **risk** and **benefit** in your answer.

.....

.....

.....

..... [2]

(c) Bina works in the nuclear medicine department of a hospital.

For Examiner's Use

Because Bina works with radioactive materials, she gets regular doses of radiation.

The hospital must make sure that Bina's health is not affected by radiation.

Suggest and explain **one** way in which the hospital can do this.

.....

.....

.....

..... [2]

[Total: 7]

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