



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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TWENTY FIRST CENTURY SCIENCE

0608/04

Paper 4

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.

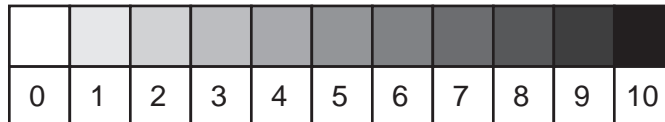


- 1 When diesel fuel is burned in a vehicle engine, very small particles of carbon, called particulates, are released into the air.

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						mean
	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	
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) 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) A second group of scientists carry out a similar investigation and obtain similar results.

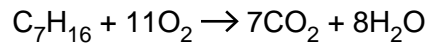
Explain why it is important that they obtain similar results.

.....
 [1]

- (c) During complete combustion of hydrocarbons, carbon dioxide and water are the only products.

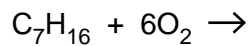
One of the hydrocarbons in petrol is heptane, C_7H_{16} .

This equation shows the complete combustion of heptane.



In a car engine some incomplete combustion takes place, producing carbon monoxide and carbon instead of carbon dioxide.

Complete this balanced equation to show this incomplete combustion of heptane



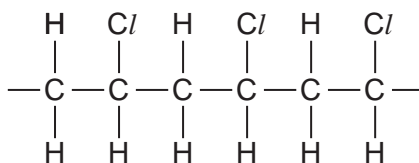
[2]

[Total: 8]

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

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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) Flexible PVC sheeting can be made to look like leather. This 'artificial leather' is used to make shoes, handbags and briefcases.

Flexible PVC has a plasticiser added to the polymer.

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.

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.

.....

.....

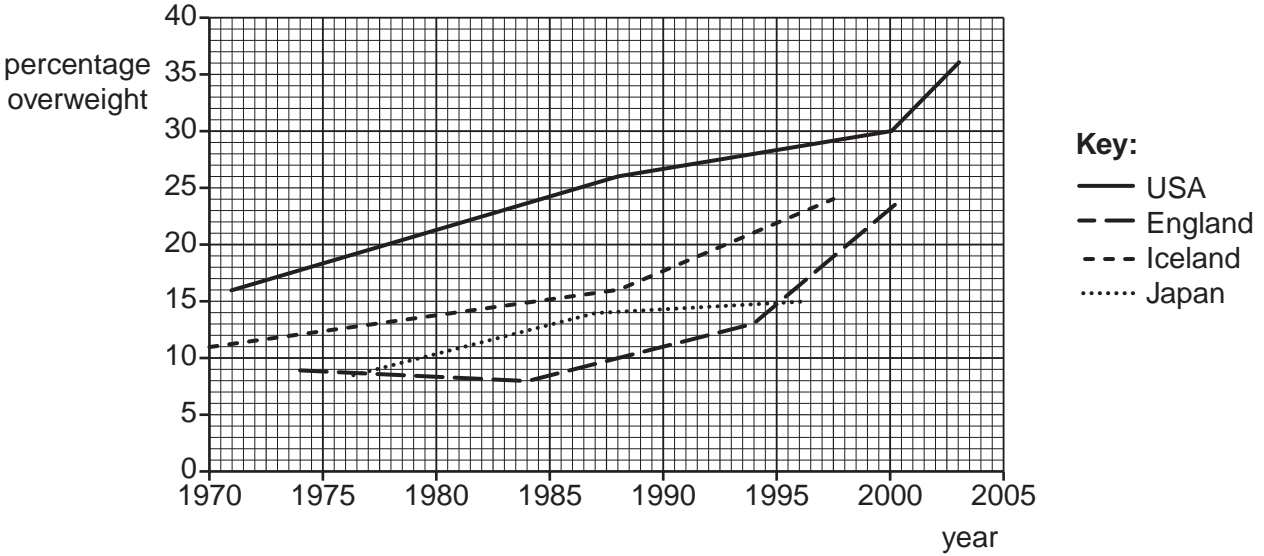
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..... [2]

[Total: 6]

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



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

.....

.....

.....

..... [2]

(b) Obesity is believed to be a cause of heart disease in adults, but not all obese people suffer from heart disease.

Adults can choose their diets.

How can adults use ideas of **risk** and **consequence** to decide whether or not to choose a diet that may cause obesity?

.....

.....

.....

..... [2]

(c) 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]

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

(a) (i) Wegener had evidence to support his theory.

Write down two facts that supported Wegener's theory.

1.

 2.
 [2]

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

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

.....
 [1]

(b) The discovery of seafloor spreading supported Wegener's theory.

Describe the process of seafloor spreading, and explain how it supported Wegener's theory.

.....

 [2]

(c) 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]

5 The first living things on Earth are believed to have evolved from simple molecules.

(a) Describe how fossils have provided scientists with evidence for evolution.

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

(b) Describe Darwin's theory of evolution.

.....
.....
.....
..... [3]

(c) Lamarck was a French scientist who suggested an explanation for evolution before Darwin.

Read these sentences about Lamarck.

1. He observed that all living things were different from each other.
2. He suggested that living things developed new characteristics 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.

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

..... [1]

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

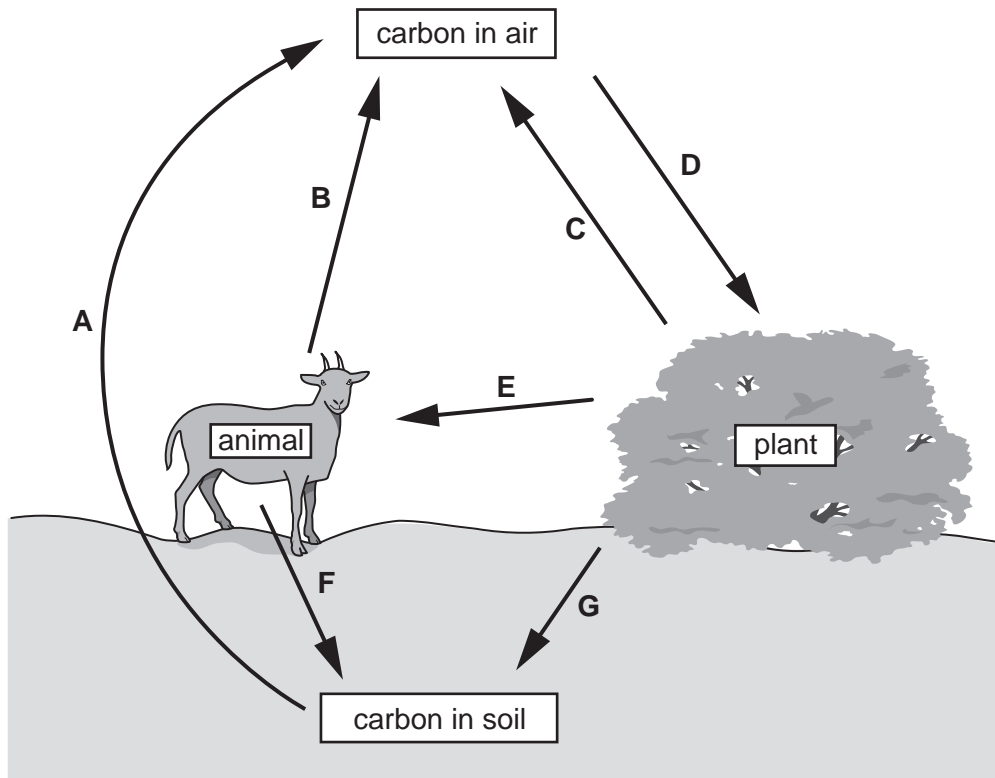
.....
..... [1]

[Total: 7]

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

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



(a) 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]

(b) Human activities have greatly increased the amount of carbon dioxide in the atmosphere during the past two hundred years.

State one activity that has caused this increase.

..... [1]

(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.

.....

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.....

.....

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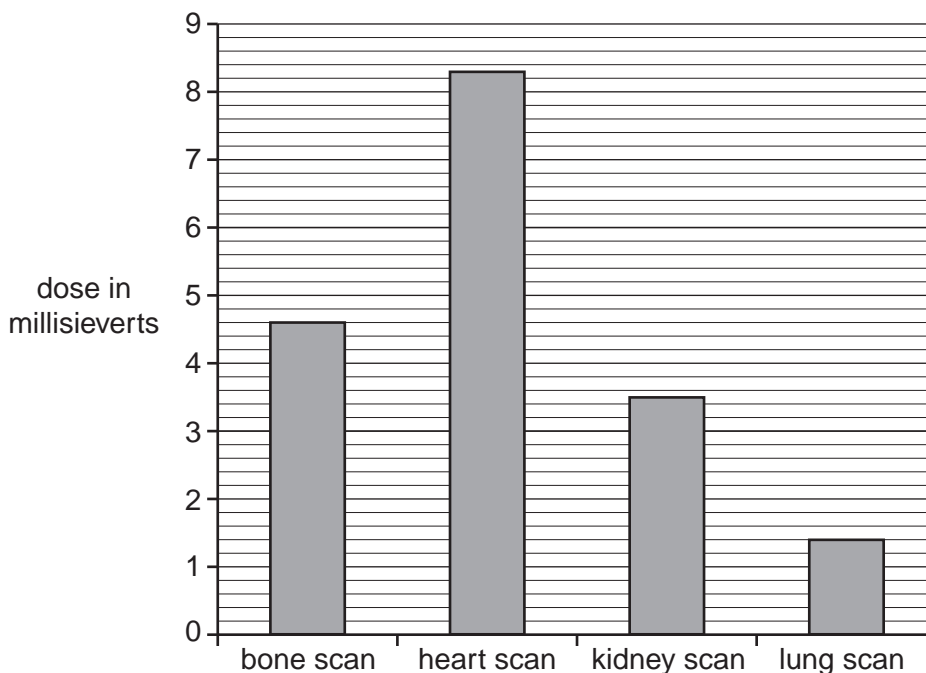
..... [2]

[Total: 5]

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

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



(i) 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]

(ii) Each year, a person receives a dose of 2 millisieverts from all sources of background radiation.

This year, this person has one heart scan as well.

Calculate the dose given by the heart scan as a percentage of her **total** dose for this year.

.....

percentage =% [2]

(iii) 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]

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



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: 8]

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

Alleles are different versions of a gene.

(a) A gene contains instructions for the cell to make chemicals.

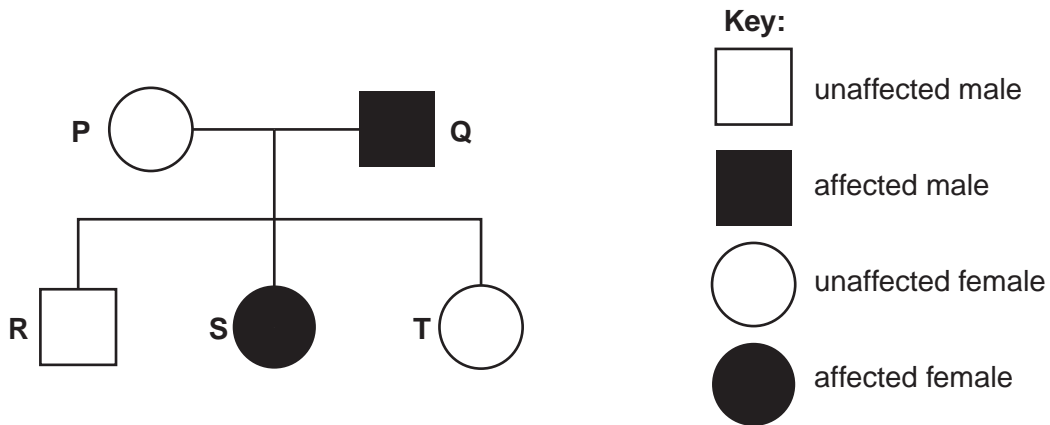
(i) Write down the name of the type of chemical produced.

.....[1]

(ii) State one function of this type of chemical in the body.

.....[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]

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

(a) 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.

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[1]

(b) 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]

(c) When drugs are tested on humans with a serious illness, placebos are not usually used.

Explain why placebos are not used in these human trials.

.....

.....

.....

[2]

[Total: 6]

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