



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

CENTRE  
NUMBER

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**TWENTY FIRST CENTURY SCIENCE**

**0608/04**

Paper 4

**May/June 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.

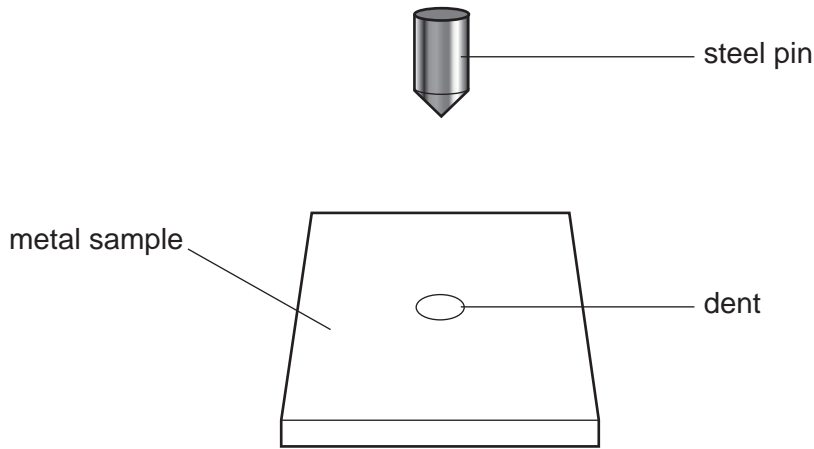
For Examiner's Use	
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6	
7	
8	
9	
<b>Total</b>	

This document consists of **15** printed pages and **1** blank page.



1 Scientists compare the hardness of two metals, **A** and **B**.

They use a machine to press a steel pin into samples of each metal. The machine presses with the same force each time.



The depth of the dent produced is measured on a scale of 0 to 100.

Their results are shown in the table.

	depth of the dent					mean
	sample 1	sample 2	sample 3	sample 4	sample 5	
metal <b>A</b>	25	23	26	15	26	
metal <b>B</b>	68	65	66	66	65	66

(a) (i) The scientists use five samples of each metal.

Explain why this is better than using only one sample of each metal.

.....

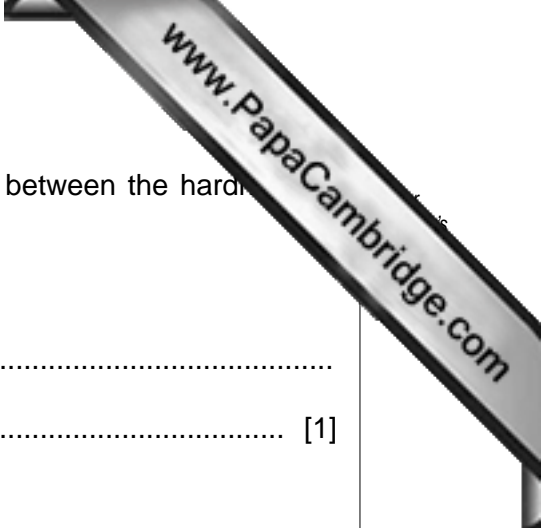
.....

..... [2]

(ii) The scientists get a best estimate for the hardness of metal **A** by calculating the mean (average) of the depth of the dent for each sample.

Use the results to get a best estimate for the depth of the dent for metal **A**.

best estimate = ..... [2]



(b) (i) The scientists conclude that there is a **real difference** between the hardness of each metal.

How do the results show this?

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

(ii) Metal **A** is harder than metal **B**.

Explain how the results show this.

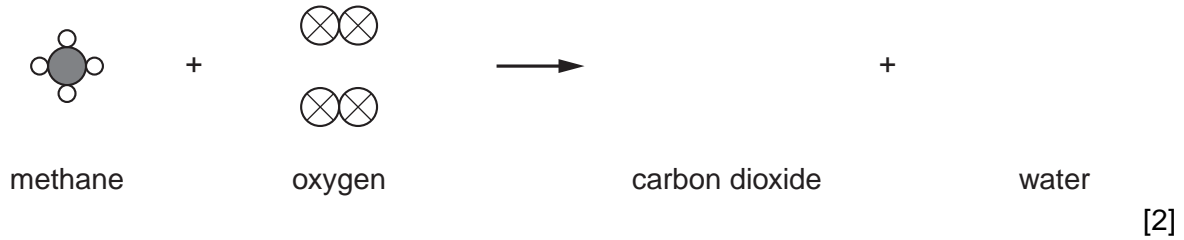
.....  
.....  
..... [2]

**[Total: 7]**

2 Carbon dioxide, nitrogen dioxide and sulfur dioxide are pollutant gases.

(a) (i) A source of carbon dioxide is the burning of fossil fuels such as methane.

Complete the diagram to show this reaction.



(ii) Carbon dioxide is removed from the air by several processes.

State two of these processes.

1 .....

2 ..... [2]

(b) (i) When a fossil fuel containing sulfur is burned, sulfur dioxide is produced.

Write a **symbol** equation for this reaction.

..... [1]

(ii) Acid rain can be formed when sulfur dioxide is released into the air.

Explain how this acid rain is formed.

.....

..... [1]

[Total: 6]

3 In some developing countries farmers use a 'slash and burn' method of agriculture.

Areas of forest are cut down and the trees burned.

Crops are grown on the cleared land for a few years.

The farmer then moves to another area of forest and repeats the process.

(a) The first year that the cleared land is used, crop yields are good.

Yields then decrease each year.

Explain why.

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

(b) Slash and burn farming is **not** a sustainable development.

Explain why.

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

(c) Crops grown in slash and burn agriculture are likely to be affected more by pests than those grown in developed countries.

Suggest and explain a reason for this.

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

**[Total: 7]**

4 Chromosomes in the nucleus of human body cells are found in 23 pairs.

(a) Why are the chromosomes found in pairs?

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

(b) One pair of chromosomes determines the sex of a human embryo.

Describe how.

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

(c) (i) Complete the genetic diagram to show how the sex of the baby is inherited.

		MOTHER	
		X	
FATHER	X	XX	

[2]

(ii) Rosie and David have three boys.

Rosie is pregnant again.

What is the probability that this baby is also a boy?

..... [1]

(d) Pre-implantation genetic diagnosis (PGD) allows the genes of an embryo to be tested.

PGD can allow parents to choose the sex of their baby.

Read these different views on PGD.

**Dao**  
Embryo selection will help to reduce the number of people suffering from genetic diseases. This has to be a good thing for everyone.

**Chipo**  
It is personal choice whether a couple should use embryo selection. It will depend on their own circumstances. One rule cannot be made for all.

**Ellen**  
It is okay to select embryos without genetic diseases but you shouldn't be allowed to select an embryo just because it is a particular sex.

**Badr**  
Embryo selection should not be allowed under any circumstances. It is unnatural and wrong.

**Amir**  
Just because we are able to select an embryo does not mean it is the right thing to do. Who knows where this may lead? One day we could all be choosing our 'perfect' babies, and I don't think this should be allowed.

(i) Who gives a reason for and against embryo selection?

..... [1]

(ii) Who explains that different courses of action may be taken in different social and environmental contexts?

..... [1]

(iii) Who distinguishes between what can be done and what should be done?

..... [1]

**[Total: 8]**

5 Mandy has a chest infection caused by bacteria.

The doctor gives Mandy an antibiotic.

(a) What is an antibiotic?

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

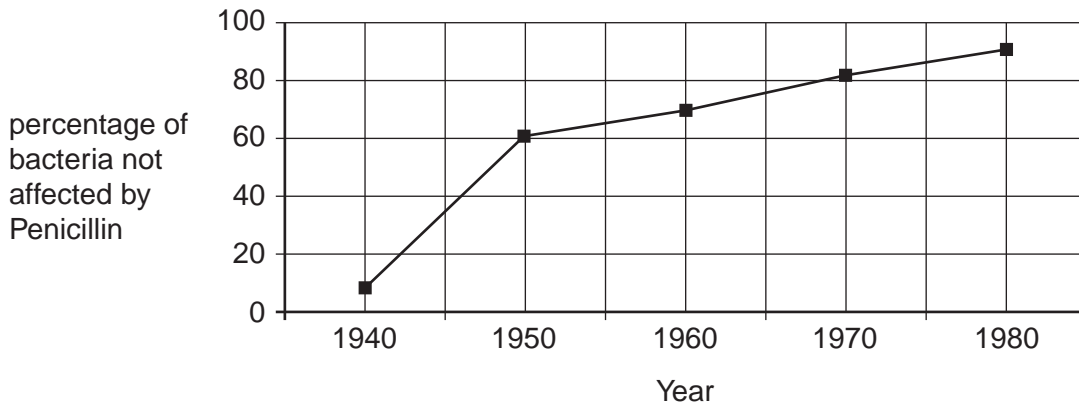
(b) The doctor tells Mandy that it is important for her to complete the course of the antibiotics.

Suggest why this is important.

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

(c) Penicillin is an antibiotic. Penicillin does not affect all bacteria.

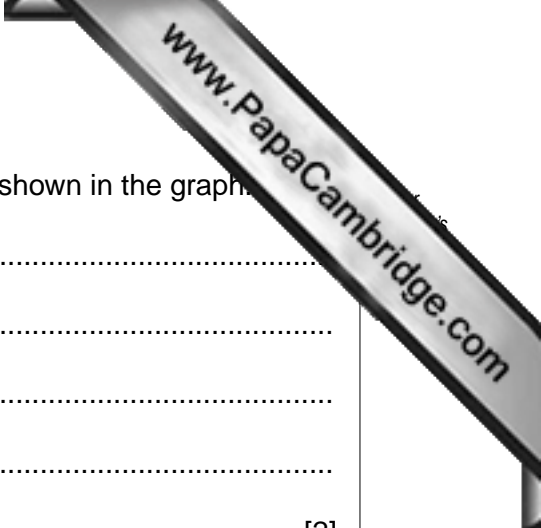
The graph shows the percentage of bacteria that were **not** affected by Penicillin from 1940 to 1980.



(i) Describe the pattern shown by the graph.

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





(ii) Explain the mechanism that may have led to the pattern shown in the graph.

.....

.....

.....

.....

.....

..... [2]

**[Total: 7]**

6 The evolution of multi-cellular organisms has led to the development of nervous and hormonal communication systems.

(a) State two differences between the nervous and hormonal communication systems.

1 .....

.....

2 .....

..... [2]

(b) Read the statements (A to F) about human evolution.

- A Hominids are extinct.
- B Bigger brains enabled human beings to walk upright.
- C Hominids could walk upright and had a smaller brain than human beings.
- D Human beings have bigger brains than apes.
- E Apes cannot walk upright.
- F Apes, humans and hominids evolved from a common ancestor.

Use the statements to complete the following questions.

Write **A, B, C, D, E** or **F** in the spaces provided.

- (i) Which statement is an explanation?  
..... [1]
- (ii) Which two statements **when put together** would increase confidence in the explanation but not prove it is correct?  
..... and ..... [1]
- (iii) Which statement is an observation that would **decrease** confidence in the explanation?  
..... [1]

[Total: 5]

7 Many scientists think that the dinosaurs died after an asteroid collided with the earth 65 million years ago.

(a) The asteroid which may have killed the dinosaurs landed near Mexico.

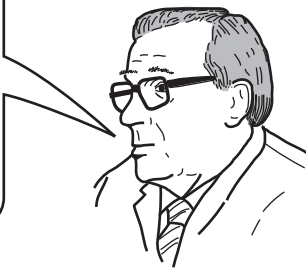
Explain how **one** asteroid landing near Mexico may have killed **all** the dinosaurs.

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

(b) This scientist has a different theory for the death of the dinosaurs.

He makes six statements, **A, B, C, D, E** and **F**.

- A** Fossil records show that the dinosaurs started dying out before 65 million years ago.
- B** Massive volcanic eruptions in India could have had the same effects as an asteroid impact.
- C** Rocks in India show that these eruptions started before the asteroid crashed in Mexico.
- D** Fossils show that many species became extinct in the Permian extinction, which happened 250 million years ago.
- E** There are enormous layers of volcanic lava in Russia dating from about the same time as the Permian extinction.
- F** Massive volcanic eruptions are the most likely cause of mass extinctions.



Some of these statements contain **data**.

Write down the letters of the statements which contain data.

Choose from **A, B, C, D, E** and **F**.

..... [1]

(c) Some scientists prefer the asteroid explanation and some prefer the volcano explanation for the death of the dinosaurs.

Suggest and explain one reason why they cannot agree on an explanation.

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

8 Many people from colder countries spend summer holidays in much hotter ones. They are at risk from the Sun's ultraviolet radiation because they are fair-skinned.

The visible light and infrared radiation are not so dangerous.

(a) How does exposure to different amounts of ionising radiation, such as ultraviolet, affect living cells?

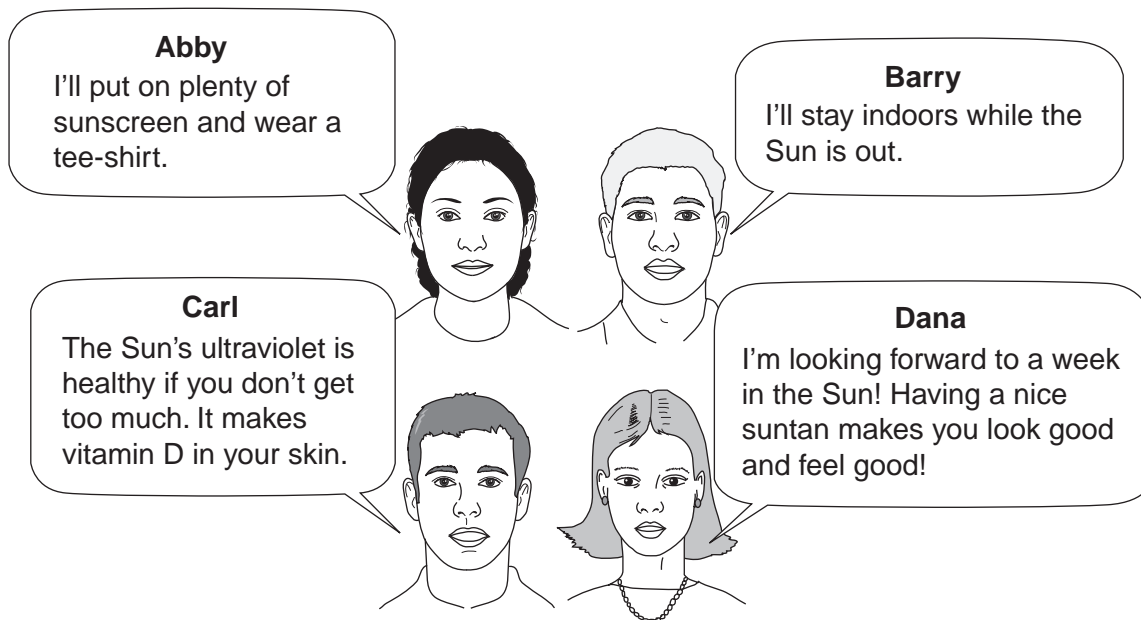
.....  
.....  
..... [2]

(b) Most of the Sun's ultraviolet radiation that reaches the Earth's atmosphere is absorbed by the ozone layer.

Explain how the ozone layer continually absorbs ultraviolet radiation.

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

(c) These four young people from Northern Europe are going to spend a week in the sunny Canary Islands.



**Abby**  
I'll put on plenty of sunscreen and wear a tee-shirt.

**Barry**  
I'll stay indoors while the Sun is out.

**Carl**  
The Sun's ultraviolet is healthy if you don't get too much. It makes vitamin D in your skin.

**Dana**  
I'm looking forward to a week in the Sun! Having a nice suntan makes you look good and feel good!

(i) Who mentions both risk and benefit?

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

Abby

Barry

Carl

Dana

[1]

(ii) Who is saying something which shows they realise there is a risk from the Sun's ultraviolet radiation?

Put a tick (✓) in the box next to each of the correct answers.

Abby

Barry

Carl

Dana

[1]

(iii) Who is planning to do something which will reduce this risk?

Put a tick (✓) in the box next to each of the correct answers.

Abby

Barry

Carl

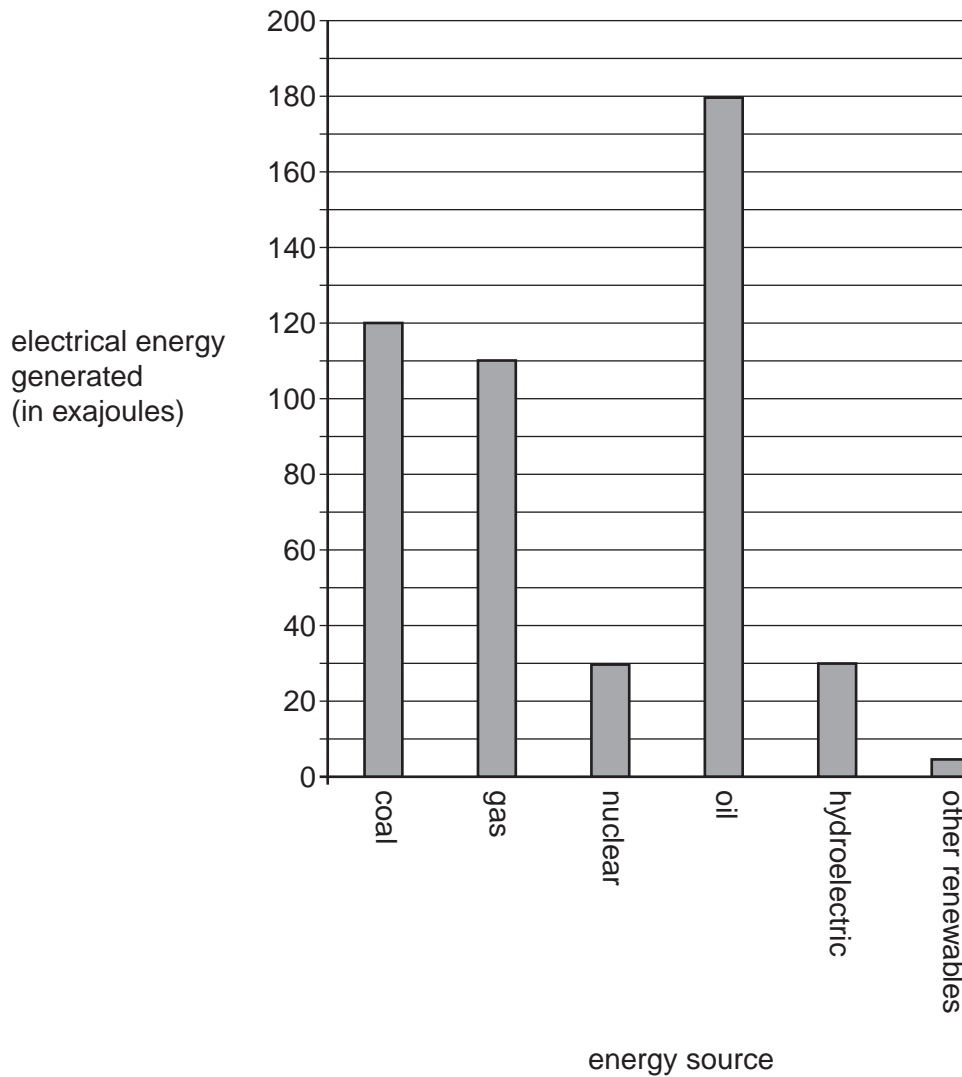
Dana

[2]

[Total: 8]

- 9 The bar chart compares different ways in which electrical energy was generated in 2004.

(One exajoule = 1 million million million joules.)



- (a) Which energy sources **each** generated more than 20% of the total amount of electrical energy generated in 2004?

..... [2]

- (b) What was the total electrical energy produced by burning carbon fuels in 2004?

(c) It is claimed that globally a quarter of all electricity is produced from nuclear power.

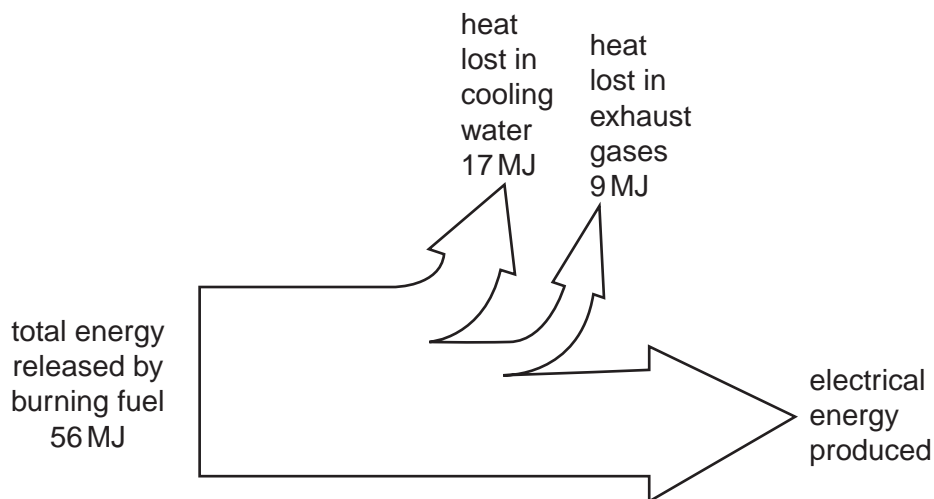
Use the data in the bar chart to show that this statement is false.

Show your working.

[2]

(d) The following energy flow diagram (Sankey diagram) shows the electrical energy generated in a power station burning a carbon fuel.

The energies shown, in megajoules (MJ), are those released when 1 kg of the fuel is burnt.



Use the information in the diagram to calculate the efficiency of electrical energy generation in the power station.

Show your working.

efficiency = ..... [2]

[Total: 7]

