



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

October/November 2013

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.

Electronic calculators may be used.

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.

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



1 This question is about different types of power station.

(a) The block diagram shows the production of electricity in a **nuclear** power station.

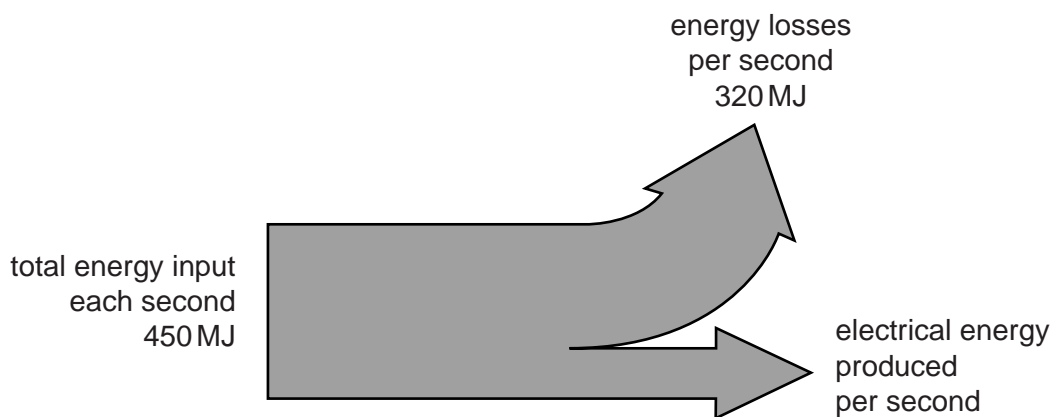
Write the three missing names in the empty boxes.



[2]

(b) In a nuclear power station, some energy is lost.

One example is shown in the energy flow (Sankey) diagram below.



Calculate the efficiency of the power station.

Show your working.

Give your answer to two significant figures.

efficiency= % [2]

(c) People who work in nuclear power stations are at risk from nuclear radiation.

Workers wear radiation monitors which measure the dose they have received.

Suggest and explain how the power station managers can use the readings from the radiation monitors to make sure that any risk to the workers is kept low.

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

(d) In many countries, nuclear power stations are being replaced by power stations which use renewable energy sources.

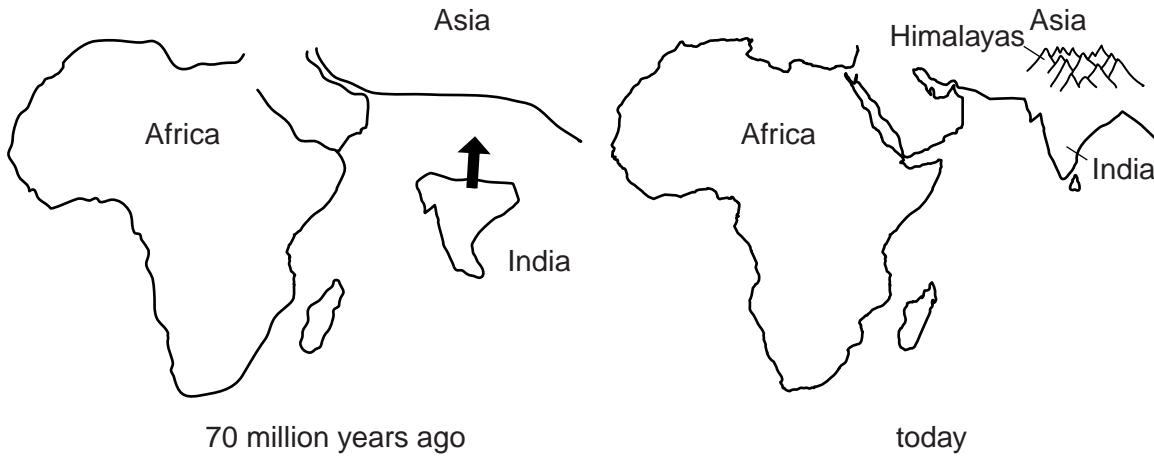
Name one such renewable energy source, and write down one **disadvantage** it has when compared with the use of nuclear power.

renewable energy source
disadvantage compared with nuclear power
.....
.....[1]

[Total: 7]

2 This question is about the movement of tectonic plates.

The diagrams below show how the Indian tectonic plate, which carries the land mass of India, has moved over the last 70 million years.



(a) 70 million years ago, the Indian plate was moving at a speed of 20 cm per year.

(i) Calculate how far the Indian plate moved in 100 years.

distance = cm [2]

(ii) When the Indian plate reached the mainland of Asia, it slowed down to 5 cm per year.

At the same time, the mountains known as the Himalayas were formed.

Explain why these two events happened at the same time.

.....

.....

.....

..... [2]

(b) The movement of India shown in the diagram opposite is caused by seafloor spreading.

Explain how changes inside the Earth produced this movement.

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

(c) About a hundred years ago, Wegener suggested that continents moved. At the time, scientists did not believe this.

Give two reasons why scientists at the time did not believe Wegener's idea.

1

.....

2

.....[2]

[Total: 7]

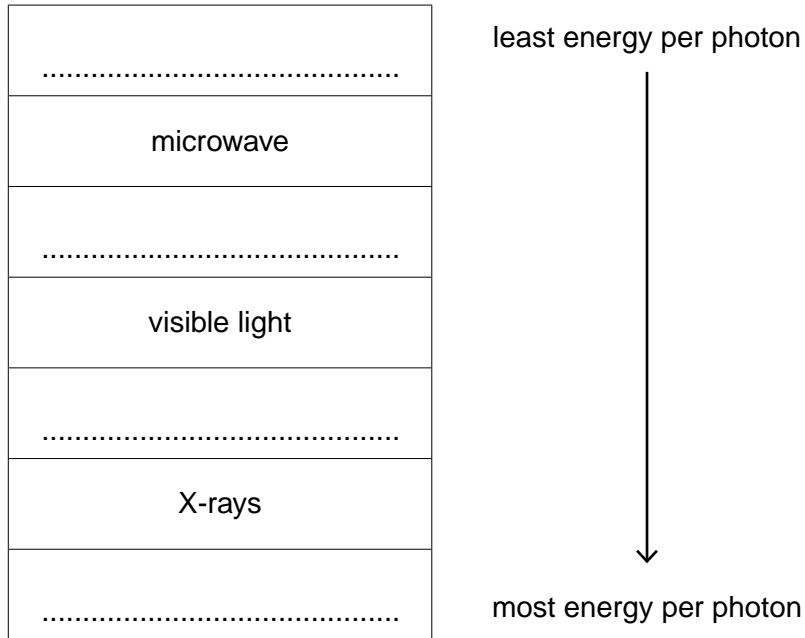
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3 This question is about the electromagnetic spectrum.

(a) The list below shows the electromagnetic spectrum.

It is arranged in order of the energy in each photon.

Complete the list by filling in the empty boxes.



[2]

(b) Explain why exposure to X-rays is more dangerous for living organisms than exposure to visible light.

.....

.....

.....

..... [2]

(c) Most scientific evidence suggests that the microwave radiation emitted by mobile phones cannot damage brain cells. Despite this, many people prefer **not** to let their children have mobile phones. Use the precautionary principle to explain why.

.....

.....

.....

..... [2]

[Total: 6]

4 This question is about chemicals that are added to food.

(a) Antioxidants are added to many processed foods to prolong their shelf lives.

Explain how they work.

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

(b) Aspartame is an artificial sweetener. It is used to replace sugar in soft drinks.

Aspartame has been found to cause cancer when fed in large doses to rats.

Many people who know this, still drink products containing aspartame.

They believe that the benefit outweighs the risk.

Explain why they believe this.

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

(c) In some countries food is eaten near where it is produced.

In other countries food is transported long distances.

Suggest **two** reasons for this difference.

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

[Total: 6]

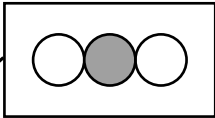
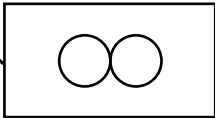
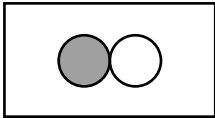
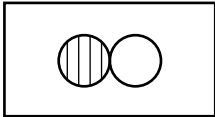
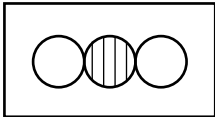
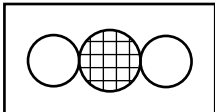
5 This question is about gases in the air.

(a) The diagram shows information about some gases found in air.

Draw a straight line from each **name** to the correct **formula**.

Draw another straight line from each **formula** to the correct **molecule diagram**.

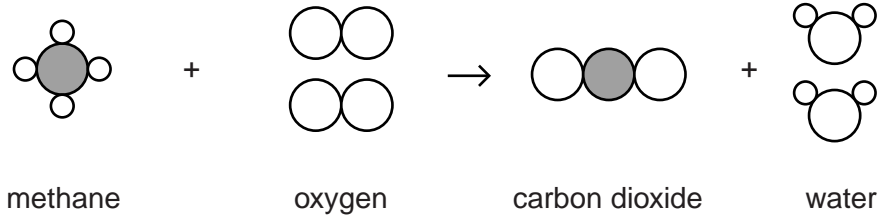
Lines for two of the gases have already been done for you.

| name | formula | molecule diagram |
|-------------------|---------|---|
| carbon dioxide | O_2 |  |
| oxygen | CO_2 |  |
| carbon monoxide | SO_2 |  |
| nitrogen monoxide | CO |  |
| nitrogen dioxide | NO |  |
| sulfur dioxide | NO_2 |  |

[3]

(b) When methane burns in a **plentiful** supply of air, complete combustion takes place.

The products are carbon dioxide and water.



When methane burns in a **limited** supply of air, less oxygen is available for the combustion reaction.

This is true for the burning of all hydrocarbons, such as those in petrol.

Describe and explain the effect this has on the products of the combustion of hydrocarbons and how this affects air quality in cities.

.....

.....

.....

.....

.....

..... [3]

[Total: 6]

6 Scientists test the effect of adding a new plasticiser to a polymer.

They make batches of the polymer with different percentages (%) of plasticiser.

They measure how far samples of each batch of polymer bend when a force is applied.

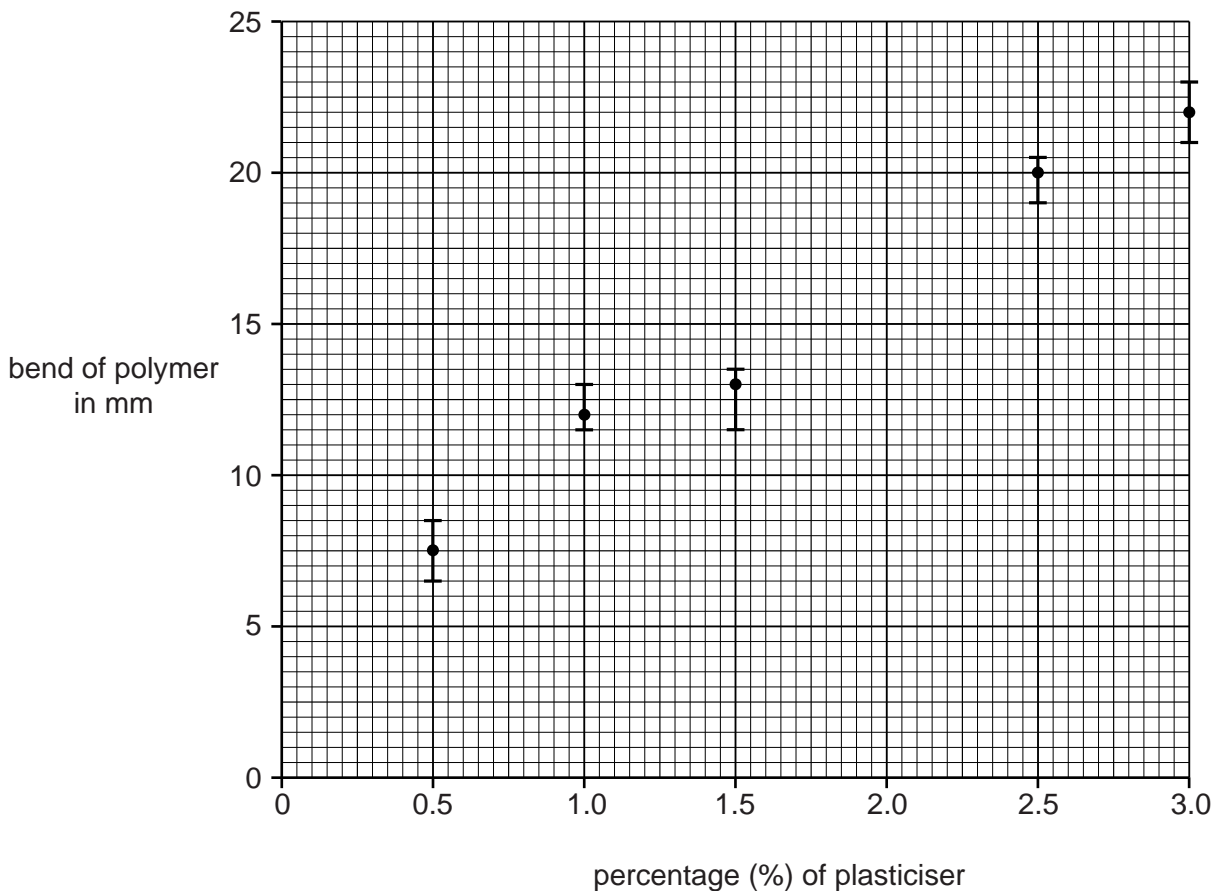
(a) The table shows the scientists' results for the polymer containing 2.0% plasticiser.

| bend of polymer in mm | | | | | |
|-----------------------|----------|----------|----------|----------|----------|
| sample 1 | sample 2 | sample 3 | sample 4 | sample 5 | sample 6 |
| 15 | 17 | 25 | 14 | 16 | 18 |

Work out the best estimate for the bend of the polymer containing 2.0% plasticiser.

best estimate = mm [2]

(b) The graph shows best estimates and ranges for the bend of the polymer containing other percentages of plasticiser.



(i) Finish the plotting of the graph by adding the **best estimate** and the **range** for 2.0% plasticiser. [1]

(ii) David says that the data show that there is a linear relationship between percentage of plasticiser and bending of the polymer. This means that the data points on this graph lie on a straight line.

Evaluate the results shown on the graph to suggest how much confidence can be placed in David's conclusion.

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

(c) The properties of this polymer could be changed by another modification.

Describe a modification, other than adding plasticiser, and the change it would make to the properties of the polymer.

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

[Total: 8]

7 (a) Describe two functions of genes.

.....

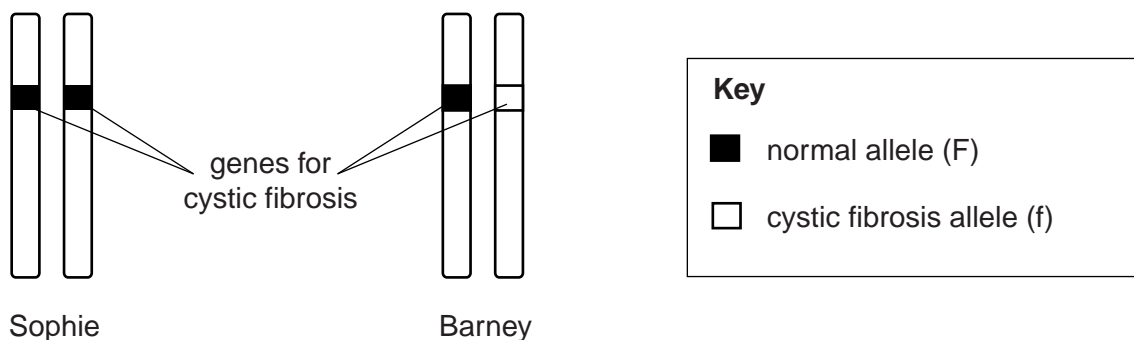
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..... [2]

(b) The diagram shows the genes for cystic fibrosis on two pairs of chromosomes.

Cystic fibrosis is caused by a recessive allele.

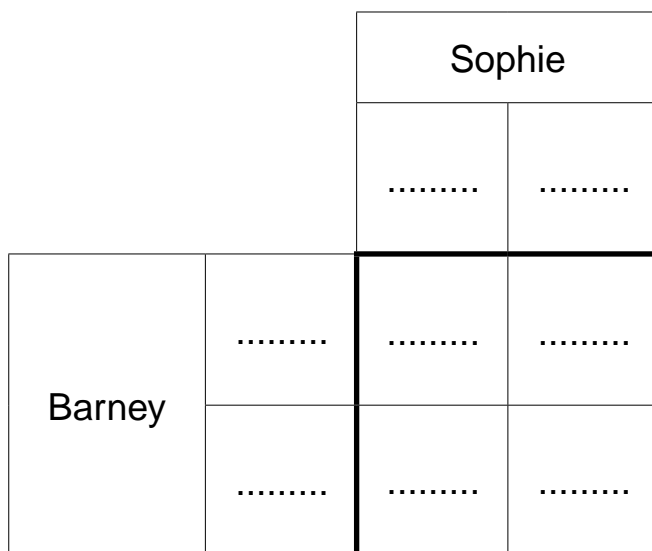
These pairs of chromosomes are found in the body cells of Sophie and Barney.



(i) Sophie and Barney are expecting a baby.

Complete the genetic diagram to show the possible combinations of alleles that their baby could have.

Use F to represent the normal allele and f to represent the cystic fibrosis allele.



[2]

- (ii) Calculate the probability of Sophie and Barney's baby being a carrier of cystic fibrosis.

probability =[1]

- (iii) Sophie wants to have their foetus tested to see if it will suffer from cystic fibrosis.

Her doctor says that the test is unnecessary.

Use your genetic diagram in (b)(i) to suggest why.

.....
[1]

- (iv) Sophie and Barney are told by their doctor that they are having a baby boy, because the foetus has X and Y chromosomes.

Describe how the sex of the baby is determined by its **genes**.

.....

[2]

- (c) It is possible to test for a variety of genetic diseases.

Many couples choose to have their foetus tested for alleles which cause genetic disease.

Discuss the possible implications of this.

.....

[2]

[Total: 10]

8 The many different species of living things on Earth are believed to have evolved from very simple living things.

(a) Complete the sentence.

Life on Earth began about million years ago. [1]

(b) Darwin published his theory of natural selection in 1859.

At the time, many people disagreed with his theory.

Since then, new data have been found to support his theory.

Draw a straight line from each **reason** why people disagreed with Darwin to the **new data** which now supports his theory.

reason

new data

The Earth was not thought to be old enough.

More fossils were discovered.

Darwin couldn't explain how variation occurred.

Mendel published his ideas about inheritance.

Darwin couldn't explain how characteristics were passed on.

The structure of DNA was discovered.

There was not much evidence that species changed over time.

The solar system was found to be about 5 thousand million years old.

[2]

(c) Scientists can compare the DNA of different organisms.

Suggest how scientists could use this information to make conclusions about the evolutionary relationships between organisms.

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

[Total: 5]

9 A virus is an example of a microorganism. Microorganisms can cause disease.

Sarah has chickenpox. Chickenpox is a disease caused by a virus.

(a) Explain how Sarah's immune system will try to destroy the chickenpox virus.

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

(b) It is possible to get your child vaccinated against chickenpox.

However, in some countries only a small percentage of the population are vaccinated.

Discuss the implications of this low uptake of vaccination.

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

[Total: 5]

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