



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

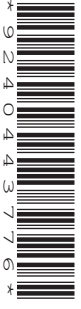
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**TWENTY FIRST CENTURY SCIENCE**

**0608/04**

Paper 4

**October/November 2011**

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

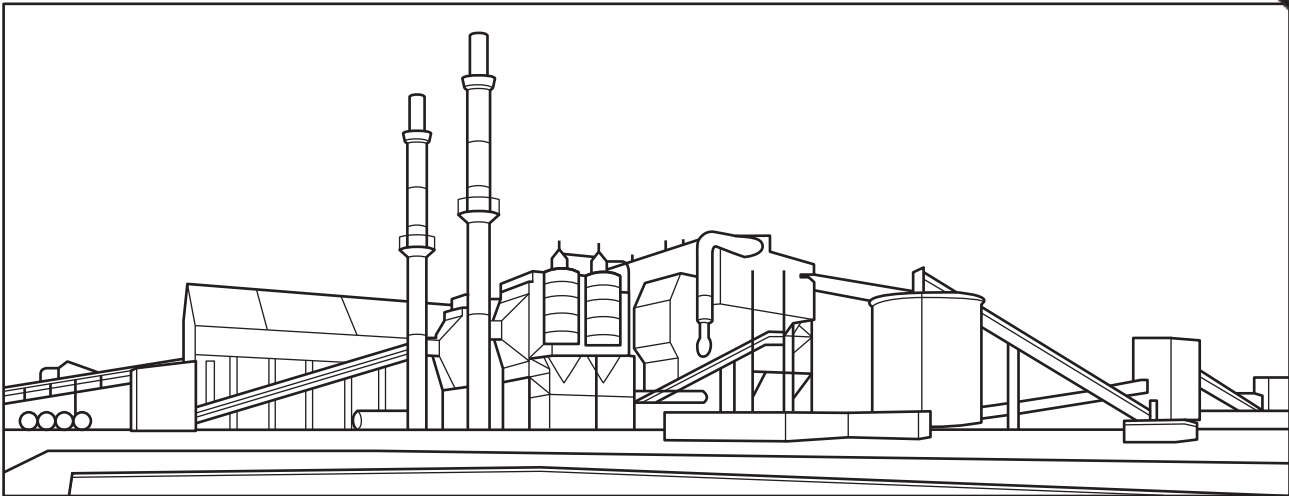
Write your Centre number, candidate number and name on all the work you hand in.  
Write in dark blue or black pen.  
You may use a pencil for any diagrams or graphs.  
Do not use staples, paper clips, highlighters, glue or correction fluid.  
**DO NOT WRITE IN ANY BARCODES.**

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                  |  |
| <b>Total</b>       |  |

This document consists of **16** printed pages.

1 This question is about generating electricity from biomass (waste vegetable matter).



(a) Burning biomass to generate electricity is an example of a renewable energy source.

Explain why burning biomass is renewable.

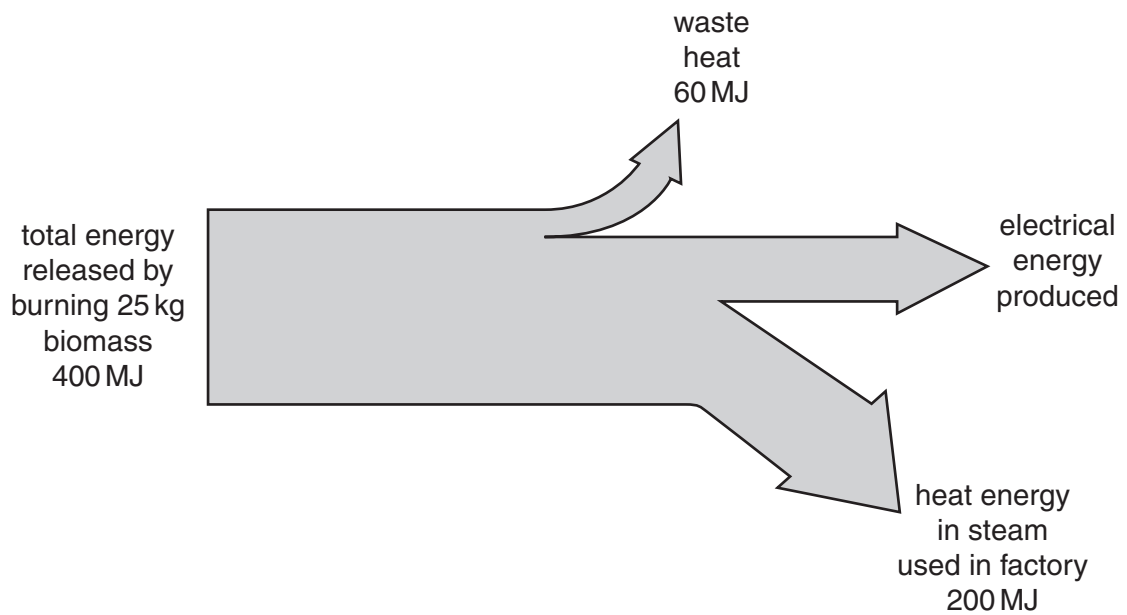
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.....

..... [1]

(b) The following energy flow diagram shows the energy obtained from burning 25 kg of biomass.

The energy is measured in megajoules (MJ).



- (i) Explain how the energy flow diagram shows that 140MJ of electrical energy is produced.

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

- (ii) Use the equation

$$\text{efficiency} = \frac{\text{useful output energy} \times 100}{\text{total input energy}} \%$$

to calculate the efficiency of production of electrical energy.

Show your working.

efficiency = ..... % [2]

- (iii) The manager of the power station claims that the efficiency is not the value calculated in (ii), but is actually 85%.

Explain how the figures in the energy flow diagram can support the manager.

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

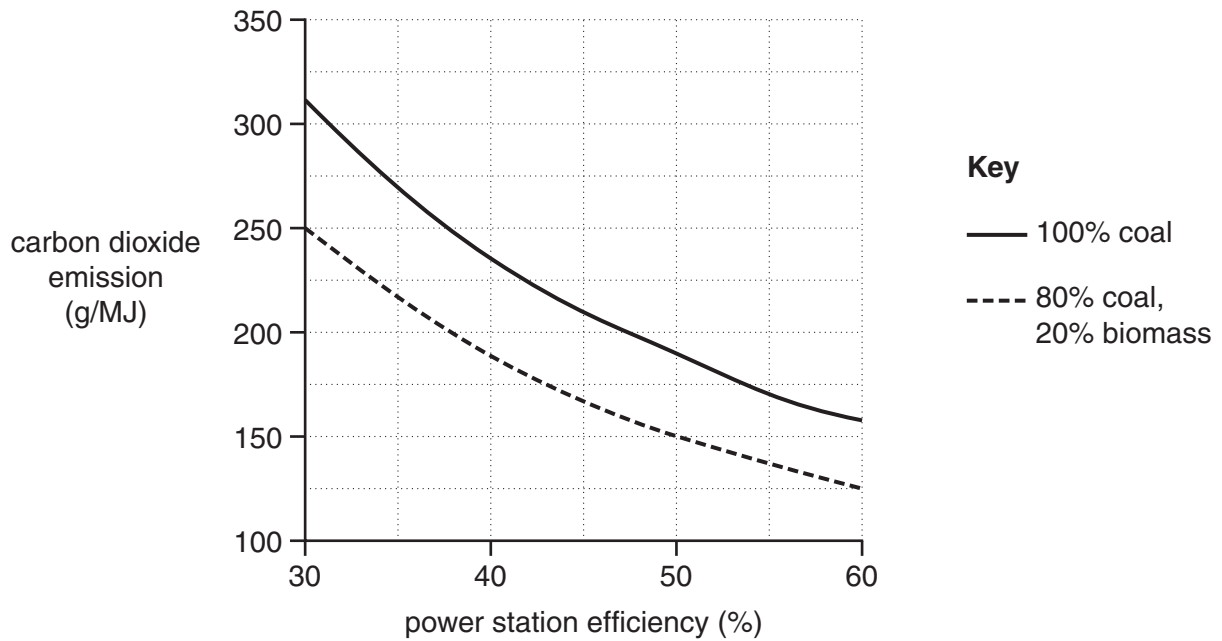
(c) Some power stations can burn both coal and biomass.

The efficiency of these power stations varies from 30% to 60%.

The graph shows the relationship between power station efficiency and the amount of carbon dioxide emitted.

Two different fuels are shown:

- 100% coal
- 80% coal, 20% biomass.



For both fuels, a more efficient power station emits less carbon dioxide.

What else does the graph show?

.....

.....

.....

.....

.....

..... [2]

[Total: 7]

2 This question is about microwave radiation.

(a) The table shows the electromagnetic spectrum.

(i) Fill in the missing names.

|             |       |       |               |       |       |            |
|-------------|-------|-------|---------------|-------|-------|------------|
| radio waves | ..... | ..... | visible light | ..... | ..... | gamma rays |
|-------------|-------|-------|---------------|-------|-------|------------|

[2]

(ii) In the table, put a tick (✓) next the name of each **ionising radiation**.

[1]

(b) Some people will not let their children have mobile phones.

These people believe that microwaves from mobile phones may be a health risk.

Explain clearly what the **precautionary principle** is, and how these people are applying it.

.....

.....

.....

..... [2]

(c) Microwave ovens are much more powerful than mobile phones, but they are not thought to be dangerous.

Explain how the construction of microwave ovens protects users from microwave radiation.

.....

..... [1]

[Total: 6]

3 This question is about the movement of the Earth's tectonic plates.

(a) Although Wegener's idea of continental drift was first suggested in 1912, it was more than 50 years before geologists believed that the Earth's crust is moving.

Suggest **two** reasons for this.

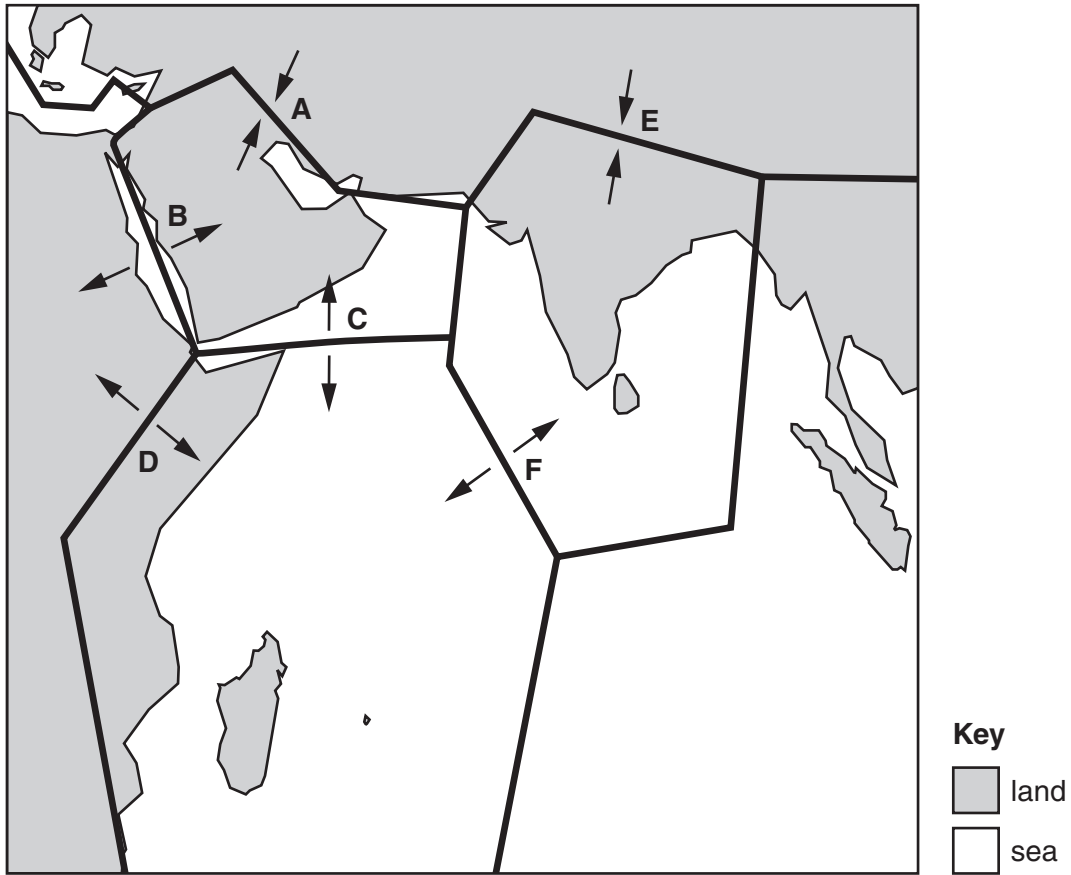
.....  
.....  
.....  
.....[1]

(b) In the 1960s, measurements of magnetism in the seafloor produced evidence to support the idea of continental drift.

Describe what was discovered, and explain how it supported the idea that continents could move.

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

(c) The Earth's tectonic plates in the Indian Ocean region are shown in the diagram. The pairs of arrows **A, B, C, D, E** and **F** show the directions of movement of the plates.



(i) Which of the movements **A, B, C, D, E** and **F** are building mountains?

Write down **each** of the letters.

..... [1]

(ii) Which of the movements **A, B, C, D, E** and **F** are causing seafloor spreading?

Write down **each** of the letters.

..... [1]

(iii) Explain how earthquakes are caused.

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

[Total: 7]

4 Country **A** is an industrialised country. Farmers in country **A** use synthetic pesticides to prevent insect pests attacking their crops. They spread synthetic fertilisers on their fields.

Country **B** is a developing country. Farmers in country **B** use organic farming methods. They do not use synthetic pesticides or synthetic fertilisers.

(a) (i) Describe **one** method that farmers in country **B** may use to protect their crops from insect pests.

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

(ii) How may farmers in country **B** be affected by the fact that they do not use pesticides?

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

(b) Pesticide residues on food can be harmful to people. Pesticides can cause environmental damage.

Suggest why, despite the problems associated with the use of pesticides, farmers in country **A** use them.

Use ideas of risk and benefit in your answer.

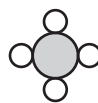
.....  
.....  
.....  
.....[2]

[Total: 4]



- 5 Methane is a fuel. It is burned to release heat energy.

Look at the formula and diagram of a molecule of methane.



In a plentiful supply of oxygen,  $\text{O}_2$ , methane burns to produce carbon dioxide,  $\text{CO}_2$ , and water,  $\text{H}_2\text{O}$ , only.

- (a) Complete this table to show the number of **atoms** of each element in the reactants and products when one molecule of methane burns.

|                              | carbon | hydrogen | oxygen |
|------------------------------|--------|----------|--------|
| number of atoms in reactants | 1      |          |        |
| number of atoms in products  | 1      |          |        |

[1]

- (b) Complete this table to show the number of **molecules** in the reactants and products when one molecule of methane burns.

|                     | reactants |        | products       |       |
|---------------------|-----------|--------|----------------|-------|
|                     | methane   | oxygen | carbon dioxide | water |
| number of molecules | 1         |        |                |       |

[3]

- (c) When methane burns in a limited supply of air, other products are also formed. These other products cause air pollution.

Name **one** of these other products.

..... [1]

[Total: 5]

6 Most window frames are made from either wood or unplasticised polyvinylchloride (uPVC).

Data from a Life Cycle Assessment (LCA) for window frames, of the same size, made from each of these two materials are shown in the table.

| part of LCA                             | wood    | uPVC     |
|---|---------|----------|
| energy for production, use and disposal | 9150 MJ | 9713 MJ  |
| fossil fuel used                        | 5.57 kg | 18.23 kg |
| carbon dioxide produced                 | 457 kg  | 487 kg   |
| smog chemicals                          | 893     | 383      |
| air acidification                       | 29.6    | 37.7     |
| water pollution                         | 67      | 1.6      |

(a) For which parts of the LCA is wood a more sustainable material for a window frame than uPVC?

Choose your answers by ticking the correct boxes.

|   | tick (✓) |
|---|----------|
| energy for production, use and disposal |          |
| fossil fuel used                        |          |
| carbon dioxide produced                 |          |
| smog chemicals                          |          |
| air acidification                       |          |
| water pollution                         |          |

[3]

(b) Wooden window frames require frequent painting, but uPVC window frames are coloured during manufacture and never need to be painted.

Describe and explain the effect this has on a comparison of the LCA for these two types of window frame.

.....

.....

..... [2]

(c) The melting point of polymers can be increased by increasing their chain length.

Explain how longer chains give a polymer a higher melting point.

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

(d) The main cause of air acidification is the release of sulfur dioxide from burning fossil fuels.

Acid rain is formed from sulfur dioxide in the air.

(i) Write a symbol equation for the burning of sulfur to produce sulfur dioxide.

.....[1]

(ii) Explain how acid rain is formed from sulfur dioxide.

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

(iii) Describe **one** environmental problem caused by acid rain.

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

[Total: 11]

7 Janet is feeling unwell and goes to the doctor.

The doctor says that Janet is suffering from influenza.

Janet asks the doctor to give her antibiotics.

The doctor says that antibiotics will not help Janet to feel better.

(a) Explain why antibiotics will not help Janet to feel better.

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

(b) John does not want to catch influenza.

He goes to the doctor for a vaccination to help prevent him catching this disease.

John had an influenza vaccination last year.

(i) Explain why John needs to have a vaccination against influenza this year, even though he had one last year.

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

(ii) Describe how vaccinations provide protection from the microorganisms that cause diseases.

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

(c) In 2009, there was an outbreak of influenza caused by a new microorganism called H1N1.

This new type of influenza spread quickly around the world.

Scientists developed a vaccine against H1N1 to help stop the spread of the disease.

Abi is pregnant. Her doctor recommends that she should have the vaccination against H1N1.

Abi is not sure whether she should have the vaccination or not.

She talks to her friends and asks their opinions.



A

The vaccine has been developed very quickly and has not been tested as thoroughly as other vaccines.



B

When you are pregnant, your immune system is weakened and you are not able to fight off infections as easily.



C

The vaccination protects against H1N1 and does not cause any damage to the baby.



D

It is important for a pregnant woman to make the right decision for both her and her baby.



E

Having the vaccination really hurts and your arm can be very sore for a few days afterwards.

Complete the table by writing the letters **A**, **B**, **C**, **D** and **E** in the correct columns. Each letter can be used once only.

| friends who give reasons to have the vaccination | friends who give reasons <b>not</b> to have the vaccination | friends whose comments do not support either argument |
|--|---|---|
|  |   |   |

[2]

[Total: 7]

8 (a) What are embryonic stem cells?

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

(b) Embryos can be cloned to produce large numbers of stem cells.

(i) Suggest **one** reason why some people believe these embryos should be cloned.

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

(ii) Suggest **one** reason why some people believe it is wrong to clone embryos.

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

(c) Read the sentences in the box.

- A** Scientists have discovered that baby teeth are a source of stem cells.
- B** Storing your children’s baby teeth could help to save their lives in the future.
- C** The stem cells are easy and painless to extract.
- D** Storing the teeth is very expensive.
- E** There is no guarantee stem cells will be able to help cure diseases.
- F** Many teeth can be stored for each child.
- G** It may not be possible to extract the stem cells if the teeth are damaged.

Which of the sentences, **A, B, C, D, E, F** and **G**, suggest reasons why

(i) parents may choose to store their children’s baby teeth

..... [1]

(ii) parents may choose **not** to store their children’s baby teeth.

..... [1]

(d) It is also possible for clones of whole animals to occur.

Describe, in terms of the cells involved, one natural and one artificial way in which clones of whole animals can occur.

natural: .....

artificial: .....

[3]

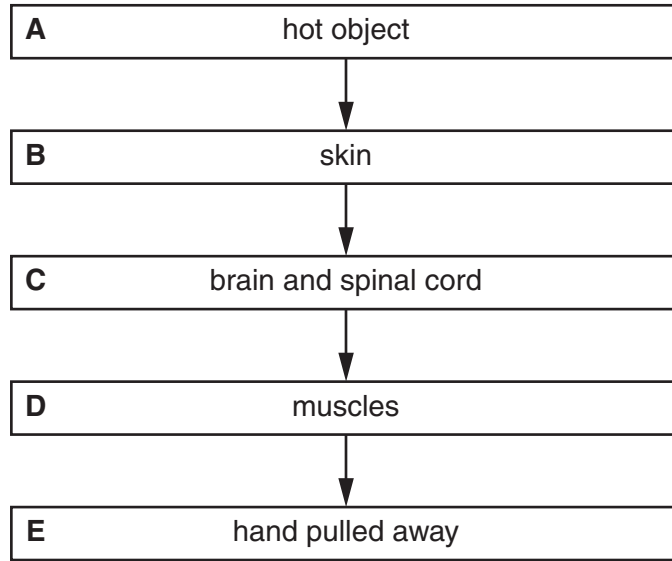
[Total: 8]

9 Multi-cellular organisms have evolved to have nervous and hormonal communication systems. These are involved in homeostasis.

(a) What is meant by the term *homeostasis*?

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

(b) Look at the flow diagram. This shows an example of nervous communication.



Which **one** of the boxes, **A**, **B**, **C**, **D** or **E**, represents:

(i) the effector cells, ..... [1]

(ii) the sensor (receptor) cells? ..... [1]

(c) Communication can be hormonal as well as nervous.

Give **one** example of hormonal communication and describe **two** differences between hormonal and nervous communication.

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

[Total: 5]

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