

**Wednesday 1 February 2012 – Afternoon**

**GCSE TWENTY FIRST CENTURY SCIENCE  
SCIENCE A**

**A213/01** Unit 3: Modules B3 C3 P3 (Foundation Tier)

Candidates answer on the Question Paper.  
A calculator may be used for this paper.

**Duration:** 40 minutes

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**MODIFIED LANGUAGE**

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

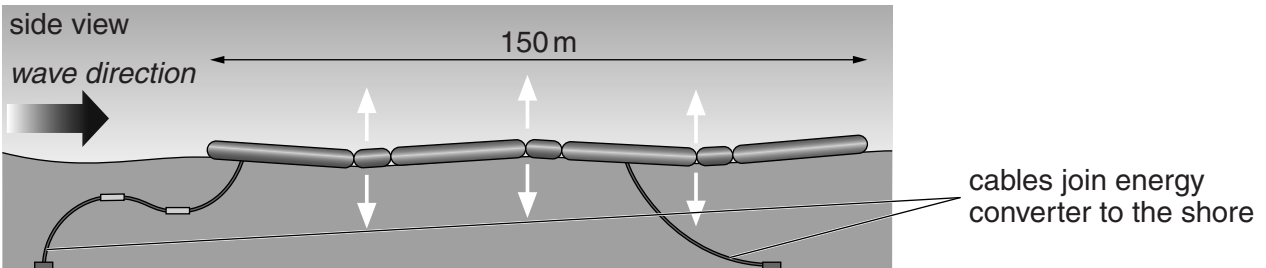
**1** Read this newspaper article.

**Power from the waves**

The Portuguese Government has set up a wave farm in the Atlantic Ocean.

It has been testing wave energy converters built in Scotland.

These have successfully generated energy for the Portuguese National Grid.



As the wave passes, the wave energy converter bends at its three joints. This pumps oil through hydraulic motors, which then drive generators. The electricity they produce passes along cables to the shore.

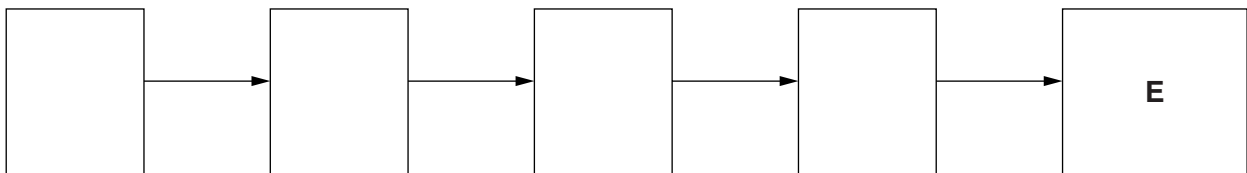
The complete wave farm will occupy a square kilometre of ocean about 10 kilometres from the shore. Its power output will be much less than a power station burning fossil fuels.

**(a)** Complete the block diagram below to show how the energy converter generates electricity.

Choose from

- A** generators turn
- B** oil is pumped through motors
- C** the converter bends at each joint
- D** waves move under the converter
- E** electricity passes to the National Grid

One has been done for you.



**[2]**

- (b) Suggest advantages **and** disadvantages of generating electricity using a wave farm in the open ocean.

Use the information in the article, together with your knowledge of renewable energy sources.

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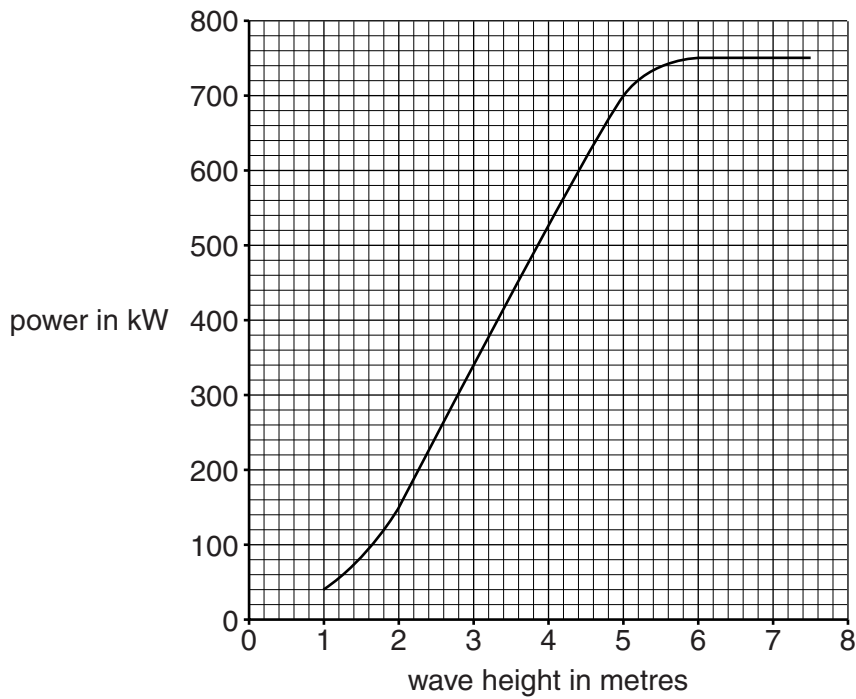
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..... [3]

- (c) The graph shows how the power produced by one energy converter depends on the height of the waves.



Use the graph to find the wave height which produces a power of 120 kW.

height = ..... metres [1]

- (d) Describe how the power output from the energy converter varies as wave height increases from 1 metre to 7 metres.

.....

.....

..... [2]

[Total: 8]

Turn over

2 The used fuel rods from nuclear power stations contain nuclear waste.

The used fuel rods give off gamma radiation.

(a) At first, used fuel rods are stored in pools of water approximately 12 metres deep.

The water keeps the fuel rods cool.

Which two statements, when taken together, provide another reason for using very deep pools of water?

Put ticks (✓) in the boxes next to the **two** statements.

Gamma radiation is ionising radiation.

Gamma radiation is very penetrating.

The activity is less under water.

The radiation dissolves in the water.

[1]

(b) Nuclear waste should be disposed of safely as it may be dangerous for many thousands of years.

There is no agreement about how nuclear waste should be disposed of.

Here are some suggestions for this disposal.

- 1 Bury nuclear waste deep underground.
- 2 Seal nuclear waste up securely and drop it into the deepest parts of the ocean.
- 3 Send nuclear waste into space in rockets so that it goes into the Sun.

Each of these methods has some risk.

Choose **two** methods of disposal and write down a risk for each one.

method.....

risk.....

.....

method.....

risk .....

..... [2]

(c) The nuclear waste is processed before it is disposed of.

People who process the waste are at risk from it.

Which of the following are **risks** to these workers?

Put ticks (✓) in the boxes next to the **two** correct answers.

Protective screens can block radiation.

The radiation might damage their bodies.

They get paid well.

They might breathe in radioactive materials.

They need to wear protective clothes.

[2]

[Total: 5]

3 Everyone is constantly exposed to some background radiation.

Name one source of background radiation.

..... [1]

[Total: 1]

4 Scientists are not sure how life on Earth started.

They do agree about when it started and what the earliest living things evolved from.

(a) Put a tick (✓) in the box next to the correct statement to complete the sentence.

Scientists have evidence that life on Earth began approximately ...

... 2000 years ago.

... 3500 years ago.

... 3500 million years ago.

... 5000 million years ago.

... 14 000 million years ago.

[1]

(b) Use a word from the list to complete the sentence.

**cells**

**fossils**

**molecules**

**nuclei**

Scientists think that the first living things developed from .....  
that could copy themselves. [1]

(c) Charles Darwin suggested that evolution happens due to **natural selection**.

Darwin got some of his ideas by studying **selective breeding**.

Describe how selective breeding is

- **similar** to natural selection
- **different** from natural selection.

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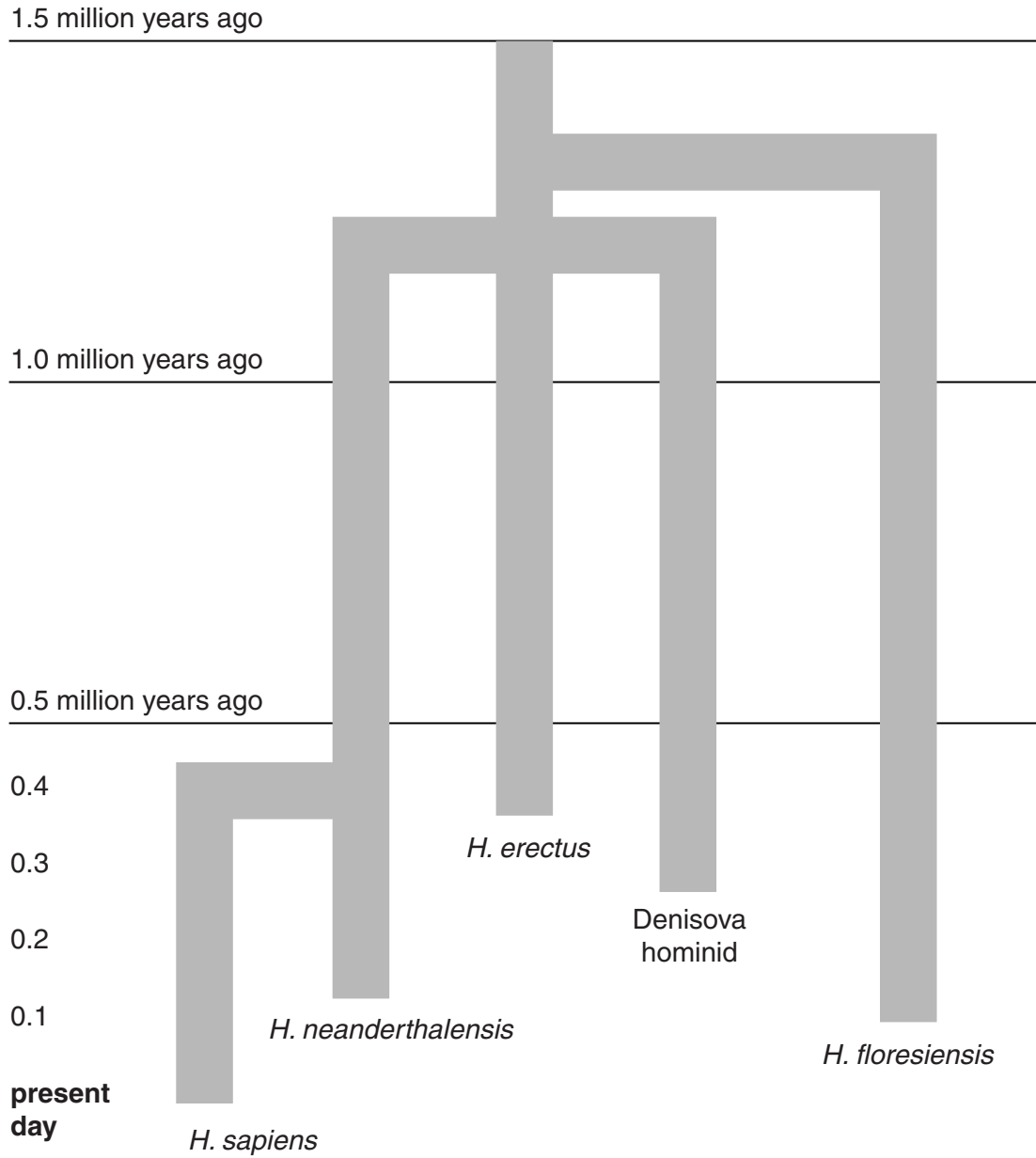
[4]

**[Total: 6]**

5 In the last 10 years evidence for two new species of hominid has been found.

These are called *H. floresiensis* and the Denisova hominid.

The diagram shows the likely evolution of hominids using the new evidence.



(a) (i) Look at the diagram.

How many species of hominid have lived at any time during the last 0.5 million years?

answer ..... [1]



(ii) All hominid species apart from *H. sapiens* are extinct.

According to the diagram, which hominid species was the most recent one to become extinct?

answer ..... [1]

(iii) On the diagram put a **ring** around an example of **divergence**. [1]

(iv) Put ticks (✓) in the boxes next to the **two** most likely causes of extinction of some hominids.

- rapid environmental change
- slow environmental change
- a constant environment
- extinction of a predator
- arrival of a new predator

[2]

(b) Most scientists think that the common ancestor of hominids lived in Africa.

They think that hominids migrated out of Africa 1.5 million years ago.

Many scientists also think that there was a second migration about 60 000 years ago.

Some scientists think that there may have been several further migrations.

Scientists cannot agree about the further migrations.

Put ticks (✓) in the boxes next to the **three** best reasons for this disagreement.

- Scientists like a good argument.
- Some scientists think not enough evidence has been collected.
- Scientists do not need evidence.
- The number of hominid migrations is not a question that science can answer.
- The evidence can be interpreted in different ways.
- Some scientists' reputations rely on the established explanation.

[3]

[Total: 8]  
Turn over

6 Len is a farmer. He uses organic farming methods to grow crops.

(a) Len grows wheat in some of his fields.

He spreads manure on these fields.

Explain why the wheat fields would become **less** fertile each year if he did **not** spread manure on them.

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

(b) Len says that organic farming is better for the environment than intensive farming.

Suggest **three** reasons that Len could give to explain why he thinks organic farming is better for the environment.

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

[Total: 5]

7 This question is about chemicals added to food.

(a) The table shows E numbers for food additives.

E number	type of additive
E100 – E199	colourings
E200 – E299	preservatives
E300 – E399	antioxidants
E400 and above	emulsifiers and stabilisers

(i) Draw a straight line from each **E number** to the **type** of additive and then to **how it works**.

E number	type	how it works
E211	antioxidant	stops food reacting with oxygen
E324	colouring	stops the growth of microbes
E401	emulsifier	allows oil and water to mix
	preservative	

[3]

(ii) Additives with an E number are approved for use in Europe.

What does the E number tell us?

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

Eating food with additives is always a risk.

The additives are completely safe.

The additives have passed a safety test.

The additives have been used for many years.

[1]

(b) Scientific advisory committees carry out risk assessments on foods.

Why do they carry out these risk assessments?

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

To reduce the amount of additives in foods.

To make sure the food tastes good.

To check the foods are labelled correctly.

To determine the safe levels of chemicals in food.

[1]

[Total: 5]

8 This is a question about diabetes.

There are two types of diabetes: type 1 and type 2.

(a) For each statement decide whether it refers to **type 1 diabetes**, **type 2 diabetes** or **both types of diabetes**.

Put a tick (✓) in the correct box in each row.  
One has been done for you.

	type 1 diabetes	type 2 diabetes	both types of diabetes
The body does not make insulin.			
The body cannot control the amount of sugar in the blood.			✓
Usually starts in people over 40.			
Can be controlled by diet.			

[3]

(b) Max is 45 and overweight.

He is at risk of developing heart disease and diabetes.

Which of these statements might make him change his diet and lifestyle?

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

The risk to your health is much more than the benefit of eating what you want.

The benefit of eating what you want is worth the risk of diabetes.

People think that the risk of heart disease is much greater than it actually is.

People who are not overweight still suffer from diabetes.

[1]

[Total: 4]

**END OF QUESTION PAPER**

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