

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**GCSE**

**B712/01**

**GATEWAY SCIENCE**  
**SCIENCE B**

**Science modules B2, C2, P2**  
**(Foundation Tier)**

**THURSDAY 17 JANUARY 2013: Afternoon**

**DURATION: 1 hour 30 minutes**  
**plus your additional time allowance**

**MODIFIED ENLARGED 18pt**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.**  
**A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**Periodic Table (inserted)**

**OTHER MATERIALS REQUIRED:**

**Pencil**


**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes on the first page. 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).

## **INFORMATION FOR CANDIDATES**

- Your quality of written communication is assessed in questions marked with a pencil () .
- A list of equations can be found on pages 4 and 5.
- An enlarged copy of the Periodic Table is inserted.
- 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 85.

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## **EQUATIONS**

$$\text{energy} = \text{mass} \times \frac{\text{specific heat}}{\text{capacity}} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

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

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

**force = mass × acceleration**

**weight = mass × gravitational field strength**

**work done = force × distance**

**power =  $\frac{\text{work done}}{\text{time}}$**

**power = force × speed**

**KE =  $\frac{1}{2}mv^2$**

**momentum = mass × velocity**

**force =  $\frac{\text{change in momentum}}{\text{time}}$**

**GPE = mgh**

**mgh =  $\frac{1}{2}mv^2$**

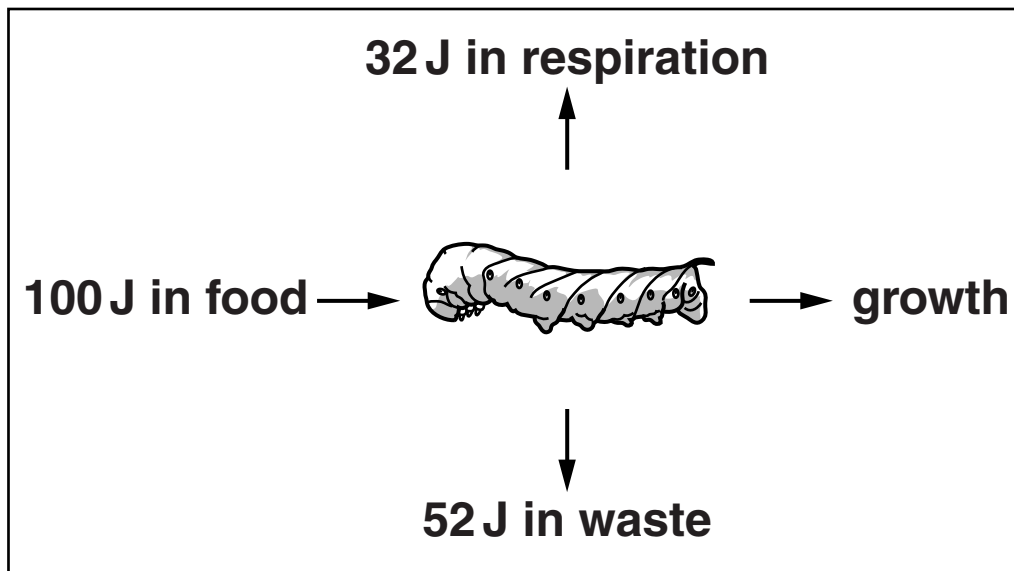
**resistance =  $\frac{\text{voltage}}{\text{current}}$**

Answer ALL the questions.

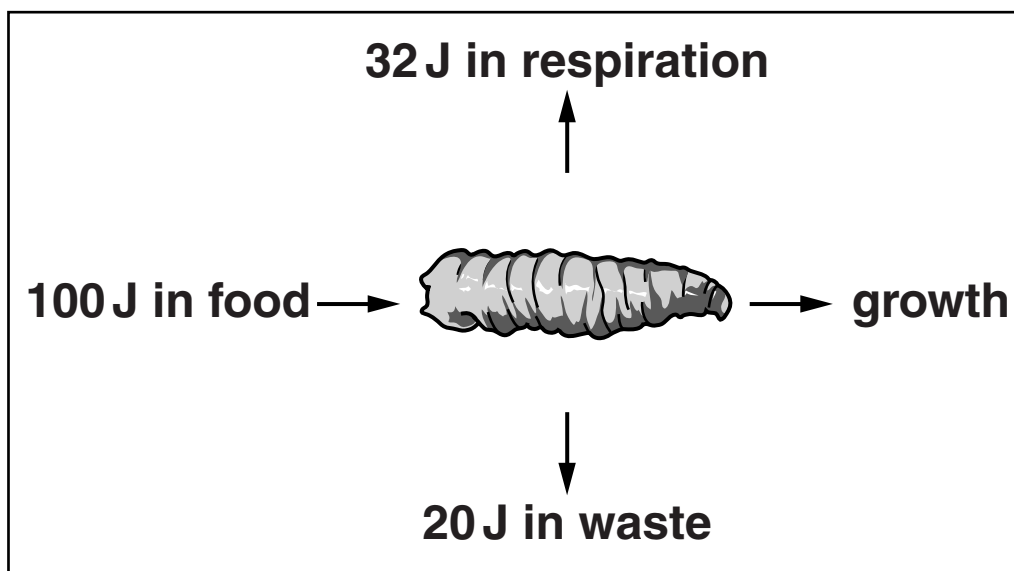
## SECTION A – MODULE B2

- 1 The diagram shows energy transfers through a caterpillar and a maggot.

### CATERPILLAR



### MAGGOT



- (a) (i) Calculate the amounts of energy used for growth in the caterpillar and the maggot for every 100 J of energy in their food.

Show your working.

caterpillar = \_\_\_\_\_ J

maggot = \_\_\_\_\_ J [2]

- (ii) Mary and Tom are talking about the two animals.

Mary says,

“Caterpillars and  
maggots are as  
active as each other.”

Tom says,

“Maggots develop  
faster than  
caterpillars.”

Use the data and your calculations to show how Mary and Tom are both correct.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

- (b) Caterpillars and maggots are both the larvae (young) of adult insects.**

**Look at the diagrams.**

**How do caterpillars and maggots look different from ADULT insects?**

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**[2]**

- (c) Look at the list.**

**Which groups are insects in?**

**Put a ring around each of the TWO correct answers.**

**animal**

**arachnid**

**arthropod**

**crustacean**

**protocista**

**[2]**

**[TOTAL: 8]**

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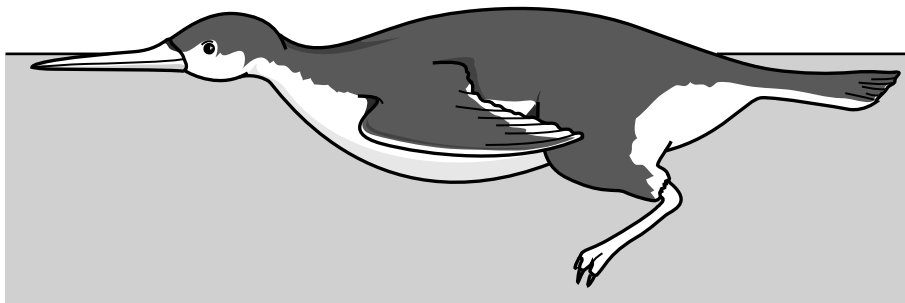
**2** *Waimanu manneringi* is the oldest known species of penguin.

It lived around 62 million years ago in what is now New Zealand.

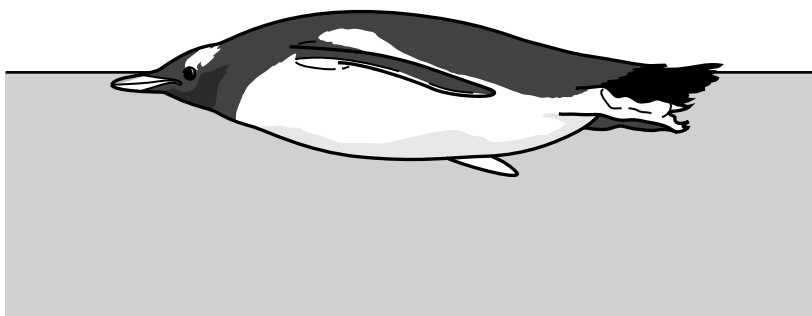
Scientists have used its fossils to reconstruct what they think it looked like.

The Gentoo penguin is a modern species of penguin that is alive today.

*Waimanu manneringi*



Gentoo penguin



Scientists think that *Waimanu manneringi* was a LESS efficient swimmer than modern species of penguin.

One reason for this is that *Waimanu manneringi* was NOT as streamlined as modern species of penguin.

- (a) Apply the theory of natural selection to explain how modern penguins could have evolved to become more streamlined than their ancestors.



The quality of written communication will be assessed in your answer to this question.

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[6]

(b) Paul says that because *Waimanu manneringi* is the oldest known species of penguin, then it must have been the FIRST species of penguin.

Liz says that we can NOT be sure until we have looked for more fossils.

Kevin says that even if we find other fossils we will NEVER be sure we have found the first species of penguin.

Who has made the best statement?

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Explain your answer.

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[2]

**(c) Look at the picture of the Gentoo penguin on page 10.**

**One way that it is adapted is its streamlined shape.**

**Describe and explain OTHER ways that YOU CAN SEE IN THE PICTURE that the Gentoo penguin is adapted.**

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**[3]**

**[TOTAL: 11]**

**3 This question is about gases in the atmosphere.**

**(a) Carbon dioxide is added to the atmosphere when fossil fuels are burnt.**

**(i) Describe how else carbon dioxide is added to the atmosphere.**

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**[2]**

**(ii) How is carbon dioxide removed from the atmosphere?**

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**[2]**

**(b) Nitrogen is another gas in the atmosphere.**

**Plants and animals contain many nitrogen compounds but they can NOT use nitrogen gas to make them.**

**(i) Why can plants and animals NOT use nitrogen gas directly?**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**(ii) What nitrogen compound do plants take in?**

\_\_\_\_\_ [1]

**[TOTAL: 6]**

## SECTION B – MODULE C2

4 David uses potassium sulfate,  $K_2SO_4$ , as a fertiliser.

(a) Fertilisers contain one or more of the three **ESSENTIAL ELEMENTS** for plant growth.

(i) Write down the **NAME** of the essential element in potassium sulfate.

\_\_\_\_\_ [1]

(ii) Sarah uses a mixture of potassium sulfate,  $K_2SO_4$  and ammonium phosphate,  $(NH_4)_3PO_4$  as a fertiliser.

Suggest why Sarah's fertiliser is a better choice than David's.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [1]

(b) Some people want to use more fertiliser and other people want to use less.

Write about the advantages and disadvantages of using fertilisers.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**(c) David wants to make some potassium sulfate solution.**

**He decides to neutralise an acid with potassium hydroxide.**

**(i) Which ACID should he use?**

\_\_\_\_\_ **[1]**

**(ii) David wants to check that a solution of potassium sulfate is neutral.**

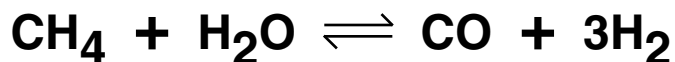
**Write about how he could do this.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[2]**

**[TOTAL: 7]**

- 5 Stowmarket Synthetics want to manufacture hydrogen from methane and water.

Look at the balanced symbol equation for this reaction.



- (a) What does the symbol  $\rightleftharpoons$  mean?

\_\_\_\_\_ [1]

- (b) Phil is a research chemist who works for Stowmarket Synthetics.

He investigates how the PERCENTAGE YIELD (%) of this process changes with temperature and with pressure.

He does this with and without a catalyst.

Look at the percentage yield (%) WITH a catalyst.

With a catalyst	Temperature in °C	Pressure in atmospheres		
		20	30	40
	300	60%	42%	34%
	500	67%	49%	42%
	700	70%	64%	58%

**Look at the percentage yield (%) WITHOUT a catalyst.**

<b>Without a catalyst</b>	<b>Temperature in °C</b>	<b>Pressure in atmospheres</b>		
		<b>20</b>	<b>30</b>	<b>40</b>
	<b>300</b>	<b>60%</b>	<b>42%</b>	<b>34%</b>
	<b>500</b>	<b>67%</b>	<b>49%</b>	<b>42%</b>
	<b>700</b>	<b>70%</b>	<b>64%</b>	<b>58%</b>

**What conclusions can Phil make about the effect of:**

**using the catalyst**

**changing the temperature**

**changing the pressure**

**on the percentage yield?**

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**[3]**

**(c) Write about the COSTS of manufacturing hydrogen by this method.**

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**[2]**

**[TOTAL: 6]**

**6 The body of a railway carriage can be made from either aluminium or steel.**



**(a) Steel is an alloy.**

**What is an alloy?**

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**[1]**

**(b) Look at the table. It shows some of the properties of aluminium and steel.**

<b>Property</b>	<b>Aluminium</b>	<b>Steel</b>
<b>corrosion in moist conditions</b>	<b>does not corrode</b>	<b>slowly rusts</b>
<b>density (1 = low, 10 = high)</b>	<b>3</b>	<b>8</b>
<b>magnetic attraction</b>	<b>not attracted</b>	<b>attracted</b>
<b>hardness (1 = soft, 10 = hard)</b>	<b>5</b>	<b>8</b>
<b>strength (1 = weak, 10 = strong)</b>	<b>4</b>	<b>9</b>
<b>electrical conductivity (1 = poor, 10 = good)</b>	<b>8</b>	<b>7</b>
<b>other properties</b>	<b>malleable and a good conductor of heat</b>	<b>malleable and a good conductor of heat</b>

**Suggest the properties needed by the metal used to make the body of a railway carriage.**

**Explain, with reasons, whether aluminium or steel is the best metal for this use.**



**The quality of written communication will be assessed in your answer to this question.**

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**[6]**

**(c) Old railway carriages are recycled in the same way as cars.**

**Write about the ADVANTAGES, other than cost, of recycling metals.**

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**[2]**

**[TOTAL: 9]**

**7 Sodium chloride is found in sea water.**

**It is an important raw material used in the chemical industry.**

**Sodium chloride solution can be chemically changed into:**

**sodium hydroxide**

**chlorine**

**hydrogen.**

**(a) Look at the symbol equation for this reaction. It is not balanced.**



**Write down the BALANCED SYMBOL equation for this reaction.**

\_\_\_\_\_ [1]

**(b) Write down the name of a substance that can be made from hydrogen.**

**Choose from the list.**

**ammonia**

**cement**

**household bleach**

**soap**

**answer \_\_\_\_\_ [1]**

**(c) Write down the name of a substance that can be made from chlorine.**

**Choose from the list.**

**ammonia**

**cement**

**household bleach**

**soap**

**answer \_\_\_\_\_ [1]**

**[TOTAL: 3]**

## SECTION C – MODULE P2

**8 Paula fits solar panels to the roof of her house.**



**The panels contain photocells.**

**They transfer light energy to electricity.**

**(a) What sort of electricity do photocells produce?**

\_\_\_\_\_ [1]

**(b) Paula wants to DOUBLE the electrical power produced from sunlight.**

**What should she do to the AREA of her solar panels?**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**(c) Paula wants to reduce her fuel bills by harnessing the Sun's energy in ANOTHER way.**

**Describe a method she could use and explain how this method would reduce her fuel bills.**

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[2]

**[TOTAL: 4]**

**9 Producing electricity in power stations is not very efficient.**

**(a) In power station A, 800 joules of energy from coal produce 300 joules of electrical energy.**

**Calculate the efficiency of this power station.**

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**answer \_\_\_\_\_ [2]**

**(b) In another power station, B, 800 joules of energy from coal produces 350 joules of electrical energy.**

**Comment on the efficiency of power stations A and B.**

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**[1]**

**[TOTAL: 3]**

**10 This question is about dealing with radioactive materials safely.**

- (a) Radioactive waste is produced by some industries and hospitals.**

**Half-life is the time it takes for the waste to become half as radioactive.**

**Look at the information in the table.**

<b>Waste containing...</b>	<b>Level of radiation</b>	<b>Half-life</b>	<b>Type of radiation given out</b>
<b>uranium</b>	<b>very radioactive</b>	<b>700 000 000 years</b>	<b>alpha</b>
<b>iodine</b>	<b>very radioactive</b>	<b>8 days</b>	<b>beta and gamma</b>
<b>a mix of sources from hospitals</b>	<b>slightly radioactive</b>	<b>up to 20 years</b>	<b>alpha, beta and gamma</b>

**Suggest how each type of waste can be disposed of safely, giving reasons for your answer.**



**The quality of written communication will be assessed in your answer to this question.**

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**[6]**

**(b) Radioactive materials can be used by science teachers in classrooms.**

**There are risks involved in handling radioactive materials.**

**Write about how these risks can be reduced.**

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**[2]**

**[TOTAL: 8]**

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**11 Tammy uses electrical appliances in her home.**

**Look at the information opposite.**

**(a) Which appliance costs the LEAST to use for one hour?**

**Choose from the table.**



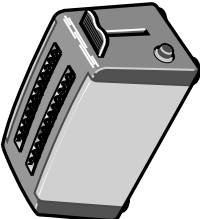
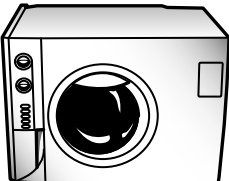
**answer \_\_\_\_\_ [1]**

**(b) The kettle and the washing machine have the same power rating.**

**The washing machine costs Tammy more to use each day than the kettle.**

**Explain why.**

\_\_\_\_\_  
\_\_\_\_\_ **[1]**

Appliance	Power in watts	Time used each day in hours
 kettle	2500	0.5
 lamp	60	8.0
 toaster	800	0.1
 washing machine	2500	1.0

**(c) Tammy has a television.**

**It is connected to the 230V mains.**

**The television takes a current of 0.8 A from the mains.**

**Calculate the power of the television.**

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**answer \_\_\_\_\_ W [2]**

**(d) The toaster is also connected to the 230V mains.**

**Use information from the table to suggest why the toaster takes more current than the television.**

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**[TOTAL: 5]**

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**12 (a) Stars give off their own light.**

**Explain why.**

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**[1]**

**(b) Spacecraft are used to explore space.**

**Some of them are manned, some are unmanned.**

**The distance from Earth to Mars is 200 million km.**

**It takes about 2 years for a spacecraft to reach Mars.**

**Look at the information about Neptune.**

<b>Distance from Earth</b>	<b>4500 million km</b>
<b>Diameter</b>	<b>49 600 km</b>
<b>Time to orbit Sun</b>	<b>165 years</b>
<b>Average temperature</b>	<b>−225 °C</b>

**A space exploration agency wants to send a spacecraft to Neptune.**

**They decide to use a MANNED spacecraft.**

**Is this a good decision?**

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**Explain your answer.**

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[2]

**(c) Large asteroids have collided with the Earth in the past.**

**What effect did these collisions have on the Earth?**

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[2]

**[TOTAL: 5]**

## **SECTION D**

- 13 This question is about the greenhouse effect and global warming.**

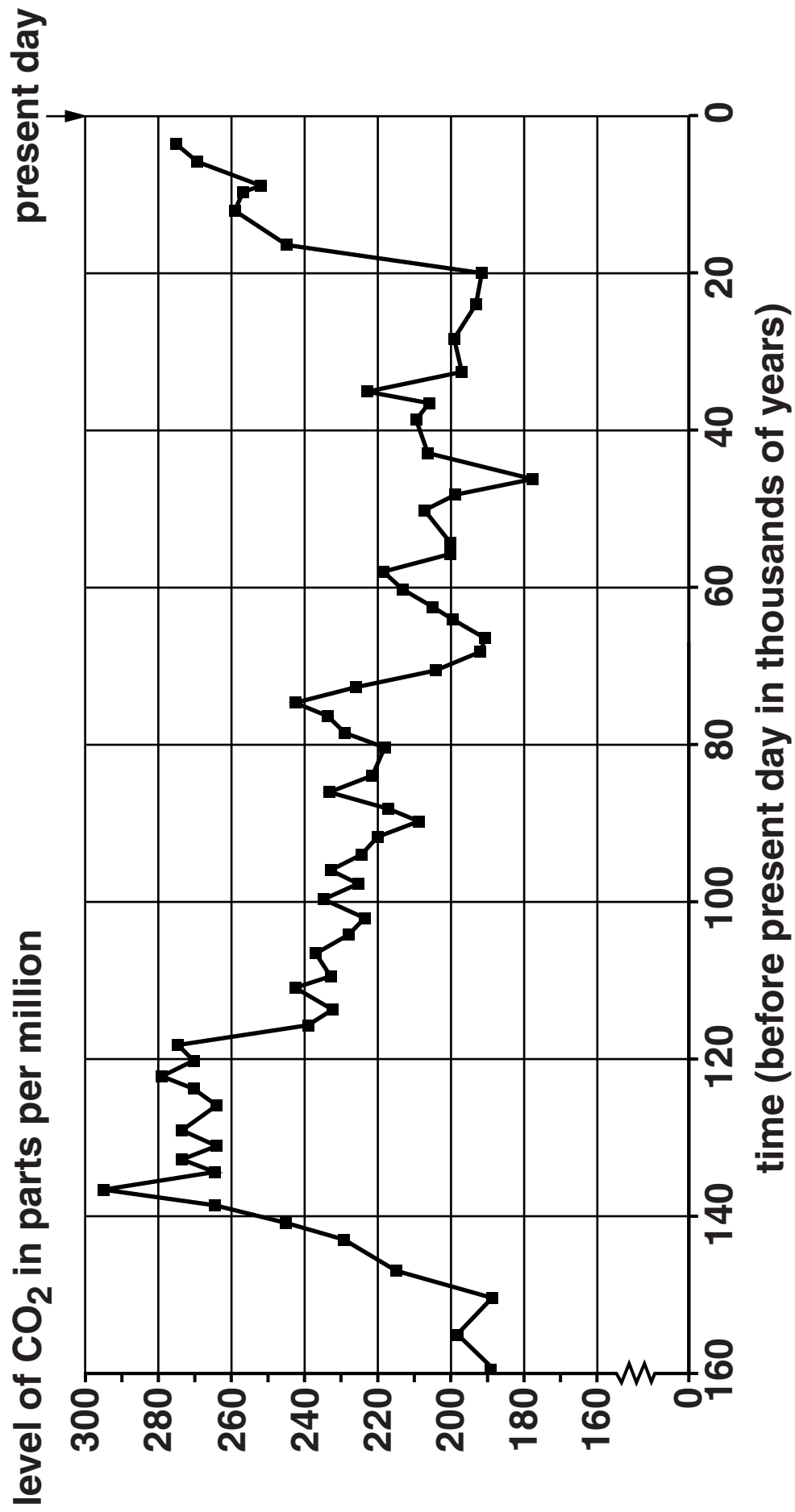
**Some scientists say that an increase in global warming is part of a natural cycle.**

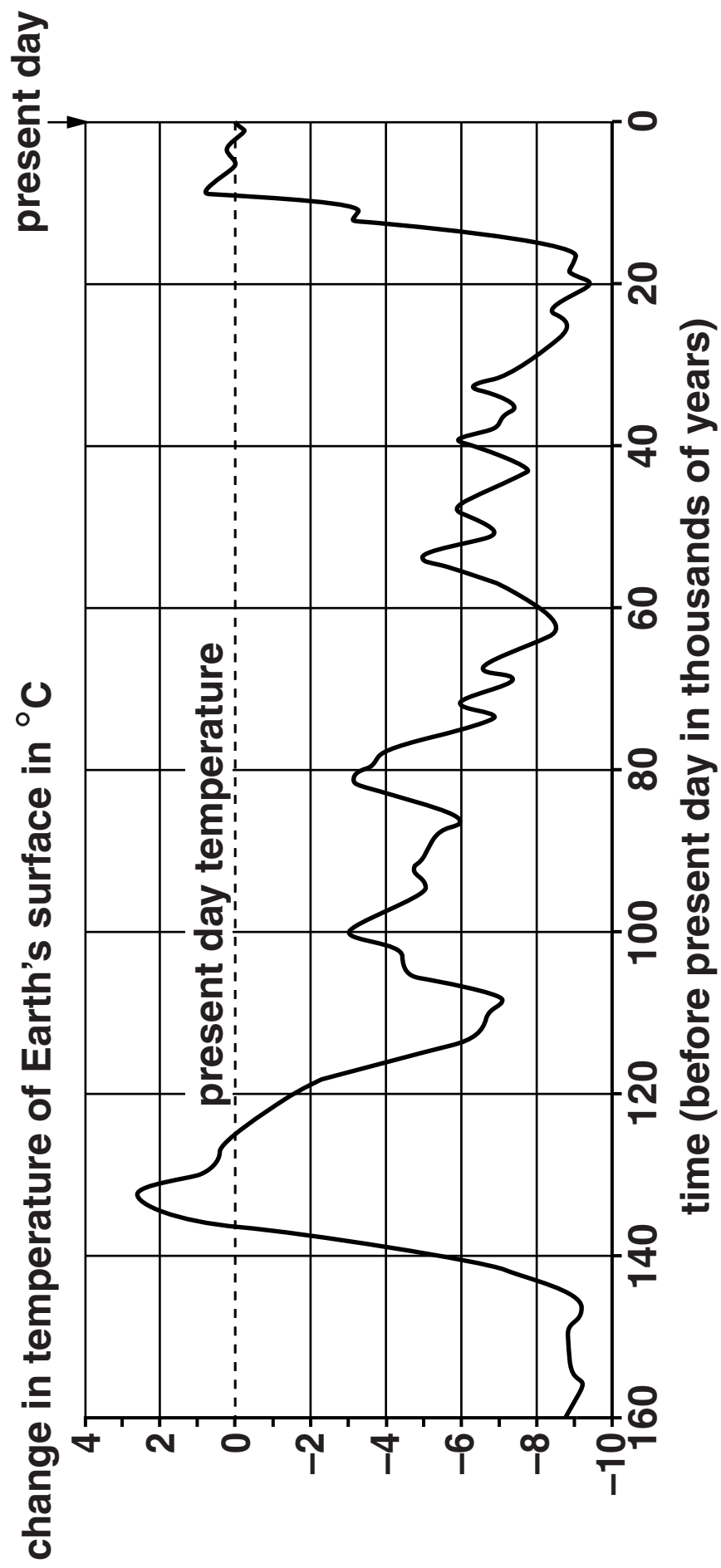
**Other scientists think that an increase in global warming will be disastrous for the world. They think that the surface temperature of the Earth is increasing and that this is because more fossil fuels are being burned.**

**Burning fossil fuels makes a lot of carbon dioxide.**

**Look at the graphs on pages 41 and 42.**

**They show how the amount of carbon dioxide in the air and the temperature of the Earth have changed over the last 160 000 years.**





- (a) (i) What is the HIGHEST level of carbon dioxide in the air during the last 160 000 years?**

\_\_\_\_\_ parts per million [1]

- (ii) Describe what has happened to the surface temperature of the Earth in the last 160 000 years.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

- (iii) Is there a link between the surface temperature of the Earth and the level of carbon dioxide in the air?**

**Explain your answer. Use information from the graphs.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**(b) Look at the table. It shows the carbon dioxide emissions for some countries in 2003.**

**It also shows the population for these countries in 2003.**

<b>Country</b>	<b>Continent</b>	<b>Carbon dioxide emissions in million tonnes per year</b>	<b>Population in millions</b>
<b>Botswana</b>	<b>Africa</b>	<b>4</b>	<b>2</b>
<b>China</b>	<b>Asia</b>	<b>3762</b>	<b>1254</b>
<b>France</b>	<b>Europe</b>	<b>390</b>	<b>62</b>
<b>Germany</b>	<b>Europe</b>	<b>854</b>	<b>82</b>
<b>Ghana</b>	<b>Africa</b>	<b>7</b>	<b>23</b>
<b>India</b>	<b>Asia</b>	<b>1050</b>	<b>1064</b>
<b>Indonesia</b>	<b>Asia</b>	<b>318</b>	<b>215</b>
<b>Japan</b>	<b>Asia</b>	<b>1201</b>	<b>128</b>
<b>Mozambique</b>	<b>Africa</b>	<b>2</b>	<b>21</b>
<b>Russia</b>	<b>Asia</b>	<b>1527</b>	<b>143</b>
<b>UK</b>	<b>Europe</b>	<b>540</b>	<b>59</b>
<b>USA</b>	<b>America</b>	<b>5729</b>	<b>291</b>
<b>World</b>		<b>24 983</b>	<b>6268</b>

- (i) Which **THREE** countries had the **LOWEST** carbon dioxide emissions in 2003?

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**Suggest why.**

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 [2]

- (ii) Show that the percentage of the world emissions of carbon dioxide in 2003 made by the USA was 22.9%.

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 [1]

- (iii) In 2003, about 4.6% of the world's population lived in the USA.

**22.9% of the world's emissions of carbon dioxide came from the USA.**

**Some other countries are concerned about the difference between these two percentages.**

**Suggest why.**

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 [2]

**[TOTAL: 10]**

**END OF QUESTION PAPER**

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