New GCSE

WJEC CBAC

4781/02

SCIENCE B
UNIT 1: Space, Energy and Life
HIGHER TIER

P.M. THURSDAY, 17 January 2013

1¼ hours

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
Section A	**1.**	24	
Section B	**2.**	8	
	3.	10	
	4.	12	
	5.	6	
	6.	10	
Total		70	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator, pencil and a ruler.

You will also need a copy of the Resource Folder to answer **Section A**.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

Section A is based upon the Pre-Release Article.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **1***(a)* and **6***(a)*.

SECTION A

You need to refer to the resource folder to answer questions in this section.

*Answer **all** questions in the spaces provided.*

1.   Water pollution can be monitored using invertebrate animals as indicators.

   (a)   Describe how you would carry out an investigation into monitoring water pollution
   using invertebrates.   [6 QWC]

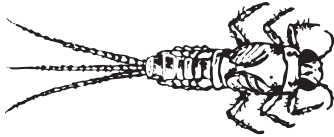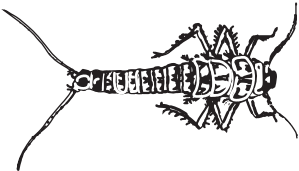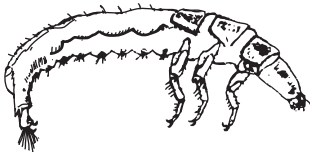   ....

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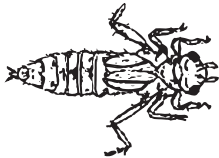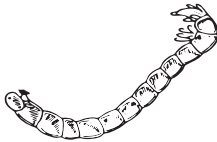   ....

(b) This table shows the results of invertebrates identified in three parts of a stream **A**, **B** and **C** obtained during an investigation.

	Photograph of invertebrate	**Species**	**Total biomass in sample (g)**		
			A	**B**	**C**
1		....	50	0	4
2		....	65	0	0
3		Caddisfly larva	0	0	30
4		....	0	4	34
5		....	0	45	10
6		....	0	100	2

(i) Use the information in the resource folder to identify each invertebrate and complete the table. One has been completed for you. [5]

(ii)   Plot the results for part **C** of the stream as a bar chart on the grid below. The data
for parts **A** and **B** in the stream have already been plotted for you.   [3]

Animals from each area
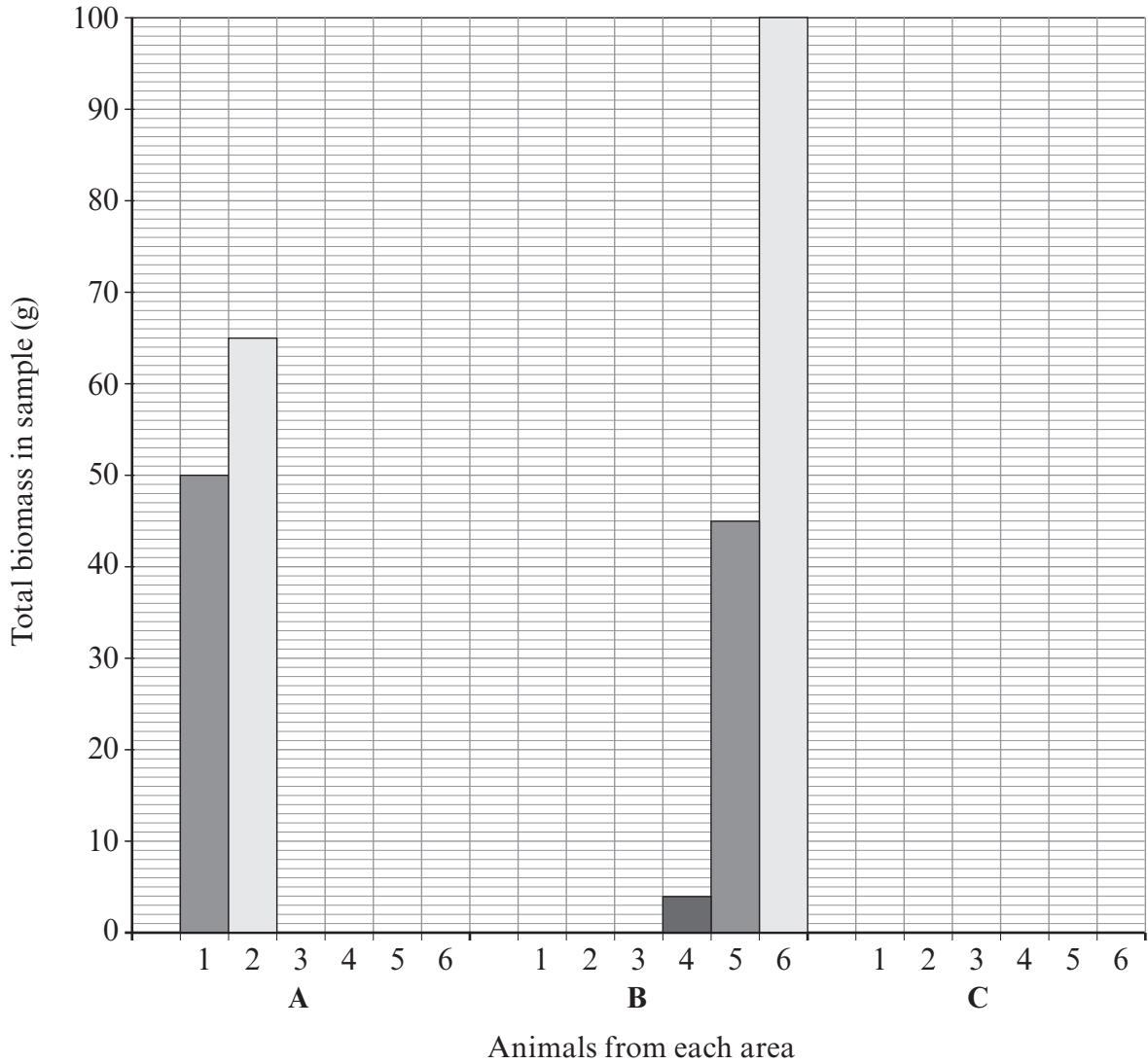
(iii) Use the information in the resource folder and the results of the investigation to
describe how the quality of water (pollution level) changes from part **A** of the
stream, as it flows to parts **B** and **C**.   [3]

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(iv)   Explain how the results to the investigation support your answer to (iii).   [3]

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(c)   During the investigation, any water boatmen collected were not counted. Explain why they were ignored.   [2]

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(d)   How could the repeatability of the data collected be improved?   [2]

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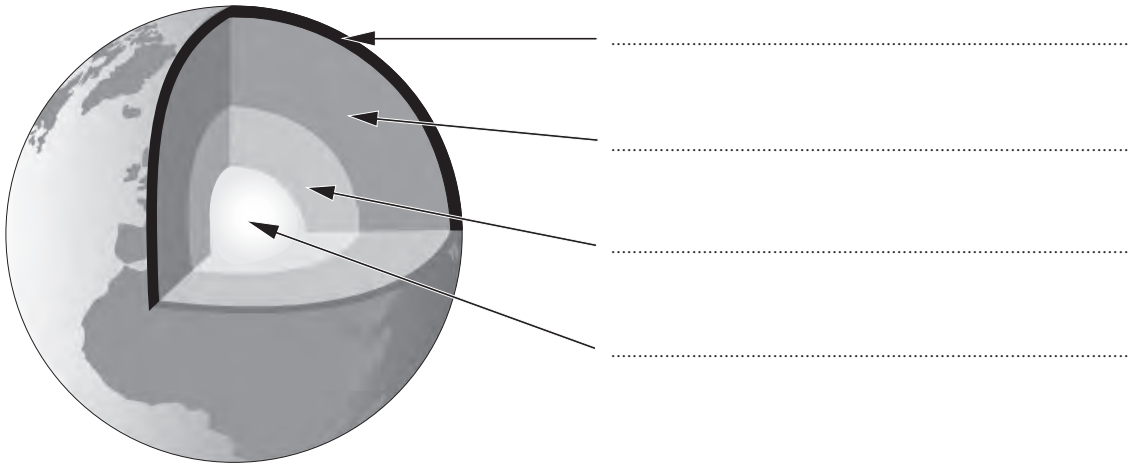
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SECTION B

*Answer **all** questions in the spaces provided.*

2. *(a)* The diagram below shows the structure of the Earth.

Label the four parts shown. [4]

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(b) The surface of the Earth changes due to geological processes. For example, Iceland was only formed because the Earth is made of plates that move.

(i) Complete the sentences below.

The Earth's crust is made up of huge slabs of rock called ....
plates. [1]

The movement of these plates is known as .... drift. [1]

(ii)   Iceland sits on the boundary between two of these plates, which are moving in the direction shown by the arrows.

Boundary between plates

Iceland
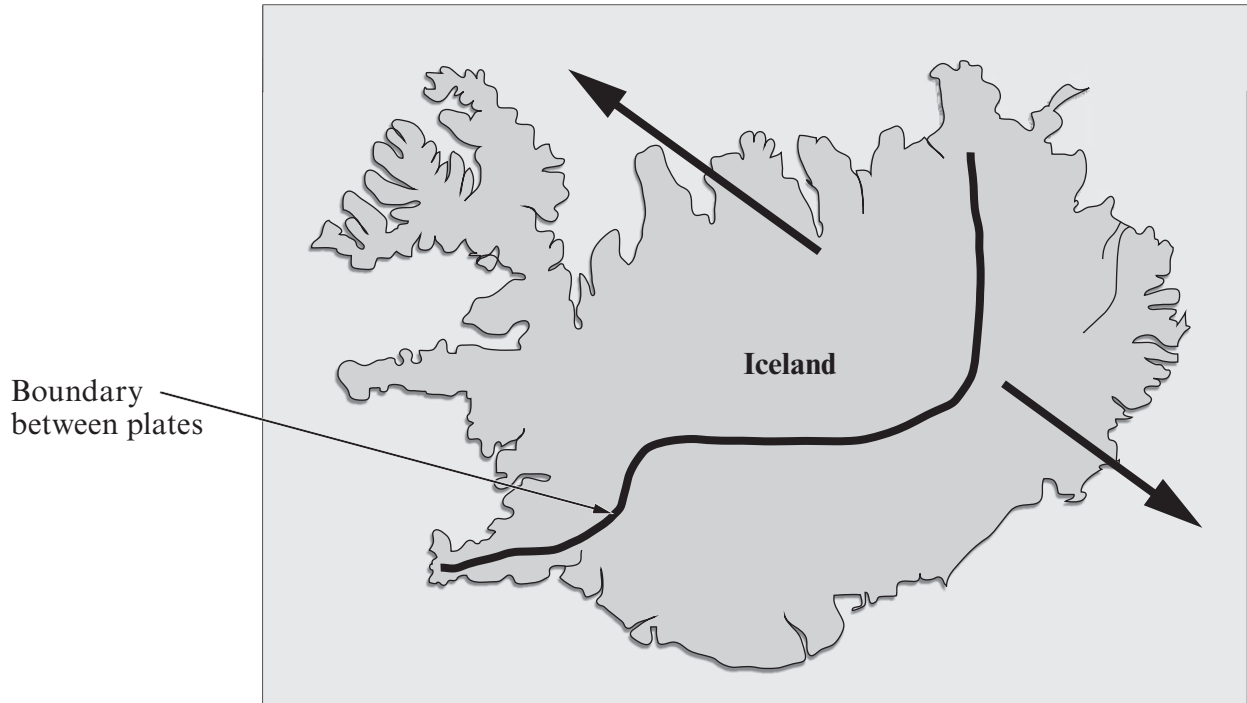
State **two** natural disasters that could be caused by these moving plates.   [2]

1. ....

2. ....

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3. Homeowners who generate electricity from solar power get paid for energy they produce under a scheme called 'Feed-in Tariff'.

The Feed-in Tariffs scheme means that homeowners who generate electricity from solar power get paid for energy they produce and use themselves. They also get paid for any electricity they produce and put into the grid. They will also see their energy bills fall slightly. This scheme is intended to compensate the homeowner for the initial cost of installing solar panels, which is approximately £9 000.

The total return is split like this for a typical **2.9 kW** household installation:

- £1 050 a year from the Generation Tariff
- £60 a year from the Export Tariff
- £90 a year reduction of current electricity bills.

(a) Explain why the use of home solar power would benefit the **environment**. [3]

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(b) (i) Use the information above to calculate the payback time of the cost of installing the solar panel. [2]

Payback time = ... years

(ii) Explain why this payback time could change. [2]

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(c) Calculate how long it would take for the solar panel to produce enough electricity to save the homeowner £90 using the equations: [3]

Units used = power (kW) × time (h)

Cost = units used × cost per unit

One unit of electricity costs 12p

Time = ...

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4. Astronomical images are collected using different parts of the electromagnetic spectrum.

(a) Compare the use of Earth-based and space-based telescopes to produce these images. [2]

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(b) The diagrams below show X-ray images and X-ray spectra of two black hole systems taken by a space based telescope.
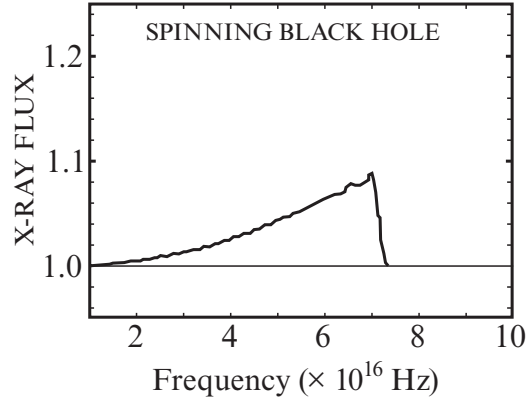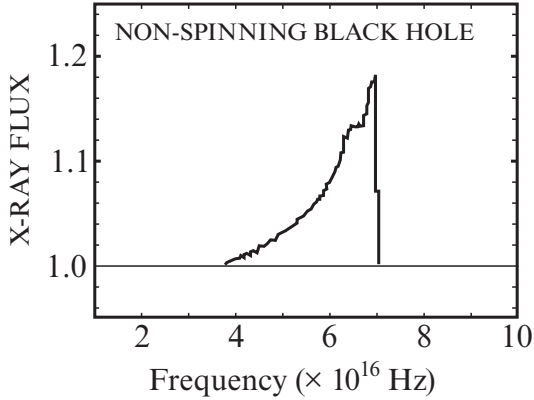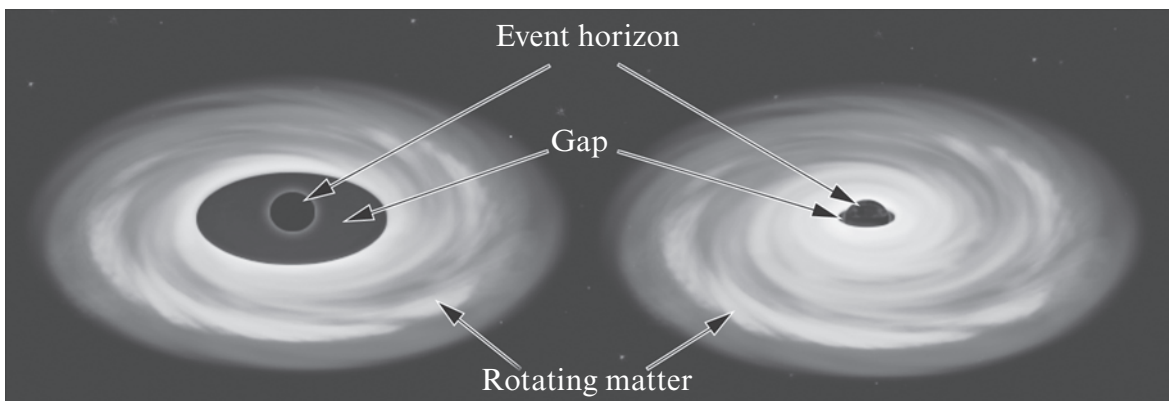
(i) Compare the images from the black holes. [2]

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(ii) Compare the X-ray spectra from both black holes. [2]

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(iii) Calculate the wavelength of the most intense X-rays in the spectrum given that the wave speed of X-rays through space is 3×10^8 m/s using the equation: [3]

wave speed = frequency × wavelength

Wavelength = ... m

(c) NASA and the European Space Agency plan to work together to build very sensitive X-ray telescopes in the future. Describe the benefits to both organisations of working together. [3]

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5. The peppered moth exists as a light form and as a mutant dark form.

Light form   Dark form

Peppered moths can be eaten by birds.

In areas affected by air pollution, the surfaces on which moths land are covered by dark, sooty deposits. The industrial revolution took place in the 1880s and was the cause of very high levels of air pollution by soot.

The graphs show the percentages of dark and light forms of moth in the same four areas of Britain **A**, **B**, **C** and **D** in 1880 and 1950.
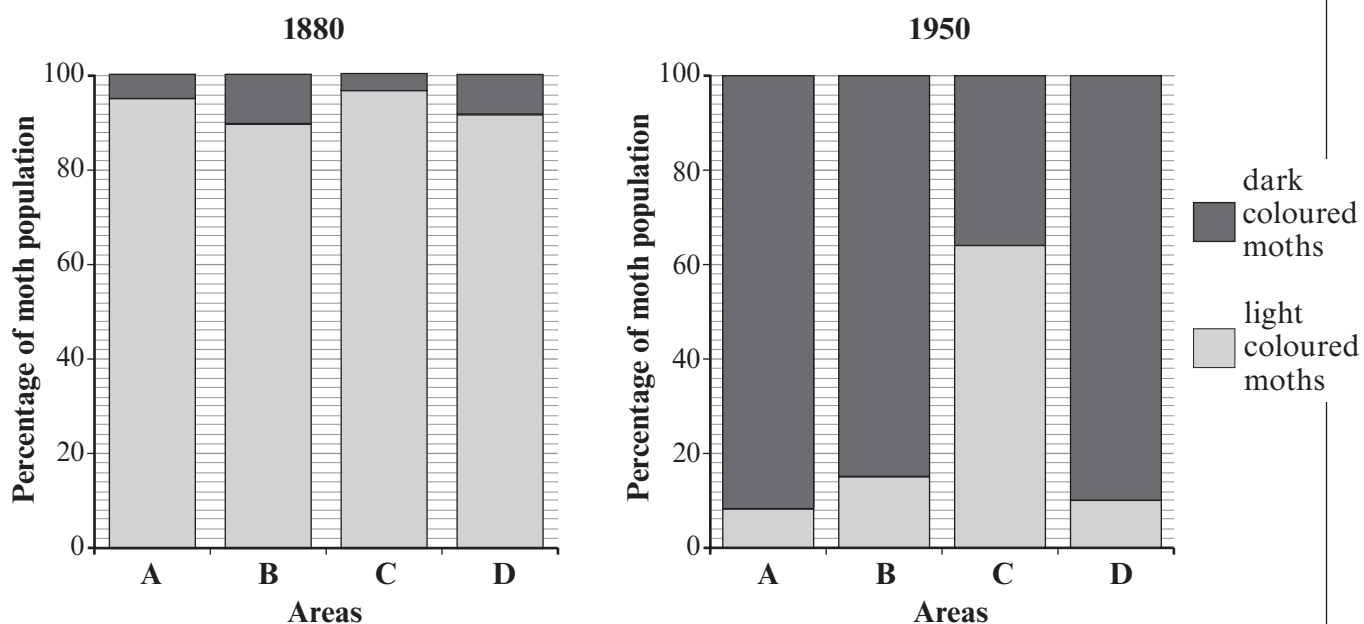
(a) Using the information in the graphs, explain how peppered moths have been affected by natural selection between 1880 and 1950. [3]

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(b) Since the Clean Air Act of 1956, industrial areas have become much less polluted.

(i) Explain the expected effect on the number of light coloured moths surviving in areas **A**, **B**, **C** and **D**. [2]

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(ii) Suggest why it might be an advantage to the species for dark mutants to occur even in a non-polluted environment. [1]

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6. *(a)* This diagram represents the carbon cycle.
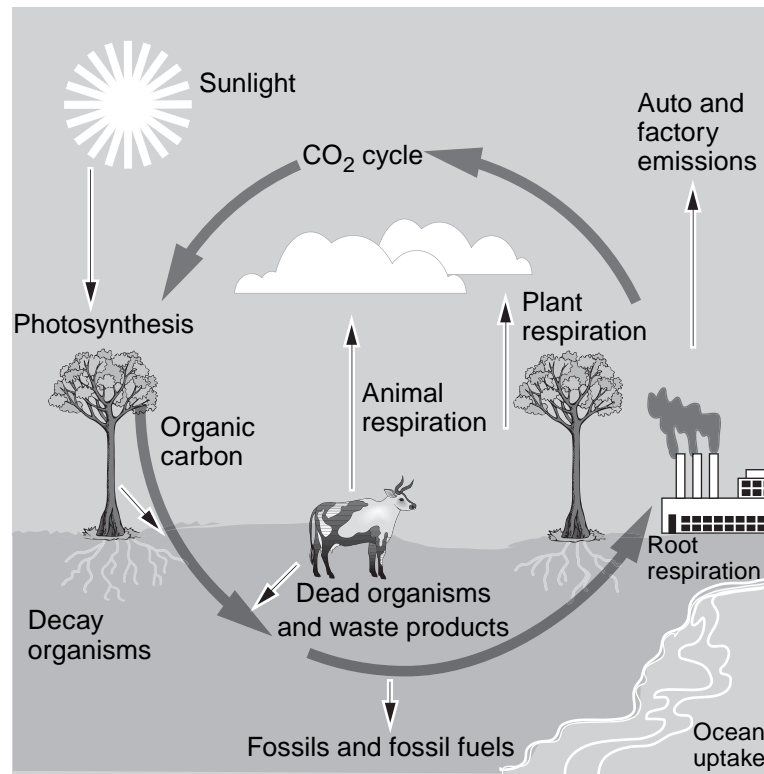
Use the information in the diagram to explain why for thousands of years the amount of carbon dioxide in the earth's atmosphere remained approximately constant. [6 QWC]

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(b) During the past 100 years, evidence suggests that the amount of carbon dioxide in the atmosphere has been steadily rising. One factor that contributes to this increase is people travelling to work.

Information from a website includes the table below. This gives information about the amount of carbon dioxide produced for **each journey** taken by **100 people** travelling to work by different methods.

	Distance to work (km)			
	10	20	25	50
Carbon dioxide produced travelling by car (tonnes)	0.4	0.8	1.0	2.0
Carbon dioxide produced travelling by coach (tonnes)	0.05	0.1	0.125	0.25
Carbon dioxide produced travelling by train (tonnes)	0.09	0.18	0.225	0.45

Use this information to calculate the amount of carbon dioxide saved during a 5 day working week, if 200 people travel 40 km **to and from** work by coach instead of car. [4]

Amount of carbon dioxide saved = ... tonnes

END OF PAPER

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