

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Higher Tier  
Specimen Paper

# Environmental Science

# 44401H

## Unit 1 Topics in Environmental Science

Date: XXXX

**For this paper you must have:**

- a ruler

You may use a calculator.

**Time allowed**

- 2 hours

**Instructions**

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 120.
- You are expected to use a calculator where appropriate.
- In some questions you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

**Advice**

- In all calculations, show clearly how you work out your answer.

The specimen assessment materials are provided to give centres a reasonable idea of the general shape and character of the planned question papers and mark schemes in advance of the first operational exams.

For Examiner's Use	
Examiner's Initials	
Question	Mark
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6	
7	
8	
9	
10	
<b>TOTAL</b>	

# H

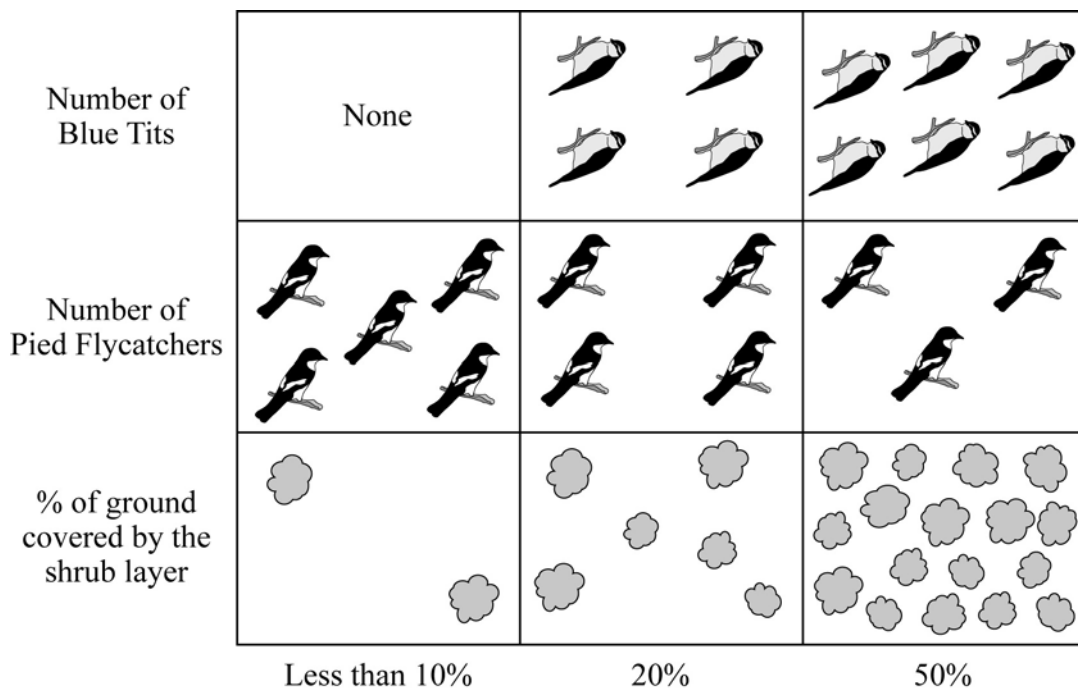
# 44401H

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

- 1** The shrub layer in woodland is made up of bushes and shrubs growing below the taller trees. Blue Tits and Pied Flycatchers are two species of birds which live in woodlands.

Environmental scientists chose areas of woodland with different amounts of ground covered by the shrub layer and counted the numbers of birds in each area.

The chart shows the results of an investigation into the relationship between the percentage cover of the shrub layer and the numbers of these birds.



- 1** (a) (i) State what happens to the number of Pied Flycatchers as the percentage of the ground covered by the shrub layer increases.

.....  
(1 mark)

- 1** (a) (ii) Identify the independent variable in this investigation.

.....  
(1 mark)



**1 (a) (iii)** Identify **one** dependent variable in this investigation.

.....  
(1 mark)

**1 (a) (iv)** Identify **one** control variable which the environmental scientists would have had to consider when carrying out this investigation.  
State **one** reason why this variable might affect the results of the investigation.

Control variable.....  
.....  
Reason.....  
.....

(2 marks)

**1 (a) (v)** The environmental scientists found, in a survey of an area of woodland, that 50 % of the ground was covered by the shrub layer. There were 46 Pied Flycatchers. How many Blue Tits would you expect to find in the same area?

.....  
(1 mark)

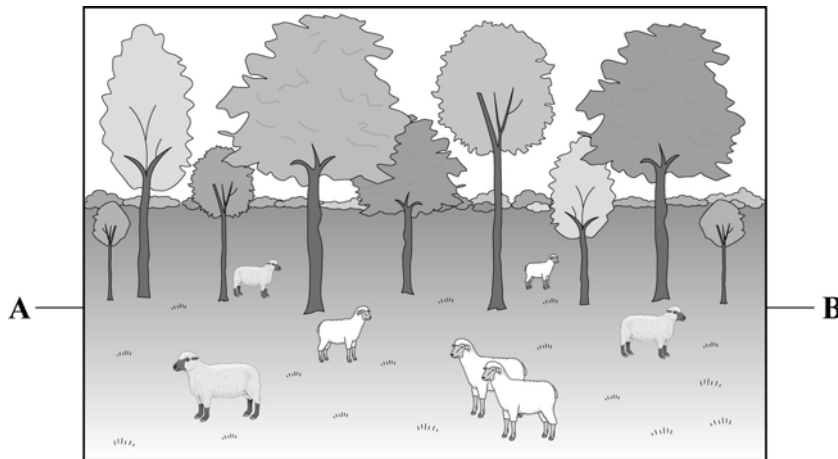
**Question 1 continues on the next page**



- 1 (b) There are large numbers of Blue Tits in most parts of the United Kingdom. Pied Flycatchers are much less common.

The sketch shows part of a nature reserve where the wardens want to encourage Pied Flycatchers to live and breed.

At present sheep are allowed to graze under the trees. They eat grass but also nibble away any young shrubs and trees which begin to grow.



- 1 (b) (i) In their management plan, the reserve wardens have suggested keeping sheep out of the woodland by building a fence from **A** to **B**. Explain why they think that this will help to increase the number of Pied Flycatchers.

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(2 marks)



- 1 (b) (ii) A rare plant grows in the grassland area in front of the trees.  
Explain why the wardens have decided to build the fence rather than removing the sheep from the whole area.

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(2 marks)

- 1 (c) Nature reserves often have car parks, toilets, picnic areas and sometimes shops for visitors.  
Suggest **one** other facility which is likely to be provided. State **one** reason for the facility you have suggested.

Facility provided.....

.....

Reason .....

.....

(2 marks)

12

**Turn over for the next question**



**There are no questions printed on this page**

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ANSWER IN THE SPACES PROVIDED**



2 (a) The table gives some details about two types of energy resource.

Energy resource	Is it predictable?	Is it intermittent?
Tidal power	Yes	Yes
Wind power		

2 (a) (i) Complete the table by writing either Yes or No in the correct boxes to show the characteristics of wind power.

(1 mark)

2 (a) (ii) State **two** reasons why some environmentalists are against the building of turbines to harness wind power.

1 .....

.....

2 .....

.....

(2 marks)

2 (a) (iii) State and explain why many environmental scientists believe that it is better to obtain energy from wind power rather than by using fossil fuels.

*In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

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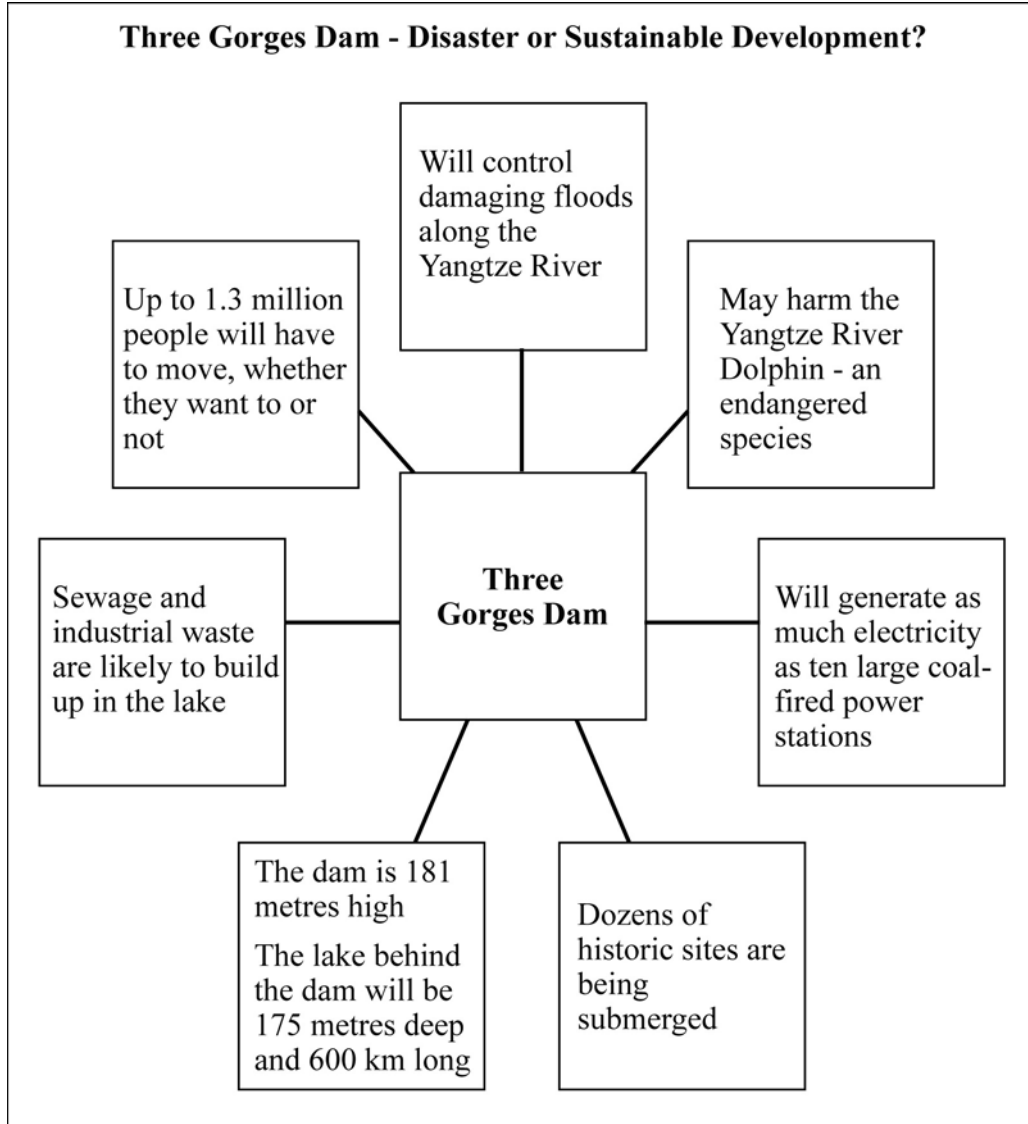
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(4 marks)



- 2 (b) The Three Gorge Dam is a hydroelectric river dam on the Yangtze River in China. Environmental scientists have argued about the costs and benefits of the project which will be the largest HE power station in the world. Use the information to answer the questions.



- 2 (b) (i) What do environmental scientists mean by the phrase *sustainable development*?

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(2 marks)





2 (b) (ii) Explain **one** possible reason why some environmental scientists believe that the Three Gorges Dam is an example of sustainable development.

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(2 marks)

2 (b) (iii) Explain **one** possible reason why some environmental scientists believe that the Three Gorges Dam is **not** an example of sustainable development.

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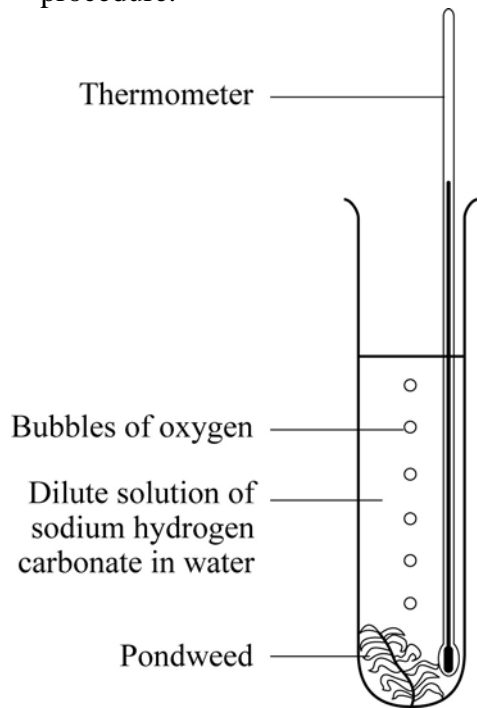
(2 marks)

13

**Turn over for the next question**



- 3 (a) Some students investigated the rate of photosynthesis at different temperatures. The diagram shows the apparatus they used. The box gives details of their procedure.



- The students set up a number of tubes like this one.
- Each tube was kept at a different temperature.
- To measure the rate of photosynthesis they counted the number of bubbles given off in five minutes.
- They used these results to calculate the number of bubbles per minute.

- 3 (a) (i) State **one** action which the students should take to help to make sure that they carried out a fair test. State **one** reason for your answer.

Action .....

.....

Reason .....

.....

(2 marks)

- 3 (a) (ii) State **one** thing which the students could do to check the reliability of their results.

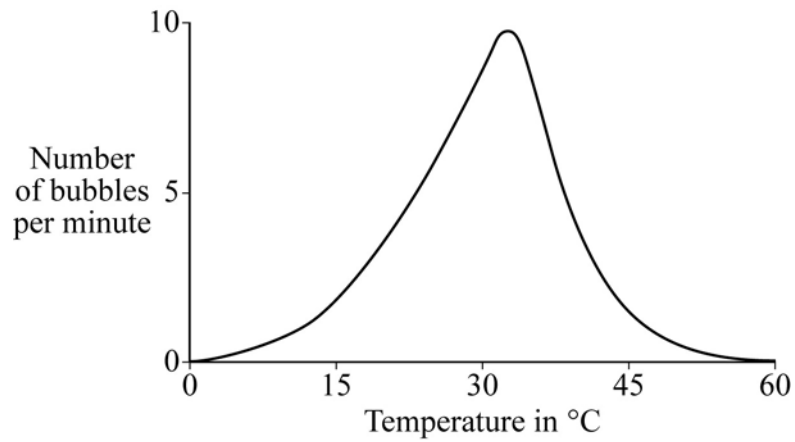
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(1 mark)



3 (a) (iii) The diagram shows a sketch graph of the students' results.



Describe fully the pattern shown by the graph.

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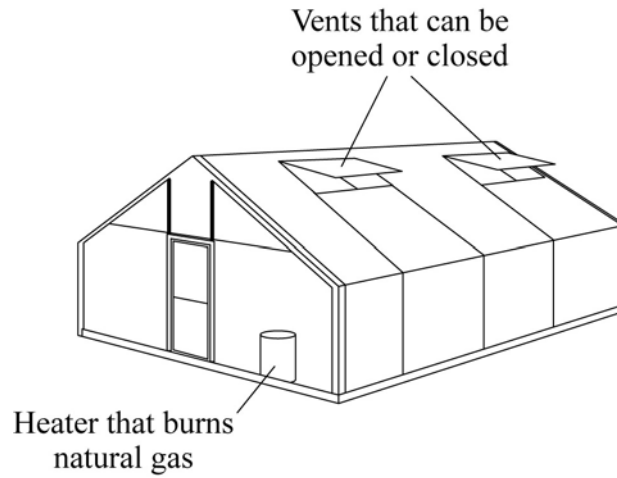
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(3 marks)

**Question 3 continues on the next page**



3 (b) The diagram shows a glasshouse used to grow crops.



3 (b) (i) Explain how use of the vents can help to increase the yield of crops in this glasshouse.

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(3 marks)

3 (b) (ii) State **two** ways in which the heater can help to increase the yield of crops in this glasshouse.

1 .....

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2 .....

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(2 marks)



**3** (b) (iii) A glasshouse is a controlled environment.

State **one** other example of the use of a controlled environment in farming.

.....  
.....

*(1 mark)*

**12**

**Turn over for the next question**



4 (a) (i) Complete the paragraph below.

The Greenhouse Effect happens because .....  
wavelength radiation from the ..... passes through the  
atmosphere and is absorbed by the Earth. Energy is re-radiated as  
..... wavelength radiation.  
Some of this is ..... by greenhouse gases  
in the atmosphere.

(4 marks)

4 (a) (ii) State **one** reason why the natural Greenhouse Effect is important for life on Earth.

.....  
.....

(1 mark)

4 (b) The article in the box gives details about the Republic of Kiribati.

**Pacific Islanders' Climate Change Fear**

- The Republic of Kiribati is a country in the Pacific Ocean. It is made up of about thirty small islands.
- Almost all the land in Kiribati is less than two metres above sea level.
- There are very few motor vehicles and no large factories or power stations on the islands.
- The people of Kiribati are worried about what will happen to their islands if an increase in the Greenhouse Effect causes changes to the Earth's climate.
- Many of the islanders say that climate change will not be their fault and that people in more economically developed countries (MEDCs) should be doing more to reduce their carbon footprints.



4 b) (i) The people of Kiribati are worried about what will happen to their islands if an increase in the Greenhouse Effect causes changes to the Earth’s climate. Explain **two** reasons why they might be worried.

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(4 marks)

4 (b) (ii) State the meaning of the term *carbon footprint*.

.....  
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(1 mark)

4 (b) (iii) Explain why the people of Kiribati believe that people in more economically developed countries (MEDCs) should do more to reduce their carbon footprints.

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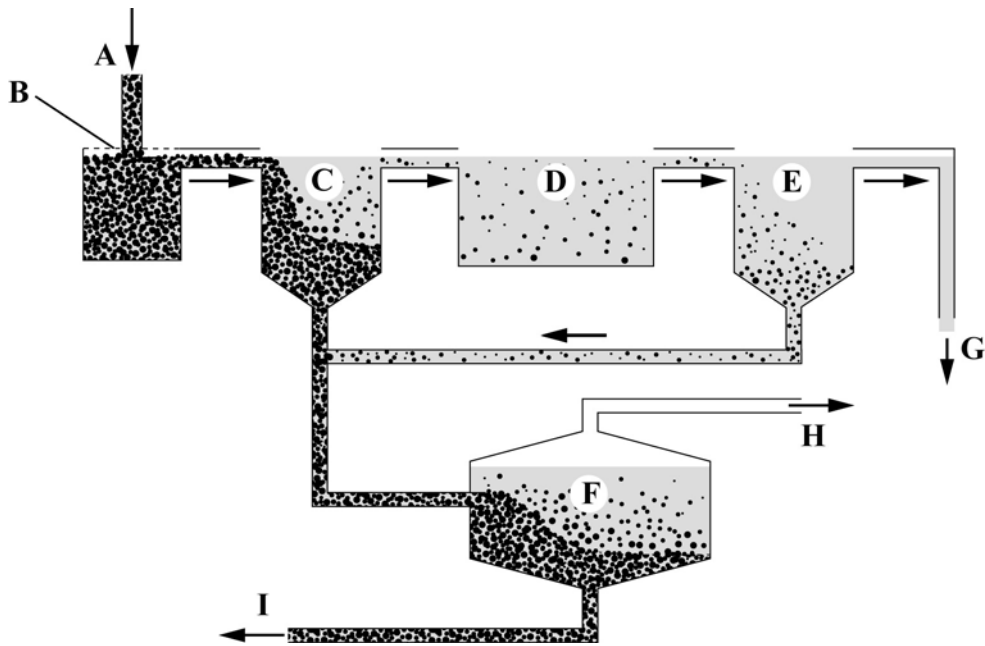
(2 marks)

12



5 The treatment of sewage is a major contribution to environmental health.

The diagram shows some of the processes involved in the treatment of sewage. Untreated sewage enters the treatment works at point **A** and treated sewage is discharged into a river at **G**.



5 (a) (i) The first process of sewage treatment occurs at point **B** on the diagram. The sewage passes through a moving grid. Name this process and state its purpose.

Name of process .....

Purpose of process .....

(2 marks)

5 (a) (ii) Tanks **C** and **E** are sedimentation (or settlement) tanks. Describe what happens in these tanks.

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 .....  
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(2 marks)





**5** (a) (iii) Aerobic biological treatment takes place in tank **D**. Describe what happens in this tank.

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*(2 marks)*

**5** (a) (iv) Anaerobic digestion takes place in tank **F**. Describe what happens in this tank.

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*(2 marks)*

**5** (b) Heavy rainfall can sometimes increase the volume of sewage arriving at a sewage works so much that untreated sewage overflows into the river.

**5** (b) (i) Explain how the discharge of untreated sewage can cause problems for human health.

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*(2 marks)*

**Question 5 continues on the next page**



**5** (b) (ii) Explain how the discharge of untreated sewage may affect organisms living in the river.

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*(2 marks)*

<hr/> <b>12</b>
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**Turn over for the next question**

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6 Agricultural scientists have developed methods of producing genetically modified plants that give greater yields. Read the information to help you answer the questions.

Ordinary maize	Bt maize - a genetically modified crop
	
<ul style="list-style-type: none"> <li>• Ordinary maize plants can be attacked by the Corn Borer insect.</li> <li>• This insect can reduce yields by up to 20%.</li> <li>• Ordinary maize crops may have to be sprayed with pesticides up to six times.</li> </ul>	<ul style="list-style-type: none"> <li>• Bt maize has been genetically modified so that it produces the Bt protein which kills the Corn Borer insect.</li> <li>• Bt maize may only need to be sprayed once.</li> </ul>

6 (a) Explain the meaning of each of the following terms used in the extract.

6 (a) (i) *Pesticides* .....

.....

.....

.....

(2 marks)

6 (a) (ii) *Genetically modified* .....

.....

.....

.....

(2 marks)



**6 (b) (i)** Apart from increasing food production, explain **one other** way in which growing Bt maize may be helpful to farmers.

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*(2 marks)*

**6 (b) (ii)** Explain **one** way in which growing Bt maize may help to conserve wildlife species living on farmland.

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*(2 marks)*

**6 (c)** Explain **two** reasons why some conservationists are against the use of genetically modified crops.

1 .....

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2 .....

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*(4 marks)*

12



- 7 (a) Carbon dioxide is the most important greenhouse gas. The table shows changes in the amounts of carbon dioxide emitted from different sources in the United Kingdom (UK) between 1990 and 2006.

The UK government have set a target of cutting UK carbon dioxide emissions by 20% by 2010, based on the amount emitted in 1990.

	1990	1995	2000	2005	2006
<b>Transport</b>	109	111	116	120	120
<b>Energy Supply</b>	242	208	200	218	221
<b>Business</b>	109	104	104	93	92
<b>Residential</b>	80	81	87	85	81
<b>Other</b>	49	45	42	42	42
<b>Total</b>	590	549	549	557	557

- 7 (a) (i) Calculate the percentage change in the total amount of carbon dioxide emitted between 1990 and 2006. Show your working.

.....  
(2 marks)

- 7 (a) (ii) Imagine that you are a politician who believes that the UK government is making progress towards meeting its carbon dioxide reduction target. Identify **two** pieces of evidence from the table which you could use to support this view.

1 .....

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2 .....

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(2 marks)



- 7** (a) (iii) Imagine that you are an environmental campaigner who believes that the UK government is unlikely to meet its carbon dioxide reduction target. How could you use evidence from the table to support this view?

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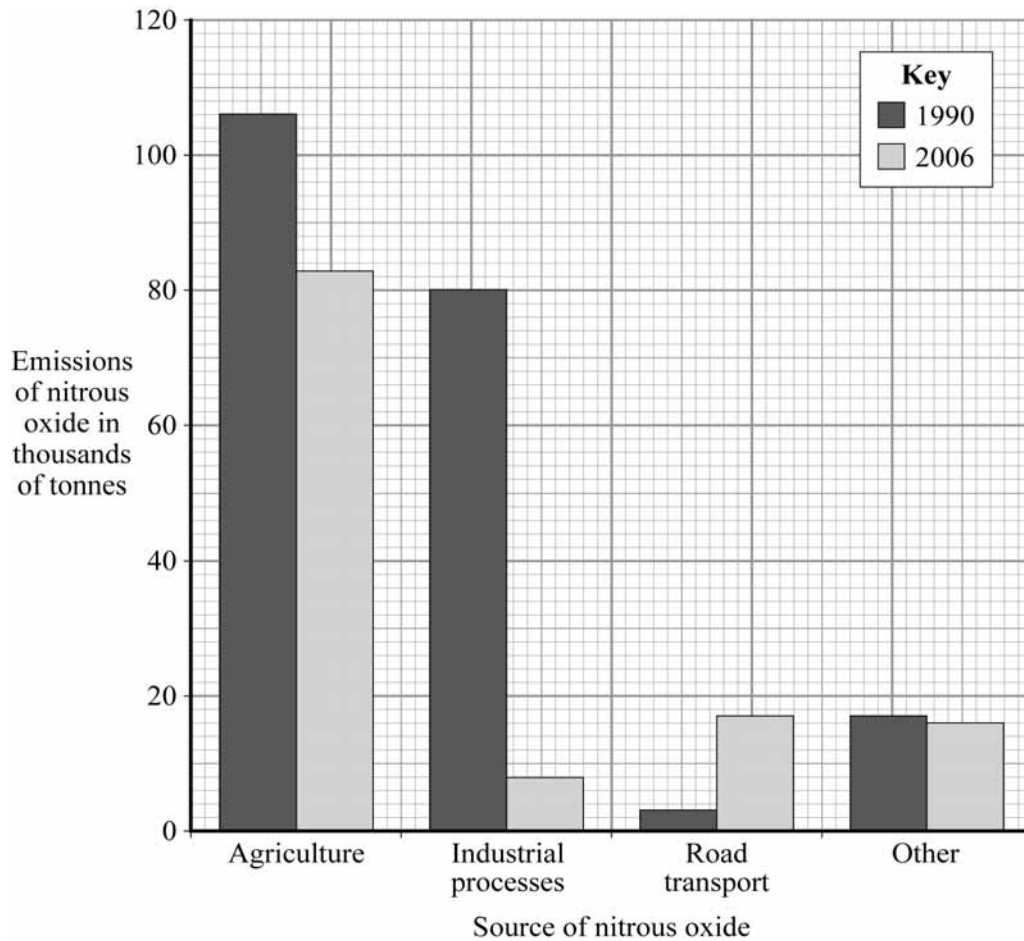
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*(2 marks)*

**Question 7 continues on the next page**



7 (b) The chart shows the amounts of nitrous oxide emitted from different sources in the UK in 1990 and 2006. Nitrous oxide is another greenhouse gas.



7 (b) (i) Describe the changes shown by the table.

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(4 marks)





- 7 (b) (ii) Fertiliser use is the main reason for the large emissions of nitrous oxide from agriculture.

Explain why fertiliser use leads to emissions of this gas.

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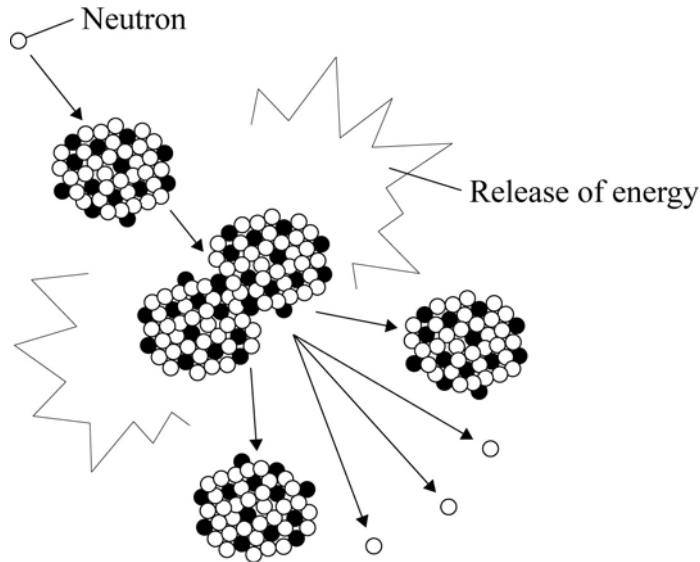
(2 marks)

12

**Turn over for the next question**



- 8 (a) In January 2008, the UK government announced that it would be in favour of new nuclear power stations being built in this country.  
The diagram shows the type of nuclear reaction that takes place in commercial nuclear reactors.



- 8 (a) (i) Name this type of nuclear reaction.

.....  
(1 mark)

- 8 (a) (ii) Name **one** element that undergoes this type of reaction in commercial nuclear stations.

.....  
(1 marks)

- 8 (a) (iii) Describe how energy released by this type of reaction is used to produce electricity.

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(3 marks)



8 (b) One reason for the government decision was that nuclear power will help the fight against global climate change.

8 (b) (i) Explain why using nuclear power may help the fight against global climate change.

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(2 marks)

8 (b) (ii) Explain why many people are against the building of new nuclear power stations.

*In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

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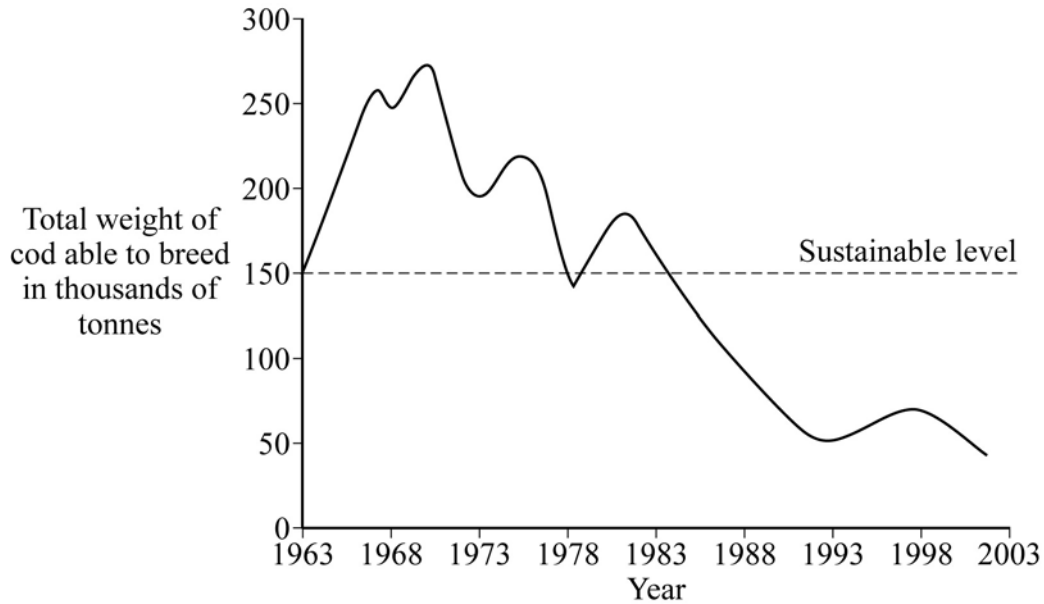
(4 marks)

11

**Turn over for the next question**



- 9 (a) Marine scientists believe that overfishing has the biggest impact on the wildlife populations of seas and oceans. The cod is a fish which is caught from the sea and used as food. The graph shows the changes in the amount of cod in the North Sea between 1963 and 2003.



- 9 (a) (i) Estimate the year for which the graph first shows clear evidence of the overfishing of cod in the North Sea. Give **one** reason for your answer.

Year .....

Reason .....

.....

(2 marks)

- 9 (a) (ii) Marine scientists collect figures for the total amount of fish in an area to provide evidence of overfishing. State **two** other pieces of evidence for overfishing which environmental scientists might observe.

1 .....

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2 .....

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(2 marks)



Barcode

9 (a) (iii) Explain how **two** changes in fishing technology have led to overfishing.

1.....  
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(4 marks)

9 (b) Marine scientists have suggested changes that would make fishing from the seas and oceans more sustainable.

Suggest and explain **two** factors that would make fishing more sustainable.

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(4 marks)

**Turn over for the next question**

12



**10** The photograph shows an environmental scientist taking samples of water from a river. Large amounts of algae have been found floating on the surface of the water. Anglers who catch fish from the river are very worried about the algae. They think that the river may have been affected by farming activities nearby.



**10** (a) (i) Explain why anglers who catch fish in the river are very worried by the rapid growth of algae.

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*(2 marks)*

**10** (a) (ii) Explain **one** way in which farming may have caused algae to appear in the river.

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.....  
.....

*(2 marks)*



- 10** (a) (iii) The environmental scientist must carry out risk a assessment for the investigation.  
Suggest **one** risk which may need to be considered when collecting samples of water from a river.  
Suggest **one** way of reducing this risk.

Risk .....

.....

Method of reducing risk .....

.....

.....

(2 marks)

- 10** (b) Describe how the environmental scientist could use indicator organisms to compare the quality of water in two rivers. In your description include the method and at least **one** precaution which she would take to ensure that the test was fair.

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(6 marks)

**END OF QUESTIONS**

12



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Question 7

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[www.defra.gov.uk/environment/statistics](http://www.defra.gov.uk/environment/statistics)

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