Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
June 2008

ENVIRONMENTAL SCIENCE **3441/F**
Written Paper
Foundation Tier **F**

Tuesday 17 June 2008 9.00 am to 11.00 am

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 maximum mark for this paper is 120.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers. Questions 3(b)(ii) and 6(a)(iii) should be answered in continuous prose. Quality of Written Communication will be assessed in these answers.

For Examiner's Use			
Question	Mark	Question	Mark
1		6	
2		7	
3		8	
4		9	
5		10	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 (a) Choose words from the box to complete the following sentences.

condensation	**evaporation**	**infiltration**	
interception	**precipitation**	**transpiration**	**run-off**

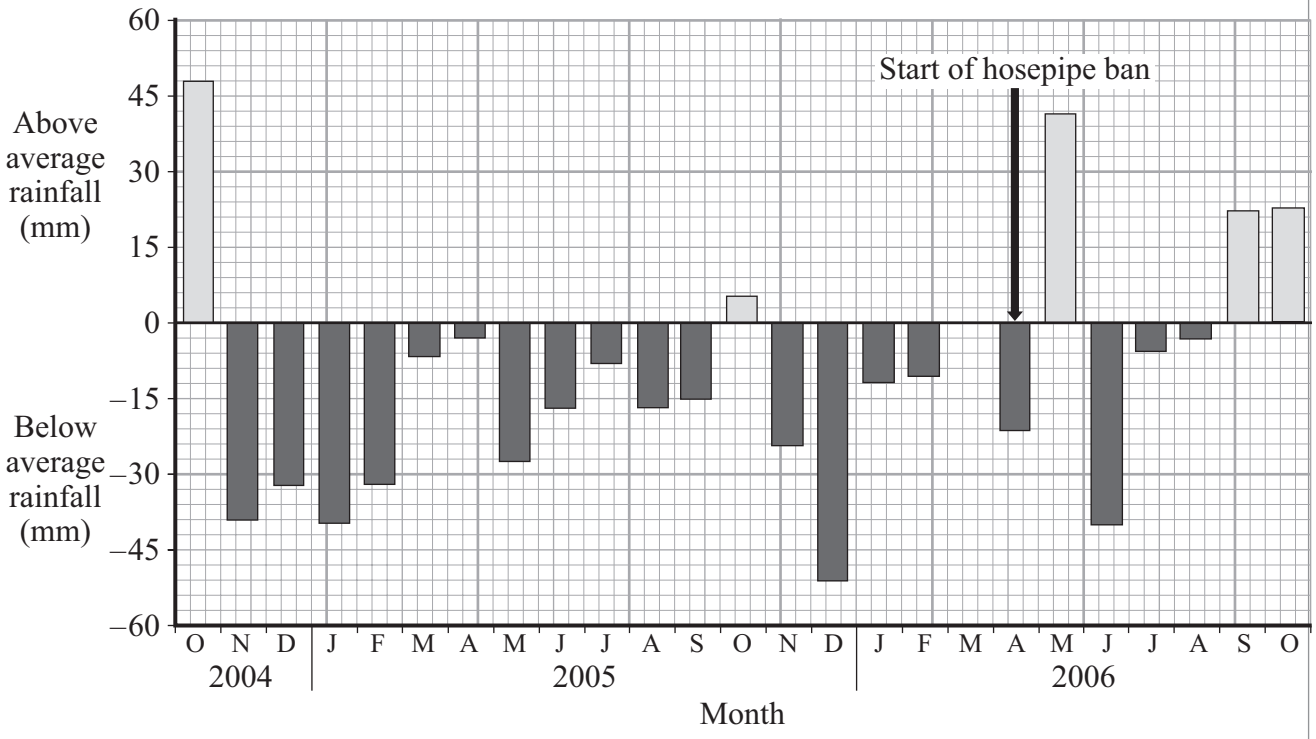
1 (a) (i) Water falling from the sky is called ..... .

1 (a) (ii) The process in which water is caught on the leaves of plants before it reaches the ground is called ..... .

1 (a) (iii) The process in which water changes from liquid water into water vapour is called ..... .

1 (a) (iv) The process in which water sinks into the ground is called ..... . *(4 marks)*

1 (b) The chart shows rainfall in the Thames Water region between October 2004 and October 2006. The bars show how much the rainfall each month was above or below the average.



1 (b) (i) When did rainfall exactly equal the average?

Month:..... Year:.....

(1 mark)

1 (b) (ii) In how many months was rainfall above average during 2005?

.....

(1 mark)

1 (b) (iii) The Thames Water company announced a hosepipe ban in April 2006.

Explain why Thames Water decided to ban the use of hosepipes when they did. Use information from the chart to help you.

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(2 marks)

1 (c) In 2006 Thames Water announced a plan for a huge new reservoir in Oxfordshire. It would mean flooding about 10 square kilometres of countryside.

1 (c) (i) Suggest **one** reason why people may be in favour of a new reservoir.

.....

.....

(1 mark)

1 (c) (ii) Suggest **two** reasons why people may be against a new reservoir.

1 .....

.....

2 .....

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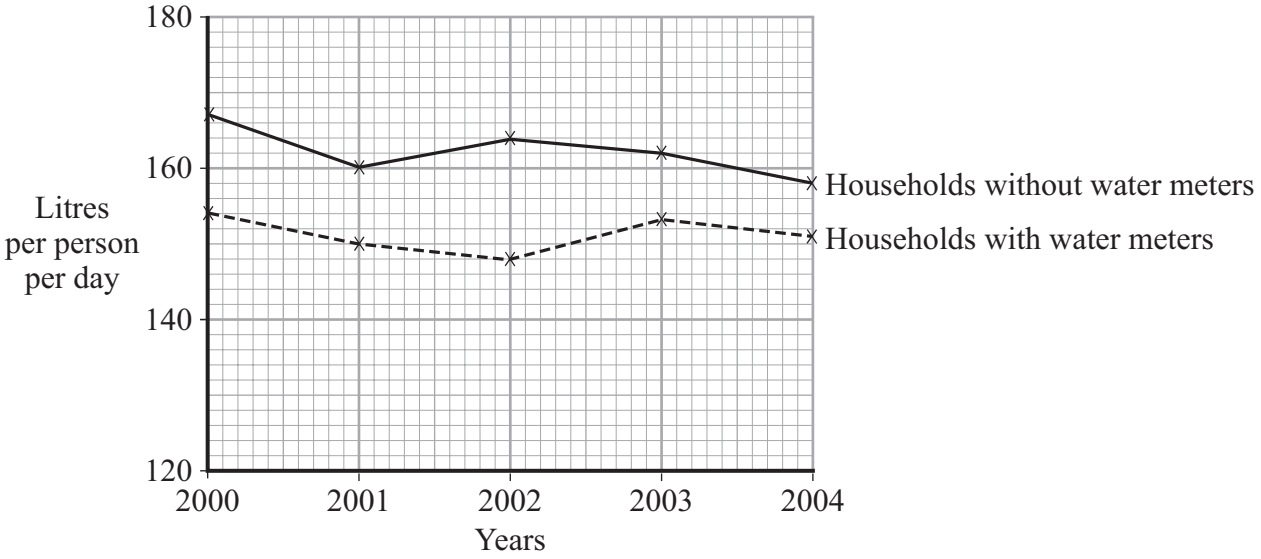
(2 marks)

1 (d) The graph shows the amount of water used in the Thames Water region by households with water meters and households without water meters.



1 (d) (i) How much water was used by households without water meters in 2001?

..... litres per person per day. *(1 mark)*

1 (d) (ii) What is a water meter?

.....

.....

(1 mark)

1 (d) (iii) Suggest **one** reason why households with water meters use less water than households without meters.

.....

.....

(1 mark)

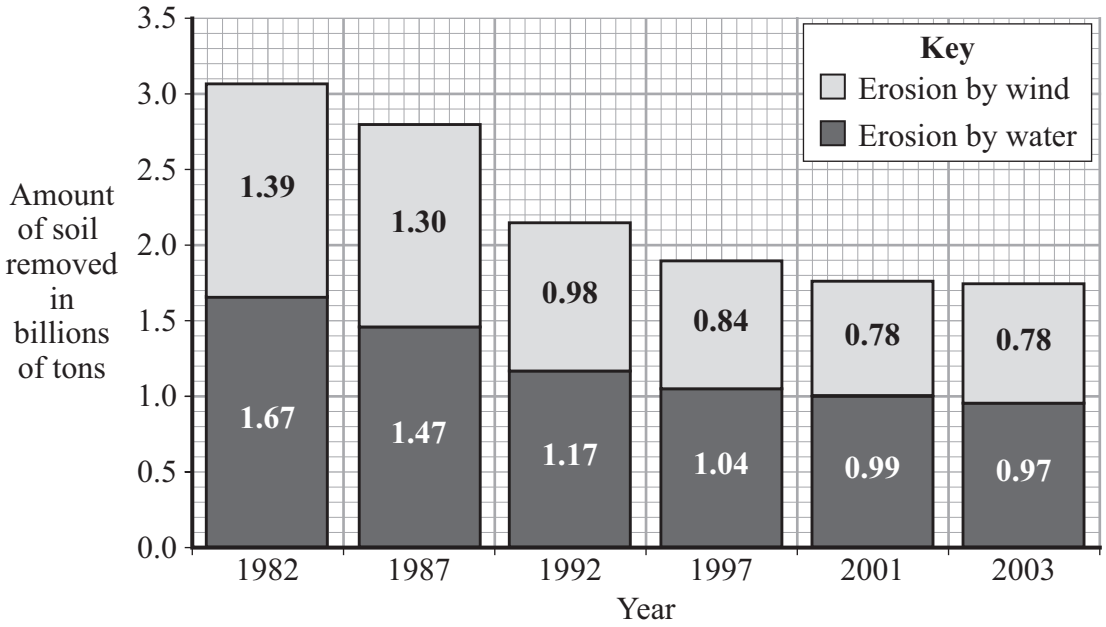
1 (d) (iv) State **one** other way in which people could reduce the amount of water they use in their homes.

.....

(1 mark)

15

2 (a) The chart shows the amount of soil removed by soil erosion from farmland in the USA.



Source: adapted from U.S. Department of Agriculture

2 (a) (i) Which type of erosion removes more soil from farmland in the USA?

.....

(1 mark)

2 (a) (ii) Calculate the total amount of soil removed in 1987.

..... billion tons. *(1 mark)*

2 (a) (iii) Describe the pattern of change shown by the chart.

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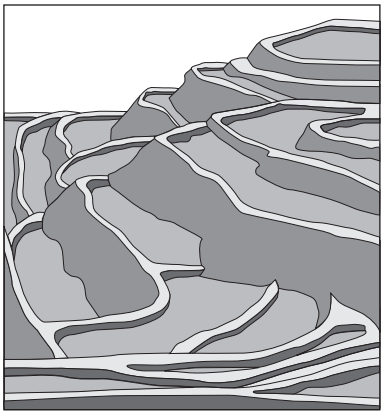
(2 marks)

Turn over ▶

2 (b) The sketch shows one method of reducing soil erosion by water.



2 (b) (i) Tick the box to show the name of this method.

☐ Strip cultivation

☐ Terracing

☐ Contour ploughing

(1 mark)

2 (b) (ii) Explain how this method helps to reduce soil erosion.

.....

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.....

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(2 marks)

2 (b) (iii) Explain **one** reason why planting trees on steeply-sloping land can also help to reduce soil erosion.

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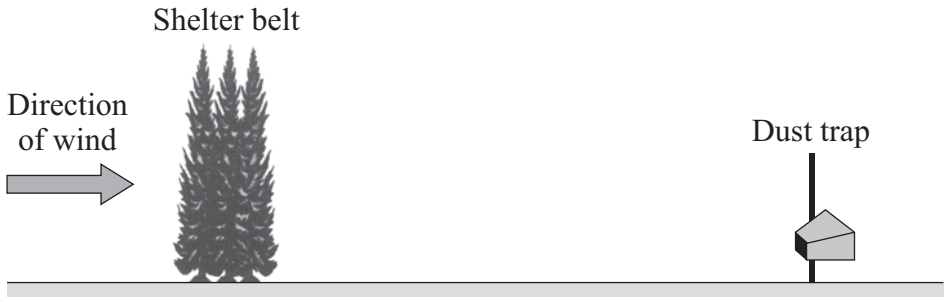
(2 marks)

2 (c) A group of scientists investigated how shelter belts affect the amount of soil erosion caused by wind. They used dust traps to measure the amount of soil being blown along by the wind.



2 (c) (i) Explain how shelter belts can help to prevent soil erosion.

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(2 marks)

2 (c) (ii) State and explain **one** thing which the scientists would need to do to make their investigation a fair test of the effect of shelter belts.

.....

.....

.....

.....

(2 marks)

2 (c) (iii) State **two** other methods which can be used to reduce wind erosion.

1 .....

2 .....

(2 marks)

15

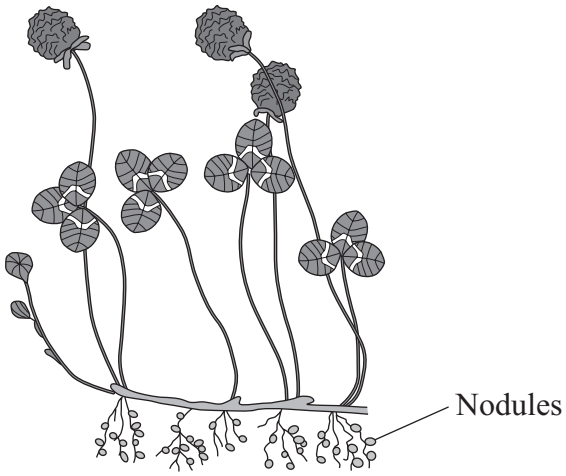
3 (a) Nitrogen is one of the three most important plant nutrients.
Which are the other two?

Tick **two** boxes.

- ☐ chlorine
- ☐ oxygen
- ☐ phosphorus
- ☐ potassium
- ☐ sodium

(2 marks)

3 (b) The sketch shows a clover plant.
Nitrogen-fixing bacteria live inside the nodules on these plants.



3 (b) (i) The sentences below are about bacteria in the nitrogen cycle.
Use words from the box to complete the sentences.

decomposing	**denitrifying**	**leaves**	**nitrifying**
nitrogen	**nitrogen-fixing**	**oxygen**	**roots**

1 Nitrogen-fixing bacteria live in nodules on the ..... of some plants, such as peas and clover.

2 These bacteria can convert ..... gas into soluble compounds which plants can use.

3 Other bacteria release ammonia, which is converted into nitrate compounds

by ..... bacteria.

4 Nitrates in the soil are broken down by ..... bacteria so that nitrogen is returned to the air.

(4 marks)

3 (b) (ii) Some people do not put fertiliser on their lawns. They often notice that their grass does not grow very well, but patches of clover are bright green and healthy.

Explain why clover often grows much better than grass on lawns which are not treated with fertiliser.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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(3 marks)

Question 3 continues on the next page

3 (c) The table shows the different sources of nitrogen compounds which can be used by plants worldwide.

Source of nitrogen compounds	Amount in millions of tonnes per year
Using fertilisers	80
Growing crops of clover and other legumes	40
Burning fossil fuels	20
Burning biomass	40
Clearing and draining land	30
Total from human activities	
Natural sources	140
Overall total	**350**

3 (c) (i) Which human activity is the source of the largest amount of nitrogen compounds?

.....

(1 mark)

3 (c) (ii) Calculate the total amount of nitrogen compounds which is the result of human activities. Write your answer in the space provided in the table.

(1 mark)

3 (c) (iii) Calculate the percentage of the overall total of nitrogen compounds which come from natural sources. Show your working.

..... % *(1 mark)*

3 (c) (iv) Nitrogen-fixing bacteria are one natural source of nitrogen compounds for plants. State **one** other natural way in which nitrogen compounds are made available for plants.

.....

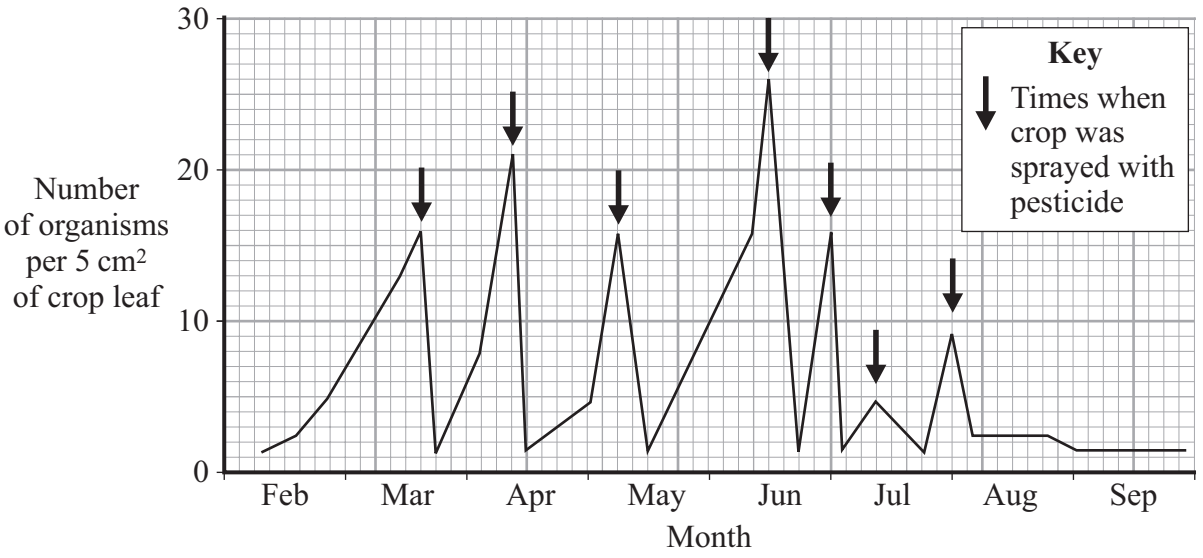
(1 mark)

13

4 (a) Two-spotted spider mites are pests which can damage crops grown in greenhouses.

Graph A shows what happened when this pest was controlled by spraying with a chemical pesticide.

Graph A – Pest control using a chemical pesticide



Source of Graph A and B: M.J. SAMWAYS, *Biological Control of Pests and Weeds*, Arnold 1981, © Michael H. Samways, 1981. Reproduced by permission of Edward Arnold (Publishers) Ltd.

4 (a) (i) In which month did the population of spider mites reach its maximum?

.....

(1 mark)

4 (a) (ii) State the maximum number of spider mites per 5 cm^2 of crop leaf.

..... spider mites per 5 cm^2 of crop leaf.

(1 mark)

4 (a) (iii) Describe the pattern shown by **Graph A**.

.....

.....

.....

.....

(2 marks)

Question 4 continues on the next page

4 (a) (iv) State **one** reason why some people are against using chemical pesticides.

.....

.....

(1 mark)

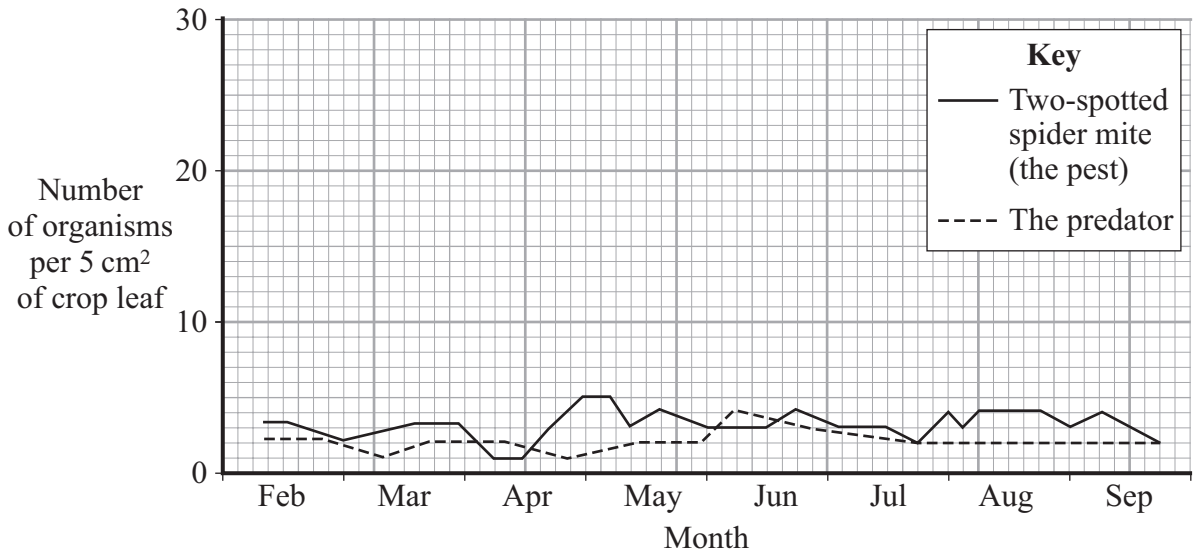
4 (a) (v) Name the type of farming in which farmers do not use chemical pesticides or fertilisers on their crops.

.....

(1 mark)

4 (b) **Graph B** shows what happened when a biological control method was used against the pest.

Graph B – Pest control using biological control



4 (b) (i) Estimate the maximum number of spider mites per 5 cm^2 of crop leaf when this method of control was used.

..... spider mites per 5 cm^2 of crop leaf.

(1 mark)

4 (b) (ii) Describe the pattern shown by **Graph B**.

.....

.....

.....

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(2 marks)

4 (b) (iii) Explain what is meant by *biological control*.

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(2 marks)

4 (b) (iv) Farmers using biological control may not want all the pests to be killed. Suggest **one** reason why not.

.....

.....

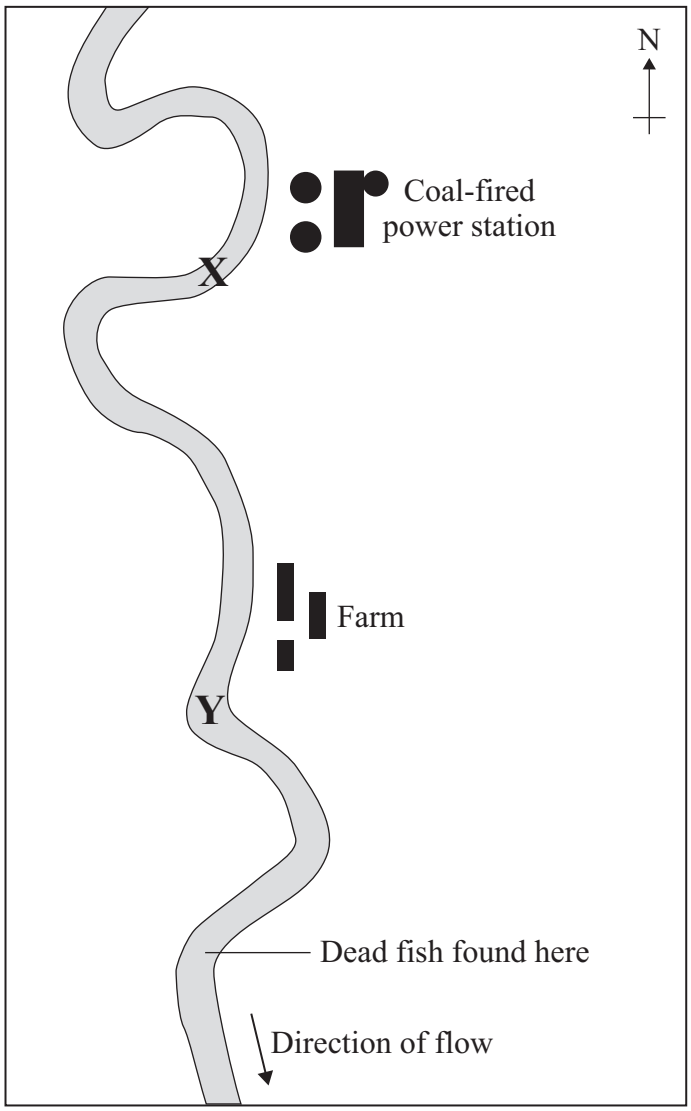
(1 mark)

12

Turn over for the next question

5 The map in **Figure 1** shows a river which flows from north to south. Dead fish were found in the river at the place marked on the map.

Figure 1



5 (a) Scientists analysed the dead fish. The fish had died because there was not enough oxygen in the water. Some people thought that the power station might have caused the problem.

5 (a) (i) State **one** way in which a coal-fired power station could have caused the river water to contain less oxygen.

.....

.....

(1 mark)

5 (a) (ii) Some students wanted to find out whether the power station was causing the problem. They decided to test samples of water from the place marked with a large **X** on the map.
Their teacher told them that they would need to test water from somewhere else as well.

Mark another **X** on the map to show where the students would need to take another set of samples. *(1 mark)*

5 (a) (iii) State **one** reason for the choice you made in part **5**(a)(ii).

.....

.....

(1 mark)

5 (a) (iv) More investigations showed that animal waste from the farm had caused the problem.
Complete the paragraph, which explains how animal waste can cause river water to contain less oxygen. Use words from the box to help you.

acid deposition	**decomposition**	**inorganic**
organic	**photosynthesis**	**sewage**

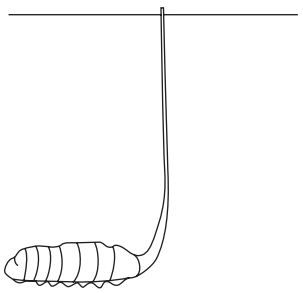
If animal waste from a farm enters a river it can cause ..... matter pollution. The waste is broken down by bacteria and fungi in the water.

This process is called ..... . The same problem can also be caused by ..... .

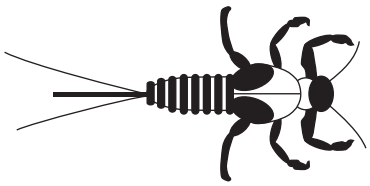
(3 marks)

Question 5 continues on the next page

5 (b) Indicator organisms can be used to investigate water pollution. The box gives details of two different types of indicator organism.



The rat-tailed maggot has a tube so that it can breathe air from above the surface of the water.



The mayfly nymph has gills along the sides of its body. It gets the oxygen it needs from the water where it lives.

5 (b) (i) The part of the river labelled **Y** on the map in **Figure 1** was badly polluted by animal waste from the farm.
Which one of the organisms shown in the box would you expect to find in large numbers in the polluted part of the river?

Name of organism .....

(1 mark)

5 (b) (ii) Explain your choice in part **5**(b)(i). Use information from the box to help you.

.....

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.....

.....

(2 marks)

5 (b) (iii) Teachers and students must carry out a risk assessment before doing practical work.
State **one** risk which students could face when collecting samples of river water.
Suggest **one** possible precaution that they could take to reduce the risk.

Risk .....

.....

Precaution .....

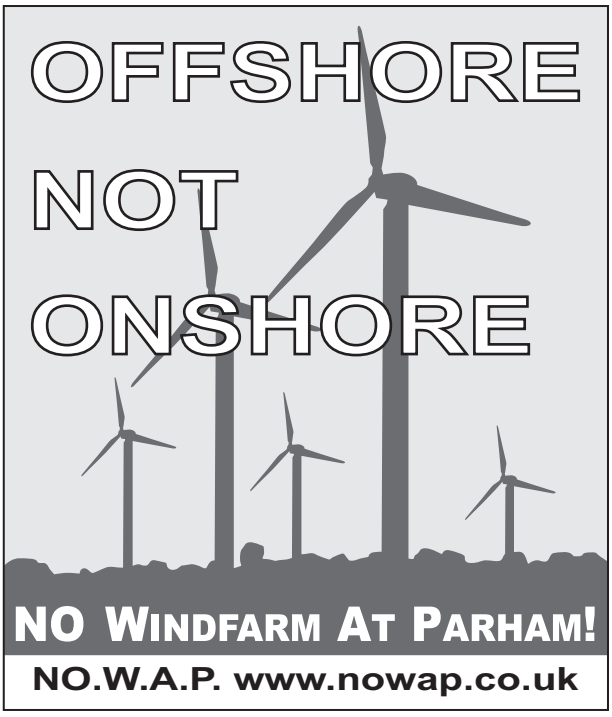
.....

(2 marks)

11

Turn over for the next question

6 (a) The picture shows a poster put up by a group of people protesting against a plan to build a windfarm.



6 (a) (i) State and explain **two** reasons why some people are against windfarms.

1 .....

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2 .....

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(4 marks)

6 (a) (ii) Suggest **one** reason why the protesters may think that it is better to build windfarms offshore rather than on land.

.....

.....

(1 mark)

6 (a) (iii) Some scientists believe that we should use more wind power rather than continuing to burn fossil fuels as much as we do now.
Explain **one** reason for this.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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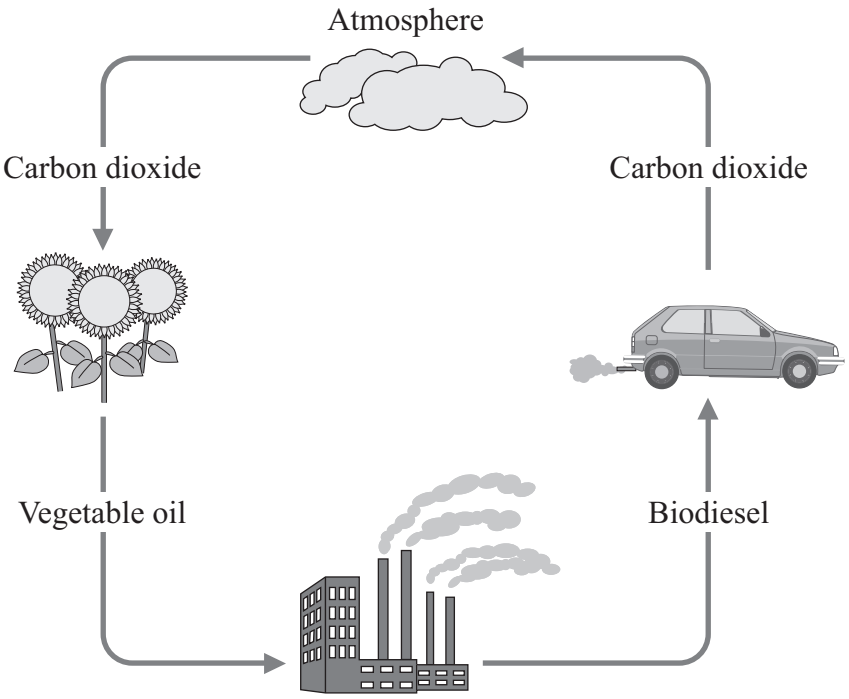
(3 marks)

Question 6 continues on the next page

6 (b) The diagram shows stages in the production and use of biodiesel, which is a biofuel.



6 (b) (i) Plants use carbon dioxide from the atmosphere in a process which produces new biomass.
Name this process.

.....

(1 mark)

6 (b) (ii) Carbon dioxide is given off when biodiesel is burnt as a fuel.
Explain why this does not cause an overall increase in the amount of carbon dioxide in the atmosphere.

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(2 marks)

11

Turn over for the next question

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7 (a) The photograph shows machinery working in a limestone quarry.

Source: Courtesy of E. Glynn Beck *Kentucky Geological Survey*, (USA)

7 (a) (i) Describe **one** problem which a quarry could cause for people living nearby.

.....

.....

.....

.....

(2 marks)

7 (a) (ii) Suggest **one** method which could be used to reduce the problem which you described in part **7**(a)(i).

.....

.....

(1 mark)

7 (a) (iii) Describe **one** way in which a quarry could affect the natural environment.

.....

.....

.....

.....

(2 marks)

7 (a) (iv) State **two** reasons why people may be in favour of quarries.

1 .....

2 .....

(2 marks)

7 (b) Limestone is used to make cement.
State **two** other uses of limestone.

1 .....

2 .....

(2 marks)

7 (c) In November 2005 the UK government organisation which controls pollution announced a plan to improve the environmental performance of the cement industry.

7 (c) (i) Name the UK government organisation which controls pollution.

.....

(1 mark)

7 (c) (ii) Two of the targets set for the cement industry are given below.
For each target state **one** way in which it would help to improve the environment.

Target 1: To reduce the use of fossil fuels.

.....

.....

Target 2: To increase the amount of energy obtained by burning waste products such as old tyres.

.....

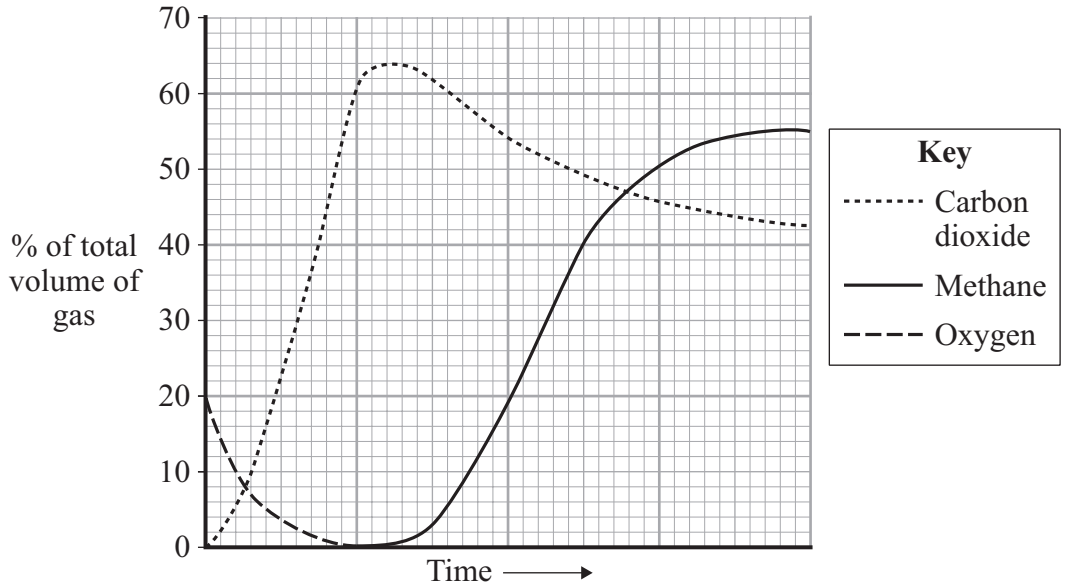
.....

(2 marks)

12

Turn over for the next question

8 (a) The graph shows the gases given off from a landfill site after rubbish has been tipped and covered over. This mixture of gases is usually called landfill gas.



8 (a) (i) Describe the changes in the percentages of oxygen and methane shown by the graph.

Oxygen .....

.....

.....

.....

Methane .....

.....

.....

.....

(4 marks)

8 (a) (ii) Name the process which produces methane gas in a landfill site.

.....

(1 mark)

8 (a) (iii) State **one** reason why methane gas does not begin to be produced as soon as the rubbish is tipped.

.....

.....

(1 mark)

8 (b) The box gives some information about methane.

- Methane can be burnt in air to release heat energy.
- When one molecule of methane is burnt in air it produces one molecule of carbon dioxide and two molecules of water.
- Methane is approximately 21 times more powerful as a greenhouse gas than carbon dioxide.

If landfill gas is not used as a fuel it can either be allowed to escape into the atmosphere or it can be collected and simply burnt, without using the heat. Explain why pollution control scientists believe that it is better to burn the gas, even if the heat is not used. Use information from the box to help you.

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(2 marks)

8 (c) Describe how landfill gas can be used to produce electricity.

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(4 marks)

12

9 (a) The photographs show two methods of keeping hens to produce eggs.

Photograph A shows hens being kept in battery cages in a controlled environment.

Photograph B shows free-range hens.

Photograph A

Photograph B

Source of photographs: Compassion in World Farming Trust (2006)

9 (a) (i) State **two** ways in which the conditions for the hens in **Photograph A** are controlled.

1 .....

.....

2 .....

.....

(2 marks)

9 (a) (ii) Explain **one** reason why some people may be against the method shown in **Photograph A**.

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(2 marks)

9 (a) (iii) Explain why eggs produced by free-range hens are usually more expensive than eggs produced by hens in battery cages.

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(2 marks)

9 (b) Explain how a controlled environment can be used to increase the yield of crops such as tomatoes.

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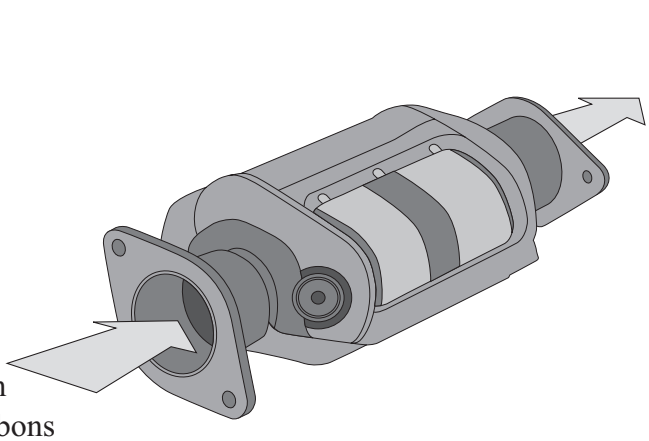
(3 marks)

9

Turn over for the next question

10 (a) The picture shows a catalytic converter.



10 (a) (i) State **one** reason why it is important to reduce the amount of carbon monoxide in the exhaust gases from motor vehicles.

.....

.....

(1 mark)

10 (a) (ii) A student wrote the following statement in an examination answer:
'Catalytic converters help to reduce global warming.'
State whether you think that the statement is right or wrong.
Explain your answer.

The statement is .....

Explanation .....

.....

.....

.....

.....

(2 marks)

10 (a) (iii) Name the type of pollution which is formed when oxides of nitrogen and unburnt hydrocarbons in the atmosphere are exposed to bright sunlight.

.....

(1 mark)

10 (a) (iv) Describe **one** other type of pollution which can be made worse by oxides of nitrogen in the atmosphere.

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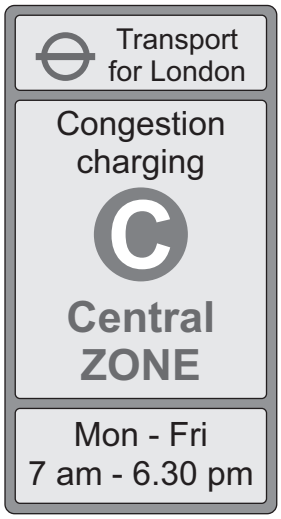
(2 marks)

10 (b) The sign below is about the congestion charge in London. Drivers must pay a charge if they want to drive into the centre of the city. There are plans for similar schemes in other cities.



Explain why many people are in favour of schemes to control traffic congestion.

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(4 marks)

10

END OF QUESTIONS

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