Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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8	
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10	
11	
12	
TOTAL	

General Certificate of Secondary Education
Foundation Tier
June 2011

Environmental Science 44401F

Unit 1 Topics in Environmental Science

Thursday 9 June 2011 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. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

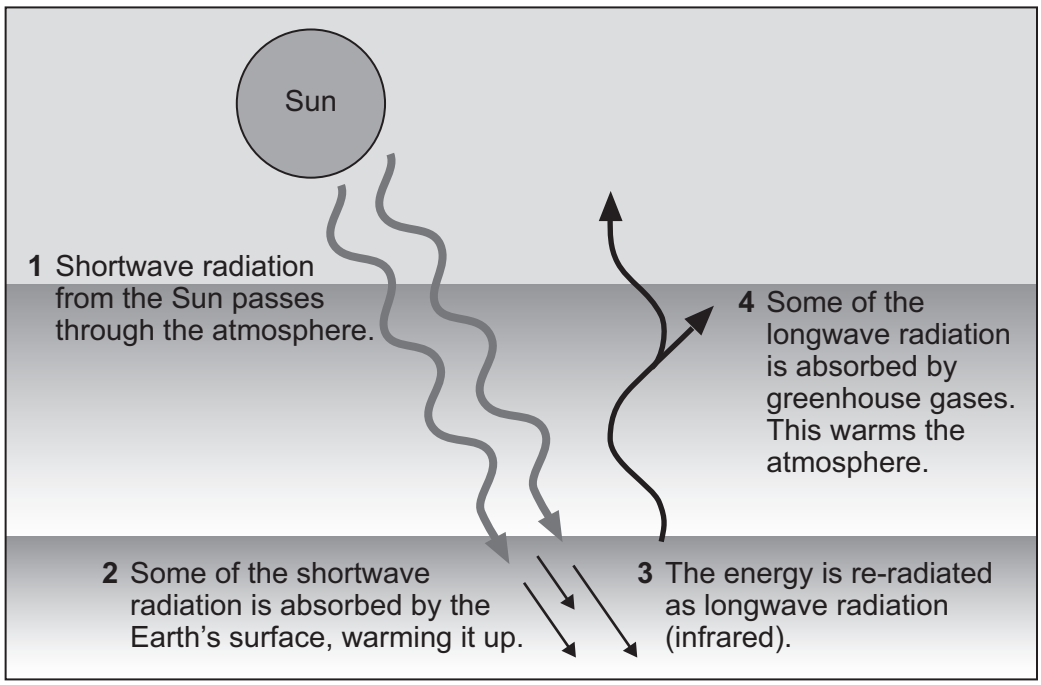
Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 120.
- You are expected to use a calculator where appropriate.
- In some questions you will be assessed on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

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

1 The diagram shows the natural greenhouse effect.

The greenhouse effect helps keep Earth at a temperature suitable for life.



Source: Reproduced with the permission of Nelson Thornes Ltd, from *AQA Environmental Science GCSE* by Kevin Byrne (2009)

1 (a) Suggest **one** reason why environmentalists are concerned about changes to the greenhouse effect.

.....

.....

(1 mark)

1 (b) Draw a line from **each** greenhouse gas to the human activity that produced it.
One has been done for you.

Greenhouse gas	**Human activity**
carbon dioxide	using aerosols
CFCs	burning rainforests
nitrogen oxides	tipping waste into landfill
methane	driving cars

(3 marks)

1 (c) Suggest **two** ways in which an increased greenhouse effect could harm life on Earth.

1 .....

.....

2 .....

.....

(2 marks)

6

Turn over for the next question

2 The following article is an extract from a local newspaper report.

New build will lead to water shortages

Large numbers of houses are being built in the town. People are concerned that there will not be enough water to supply these houses. The water authority has suggested that, unless new sources of supply are found within the next 10 years, demand will outstrip supply.

2 (a) At the moment water for the houses is supplied from an aquifer.

2 (a) (i) Suggest **one** property of a rock which would make it a suitable aquifer.

.....

(1 mark)

2 (a) (ii) In which **one** of the following rock types can aquifers be found?
Tick **one** box.

Granite ☐

Sandstone ☐

Slate ☐

(1 mark)

2 (b) Students from the local school investigated whether the local stream could supply the extra water needed for the town.

They measured the cross-section of the stream and the flow rate.

From this they calculated that the flow rate was 950 000 litres per day.

2 (b) (i) Suggest why this figure is likely to be an inaccurate estimate of the average daily flow rate for the stream.

.....

.....

(1 mark)

2 (b) (ii) Suggest **one** way in which the students could improve the reliability of their investigation.

.....

.....

(1 mark)

2 (b) (iii) The town's population is expected to increase from 12 000 to 16 000.
Each person uses 200 litres of water per day.

Use these figures to calculate how much extra water will be needed.
Show your working.

..... litres

(2 marks)

Question 2 continues on the next page

2 (c) The students also looked at the quality of the water.

2 (c) (i) They carried out a kick sample of the stream to check the biotic indicator species.

How are biotic indicator species used to measure pollution?

.....

.....

(1 mark)

2 (c) (ii) Then the students tested the water for nitrates and phosphates.

Suggest a source for each of these pollutants.

Nitrates .....

Phosphates .....

(2 marks)

2 (c) (iii) What word is used to describe the changes to a stream caused by nutrient pollution? Draw a ring around your answer.

conservation **clarification** **eutrophication** **irrigation**

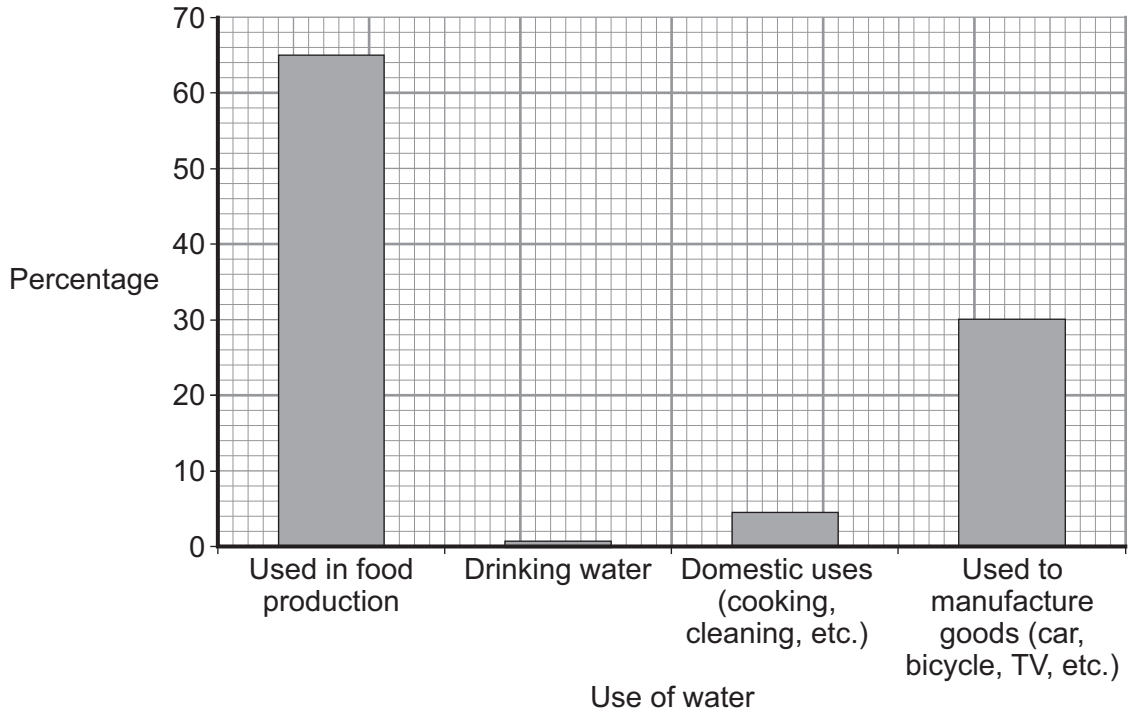
(1 mark)

10

3 The average person in the UK drinks between 2 and 5 litres of water per day. Each person will use approximately 145 litres for cooking, cleaning, washing and flushing the toilet.

Manufacturing the goods we use and producing the food we eat uses another 3400 litres per person.

The percentage of each of these uses is shown in the chart.



3 (a) What percentage of water in the UK is used to manufacture goods?

..... %

(1 mark)

Question 3 continues on the next page

3 (b) The table shows estimates of the volume of water used to make different products.

Portion	Litres	Portion	Litres	Portion	Litres
Slice of bread, 30 g	135	Glass of apple juice, 200 ml	190	Bag of potato crisps, 200 g	185
Glass of milk, 200 ml	200	Tomato, 70 g	13	Hamburger, 150 g	2400
Potato, 100 g	25	Apple, 100 g	70	Leather shoes	8000

Using information from the table which of the following uses least water and which of the following uses most water in production?

animal products **fruit and vegetables** **processed foods from plants**

Uses **least** water .....

Uses **most** water .....

(2 marks)

3 (c) There are water shortages in the UK whenever we have a dry summer.

3 (c) (i) Suggest **one** reason why there might be more water shortages in the future.

.....

.....

(1 mark)

3 (c) (ii) For **each** of the following groups suggest a way in which they might help to reduce water wastage in the future.

1 Water supply companies

.....

.....

(1 mark)

2 Schools

.....

.....

(1 mark)

3 People in their homes

.....

.....

(1 mark)

7

Turn over for the next question

4 (a) Match **each** method of food preservation with how it works.
Write **each** answer in the correct space in the table.

Canning **Drying** **Freezing** **Pickling**

Method of Preservation	**How it works**
	Food is chilled to stop bacteria from growing
	Food is put into a weak acid
	Food is heated to kill bacteria and sealed
	Water is removed from the food

(4 marks)

4 (b) Suggest **two** reasons for preserving food.

1 .....

.....

2 .....

.....

(2 marks)

4 (c) Describe how you might investigate the best temperature at which to store strawberries.

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

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

10

Turn over for the next question

5 (a) The table shows some agricultural practices.

Decide whether **each** agricultural practice is intensive or extensive.
Tick **one** box in **each** row to show your decision.

Agricultural Practice	Intensive	Extensive
High energy consumption		
Large numbers of workers		
Seen as better for animal welfare		
Highly mechanised		
Small numbers of animals per hectare		
Animals housed indoors		

(6 marks)

5 (b) Suggest **two** reasons why some campaigners are against intensive livestock production.

1 .....

.....

2 .....

.....

(2 marks)

5 (c) Explain why highly-mechanised crop production might lead to increased soil erosion.

.....

.....

.....

.....

(2 marks)

5 (d) Give **two** ways in which farmers might reduce soil erosion.
Tick **two** boxes.

Plant more hedges ☐

Add more inorganic fertiliser ☐

Plough up and down a slope ☐

Add organic material such as manure ☐

(2 marks)

12

Turn over for the next question

There are no questions printed on this page

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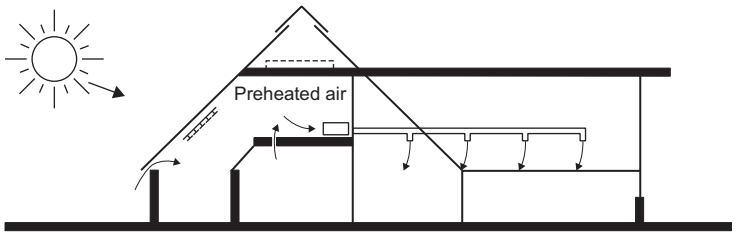
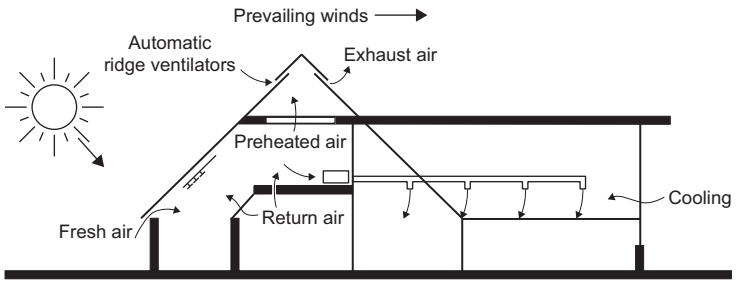
ANSWER IN THE SPACES PROVIDED

6 A school uses passive solar technology to heat the buildings.
A conservatory runs the length of the school.
Warm air collected within the conservatory is used to heat the classrooms.

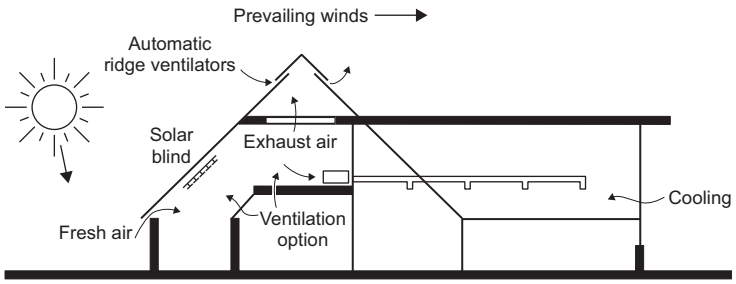
Winter



Spring and Autumn



Summer



Source: Cambridge Architectural Research Ltd, and Architects Journal

6 (a) Suggest why:

6 (a) (i) the conservatory was located on the south side of the building

.....

.....

(1 mark)

6 (a) (ii) the north side of the building has only small windows.

.....

.....

(1 mark)

Turn over ▶

6 (b) If the school installed a wind generator to provide electricity for lighting in the classrooms it could save even more energy.

Source: Getty Images

The cost of the generator was £30 000 and it saves £2000 per year in electricity bills.
How long will it be before the generator has paid for itself?

..... years
(1 mark)

6 (c) The Carbon Trust believes that UK schools could reduce energy costs by around £20 million per year.
This in turn would prevent 300 000 tonnes of CO_2 entering the atmosphere.

Teachers and pupils could make simple changes in their behaviour to reduce the energy consumption of their school.

Suggest **four** things that they could do.

1 .....

2 .....

3 .....

4 .....
(4 marks)

6 (d) The table shows the typical power of different types of ICT equipment.

Type of equipment	Average power while in use in watts	Standby power in watts
PC	74	6
PC monitor	100	4
Inkjet printer	17	9
Laser printer	280	18
Fax machine	82	7
Photocopier	400	103

Source: Schools learning to improve energy efficiency – Carbon Trust

6 (d) (i) Which piece of ICT equipment uses **least** power when in use?

.....

(1 mark)

6 (d) (ii) Which piece of equipment saves the **most** power when it goes into standby mode?

.....

(1 mark)

9

Turn over for the next question

7 Waste disposal has become a major problem over much of the developed world.

Environment Agency figures show that 159 million tonnes of waste was put into landfill in England and Wales in 2007.

The photograph shows a typical landfill site.

Source: Getty Images

7 (a) Suggest **three** problems of using landfill for waste disposal.

1 .....

.....

2 .....

.....

3 .....

.....

(3 marks)

7 (b) Suggest **two** alternative methods of waste disposal.

1 .....

2 .....

(2 marks)

7 (c) Many local councils have helped people to reduce the amount of their waste that goes into landfill.

Suggest **one** way in which councils have helped.

.....

.....

(1 mark)

7 (d) Much of our waste comes with goods purchased from supermarkets.

Suggest **one** way in which supermarkets could help us to reduce our waste.

.....

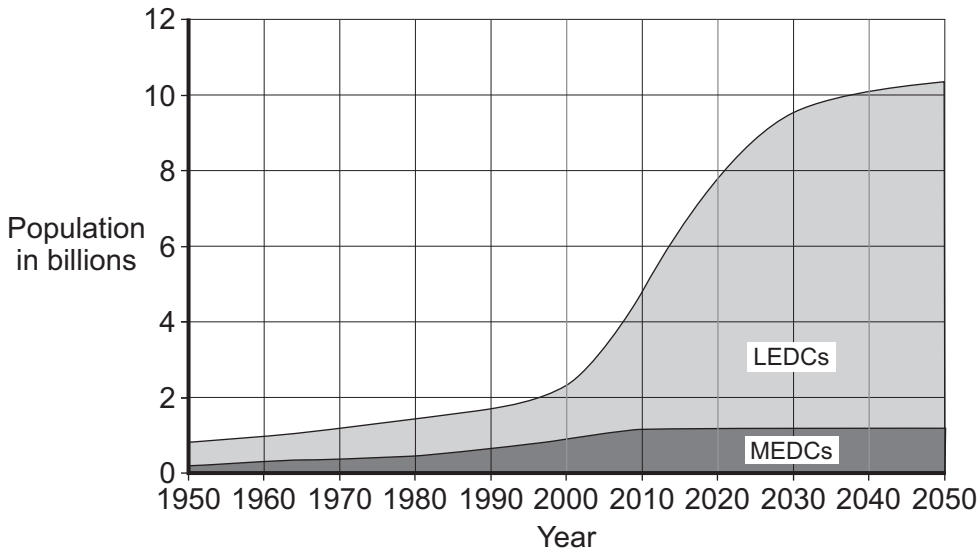
.....

(1 mark)

7

Turn over for the next question

8 The graph shows world population growth in both more economically developed countries (MEDCs) and less economically developed countries (LEDCs).

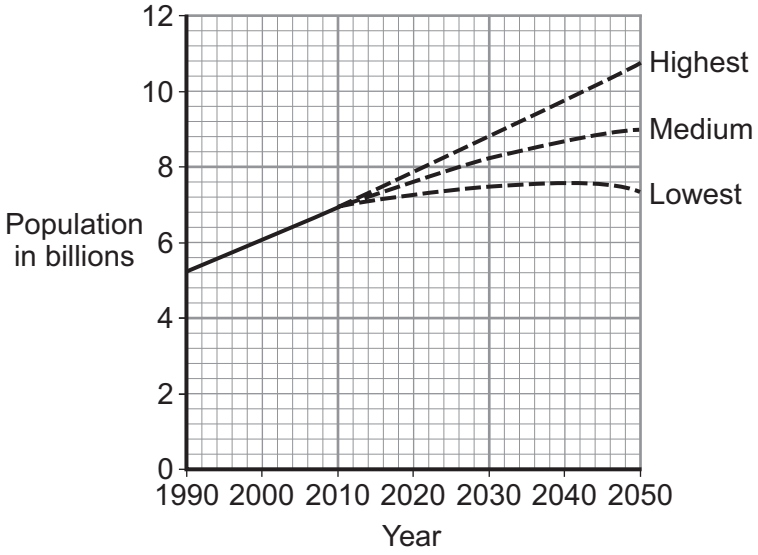


8 (a) Look at the table. For **each** of the factors decide if it would increase or decrease population growth.
Write *increase* or *decrease* in the table.

Factor	Population increase or decrease?
Access to birth control	
Vaccination	
Improved agricultural output	
More women working	
Increased cost of raising children	

(5 marks)

8 (b) The graph shows United Nations world population figures to date and projections up to 2050.



Source: adapted from *World Population to 2003 United Nations Dept of Economic and Social Affairs / Pollution Division*

8 (b) (i) Calculate the difference between the highest and the lowest predictions for 2050. Show your working.

.....

(1 mark)

8 (b) (ii) Suggest why it is difficult to get accurate population projections.

.....

.....

(1 mark)

8 (c) (i) Which of the following is a correct definition of 'ecological footprint'? Tick **one** box.

The amount of carbon produced by each person on the planet ☐

The damage caused to a habitat by a person ☐

The amount of the Earth's resources that a person consumes ☐

(1 mark)

8 (c) (ii) State **two** reasons why scientists believe that the *ecological footprint* of the predicted future population is unsustainable.

1 .....

.....

2 .....

.....

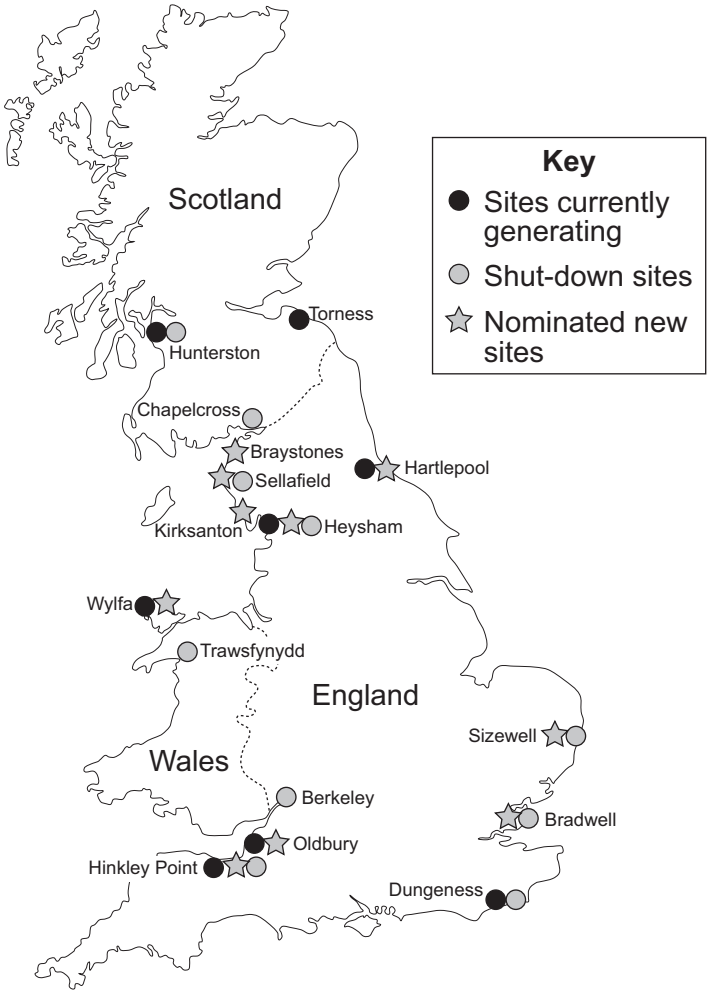
(2 marks)

10

9 In 2009 the UK government made a commitment to build 10 new nuclear power stations within the UK. The first power station is expected to begin electricity production by about 2017.

Approximately 20 % of the UK's electricity comes from existing nuclear power stations. All but one of these will need to close by 2023.

The map shows the current nuclear sites and the sites for the proposed new stations.



9 (a) Suggest **one** reason why most nuclear power stations are located on the coast.

.....

.....

(1 mark)

9 (b) All the proposed new stations are on the sites of existing power stations.

Suggest **one** reason why the decision was taken to use existing sites rather than new locations.

.....

.....

(1 mark)

9 (c) Explain why building these nuclear power stations might reduce CO_2 emissions in the UK.

.....

.....

(1 mark)

9 (d) Suggest **two** reasons why some environmental groups are opposed to the building of more nuclear power stations.

1 .....

.....

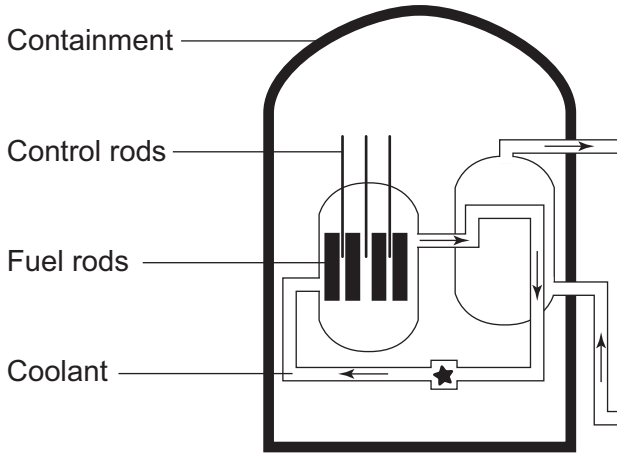
2 .....

.....

(2 marks)

Question 9 continues on the next page

9 (e) The diagram shows the main parts of a nuclear reactor.



9 (e) (i) The words below show materials used in the reactor.
Write **each** word in the correct place in the 'Material' column in the table.

boron **concrete** **uranium** **water**

(4 marks)

9 (e) (ii) Describe what **each** component of the reactor does.
Write your answers in the 'Function' column in the table.

(4 marks)

Component	Material	Function
control rods		
fuel rods		
containment		
coolant		

13

10 UK shops sell a wide range of foods. Many of these are imported.

Source: Getty Images

People are concerned about the 'food miles' needed to bring these foods to us.

10 (a) Explain what is meant by *food miles*.

.....

.....

(1 mark)

10 (b) Suggest **two** ways in which importing food leads to increased energy consumption.

1 .....

.....

2 .....

.....

(2 marks)

Question 10 continues on the next page

10 (c) One alternative to importing food is to produce more food in the UK using huge glasshouses such as Planet Thanet.

Planet Thanet

Source: Phil Bull

- Planet Thanet is a complex of 7 massive glasshouses covering an area greater than 80 football pitches.
- It grows 1.3 million plants, supplying 15 % of the UK's home-grown salad crops.
- Crops are grown hydroponically (in nutrient-rich water rather than soil or compost) using water from boreholes beneath the site and runoff from the glasshouses roofs.
- Each glasshouse has its own combined heat and power station which generates enough energy for its own needs and 50 % of that needed for the Thanet area.
- Waste heat and CO_2 from the power stations are fed to the glasshouses, the CO_2 being largely absorbed by the growing plants.
- Bees are introduced into the glasshouses for pollination.
- Pest control uses biological methods.

10 (c) (i) Suggest **five** ways in which Planet Thanet uses natural resources to help produce the crops.

.....

.....

.....

.....

.....

.....

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.....

.....

.....

(5 marks)

10 (c) (ii) Suggest why controlling **each** of the following factors will increase yield in the glasshouse.

Temperature: .....

.....

Carbon dioxide: .....

.....

Water: .....

.....

(3 marks)

10 (d) Why might growing tropical crops in the UK have a larger carbon footprint than importing them from their natural habitats?

.....

.....

(1 mark)

Question 10 continues on the next page

10 (e) People in Less Economically Developed Countries (LEDCs) grow crops for export to More Economically Developed Countries (MEDCs).
In the long term this may not benefit the people who grow them.

Suggest **two** reasons why.

1 .....

.....

2 .....

.....

(2 marks)

14

Turn over for the next question

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11 Use information from this article and your own knowledge to answer the questions which follow.

Longhorn Cattle help the Chough return to Cornwall after 150 year absence

A longhorn cow

Source: Thinkstock

A Chough

Source: Getty Images

- Adrian Thomas grazes his longhorn cattle on his own farm in Cornwall in return for subsidies under Natural England's Environmental Stewardship Scheme.
- The farmer said that cattle grazing had helped the environment by bringing back the Chough to West Cornwall's coast.
- Chough have returned for the first time in 150 years and conservationists feel that cliff grazing has been hugely significant in returning the heathland to its natural habitat.
- Longhorns, a traditional breed, will eat and remove tough shrubby plants before they grow too tall.
- Chough eat insects and larvae and prefer grass less than 5 cm long in which to probe.
- Cow pats are a good source of dung beetles and dung flies in winter, when other insects are scarce.
- Not everyone is happy with the cattle being on the cliffs. The South West long-distance footpath cuts through the farm and there have been complaints from walkers and horse riders.
- The cattle are grazing on the site of an ancient Iron Age settlement.

11 (a) Suggest **two** reasons why Chough may have become extinct in the area.

1 .....

.....

2 .....

.....

(2 marks)

11 (b) How might cattle grazing have helped the Chough to return?

.....

.....

.....

.....

(2 marks)

11 (c) Suggest a way in which conservationists might estimate the population of Chough as they return.

.....

.....

(1 mark)

11 (d) What could conservationists do to prevent walkers from disturbing Choughs' nesting sites?

.....

.....

(1 mark)

Question 11 continues on the next page

11 (e) Suggest **one** reason why **each** of the following groups of people might object to longhorn cattle grazing the cliffs.

11 (e) (i) Walkers

.....

.....

(1 mark)

11 (e) (ii) Horse riders

.....

.....

(1 mark)

11 (e) (iii) Archaeologists

.....

.....

(1 mark)

11 (f) Natural England provides funding under the Environmental Stewardship Scheme.

Outline **one** other role that Natural England has in conservation.

.....

.....

(1 mark)

10

12 The use of biofuels may help to conserve our fossil fuel resources. Using biofuels may also reduce greenhouse gas emissions.

Source: Getty Images

12 (a) Suggest why biofuels can be regarded as an indirect solar energy resource.

.....

.....

.....

.....

(2 marks)

12 (b) For **each** type of biofuel, fill in the gaps in the table.

Type of biofuel	Biofuel name	Method of production	Use for the fuel
Solid			Burn in power stations to produce electricity
Liquid		Vegetable oil is reacted with a small amount of alcohol and sodium hydroxide	
Gaseous	Methane		

(6 marks)

Turn over ▶

12 (c) Biofuels may help to reduce our greenhouse gas emissions because they are thought to be '**carbon neutral**'.

Explain what is meant by *carbon neutral*.

.....

.....

(1 mark)

12 (d) Some environmentalists argue that the harm which biofuels can do to the environment outweighs their environmental benefits.

Suggest why the growing of crops for making biofuels might:

12 (d) (i) increase environmental pollution

.....

.....

(1 mark)

12 (d) (ii) lead to food shortages

.....

.....

(1 mark)

12 (d) (iii) reduce wildlife habitats.

.....

.....

(1 mark)

12

END OF QUESTIONS

There are no questions printed on this page

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