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Candidate Signature										



General Certificate of Secondary Education
Higher Tier
June 2011

Environmental Science

44401H

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.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	



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44401H

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

- 1** 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.

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

.....

.....

(1 mark)

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

1

.....

2

.....

(2 marks)

Question 1 continues on the next page

Turn over ►



- 1 (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 CO₂ from the power stations are fed to the glasshouses, the CO₂ being largely absorbed by the growing plants.
- Bees are introduced into the glasshouses for pollination.
- Pest control uses biological methods.



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

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(5 marks)

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

Temperature:

.....

Carbon dioxide:

.....

Water:

.....

(3 marks)

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

.....

.....

(1 mark)

Question 1 continues on the next page

Turn over ►



- 1 (e)** People in Less Economically Developed Countries (LEDs) 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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- 2 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.



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

1

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2

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(2 marks)

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

.....

.....

.....

.....

(2 marks)

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

Question 2 continues on the next page

Turn over ►



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

2 (e) (i) Walkers

.....
.....
(1 mark)

2 (e) (ii) Horse riders

.....
.....
(1 mark)

2 (e) (iii) Archaeologists

.....
.....
(1 mark)

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

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

.....
.....
(1 mark)

10



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



Source: Getty Images

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

.....

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.....

(2 marks)

- 3 (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 ►



- 3 (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)

- 3 (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:

- 3 (d) (i)** increase environmental pollution

.....
.....
(1 mark)

- 3 (d) (ii)** lead to food shortages

.....
.....
(1 mark)

- 3 (d) (iii)** reduce wildlife habitats.

.....
.....
(1 mark)

- 3 (e)** How does the energy density of biofuels compare with the energy density of fossil fuels?

.....
.....
.....
.....
(2 marks)



4



Source: WWF

On 28 March 2009 over 1 billion people and 1000 cities worldwide took part in Earth Hour.

At 8.30 pm local time millions of people and corporations turned off at least one light bulb for an hour.

In co-ordinating this action the World Wide Fund For Nature (WWF) is acting as a pressure group.

4 (a) Suggest **two** aims of the WWF in promoting this action.

1

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2

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(2 marks)

4 (b) The media frequently describe the greenhouse effect in negative terms.

Explain why, without the greenhouse effect, there would be no life on Earth.

.....

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(1 mark)

Question 4 continues on the next page

Turn over ►



- 4 (c)** Use the words below to complete the paragraph describing the greenhouse effect. Words can be used once, more than once or not at all.

absorbed longwave reflected shortwave

The Sun produces vast amounts of energy, some of which reaches the Earth.

This radiation passes through the atmosphere and then is by the Earth's surface, warming it up. Energy is then re-radiated as radiation which is then by the greenhouse gases warming the Earth's atmosphere.

(4 marks)

- 4 (d)** For **each** of the gases in the table, suggest a human activity that increases the amount of the gas in the atmosphere.

Write your answers in the table.

Greenhouse gas	Human activity
Carbon dioxide	
Methane	
Nitrogen oxides	

(3 marks)



4 (e) Governments have set targets to reduce emissions of carbon dioxide.
One way they hoped to achieve this was by issuing carbon licences to business.

4 (e) (i) Explain how carbon licences might be used to reduce carbon dioxide emissions.

.....

.....

(1 mark)

4 (e) (ii) Outline **one** reason why carbon licences have not been as effective as it was hoped in reducing total carbon dioxide emissions.

.....

.....

(1 mark)

12

Turn over for the next question

Turn over ►



5 The total energy consumed worldwide is expected to increase by 25% by 2030.

5 (a) Suggest **two** reasons for this predicted rise in energy consumption.

1

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2

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(2 marks)

5 (b) Alternative energy resources could make a greater contribution than they do at present. Potential wind energy worldwide is estimated to be about 100 times our total needs and solar energy 500 times our total needs. We can only make use of a tiny fraction of this energy available from wind and the Sun.

Suggest **two** reasons why we can only make use of a fraction of this energy.

1

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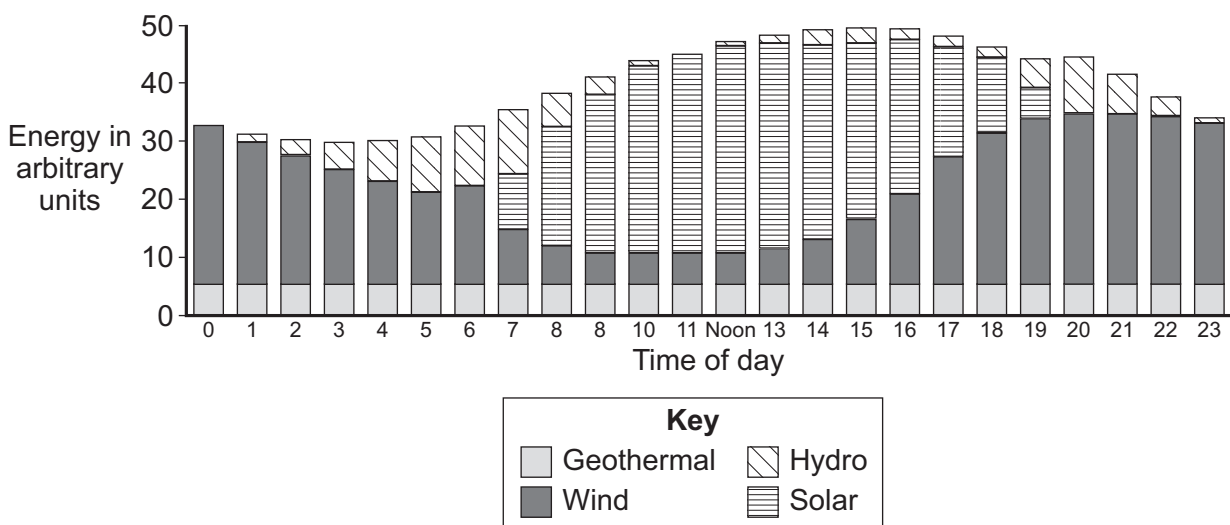
2

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(2 marks)

5 (c) **Chart 1** shows how renewable energy could supply all of California's energy needs over a 24 hour period.

Chart 1



5 (c) (i) Suggest why demand for energy changes over the 24 hour period.

.....

.....

.....

.....

(2 marks)

5 (c) (ii) Using the terms 'predictability' and 'intermittency', explain why the relative proportions of the energy sources shown in **Chart 1** change over the 24 hour period.

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)

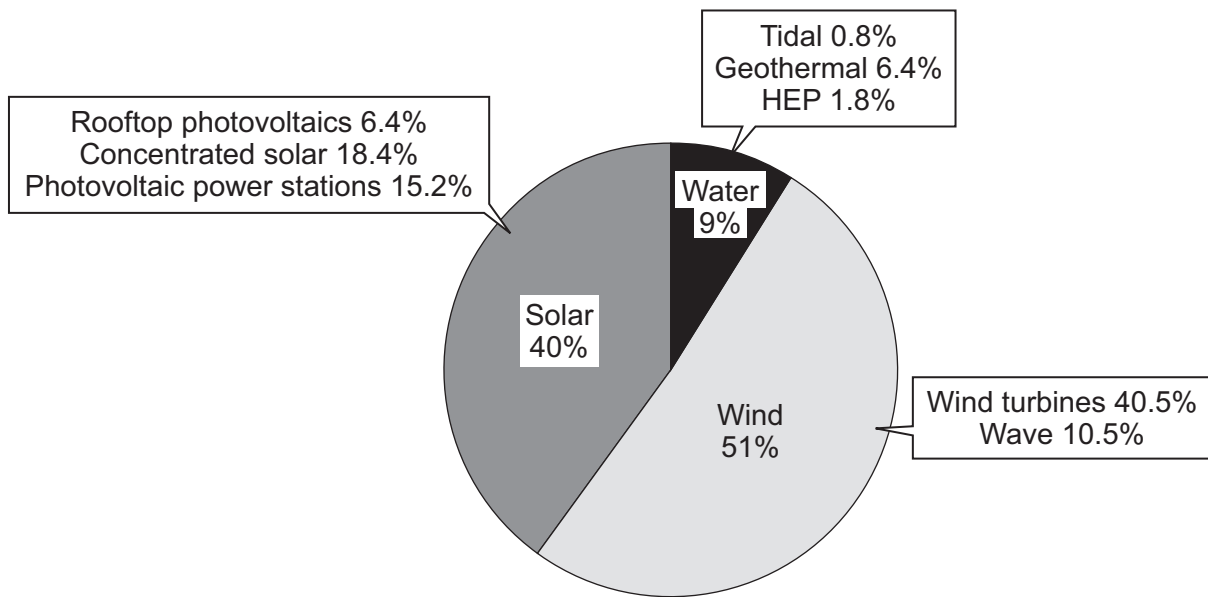
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- 5 (d)** **Chart 2** shows how it is thought we could meet worldwide energy needs in 2030 using only renewable sources.

Chart 2



- 5 (d) (i)** Suggest why wave power is included in the wind section of **Chart 2**.

.....

 (1 mark)

- 5 (d) (ii)** Name **one** energy source shown on **Chart 2** which does not rely on solar power.

.....
 (1 mark)

- 5 (d) (iii)** Suggest why the contribution from hydroelectric power is unlikely to increase significantly by 2030.

.....

 (2 marks)

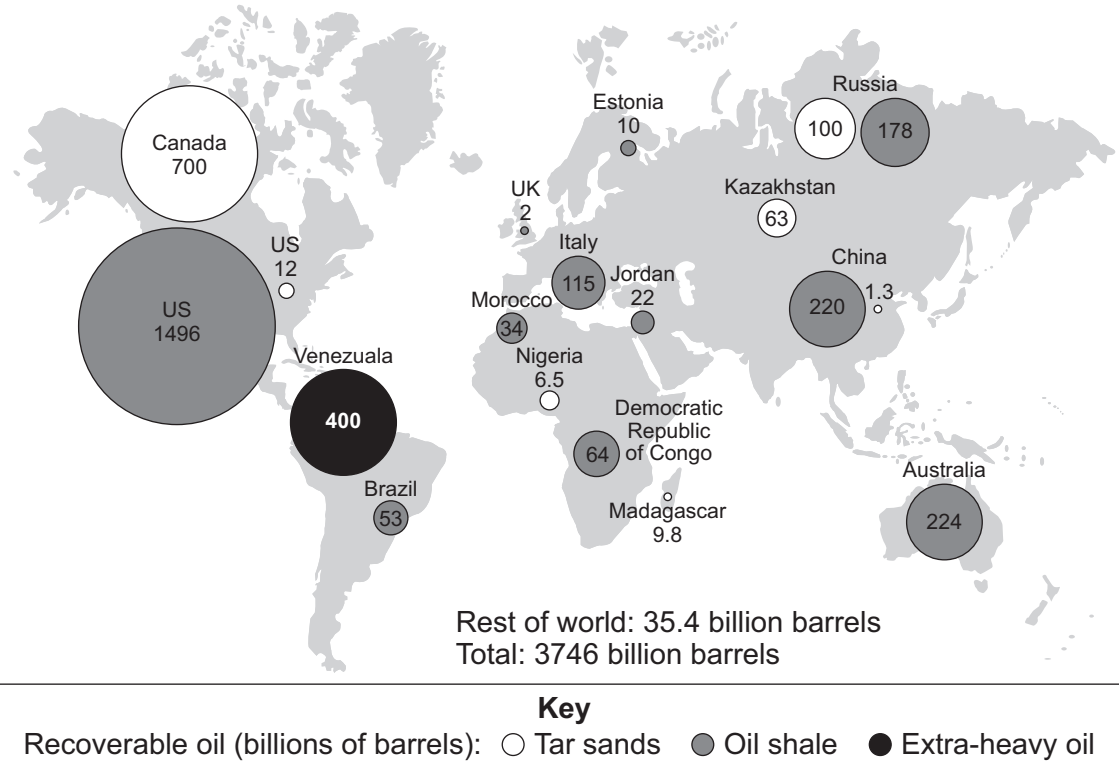


- 6 A recent article in New Scientist stated that there would be plenty of oil reserves left throughout the world if we increased our exploitation of alternative oil deposits.

These alternative oil deposits include tar sands and oil shales.

More than enough?

There are more sources of unconventional oil left to extract than we have consumed in all history. But at what cost?



Source: adapted from, *New Scientist* (5 Dec 2009)

- 6 (a) Which country has the largest deposits of oil shales?

.....
(1 mark)

- 6 (b) What percentage of the world's tar sand deposits are located in Canada?

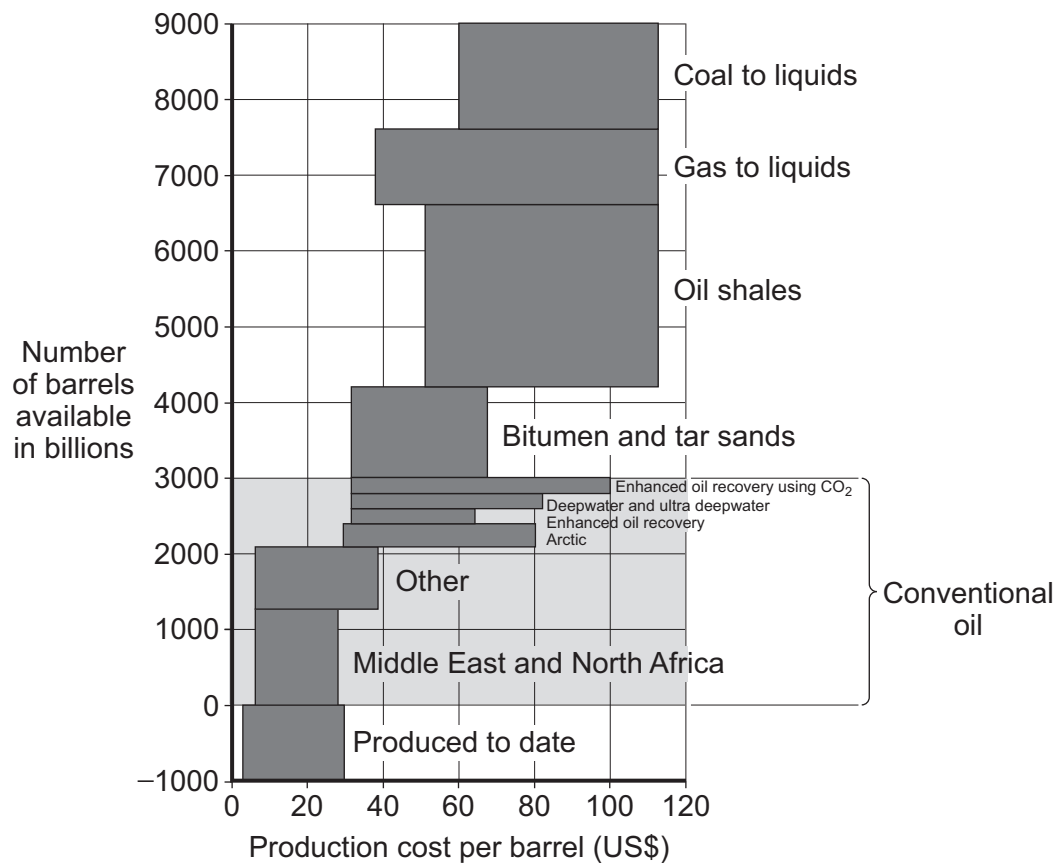
..... %
(1 mark)

Question 6 continues on the next page

Turn over ►



6 (c) Use the graph to answer the questions that follow.



Source: adapted from, *New Scientist* (5 Dec 2009)

6 (c) (i) How many billion barrels of oil have been produced to date?

.....
(1 mark)

6 (c) (ii) What is the maximum production cost of a barrel of conventional oil?

.....
(1 mark)

6 (c) (iii) What is the range of cost for producing a barrel of oil from oil shale?

.....US\$ toUS\$
(1 mark)



- 6 (d)** Conventional oil extraction involves drilling down to oil trapped in rocks below ground. The oil rises to the surface under its own pressure.

Extracting oil from tar sands uses open-cast quarrying. The mines located in North America cover large areas of what was once remote wilderness.

The table gives some details of the two production methods.

Requirements per barrel of oil produced	Conventional drilling for crude oil	Open-cast mining for tar sands
Treatment needed to make crude oil	None	Rinsing in hot water and chemicals
Energy needed in barrels of oil equivalent	0.05	0.1
CO ₂ released in kg	50	69
Water in litres	0	640
Solid waste to be disposed of in tonnes	0	2

Use the information in the table and your own knowledge to compare the environmental impact of these two methods of oil extraction.

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(4 marks)

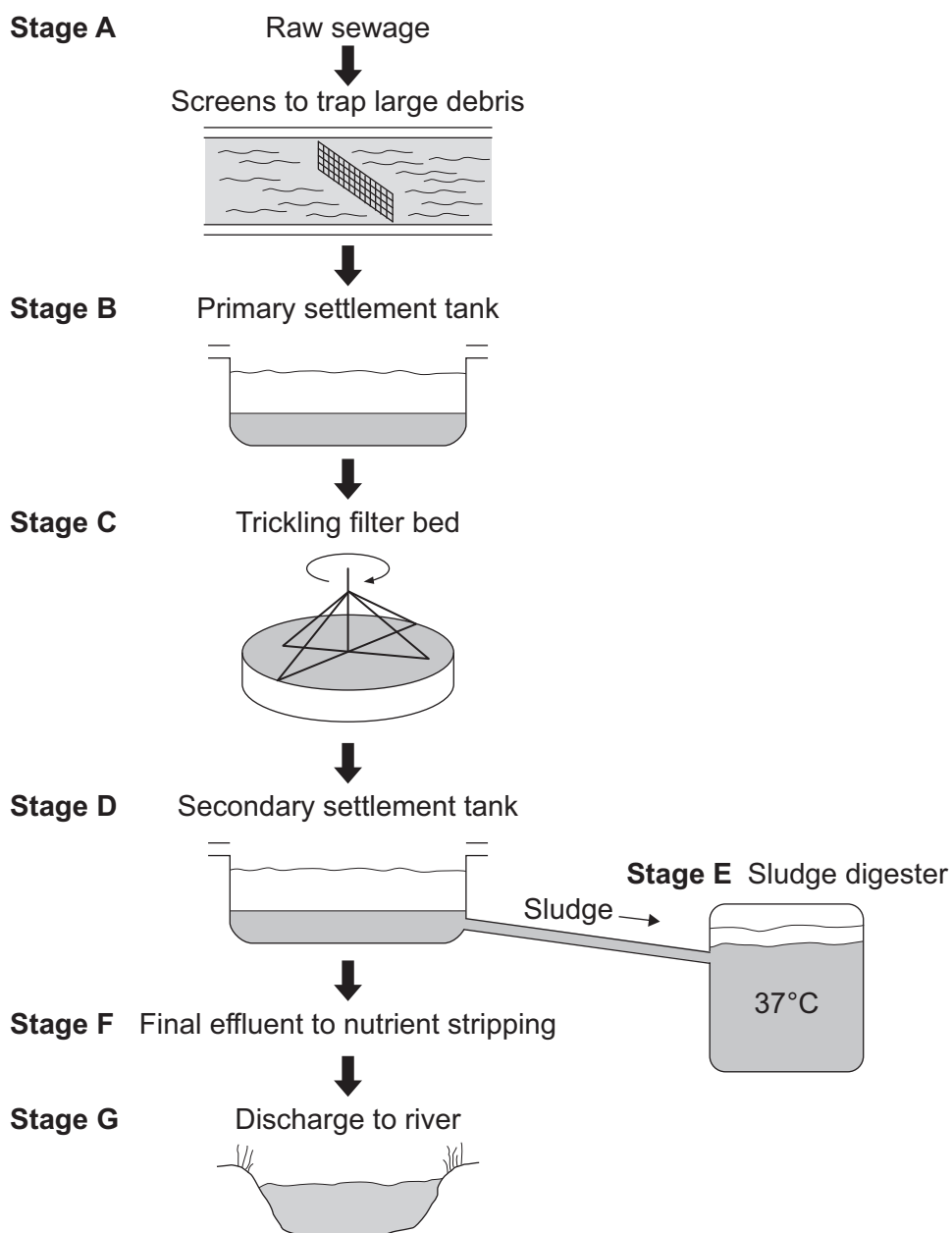
9

Turn over for the next question

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- 7 The diagram shows the processes involved in the treatment of sewage.



- 7 (a) For **each** of the three stages shown in the table, tick (✓) the box in the table to show whether the process is biological, chemical or physical.

Stage	biological	chemical	physical
A			
C			
F			

(3 marks)



7 (b) Both anaerobic and aerobic bacteria are involved in the treatment process at different stages.

7 (b) (i) Identify **one** stage where **anaerobic** bacteria are working.

Stage
(1 mark)

7 (b) (ii) Identify **one** stage where **aerobic** bacteria are working.

Stage
(1 mark)

7 (c) Which **two** nutrients are removed during nutrient stripping?

1

2

(2 marks)

7 (d) Describe the changes that might occur in the river if large quantities of nutrients were released into it.

.....

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.....

(3 marks)

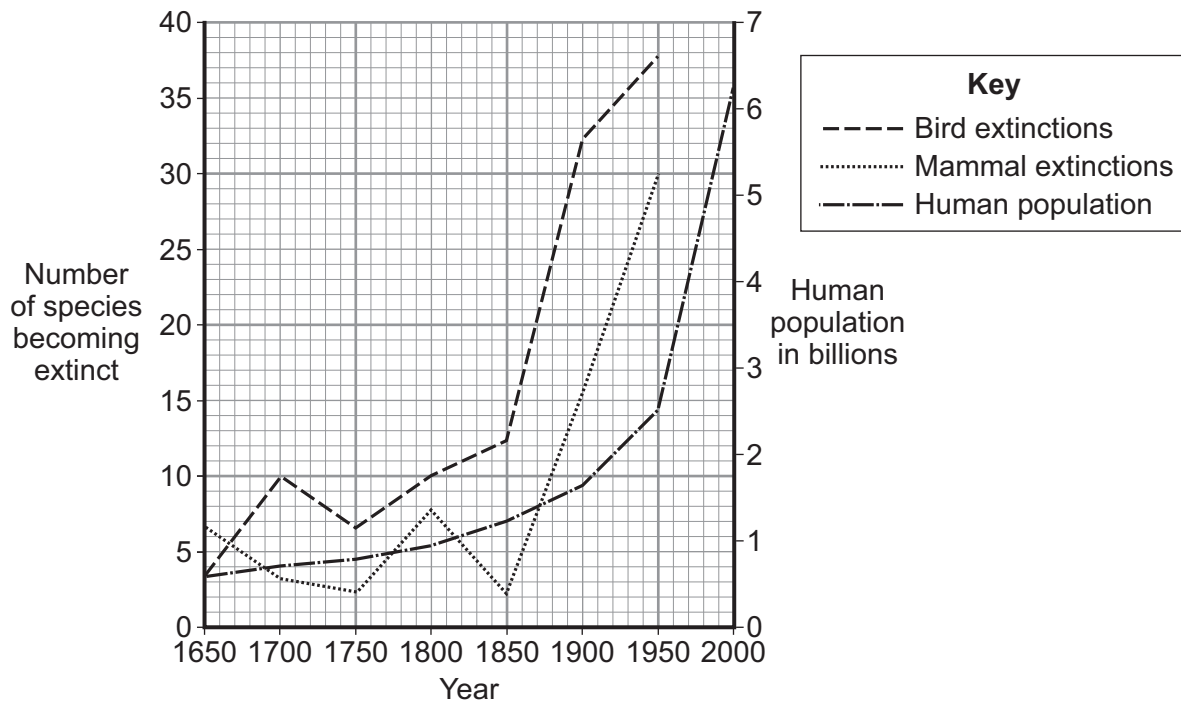
10

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- 8 The graph shows the numbers of bird and mammal extinctions and the growth of human population.



- 8 (a) (i) Describe the relationship between the numbers of extinctions and human population.

.....

 (1 mark)

- 8 (a) (ii) Suggest **three** reasons to explain the relationship you have described.

1

 2

 3

 (3 marks)



- 8 (b)** For species you have studied describe **three** ways in which the environment has been managed to improve it for wildlife.

1

.....

2

.....

3

.....

(3 marks)

- 8 (c)** Successful wildlife preservation often involves international cooperation.
The international community has agreed several conventions to protect species.

For **each** of the following conventions state its conservation role.

- 8 (c) (i)** CITES

.....

.....

(1 mark)

- 8 (c) (ii)** IUCN

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(1 mark)

- 8 (c) (iii)** Ramsar

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(1 mark)

10

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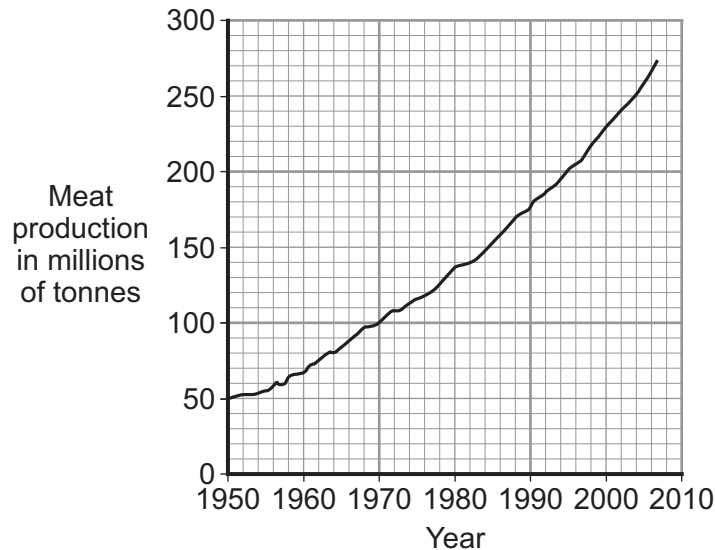
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- 9 The graph shows the way in which meat production has been increased worldwide to keep pace with increased demand.

- In 2006 farmers produced 276 million tonnes of meat.
- This is five times as much as in the 1950s.

World meat production (1950–2006)



Source: adapted from, Worldwatch Institute, *State of the World 2008*, www.worldwatch.org

- 9 (a) Animal productivity has been increased in three main ways.
For **each** of the following give **one** way in which it can be used to increase productivity.

- 9 (a) (i) Genetics

.....

 (1 mark)

- 9 (a) (ii) Feeding

.....

 (1 mark)

- 9 (a) (iii) Technology

.....

 (1 mark)



9 (b) Achieving increased agricultural outputs has required higher inputs.

9 (b) (i) Using examples, suggest why intensive agriculture needs high levels of energy input.

.....

.....

.....

.....

.....

(3 marks)

9 (b) (ii) Why might these high levels of input be unsustainable?

.....

.....

(1 mark)

9 (c) Suggest why intensive agriculture might result in:

9 (c) (i) habitat destruction

.....

.....

(1 mark)

9 (c) (ii) loss of biodiversity

.....

.....

(1 mark)

9 (c) (iii) soil erosion

.....

.....

(1 mark)

9 (c) (iv) water pollution.

.....

.....

(1 mark)

Turn over ►



Some scientists argue that we will not be able to meet the world's future food needs without using genetically modified crops.



Source: Alamy

- 9 (d)** One example of genetic modification uses transgenic material. Explain what is meant by *transgenic material*.

.....

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(1 mark)

- 9 (e)** Another example of genetic modification involves inserting a gene into a cereal crop, which makes it resistant to herbicides.

- 9 (e) (i)** Why might growers want a crop that is resistant to herbicide?

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(1 mark)

- 9 (e) (ii)** Suggest why some environmental campaigners are against the use of this type of genetic modification.

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(2 marks)

15



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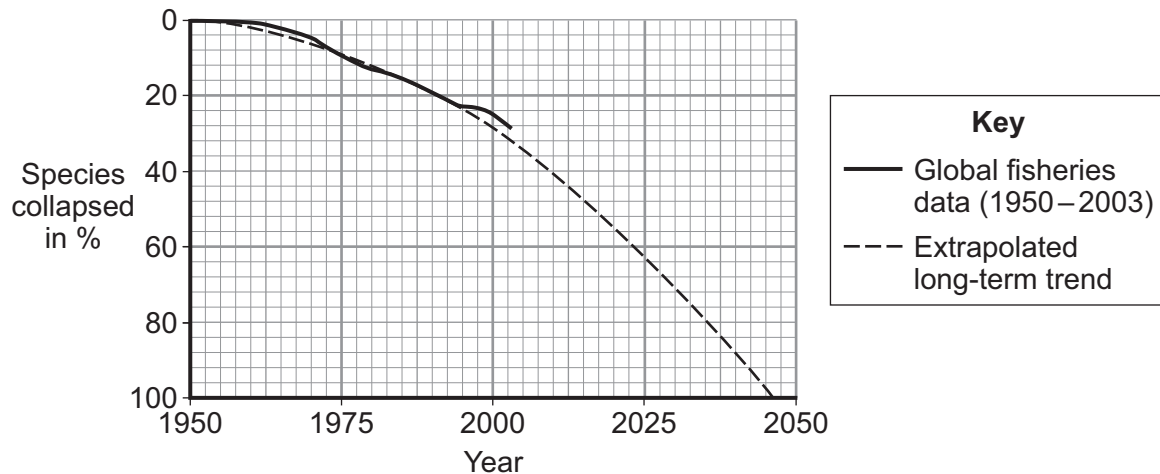
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A major scientific study in 2003 suggested that if current trends continued there would be nothing left to fish from the seas by the middle of the century.

Global loss of seafood species



Source: B WORM et al, *Impacts of Biodiversity Loss on Ocean Ecosystem Services* (Nov 2006)
Reproduced with permission from the American Association for the Advancement of Science

10 (a) Suggest why fish stocks have declined so dramatically in the last 50 years.

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the entire width of the page. There are no margins, text, or other markings present.

(6 marks)



10 (b) Give **one** reason why **each** of the following helps to make fishing more sustainable.

10 (b) (i) Fish farming

.....

(1 mark)

10 (b) (ii) Line fishing

.....

(1 mark)

10 (b) (iii) Net mesh sizes

.....

(1 mark)

10 (b) (iv) Fishing quotas

.....

(1 mark)

10 (c) How is the Convention for the Conservation of Antarctic Marine Living Resources different in its approach to the EU Common Fisheries Policy?

.....

(2 marks)

12

END OF QUESTIONS



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