| Centre Number | | | | | | Candidate Number | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

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

General Certificate of Secondary Education
Foundation Tier
June 2012

# Environmental Science 44401F

## Unit 1 Topics in Environmental Science

**Monday 28 May 2012 1.30 pm to 3.30 pm**

**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 (a) (i)** Classify **each** of the energy resources in **Table 1** as predictable, intermittent, or both by putting ticks in the appropriate places in the table.

**Table 1**

| Energy resource | Predictable | Intermittent |
|---|---|---|
| Fossil fuels | | |
| Nuclear power | | |
| Biofuels | | |
| Tidal power | | |
| Wind power | | |

*(5 marks)*

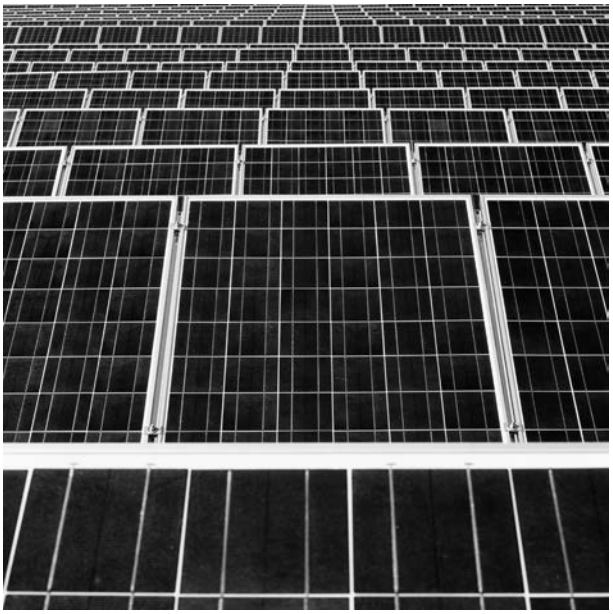
**1 (a) (ii)** Put ticks in **Table 2** to show which **three** resources obtain their energy directly or indirectly from the sun.

**Table 2**

| Energy resource | Solar |
|---|---|
| Fossil fuels | |
| Nuclear power | |
| Biofuels | |
| Tidal power | |
| Wind power | |
| Geothermal | |

*(2 marks)*

**1 (b)** Some countries are investing in large-scale solar power stations. One in the USA covers 100 hectares of desert and generates enough power for 9000 homes.



Source: Getty images

Other countries, such as France and Spain, are building solar furnaces. The photograph shows one of these.

Source: Getty images

**1 (b) (i)** Suggest why these countries are better suited to the use of solar power than the United Kingdom.

.....

.....

*(1 mark)*

**Turn over ▶**

**1 (b) (ii)** Why might the USA be more suited to systems using large-scale flat panel solar generation than either France or Spain?

.....

.....

*(1 mark)*

**1 (b) (iii)** The most effective solar panels have automatic systems to change their angles in both horizontal and vertical directions.

Explain why changing the angles of a solar panel makes it more effective.

.....

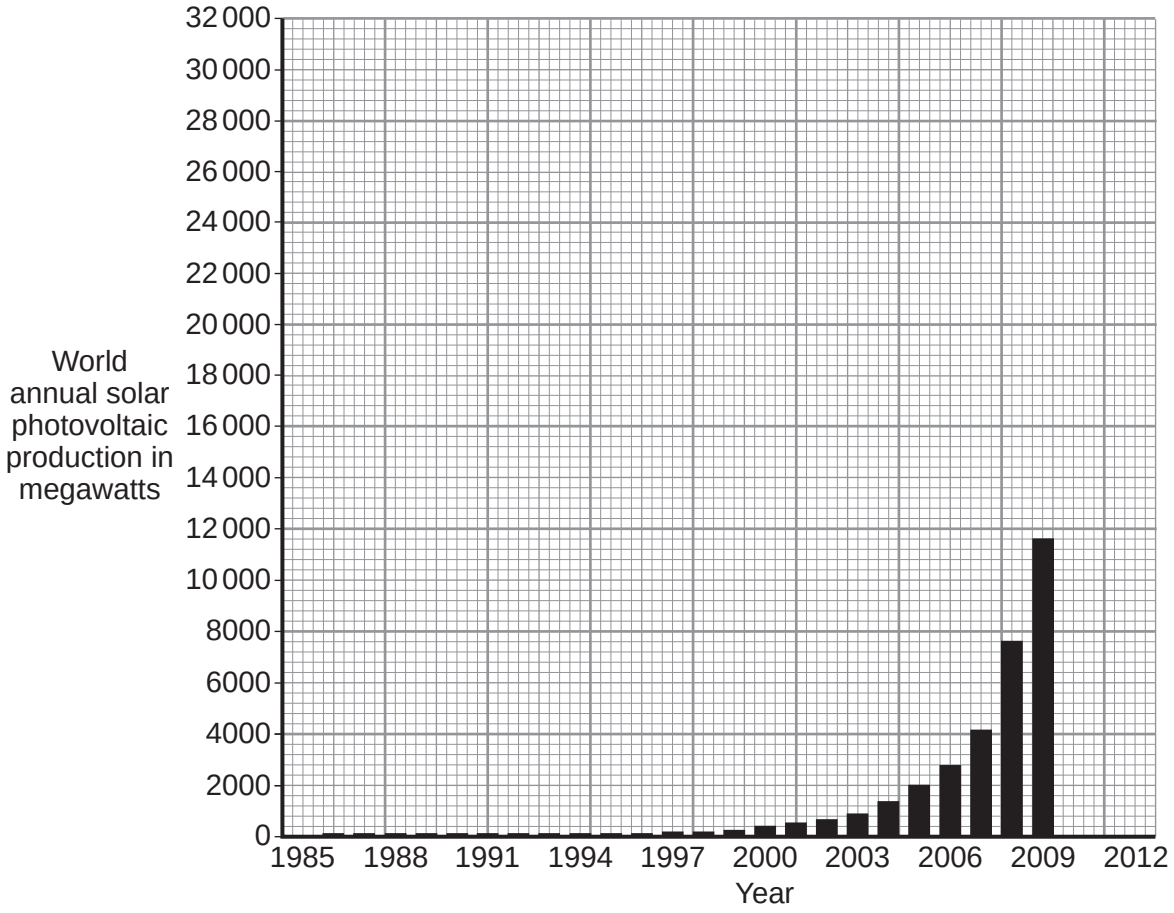
.....

.....

.....

*(2 marks)*

**1 (c)** The graph shows the world's annual solar photovoltaic power production from 1985 to 2009.




Source: adapted from J. MATHEW RONEY, *Solar Cell Production Climbs to Another Record in 2009* Eco-Economy Indicator (Washington DC: Earth Policy Institute, 21 September 2010)

**1 (c) (i)** Use the graph to estimate the power production in 2012.

..... megawatts
*(1 mark)*

**1 (c) (ii)** Suggest why there has been such a rapid rise in the use of solar power in the last 12 years.

.....

.....

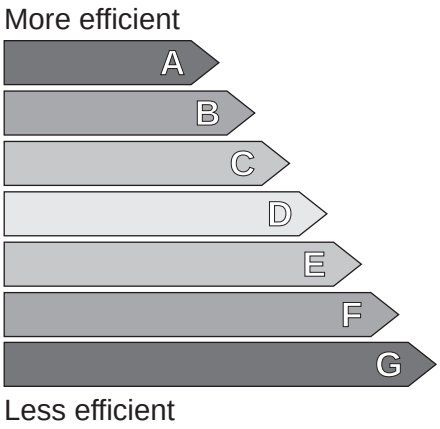
.....

.....
*(2 marks)*

14

**Turn over ▶**

**2 (a)** Many household appliances, such as washing machines and fridges, now come with an energy rating label. These labels are intended to enable consumers to choose more energy-efficient appliances.



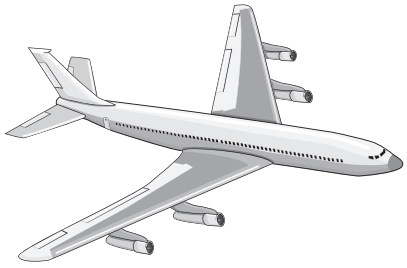

Suggest what impact this change might have on manufacturers when they are designing new machines.

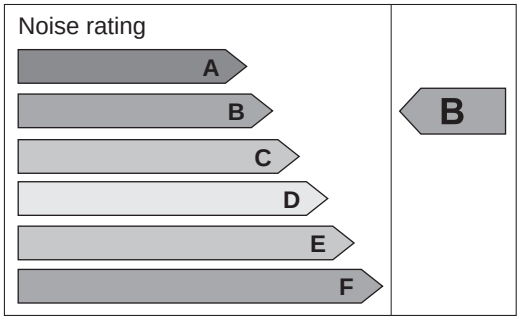
.....

.....

*(1 mark)*

**2 (b)** A similar scheme has been adopted by some airlines.






| | | |
|---|---|---|
| Total aircraft fuel consumption by journey length | Domestic (500 km) | **B** (1677 kg) |
| | Near EU (1000 km) | **B** (2719 kg) |
| | Short haul (1500 km) | **B** (3962 kg) |
| $CO_2$ emissions per seat by journey length | Domestic (500 km) | **B** (45 kg) |
| | Near EU (1000 km) | **B** (73 kg) |
| | Short haul (1500 km) | **B** (106 kg) |
| Take off and landing $CO_2$ emissions | | **C** (2066 kg) |
| Take off and landing $CO_2$ emissions (per seat) | | **C** (17.5 kg) |

**2 (b) (i)** Explain the environmental importance of the following criteria.

Noise rating

.....

.....

Fuel consumption

.....

.....

*(2 marks)*

**2 (b) (ii)** Suggest why $CO_2$ emissions are given as:

Take off and landing

.....

.....

$CO_2$ emissions per seat.

.....

.....

*(2 marks)*

**2 (c)** Buying energy-efficient appliances and flying on more efficient aircraft helps conserve energy. However, many experts believe that lifestyle changes could save even more energy.

List **four** ways in which an individual could reduce their energy consumption by making simple changes to their lifestyle.

1 .....

2 .....

3 .....

4 .....

*(4 marks)*

9

**3**

Source: Getty images

**3 (a)** Some Governments view nuclear power as the best way to meet increasing energy demand.
Suggest **two** reasons why.

1 .....

.....

2 .....

.....

*(2 marks)*

**3 (b) (i)** The production of nuclear waste is used as an argument against the increased use of nuclear power.

Explain why nuclear waste causes such concern.

.....

.....

.....

.....

*(2 marks)*

**3 (b) (ii)** Suggest **two** ways in which nuclear waste can be treated to make it less hazardous.

1 .....

2 .....

*(2 marks)*

**3 (c)** State **two** ways in which water is used in the generation of electricity from nuclear power.

1 .....

2 .....

*(2 marks)*

**3 (d)** In what way is geothermal energy a form of nuclear power?

.....

.....

*(1 mark)*

9

**Turn over for the next question**

**4** The introduction of the grey squirrel has caused problems for our native wildlife.

Source: Getty images

**4 (a)** Give **three** ways in which an introduced species may harm our native wildlife.

1 .....

.....

2 .....

.....

3 .....

.....

*(3 marks)*

**4 (b)** Draw lines to connect each organisation to its responsibility in protecting wildlife.

| **Organisation** | **Responsibility** |
|---|---|
| Environment Agency | Set up breeding programmes for wild animals |
| Natural England | Protect habitats for birds |
| RSPB | Maintenance of National Parks |
| WWF | Monitor environments for pollution |

*(4 marks)*

**4 (c)** Which of the following international agreements makes the sale of products made from endangered species illegal?

Tick (✓) **one** box.

CITES ☐

EU ☐

WWF ☐

Ramsar ☐

*(1 mark)*

**4 (d)** Suggest **one** reason why captive-bred wild animals cannot always be successfully returned to the wild.

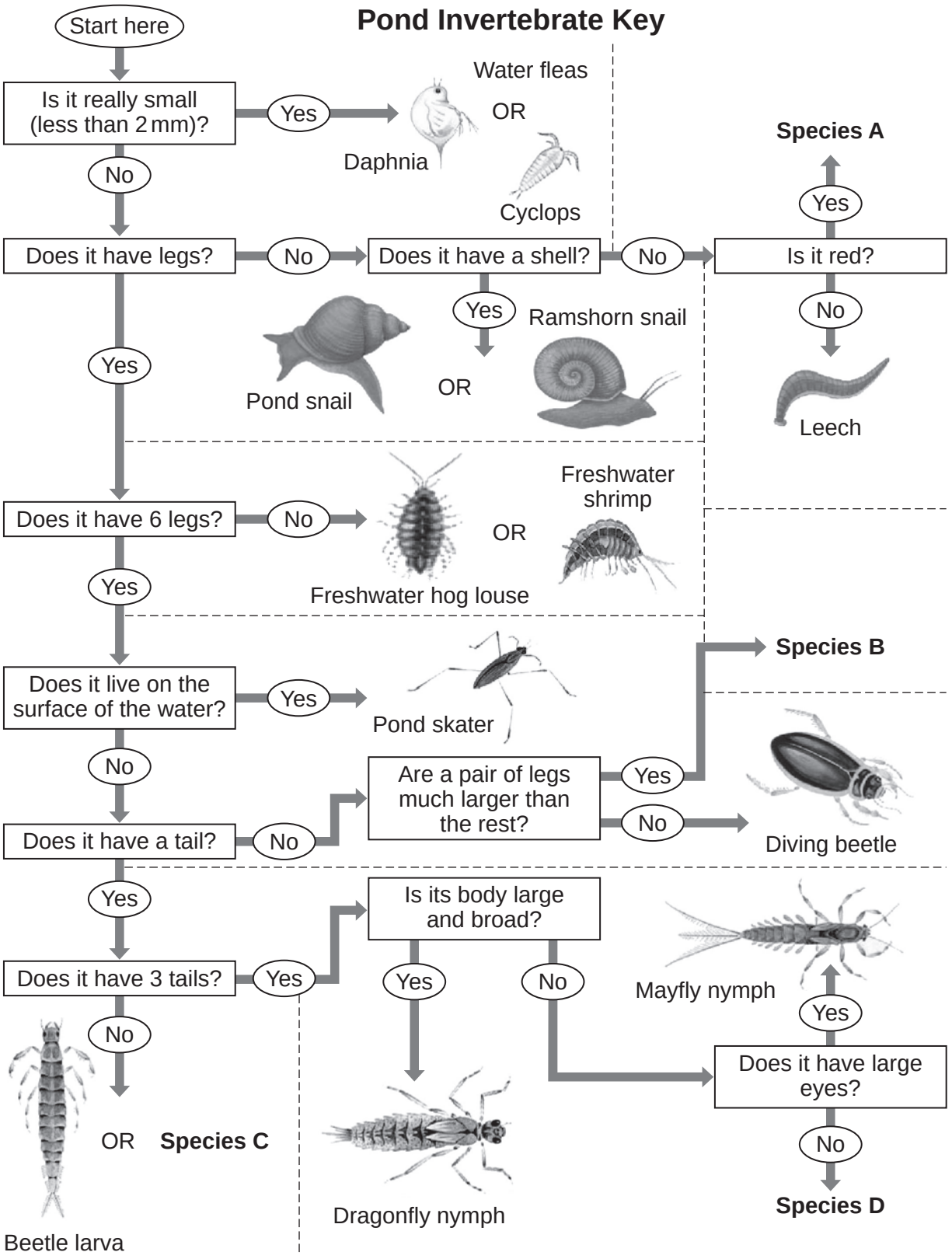
.....

.....

*(1 mark)*

**Question 4 continues on the next page**

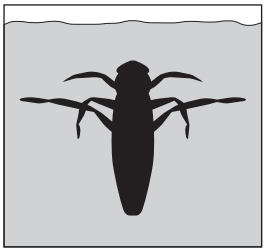
**4 (e)**



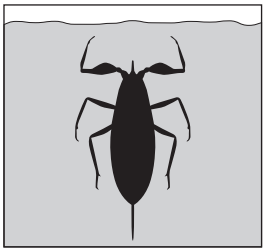

Source: adapted from Royal Borough of Kensington and Chelsea Ecology Service

Use the key to identify correctly the following species.

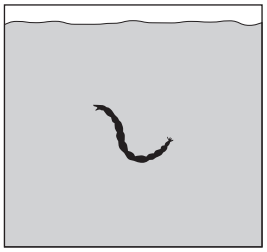
Water Boatman

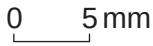


Water Scorpion



Red Midge larva






Put **A**, **B**, **C** or **D** in the correct space in the table.

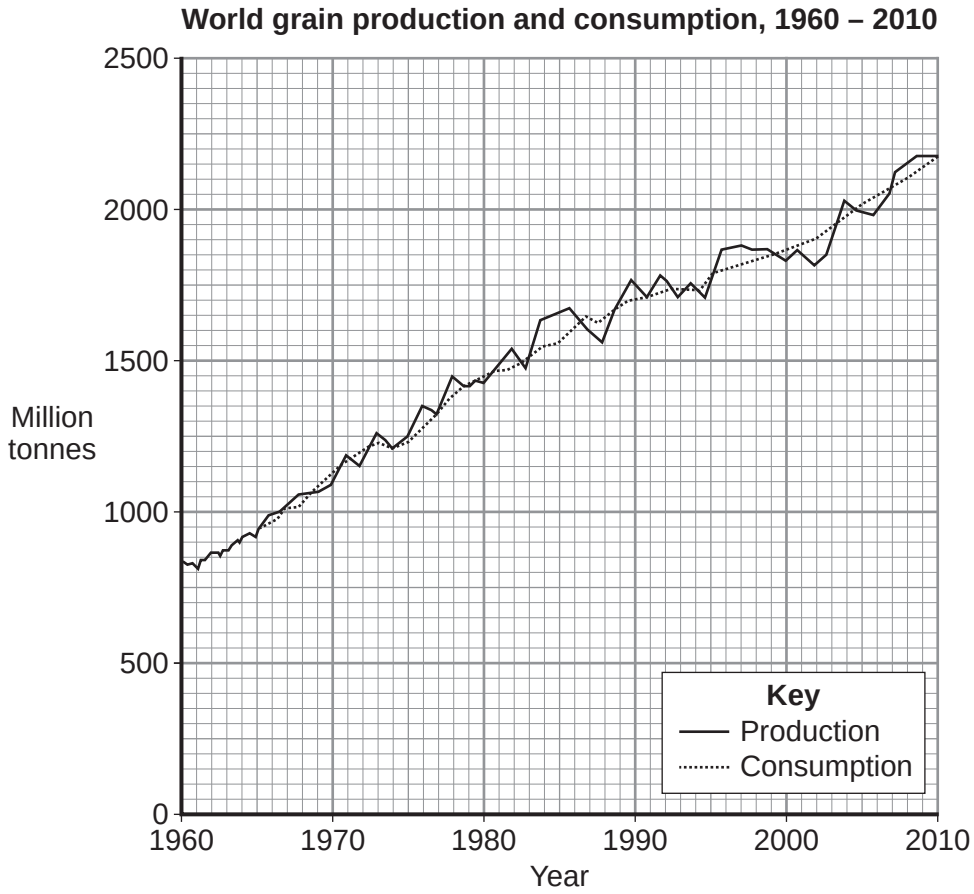
| Name | Species |
|---|---|
| Water Boatman | |
| Water Scorpion | |
| Red Midge larva | |

*(3 marks)*

12

**Turn over for the next question**

**5** The graph shows that farmers have met the increased demand for food by increasing agricultural output.




Source: adapted from graph produced by www.*earth-policy-org*, data from USDA

**5 (a) (i)** Give a reason why **each** of the following has helped farmers to increase their production of grain.

Mechanisation

.....

.....

The use of chemicals

.....

.....

Plant breeding

.....

.....

*(3 marks)*

**5 (a) (ii)** Give a reason why **each** of these may harm the environment.

Mechanisation

.....

.....

The use of chemicals

.....

.....

Plant breeding

.....

.....

*(3 marks)*

**5 (b)** Suggest why world grain production fluctuates from one year to the next.

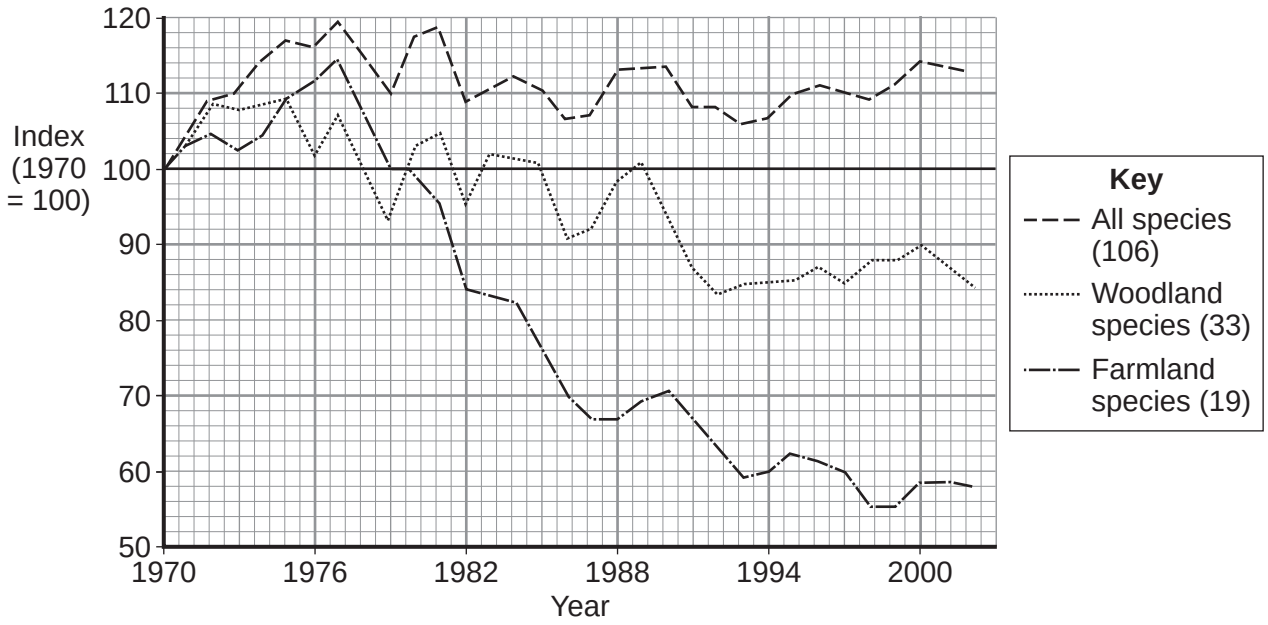
.....

.....

*(1 mark)*

**Question 5 continues on the next page**

**5 (c)** The graph shows the changes in the populations of wild birds in the United Kingdom between 1970 and 2003.




Source: adapted from Defra, Royal Society for the Protection of Birds, BTO


**5 (c) (i)** Describe how **each** of the populations of wild birds changed between 1970 and 2003.

.....

.....

.....

.....

.....

.....

*(3 marks)*

**5 (c) (ii)** Suggest why there has been a change in the numbers of wild birds on farmland.

.....

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.....

.....

.....

.....

*(3 marks)*

**5 (c) (iii)** How might farmers improve farms for wild birds?

.....

.....

.....

.....

.....

.....

*(3 marks)*

16

**Turn over for the next question**

**6** Human population growth is a major cause of concern. World population is expected to double over the next 60 years.

**6 (a)** Why are scientists concerned that the population is growing so rapidly?

.....

.....

.....

.....

.....

.....

*(3 marks)*

**6 (b)** Suggest **three** ways in which science might help us to meet the needs of a growing population.

1 .....

.....

2 .....

.....

3 .....

.....

*(3 marks)*

**6 (c)** What might individuals do to reduce their *ecological footprint*?

.....

.....

.....

.....

*(2 marks)*

**6 (d)** In many countries, population growth rates have fallen.

Suggest **three** ways in which countries have managed to slow their growth rates.

1 .....

.....

2 .....

.....

3 .....

.....

*(3 marks)*

11

**Turn over for the next question**

**7** The carbon cycle is made up of processes that:

- add carbon dioxide to the atmosphere
- remove carbon dioxide from the atmosphere
- store carbon (sinks).

**7 (a)** Name **one natural** example of **each** of the following.

**7 (a) (i)** A process that adds carbon dioxide to the atmosphere

.....

*(1 mark)*

**7 (a) (ii)** A process that removes carbon dioxide from the atmosphere

.....

*(1 mark)*

**7 (a) (iii)** A carbon sink

.....

*(1 mark)*

**7 (b)** Carbon dioxide is not the only gas that contributes to global warming.

For **each** of the greenhouse gases in the table, suggest **one** human activity that can increase its proportion in the atmosphere.

Write your answers in the table.

| Greenhouse gas | Human activity |
|---|---|
| Carbon dioxide | |
| Water vapour | |
| Methane | |
| Nitrous oxides | |

*(4 marks)*

**7 (c)** Global climate change is beginning to affect our environment.

Suggest a reason why global warming might cause **each** of the following.

**7 (c) (i)** Flooding of coastal areas

.....

.....

*(1 mark)*

**7 (c) (ii)** Reduced food production

.....

.....

*(1 mark)*

**7 (c) (iii)** Loss of wildlife species

.....

.....

*(1 mark)*

**7 (c) (iv)** Increased rainfall

.....

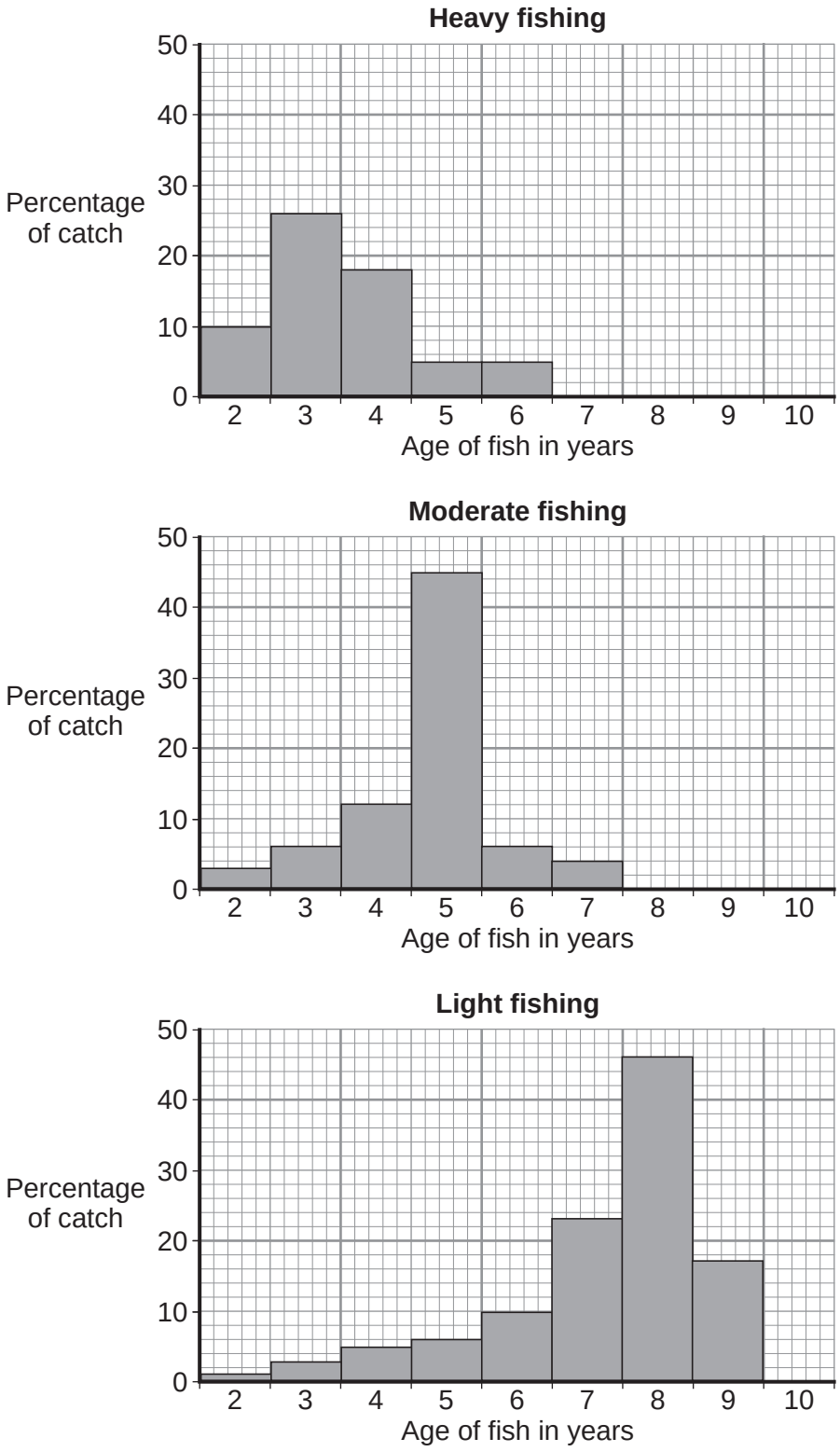
.....

*(1 mark)*

11

**Turn over for the next question**

**8** The graphs show the effect of different levels of fishing on the structure of the fish populations.




Source: *Environmental Science*, Biozone International © 2008

**8 (a)** Describe and explain how different levels of fishing impact on the sustainability of the fishing.

.....

.....

.....

.....

*(2 marks)*

**8 (b)** Suggest **two** reasons why fish farming might be damaging stocks of wild fish.

.....

.....

.....

.....

*(2 marks)*

**8 (c)** State how **each** of the following helps to make fishing more sustainable.

Quotas

.....

.....

Nets with larger mesh size

.....

.....

Zoning of fishing grounds

.....

.....

Line fishing

.....

.....

*(4 marks)*

**8 (d)** Name **one** international fishing agreement.

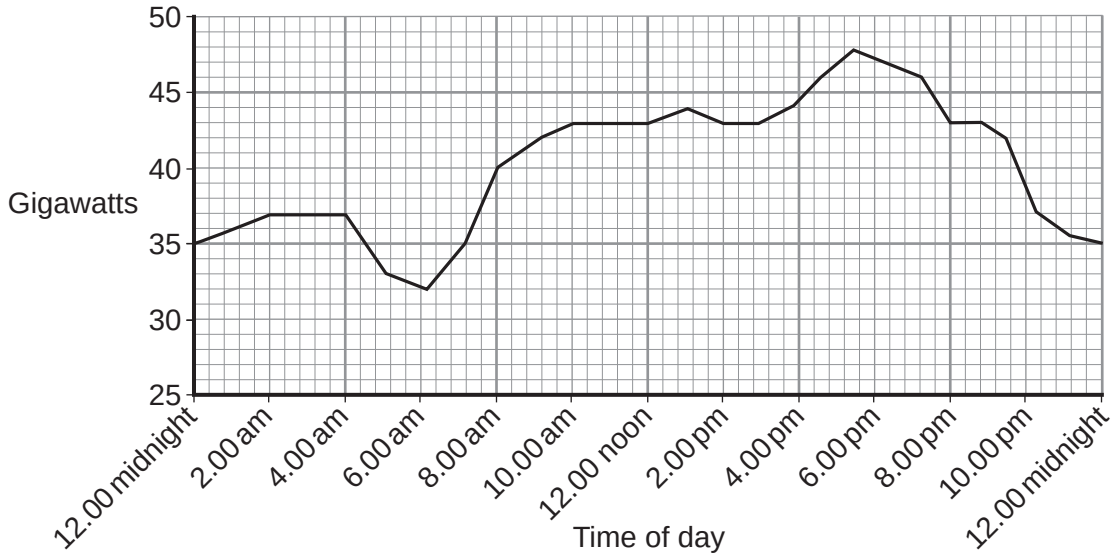
.....

*(1 mark)*

**9**

**9** **Graph A** shows changes in demand for electricity that occur during a typical winter's day.

**Graph A**




**9 (a) (i)** Identify and explain **two** changes in demand for energy over the 24 hours, as shown in **Graph A**.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

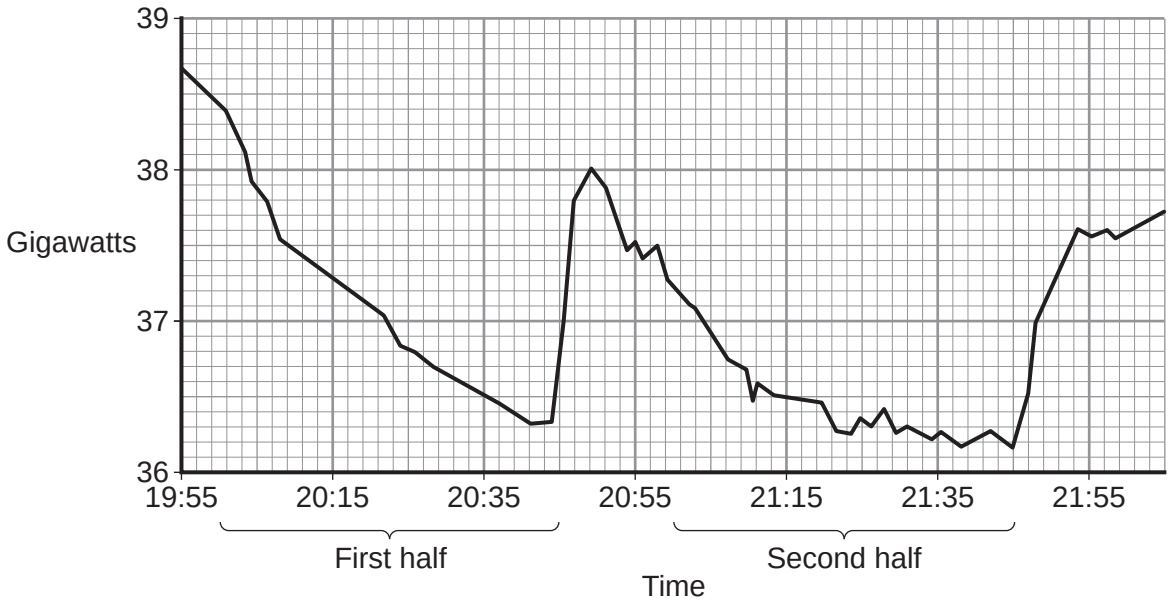
.....

*(4 marks)*

**9 (a) (ii)** **Graph B** shows how watching popular television programmes can affect energy demand.

**Graph B**

**World Cup 2006 first round, England vs Sweden, kick off 20:00 hours**




A range of energy sources are available in the UK.
Explain how these can be used to meet fluctuating daily electricity demand.

Use information in the graphs and your own knowledge to help you to answer this question.

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

.....

.....

.....

.....

.....

.....

.....

.....

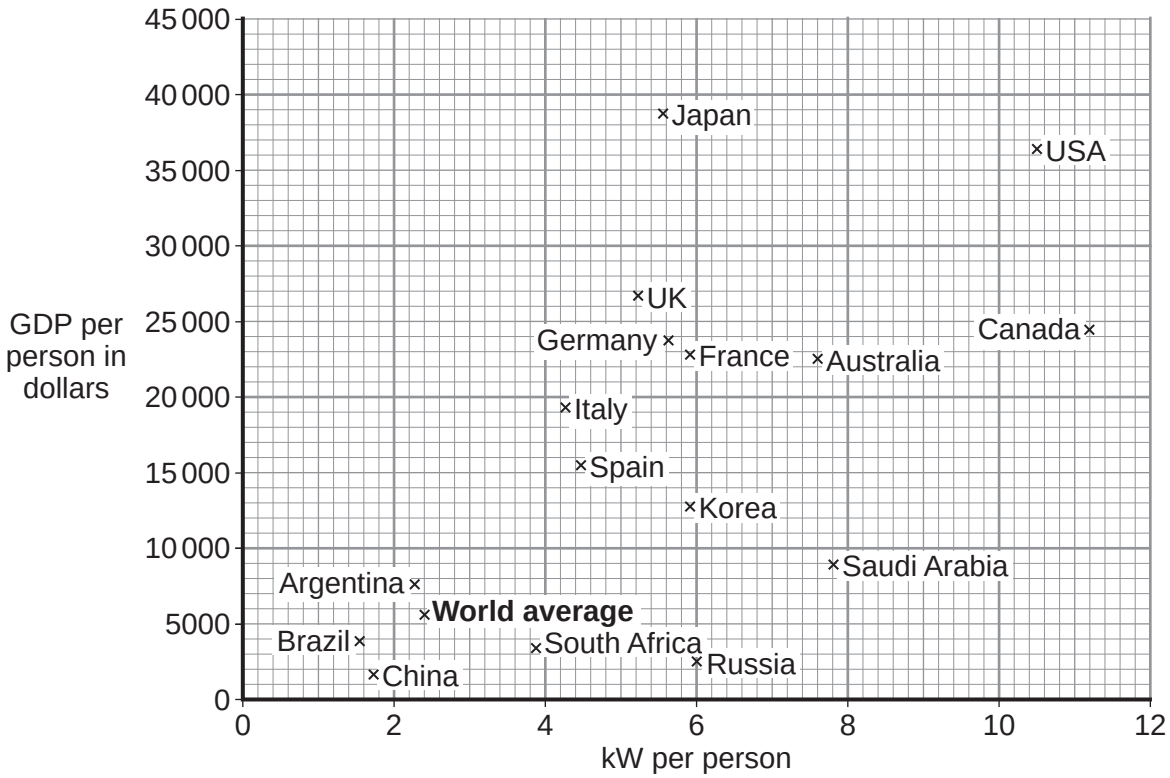
.....

.....

*(4 marks)*

**Turn over ▶**

**9 (b)** The chart shows the relationship between energy consumption and gross domestic product (GDP) (the value of goods produced by a country).




Source: adapted from International Energy Agency, 2008 Key World Energy Statistics, Frank van Mierlo

**9 (b) (i)** What relationship between energy consumption and GDP is shown by the chart?

.....

.....

*(1 mark)*

**9 (b) (ii)** Suggest **two** reasons for the relationship that you have described in **9(b)(i)**.

1 .....

.....

2 .....

.....

*(2 marks)*

**11**

**10** Drinking water supplies are obtained from rivers, reservoirs and aquifers.

**10 (a)** For **each** water source shown in **Table 1**, suggest an advantage **and** a disadvantage of it as a source of drinking water supply.

**Table 1**

| Water source | Advantage | Disadvantage |
|---|---|---|
| **Rivers** | | |
| **Reservoirs** | | |
| **Aquifers** | | |

*(6 marks)*

**10 (b)** **Table 2** shows some characteristics of three rocks, **A**, **B** and **C**.

**Table 2**

| | Rock A | Rock B | Rock C |
|---|---|---|---|
| **Porosity %** | 0.75 | 55 | 45 |
| **Permeability cm/s** | 0.01 | 1 | 10 |

Which rock would make the best aquifer?

Draw a ring around your answer.

**Rock A** **Rock B** **Rock C**

*(1 mark)*

**10 (c)** Which **one** of the following rock types would make a suitable aquifer rock?

Draw a ring around your answer.

**basalt** **granite** **sandstone** **slate**

*(1 mark)*

**10 (d)** Suggest **three** things that planners should consider when looking for a site for a new reservoir.

1 .....

.....

2 .....

.....

3 .....

.....

*(3 marks)*

**10 (e)** Reservoirs are frequently used for a range of activities.

Source: Getty images

This multiple use can sometimes lead to conflict between users.

**10 (e) (i)** Give **one** example of how different users might come into conflict.

.....

.....

*(1 mark)*

**10 (e) (ii)** Suggest **two** ways in which managers of the reservoir might avoid conflict between different users.

1 .....

.....

2 .....

.....

*(2 marks)*

**10 (f)** Environmentalists are recommending that more homes should consider using 'grey' water.

Explain what is meant by the term *grey* water.

.....

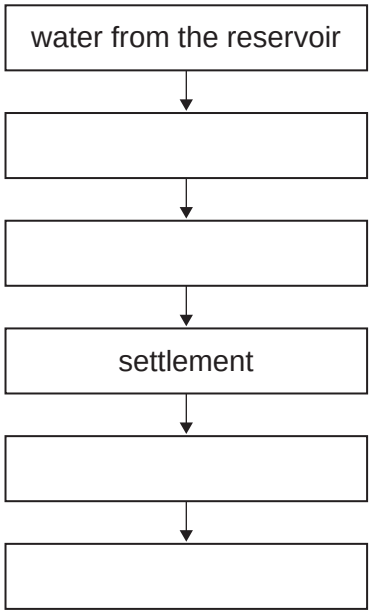
.....

*(1 mark)*

**10 (g)** The following processes are used in the production of drinking water.

Put them in their correct order in the flow chart. One has been done for you.

**clarification** **disinfection** **filtration** **screening**




*(3 marks)*

18

**END OF QUESTIONS**

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