| 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 | |
| 11 | |
| TOTAL | |

AQA

General Certificate of Secondary Education
Higher Tier
June 2014

# Environmental Science 44401H

## Unit 1 Topics in Environmental Science

Thursday 5 June 2014 9.00 am to 11.00 am

**For this paper you must have:**
- a ruler.

You may use a calculator.

**Time allowed**
- 2 hours

A

**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.

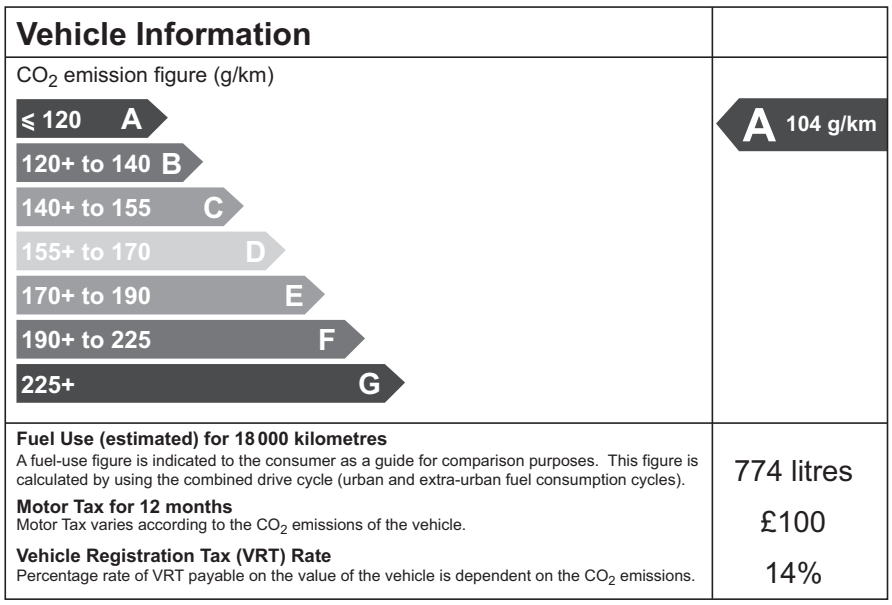
**Information**
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 120.
- You are expected to use a calculator where appropriate.
- In some questions you will be assessed on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary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

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

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

**1 (a)** **Figure 1** shows part of the environmental information that must now be shown on all new cars that are for sale.

**Figure 1**




**1 (a) (i)** Suggest **two** ways how this information displayed on cars benefits the environment.

**[2 marks]**

.....

.....

.....

.....

**1 (a) (ii)** The amount of motor tax paid is based on the amount of carbon dioxide ($CO_2$) that cars emit.

Suggest how this could affect how people choose their cars.

**[1 mark]**

.....

.....

**1 (b)** **Table 1** shows information about the fuel consumption of a car.

**Table 1**

| Where driven | Fuel consumption in litres per 100 km |
|---|---|
| Urban (in town) | 5.0 |
| Extra-urban (out of town) | 4.2 |
| Combined (both) | 4.3 |

The way a car is driven can change its fuel consumption.

Suggest **two** examples how, using information in **Table 1** or your own knowledge.

**[2 marks]**

.....

.....

.....

.....

**1 (c)** You want to compare the fuel consumption of three cars.

Outline the main steps of a practical investigation to give a fair comparison of the three cars.

**[4 marks]**

.....

.....

.....

.....

.....

.....

.....

.....

**9**

**2 (a)** **A**, **B**, **C** and **D** are four of the stages in eutrophication.

**A** Break down of organic waste by aerobic bacteria

**B** Loss of oxygen from the water

**C** Death of aquatic plants

**D** Increased growth of aquatic plants

Write **one** letter in each box so the stages are in the correct order.

**[2 marks]**

Pollution by nutrients

☐

☐

☐

☐

Death of aquatic animals

**2 (b)** Which of the following would **not** cause eutrophication?

Tick (✓) **one** box.

**[1 mark]**

Detergents containing phosphate ☐

Lime ☐

Nitrate fertiliser ☐

Run-off from a manure heap ☐

**2 (c)** Describe how nutrients put on a field might get into aquifer water.

**[3 marks]**

.....

.....

.....

.....

.....

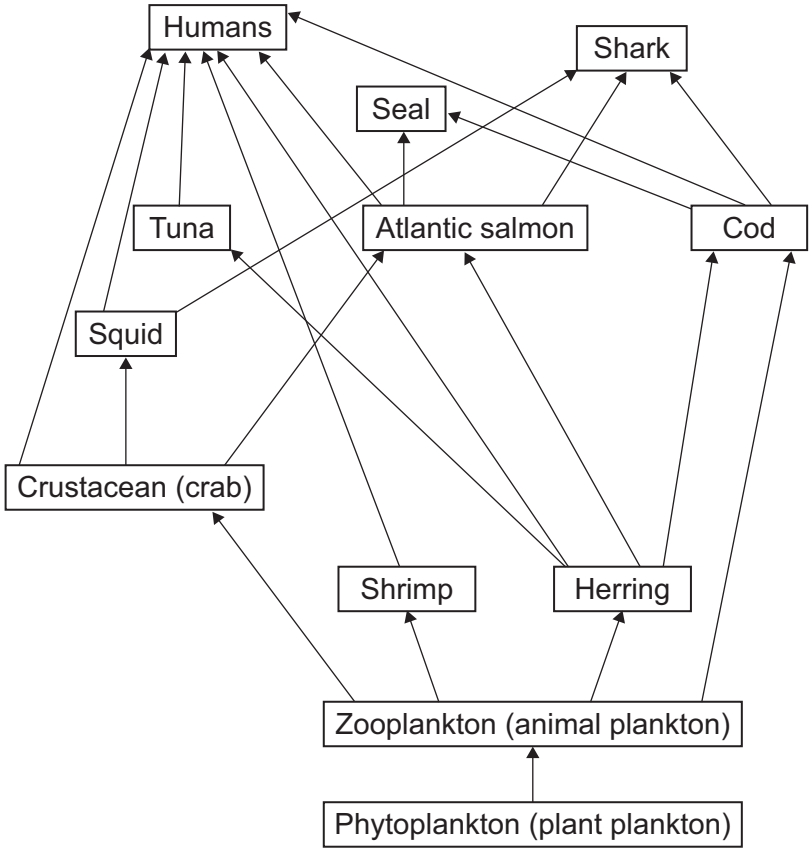
.....

6

**Turn over for the next question**

**3** **Figure 2** shows a food web from the North Atlantic Ocean.

**Figure 2**




**3 (a)** Describe the impact on the other species shown in the web if cod became extinct.

**[3 marks]**

.....

.....

.....

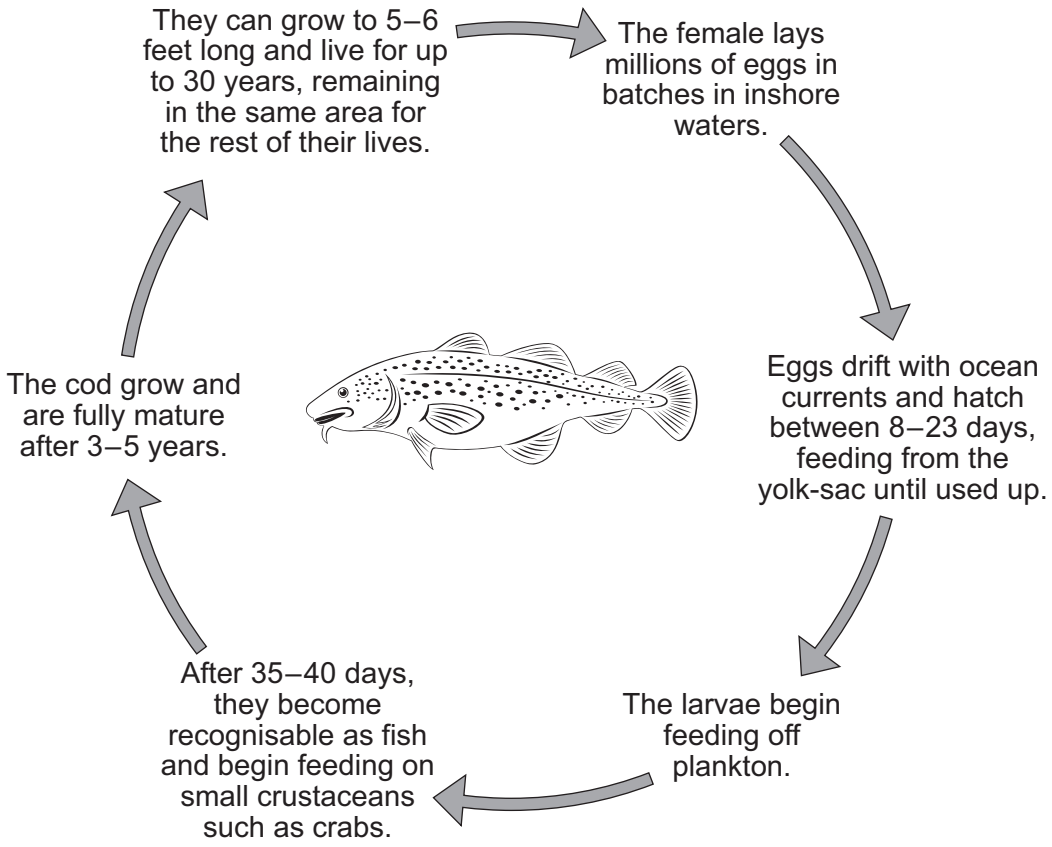
.....

.....

.....

**3 (b)** **Figure 3** shows the breeding cycle of cod.

**Figure 3**




Use the information in the breeding cycle and your own knowledge to suggest how cod can be protected for future generations.

**[3 marks]**

.....

.....

.....

.....

.....

.....

**3 (c)** The EU Common Fisheries Policy sets fishing quotas.

Which of the following best describes fishing quotas?

Tick (✓) **one** box.

**[1 mark]**

A limit on the . . .

areas of the sea in which you are allowed to fish. ☐

numbers of a particular species that you are allowed to catch. ☐

total number of all species of fish caught. ☐

size of fish that you are allowed to catch. ☐

**3 (d)** Suggest **three** other ways to make cod fishing more sustainable.

**[3 marks]**

.....

.....

.....

.....

.....

.....

10

**Turn over for the next question**

**DO NOT WRITE ON THIS PAGE**
**ANSWER IN THE SPACES PROVIDED**

**4** **Figure 4** shows large-scale crop production.

**Figure 4**

**4 (a)** As world population increases, farmers are having to produce more food on less land.

Suggest **three** reasons why there is less land available to produce food.

**[3 marks]**

.....

.....

.....

.....

.....

.....

**4 (b)** Which of the following **cannot** be produced by selective breeding?

Tick (✓) **one** box.

**[1 mark]**

A more uniform crop ☐

A higher yielding crop ☐

A crop with a greater environmental tolerance ☐

A crop with genes not present in its parents ☐

**4 (c)** What is **transgenic** genetic modification?

**[1 mark]**

.....

.....

**4 (d)** Agricultural scientists think that the 'Green Revolution' helped food production meet the needs of a growing world population.

Describe and explain how changes in agricultural methods increased crop yields.

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

**[4 marks]**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

9

**Turn over for the next question**

**5** Most of the world's energy comes from non-renewable fossil fuels.

**5 (a)** **Table 2** shows how long we think these fuels will last.

**Table 2**

| Fuel | Reserves | Predicted average use per year | Years left |
|---|---|---|---|
| Coal | 860 944 million tonnes | 7 687 million tonnes | ..... |
| Gas | 207.9 trillion $m^3$ | 3.3 trillion $m^3$ | 63 |
| Oil | 1 635 billion barrels | 30 billion barrels | 54.5 |

Use the table to calculate how long coal reserves are expected to last.

Write your answer in the table.

**[1 mark]**

.....

.....

**5 (b)** Suggest **three** factors which would need to be considered when estimating future coal use.

**[3 marks]**

.....

.....

.....

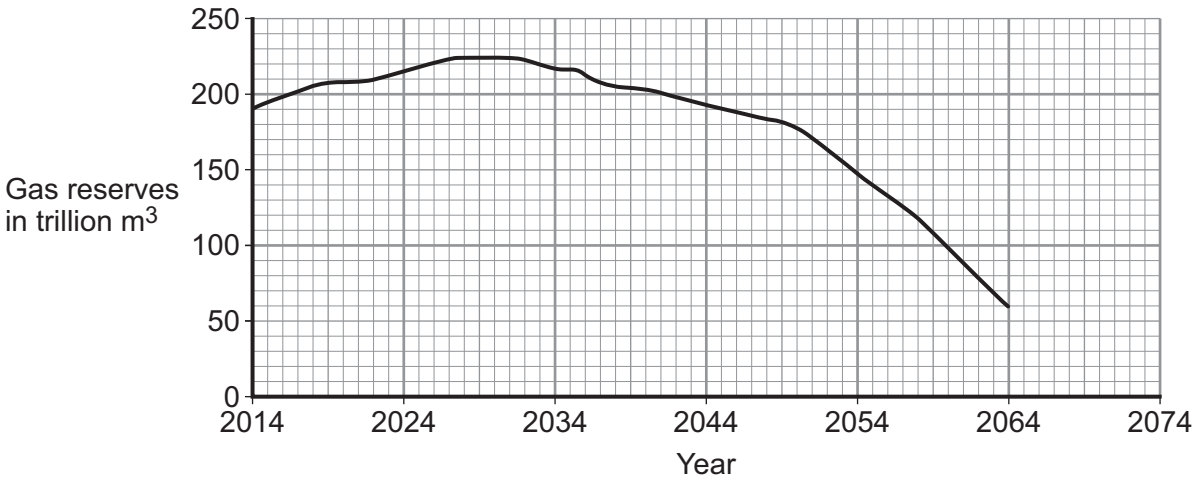
.....

.....

.....

**5 (c)** The graph in **Figure 5** shows how the world's gas reserves will change over the next 50 years.

**Figure 5**




**5 (c) (i)** Suggest why gas reserves are predicted to rise in the next few years.

**[1 mark]**

.....

.....

**5 (c) (ii)** Use the graph to estimate when world gas reserves will run out.

**[1 mark]**

.....

.....

**Question 5 continues on the next page**

**5 (d)** Discuss the advantages and disadvantages of using coal to meet our future energy needs.

**[6 marks]**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**5 (e)** Explain why biofuels are considered to be 'carbon neutral' while fossil fuels are not.

**[2 marks]**

.....

.....

.....

.....

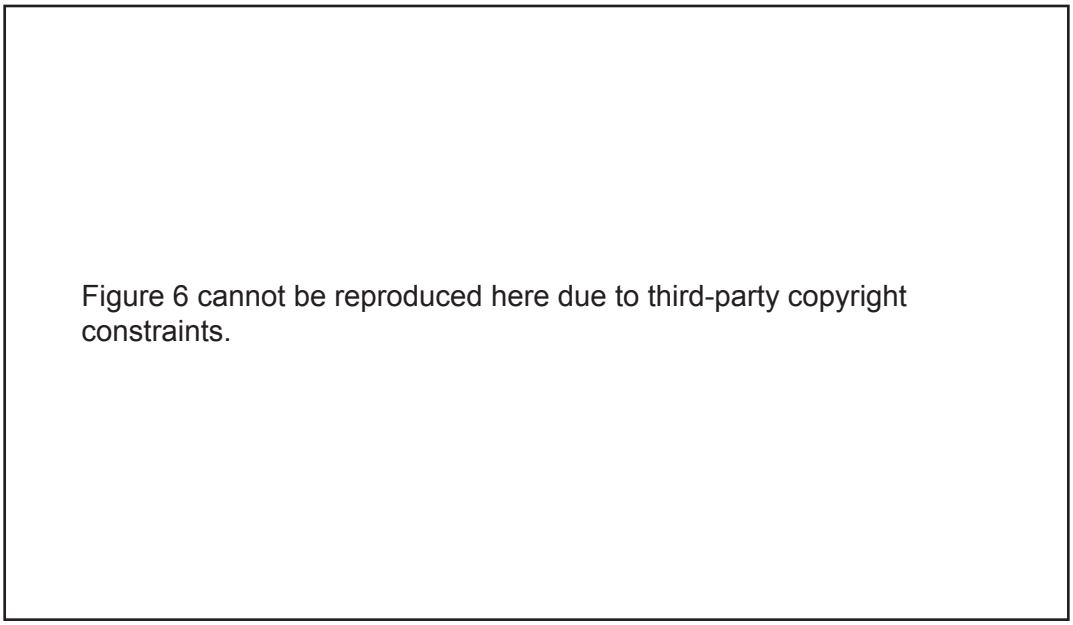
14

**Turn over for the next question**

**DO NOT WRITE ON THIS PAGE**
**ANSWER IN THE SPACES PROVIDED**

**6** The map in **Figure 6** shows where the main aquifers in the UK are.

**Figure 6**




**6 (a) (i)** Which water authority in the UK gets the greatest percentage of its water from aquifers?
**[1 mark]**

.....

.....

**6 (a) (ii)** What do all these aquifers have in common?

Tick (✓) **one** box.

**[1 mark]**

They are all in igneous rocks ☐

They are all in sedimentary rocks ☐

They are all in metamorphic rocks ☐

**6 (a) (iii)** The South East of the UK has a high proportion of the UK's aquifers.

Suggest **two** reasons why this is an advantage for the South East.

**[2 marks]**

.....

.....

.....

.....

**6 (b)** State **two** properties of the rock needed for a good aquifer.

**[2 marks]**

.....

.....

**6 (c)** Explain why water companies prefer to use water from aquifers rather than from rivers.

**[2 marks]**

.....

.....

.....

.....

**6 (d)** Taking too much water from aquifers can lower the water table.

Describe **two** problems that might result from a lower water table.

**[2 marks]**

.....

.....

.....

.....

**6 (e)** How could we use the extra rain in winter to add water to an aquifer?

**[2 marks]**

.....

.....

.....

.....

**12**

**7 (a)** Waste water must be treated before it is released into rivers or the sea.

**Figure 7** shows a waste water treatment works.

**Figure 7**

Why must waste water be treated?

Give **two** reasons.

**[2 marks]**

.....

.....

.....

.....

**Question 7 continues on the next page**

**7 (b)** Use the correct answer from the box to complete each sentence.

**[4 marks]**

| | | |
|---|---|---|
| **aerobic** | **anaerobic** | **nutrient stripping** |
| **oxidation** | **screens** | **solids** |

The first stage in waste water treatment is when the effluent is passed through ..... which remove large objects.

The water then passes into a channel where it slows to allow ..... to settle out.

In the filter beds, ..... bacteria help to break down the organic matter. Sludge is further broken down by ..... bacteria which also produce methane. Finally, ..... helps to prevent eutrophication when the water is released.

**7 (c)** In addition to the liquid effluent, methane gas and a solid effluent (sludge) are produced.

Give **one** possible use for each of these.

**[2 marks]**

Methane gas .....

.....

Solid effluent (sludge) .....

.....

**7 (d)** Northumbrian Water estimates that the 1.9 million people living in the area produce approximately 500 000 tonnes of sewage sludge a year.

There are 56.1 million people living in England and Wales.

Use the Northumbrian Water estimate to calculate the total annual sewage sludge production in England and Wales.

**[2 marks]**

..... tonnes

**7 (e)** Suggest **one** reason why disposal of this sludge would be a problem.

**[1 mark]**

.....

.....

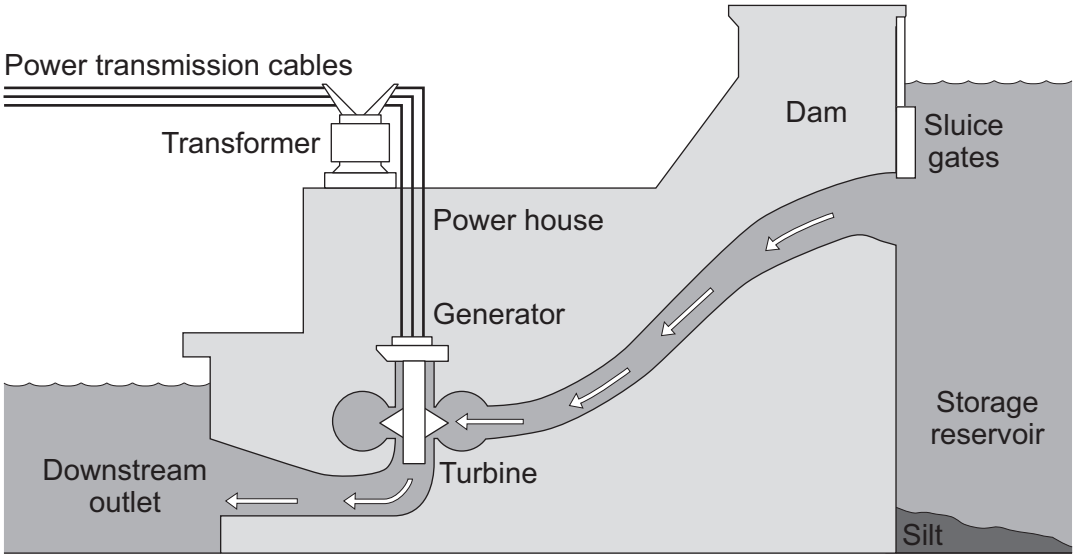
11

**Turn over for the next question**

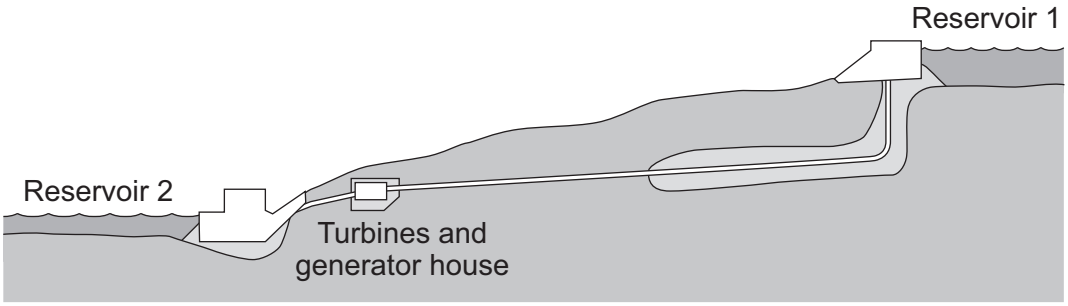
**8** **Figure 8** shows two main types of hydroelectric power (HEP), conventional and pumped storage.

**Figure 8**

**Conventional HEP**




**Pumped storage HEP**




**8 (a)** Explain why conventional HEP needs only one reservoir while pumped storage HEP needs two reservoirs.

**[2 marks]**

.....

.....

.....

.....

**8 (b)** Describe how pumped storage HEP uses 'surplus' electricity at night.

**[1 mark]**

.....

.....

**8 (c)** One pumped storage power station in Wales can reach maximum electricity generation in six seconds.

How does this help when we need different amounts of energy at different times of day?

**[1 mark]**

.....

.....

**8 (d)** Describe how the Sun provides the energy for hydroelectric power.

**[2 marks]**

.....

.....

.....

.....

**8 (e)** Tidal power also uses moving water to make electricity.

What best describes the source of energy that moves the water in tides?

Tick (✓) **one** box.

**[1 mark]**

The Earth's rotation ☐

The moon ☐

The Sun ☐

The Sun and the moon ☐

All of these ☐

**8 (f)** Suggest **two** reasons why there are not many tidal power stations worldwide.

**[2 marks]**

.....

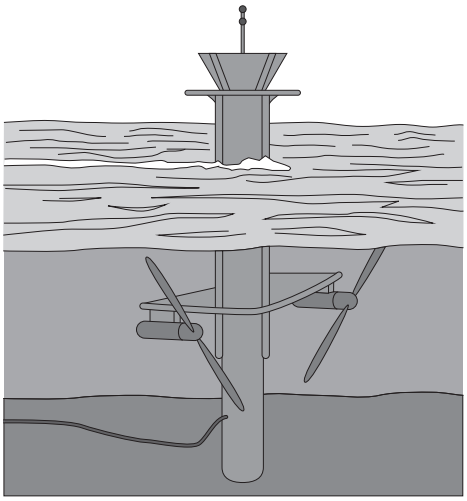
.....

.....

.....

**8 (g)** The latest tidal power stations have turbines under the water in an estuary, as shown in **Figure 9**.

**Figure 9**



Suggest **four** advantages of this form of tidal power compared with building a dam across the estuary.

**[4 marks]**

.....

.....

.....

.....

.....

.....

.....

.....

13

**9** A teacher asks a class to collect water samples from a stream to test for nutrients, as shown in **Figure 10**.

**Figure 10**

**9 (a) (i)** Give **three** safety guidelines for collecting the water samples.

**[3 marks]**

.....

.....

.....

.....

.....

.....

**Question 9 continues on the next page**

**9 (a) (ii)** Describe how the students could test the water for nutrients.

**[4 marks]**

.....

.....

.....

.....

.....

.....

.....

.....

**9 (b) (i)** Biological indicators could be used to test how clean the water is.

Describe how you could test for pollution levels in the stream using biological indicators.

**[3 marks]**

.....

.....

.....

.....

.....

.....

**9 (b) (ii)** Changes in one of the abiotic factors below determines the numbers of biological indicators in the water.

Draw a ring around the correct answer.

**[1 mark]**

**ammonia** **nitrates** **oxygen** **phosphates**

**9 (b) (iii)** Suggest **one** advantage of using biological indicators rather than chemical testing for water pollution.

**[1 mark]**

.....

.....

12

**Turn over for the next question**

**10** Intensive animal production involves managing the environment in which the animals are kept (see **Figure 11**).

**Figure 11**

**10 (a)** Suggest **three** reasons why managing the animals' environment increases the productivity of those animals.

**[3 marks]**

.....

.....

.....

.....

.....

.....

**10 (b)** How did the Common Agricultural Policy allow farmers to invest in intensive production systems?

**[2 marks]**

.....

.....

.....

.....

**10 (c)** Suggest **two** disadvantages of intensive animal production.

**[2 marks]**

.....

.....

.....

.....

**10 (d)** Intensive production puts many animals in a few large units.

Describe how this affects the food miles of the animal products.

Give a reason for your answer.

**[2 marks]**

.....

.....

.....

.....

**10 (e)** Give **two** reasons why organisations such as the Rare Breeds Survival Trust think it is important to keep traditional breeds, and not to let them become extinct.

**[2 marks]**

.....

.....

.....

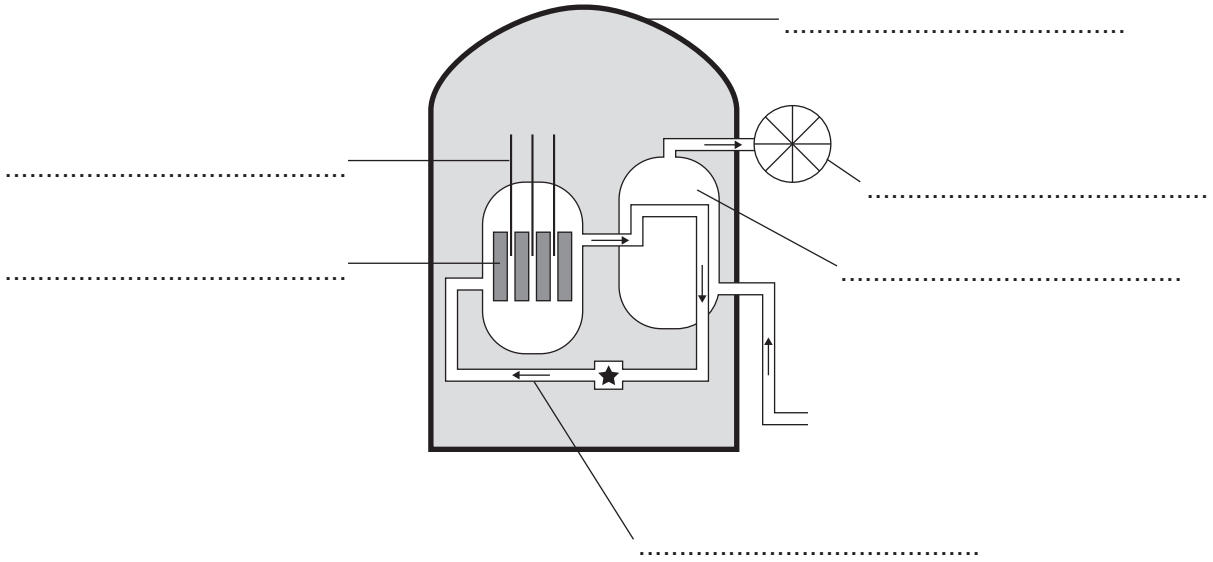
.....

11

**Turn over for the next question**

**11** **Figure 12** shows a nuclear reactor.

**Figure 12**




**11 (a)** Use words from the box to label the parts of the nuclear reactor in **Figure 12**.

**[3 marks]**

| | | |
|---|---|---|
| **control rods** | **containment vessel** | **coolant** |
| **fuel rods** | **heat exchanger** | **turbine** |

**11 (b)** Name **one** fuel used to produce nuclear power.

**[1 mark]**

.....

.....

**11 (c)** Suggest **two** advantages nuclear power stations have over conventional fossil fuel power stations.

**[2 marks]**

.....

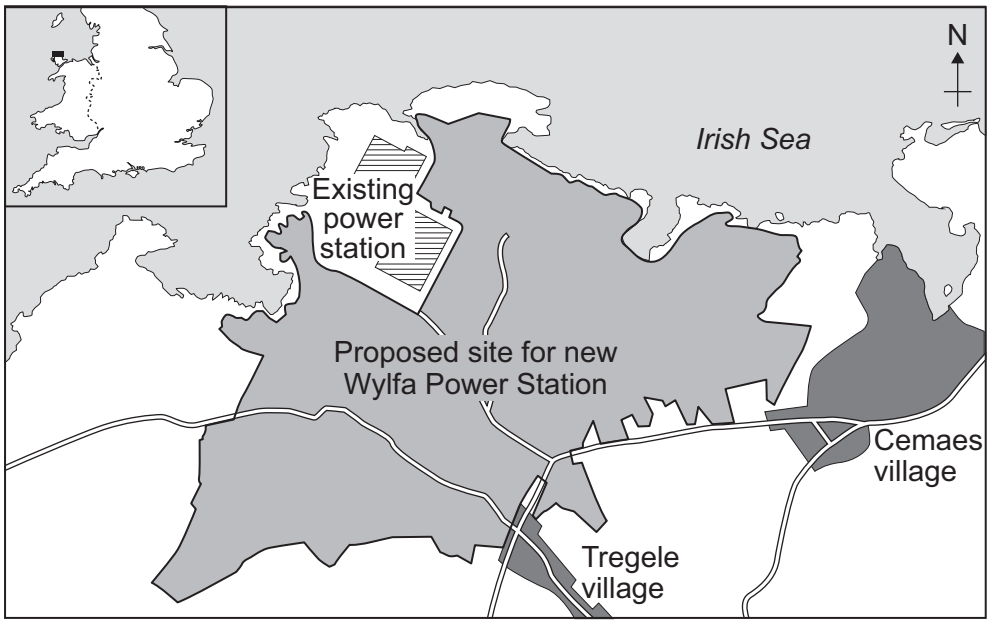
.....

.....

.....

**11 (d)** The map in **Figure 13** shows where a new nuclear power station may be built in North Wales.

**Figure 13**




**11 (d) (i)** Suggest **four** reasons why this is considered to be a particularly suitable site.

**[4 marks]**

.....

.....

.....

.....

.....

.....

.....

.....

**Question 11 continues on the next page**

**11 (d) (ii)** The company building the power station employs environmental scientists to look at the possible impact the power station might have on the surrounding area.

Name **three** things they would need to assess.

**[3 marks]**

.....

.....

.....

13

**END OF QUESTIONS**