AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.3

National and global energy resources

Past-paper questions

Tier	**Foundation**
Question groups	**106**
Available paper years	**2004–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

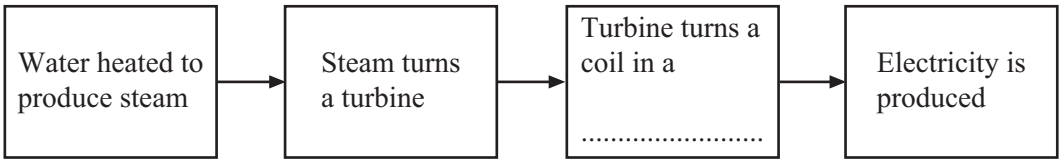
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.1.3 National and global energy resources

Question 01

June 2004 | 3451F | Original Q3 | Legacy

3 (a) In Britain most power stations burn fuel to produce heat. The diagram shows the stages by which the heat is transferred into electrical energy.
Complete the diagram by filling in the missing word.



(1 mark)

(b) A fuel burning power station uses 2000 joules of fuel energy to generate 600 joules of electrical energy. The rest of the fuel energy is wasted as heat.

(i) For every 600 joules of electrical energy generated, how much fuel energy is wasted as heat?

.....

(1 mark)

(ii) Use the following equation to calculate the efficiency of the power station.
Show clearly how you work out your answer.

$$\text{efficiency} = \frac{\text{useful energy transferred by device}}{\text{total energy supplied to device}}$$

.....

.....

efficiency = ...

(2 marks)

(c) List **A** gives three energy resources used to generate electricity.
List **B** gives environmental problems that may be caused by using different energy resources.
Draw a straight line from each energy resource in List **A** to the environmental problem it may cause in List **B**. Draw **three** lines only.

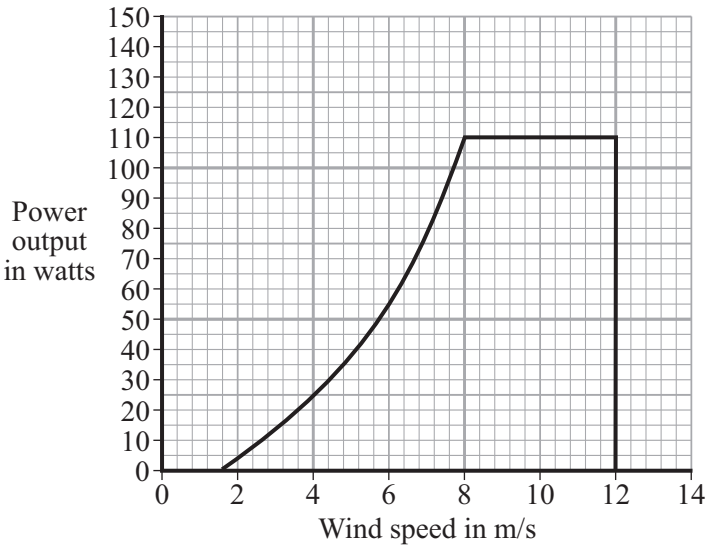
List A **Energy resource**	**List B** **Environmental problem that may be caused**
Wind	Destroys the habitat of wading birds in river estuaries
Tides	Produces a lot of noise
Falling water (hydroelectricity)	Produces the gas sulphur dioxide
	Floods land used for farming or forestry

4.1.3 National and global energy resources

Question 01 · continued

MARGIN BLANK

(d) A small wind generator is used to charge a battery. The graph shows the power output of the generator at different wind speeds.



(i) What is the maximum power produced by the generator?

..... watts
(1 mark)

(ii) The generator is designed to stop if the wind speed is too high.

At what wind speed does the generator stop working?

..... m/s
(1 mark)

(iii) Give **one** disadvantage of using a wind generator to charge a battery.

.....

.....
(1 mark)

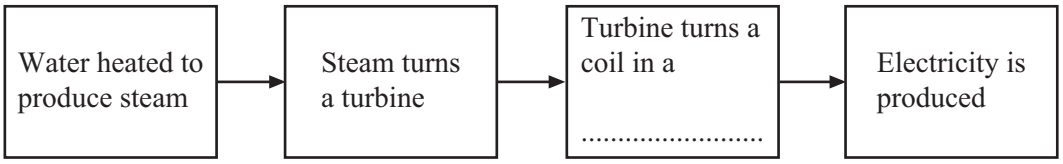
10

4.1.3 National and global energy resources

Question 02

June 2004 | 3462F3 | Original Q3 | Legacy

3 (a) In Britain most power stations burn fuel to produce heat. The diagram shows the stages by which the heat is transferred into electrical energy.
Complete the diagram by filling in the missing word.



(1 mark)

(b) A fuel burning power station uses 2000 joules of fuel energy to generate 600 joules of electrical energy. The rest of the fuel energy is wasted as heat.

(i) For every 600 joules of electrical energy generated, how much fuel energy is wasted as heat?

.....

(1 mark)

(ii) Use the following equation to calculate the efficiency of the power station.
Show clearly how you work out your answer.

$$\text{efficiency} = \frac{\text{useful energy transferred by device}}{\text{total energy supplied to device}}$$

.....

.....

efficiency = ...

(2 marks)

(c) List **A** gives three energy resources used to generate electricity.
List **B** gives environmental problems that may be caused by using different energy resources.
Draw a straight line from each energy resource in List **A** to the environmental problem it may cause in List **B**. Draw **three** lines only.

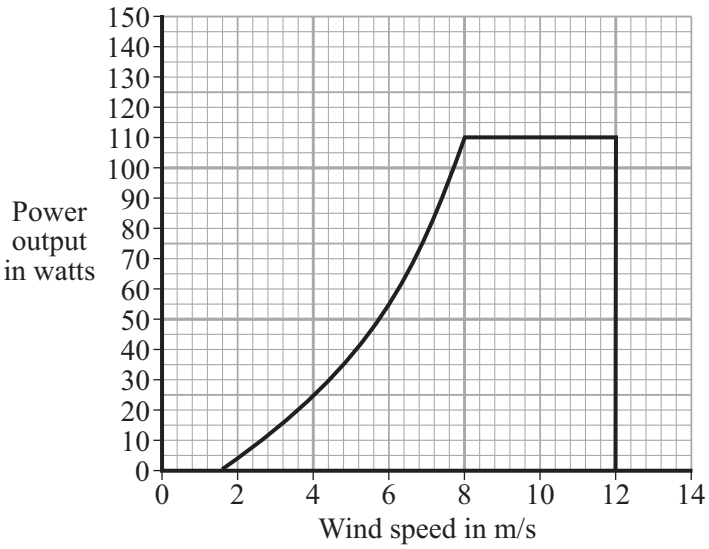
List A **Energy resource**	**List B** **Environmental problem that may be caused**
Wind	Destroys the habitat of wading birds in river estuaries
Tides	Produces a lot of noise
Falling water (hydroelectricity)	Produces the gas sulphur dioxide
	Floods land used for farming or forestry

4.1.3 National and global energy resources

Question 02 · continued

MARGIN BLANK

(d) A small wind generator is used to charge a battery. The graph shows the power output of the generator at different wind speeds.



(i) What is the maximum power produced by the generator?

..... watts
(1 mark)

(ii) The generator is designed to stop if the wind speed is too high.

At what wind speed does the generator stop working?

..... m/s
(1 mark)

(iii) Give **one** disadvantage of using a wind generator to charge a battery.

.....

.....
(1 mark)

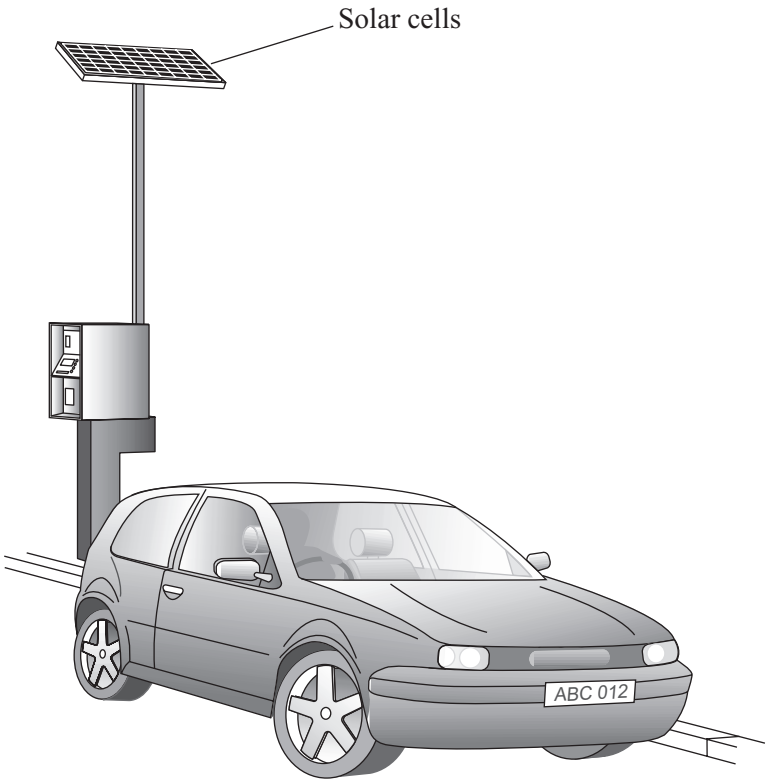
10

4.1.3 National and global energy resources

Question 03

June 2005 | 3451 | Original Q4 | Legacy

4 A castle is a long way from the nearest town. Batteries power the car park ticket machine. Solar cells are used to keep the batteries charged.



(a) Complete the following sentences by choosing the correct words from the box.

Each word may be used once or not at all.

chemical	**electrical**	**heat**	**light**	**sound**

(i) The energy input to the solar cells is ..... energy.

(1 mark)

(ii) The useful energy output from the solar cells is ..... energy.

(1 mark)

4.1.3 National and global energy resources

Question 03 · continued

MARGIN BLANK

(b) For every 500 J of energy absorbed by the solar cells, 75 J of energy are transferred to the batteries.

Use the following equation to calculate the efficiency of the solar cells.
Show clearly how you work out your answer.

$$\text{Efficiency} = \frac{\text{useful energy transferred by device}}{\text{total energy supplied to device}}$$

.....

.....

Efficiency = ...

(2 marks)

(c) Which **one** of the following statements gives the main reason for using solar cells to charge the batteries?

Tick (✓) the box next to your choice.

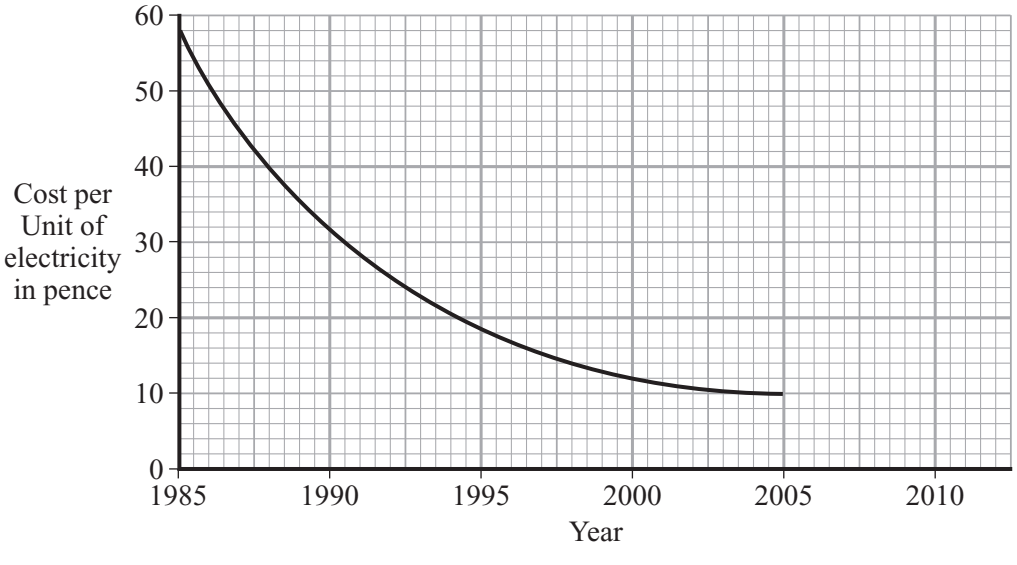
Solar cells give a constant supply of electricity. ☐

A few solar cells can provide a large amount of electricity. ☐

The ticket machine is a long way from other electricity supplies. ☐

(1 mark)

(d) The graph shows how the cost of producing electricity using solar cells has changed.



Use the graph to predict the cost of one Unit of electricity in 2010.

.....

(1 mark)

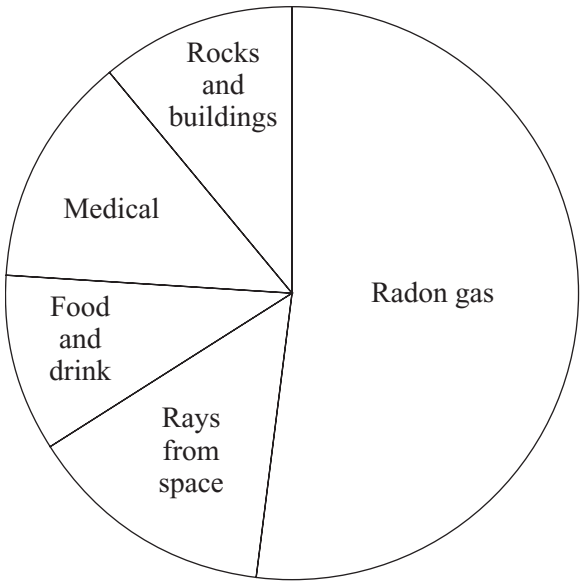
6

4.1.3 National and global energy resources

Question 04

June 2005 | 3451 | Original Q5 | Legacy

5 (a) Radiation is around us all of the time. The pie chart shows the sources of this radiation.



(i) What is the main source of this radiation?

.....

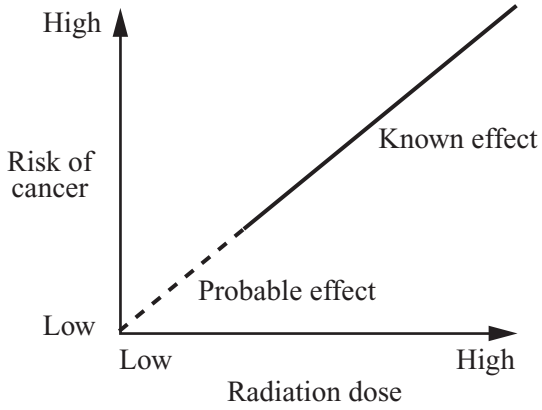
(1 mark)

(ii) What name is given to the radiation that is around us all of the time?

.....

(1 mark)

(b) Radiation can cause cancer. The graph shows that the risk of cancer depends on the radiation dose a person is exposed to.



Complete the following sentence.

The ..... the dose of radiation a person gets, the greater the risk of cancer.

(1 mark)

9

MARGIN BLANK

(c) A worker in a nuclear power station wears a special badge (diagram **1**). Diagram **2** shows what is inside the badge. When the film inside the badge is developed, it will be dark in the places where it has absorbed radiation.

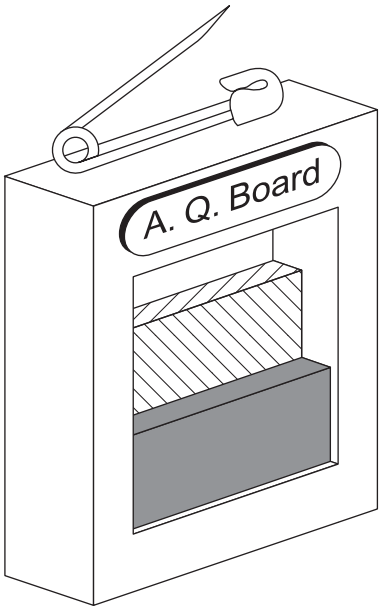


Diagram 1

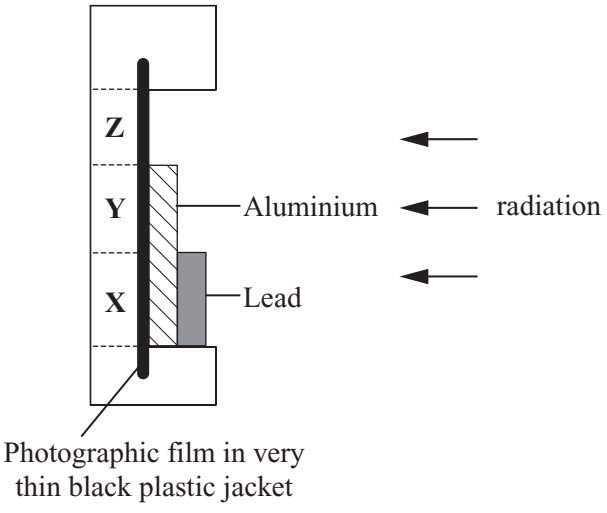


Diagram 2

Which part of the film, **X**, **Y** or **Z**, would darken if the worker had received a dose of alpha radiation?

.....

Give a reason for your answer.

.....

.....

(2 marks)

5

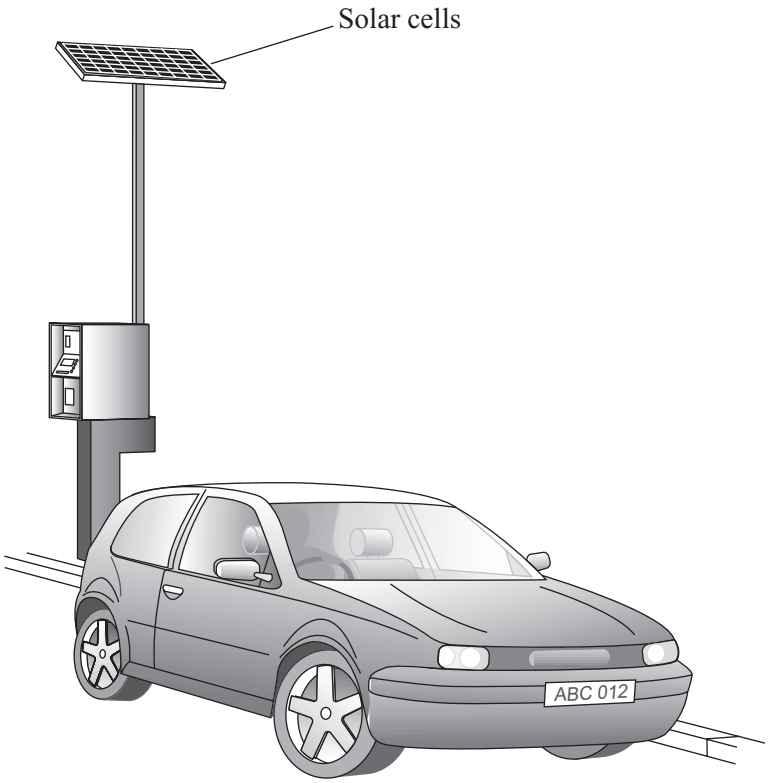
TURN OVER FOR THE NEXT QUESTION

4.1.3 National and global energy resources

Question 05

June 2005 | 3462 | Original Q4 | Legacy

4 A castle is a long way from the nearest town. Batteries power the car park ticket machine. Solar cells are used to keep the batteries charged.



(a) Complete the following sentences by choosing the correct words from the box.

Each word may be used once or not at all.

chemical	**electrical**	**heat**	**light**	**sound**

(i) The energy input to the solar cells is ..... energy.

(1 mark)

(ii) The useful energy output from the solar cells is ..... energy.

(1 mark)

4.1.3 National and global energy resources

Question 05 · continued

MARGIN BLANK

(b) For every 500 J of energy absorbed by the solar cells, 75 J of energy are transferred to the batteries.

Use the following equation to calculate the efficiency of the solar cells.
Show clearly how you work out your answer.

$$\text{Efficiency} = \frac{\text{useful energy transferred by device}}{\text{total energy supplied to device}}$$

.....

.....

Efficiency = ...

(2 marks)

(c) Which **one** of the following statements gives the main reason for using solar cells to charge the batteries?

Tick (✓) the box next to your choice.

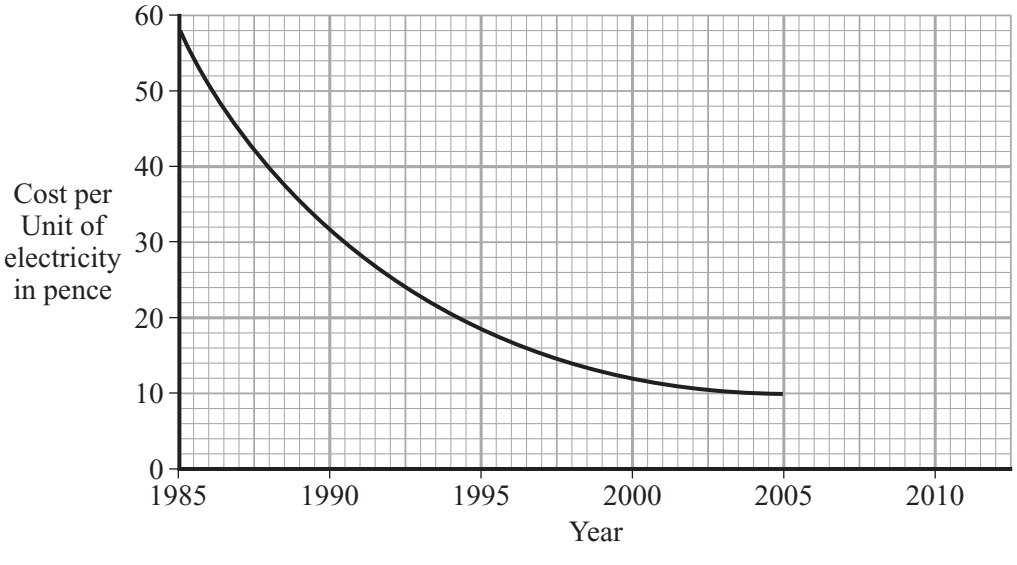
Solar cells give a constant supply of electricity. ☐

A few solar cells can provide a large amount of electricity. ☐

The ticket machine is a long way from other electricity supplies. ☐

(1 mark)

(d) The graph shows how the cost of producing electricity using solar cells has changed.



Use the graph to predict the cost of one Unit of electricity in 2010.

.....

(1 mark)

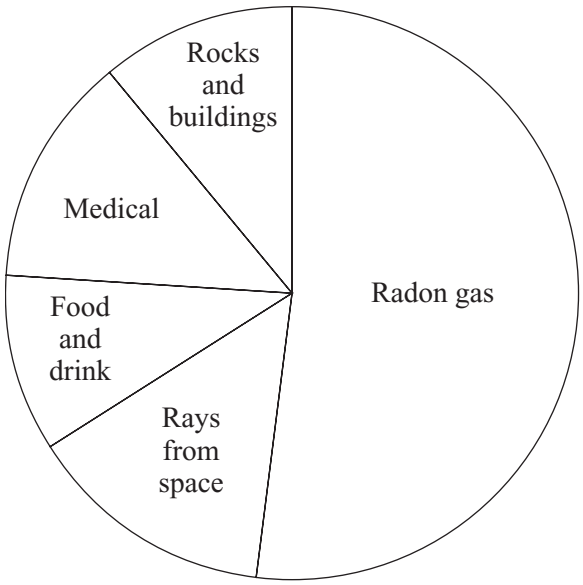
6

4.1.3 National and global energy resources

Question 06

June 2005 | 3462 | Original Q5 | Legacy

5 (a) Radiation is around us all of the time. The pie chart shows the sources of this radiation.



(i) What is the main source of this radiation?

.....

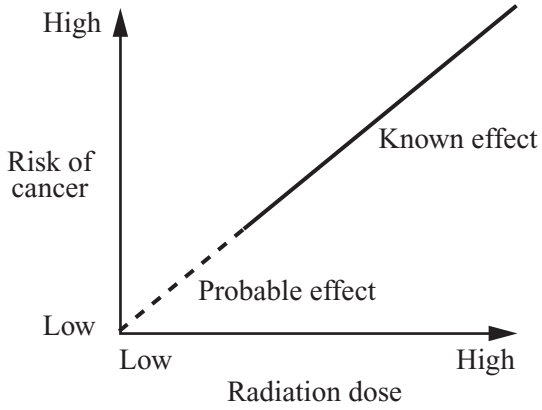
(1 mark)

(ii) What name is given to the radiation that is around us all of the time?

.....

(1 mark)

(b) Radiation can cause cancer. The graph shows that the risk of cancer depends on the radiation dose a person is exposed to.



Complete the following sentence.

The ..... the dose of radiation a person gets, the greater the risk of cancer.

(1 mark)

(c) A worker in a nuclear power station wears a special badge (diagram **1**). Diagram **2** shows what is inside the badge. When the film inside the badge is developed, it will be dark in the places where it has absorbed radiation.

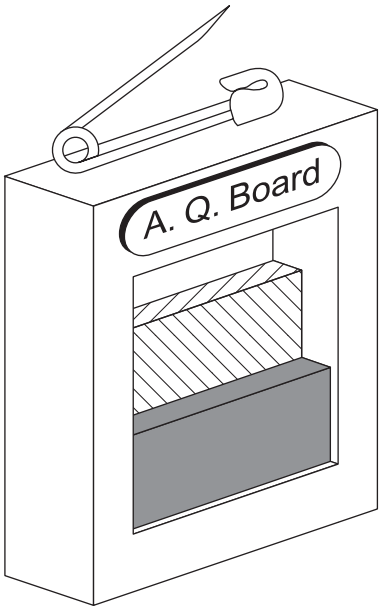


Diagram 1

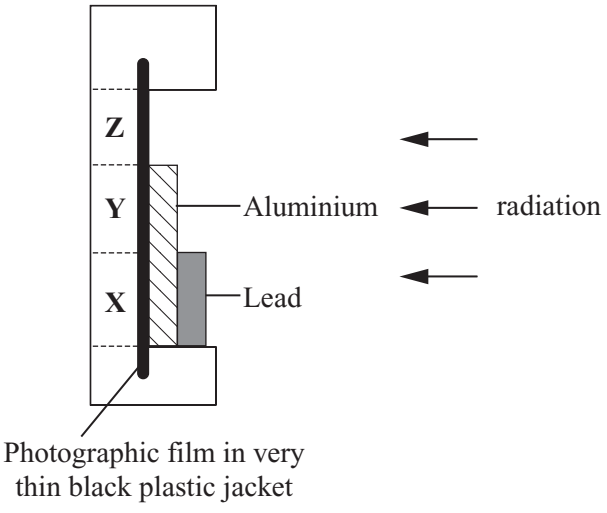


Diagram 2

Which part of the film, **X**, **Y** or **Z**, would darken if the worker had received a dose of alpha radiation?

.....

Give a reason for your answer.

.....

.....

(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

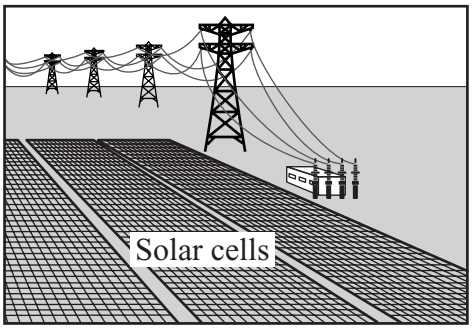
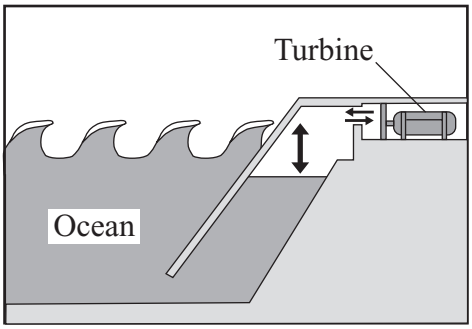
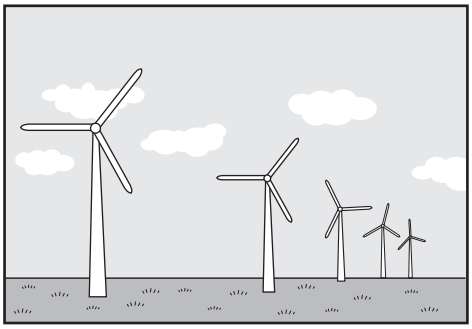
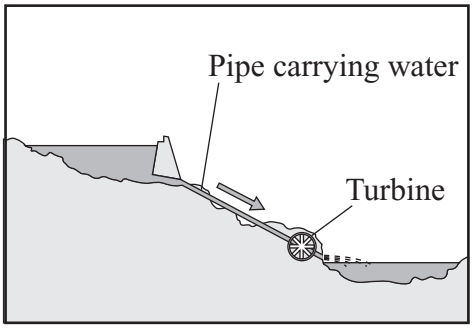
4.1.3 National and global energy resources

Question 07

June 2006 | 3451 | Original Q1 | Legacy

1 (a) The diagrams show four types of power station. Each one uses a different energy resource to generate electricity.

Draw straight lines to link each power station to its energy resource. Draw only **four** lines.

Power station	Energy resource
	Falling water
	Geothermal
	Sunlight
	Waves
	Wind

(4 marks)

4.1.3 National and global energy resources

Question 07 · continued

BLANK

(b) A coal-burning power station generates 1000 million watts of power. A solar power station generates 250 million watts of power.

How many solar power stations would be needed to replace one coal-burning power station?

.....

(1 mark)

(c) Electricity is generated at nuclear, coal or natural gas power stations.

(i) Which **one** of these power stations does **not** produce any waste gases?

.....

(1 mark)

(ii) Which **one** of these power stations has the shortest start-up time?

.....

(1 mark)

7

Turn over for the next question

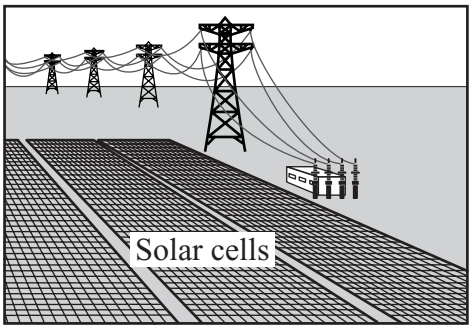
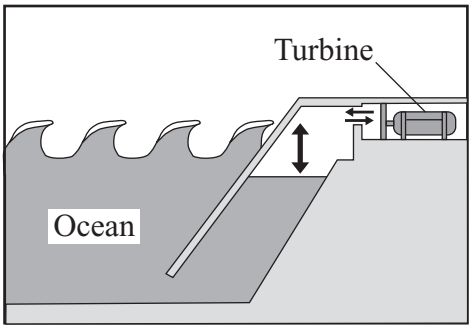
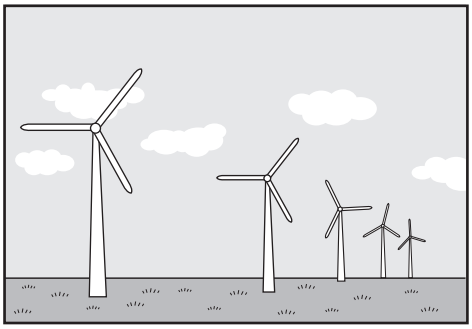
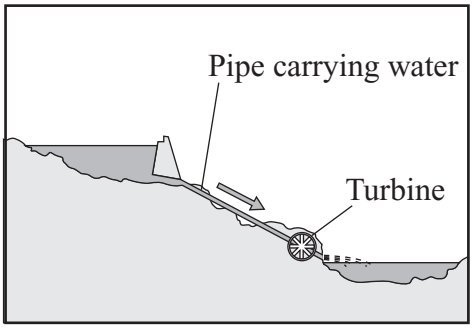
4.1.3 National and global energy resources

Question 08

June 2006 | 3462 | Original Q1 | Legacy

1 (a) The diagrams show four types of power station. Each one uses a different energy resource to generate electricity.

Draw straight lines to link each power station to its energy resource. Draw only **four** lines.

Power station	Energy resource
	Falling water
	Geothermal
	Sunlight
	Waves
	Wind

(4 marks)

4.1.3 National and global energy resources

Question 08 · continued

BLANK

(b) A coal-burning power station generates 1000 million watts of power. A solar power station generates 250 million watts of power.

How many solar power stations would be needed to replace one coal-burning power station?

.....

(1 mark)

(c) Electricity is generated at nuclear, coal or natural gas power stations.

(i) Which **one** of these power stations does **not** produce any waste gases?

.....

(1 mark)

(ii) Which **one** of these power stations has the shortest start-up time?

.....

(1 mark)

7

Turn over for the next question

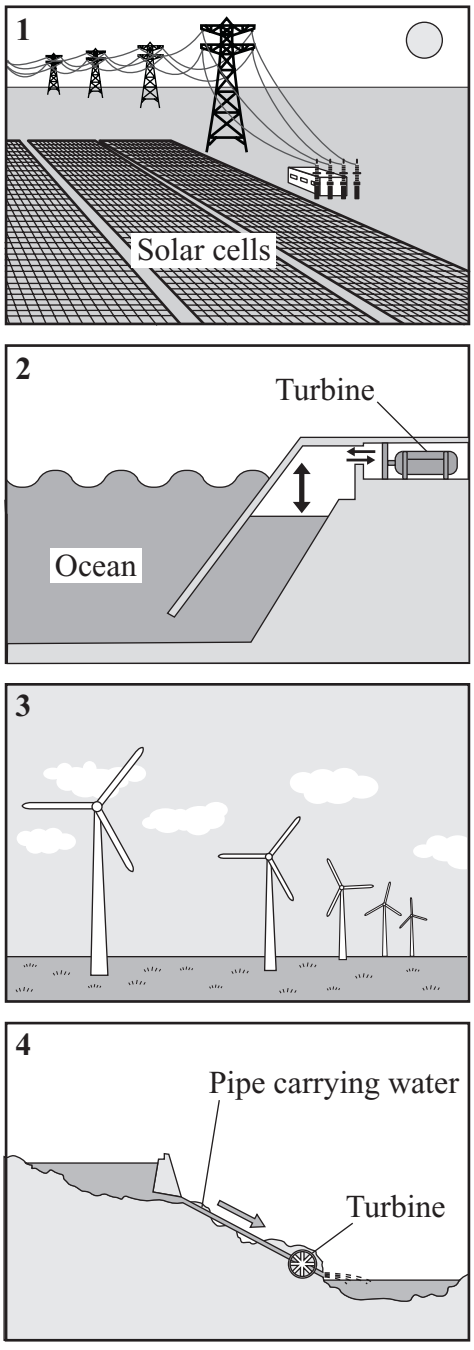
4.1.3 National and global energy resources

Question 09

November 2006 | PHY1A | Original Q2 | Legacy

QUESTION TWO

The diagrams show four types of power station, which may help to meet our future energy needs. Each one uses a different energy source to produce electricity.



Match energy sources, **A**, **B**, **C** and **D**, with the power stations **1–4**.

A falling water

B sunlight

C waves

D wind

4.1.3 National and global energy resources

Question 10

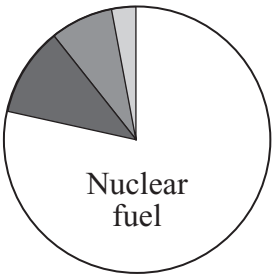
November 2006 | PHY1A | Original Q3 | Legacy

QUESTION THREE

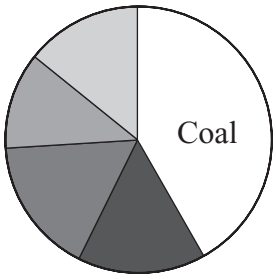
Different countries generate their electricity from different sources of energy.

The pie charts are for four different countries.

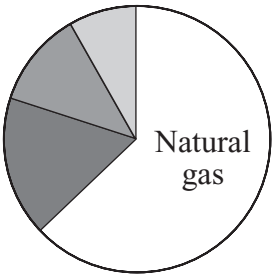
On each pie chart, the main source of energy used to generate electricity is named.



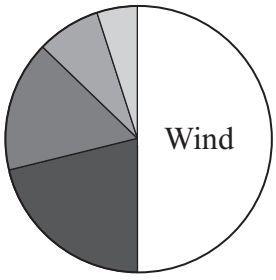
1



2



3



4

Match the countries, **A**, **B**, **C** and **D**, in the table, with the pie charts **1–4**.

Country	Most likely pollution
A	Atmosphere becomes polluted with extra carbon dioxide and with sulfur dioxide
B	Atmosphere becomes polluted with extra carbon dioxide but not with sulfur dioxide
C	Noise pollution produced
D	Environment may become polluted with radioactive substances

4.1.3 National and global energy resources

Question 11

March 2007 | PHY1A | Original Q2 | Legacy

QUESTION TWO

Various types of power station use different energy sources and affect the environment in various ways.

Match types, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A Coal-fired power stations

B Geothermal power stations

C Nuclear power stations

D Tidal power stations

. . . **1** . . . use energy from the natural decay of radioactive substances in the Earth.

. . . **2** . . . use no fuel but river estuaries have to be flooded.

. . . **3** . . . use uranium as a fuel in reactors.

. . . **4** . . . can pollute the atmosphere with sulfur dioxide.

4.1.3 National and global energy resources

Question 12

March 2007 | PHY1A | Original Q6 | Legacy

QUESTION SIX

Read this extract from a magazine article.

New device improves wind turbines

A recent study found that wind turbines fitted with a new device, which makes them more responsive to small changes in wind direction, give a better output.

Scientists investigated the output of some wind turbines. They compared wind turbines of similar design, in similar locations. Half of the turbines were fitted with 'wind finders' which respond to small changes in wind direction. They found that 'wind finders' can improve the useful output of wind turbines by up to 10 %.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A conclusion

B control

C environment

D evidence

The wind turbines without 'wind finders' were the scientists' . . . **1** . . . .

The useful output from the wind turbines was the scientists' . . . **2** . . . .

What the scientists found out helped them to reach their . . . **3** . . . .

Improving wind turbines is important for the . . . **4** . . . .

4.1.3 National and global energy resources

Question 13

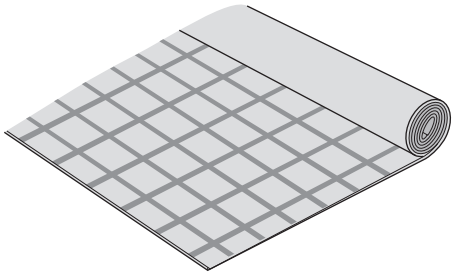
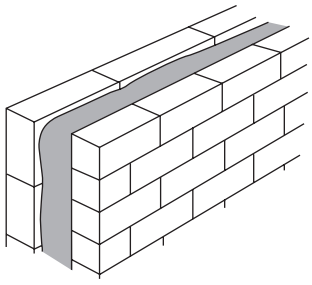
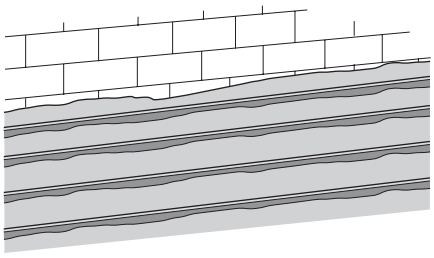
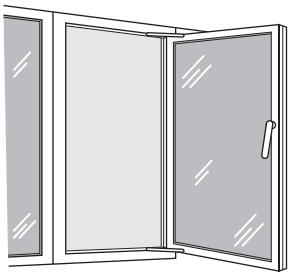
March 2007 | PHY1A | Original Q9 | Legacy

QUESTION NINE

Energy costs rising

Many householders are concerned at the rising cost of energy.

The drawings are from a magazine article on how to reduce the cost of home heating by using insulation.

Carpeting the floor  Saving per week for each square metre **25p**	**Putting foam in wall cavities**  Saving per week for each square metre **20p**
Insulating the loft  Saving per week for each square metre **10p**	**Fitting double-glazed windows**  Saving per week for each square metre **24p**

9A All the methods shown in the diagrams make use of . . .

1 good emitters of thermal radiation.

2 materials that prevent warm air from rising.

3 trapped air.

4 warm materials.

Question 13 · continued

9B A student is asked to explain why the savings in the magazine article may not be correct for different houses.

The student makes the following points:

- not all double glazing is equally good
- not all insulation in the loft is to the same depth
- the difference between the outside temperature and the inside temperature of the different houses is not constant.

Which one of the following statements is correct?

1 Only the student's first point is correct.

2 Only the student's first two points are correct.

3 All three of the student's points are correct.

4 None of the student's points is correct.

9C An energy saving expert suggests how to reduce the heating bill for a house. She says that having foam inserted in the wall cavity will reduce the heating bill more than having double glazing fitted.

Her statement is correct.

This is because . . .

1 foam insulation is cheaper than double glazing.

2 more heat is lost through each square metre of window compared with each square metre of wall.

3 the area of the walls is much greater than the area of the windows.

4 the windows are not always closed.

9D The Government wants to encourage energy saving. There will be several advantages to the environment if this is achieved.

Which of the following will be the most important advantage to the environment?

1 It will be more important to develop renewable energy technology.

2 Less energy will need to be transformed from fossil fuels.

3 Less energy will need to be transformed from renewable resources.

4 There will be no need to build new nuclear power stations.

4.1.3 National and global energy resources

Question 14

June 2007 | PHY1A | Original Q3 | Legacy

QUESTION THREE

This question is about different types of power station which produce electricity.

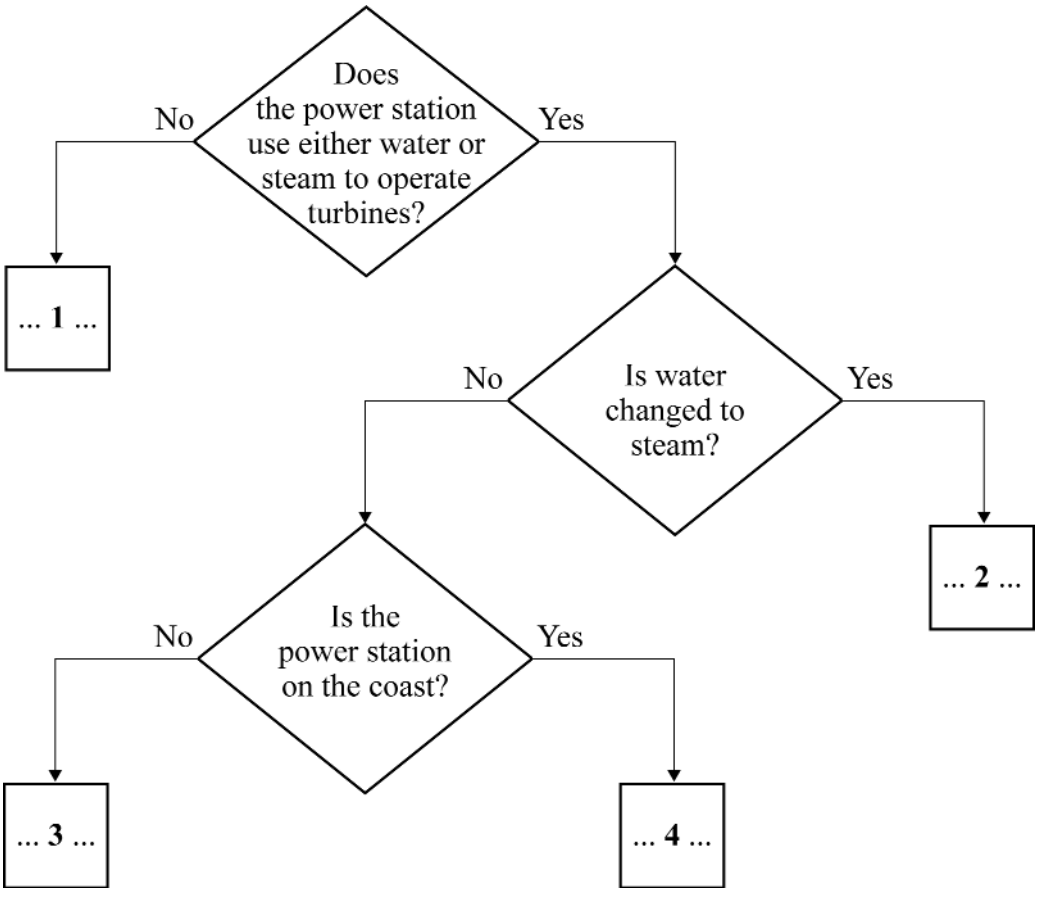
Match the types of power station, **A**, **B**, **C** and **D**, with the numbers **1–4** in the flow chart.

A hydroelectric

B nuclear

C wind

D tidal



4.1.3 National and global energy resources

Question 15

June 2007 | PHY1A | Original Q9 | Legacy

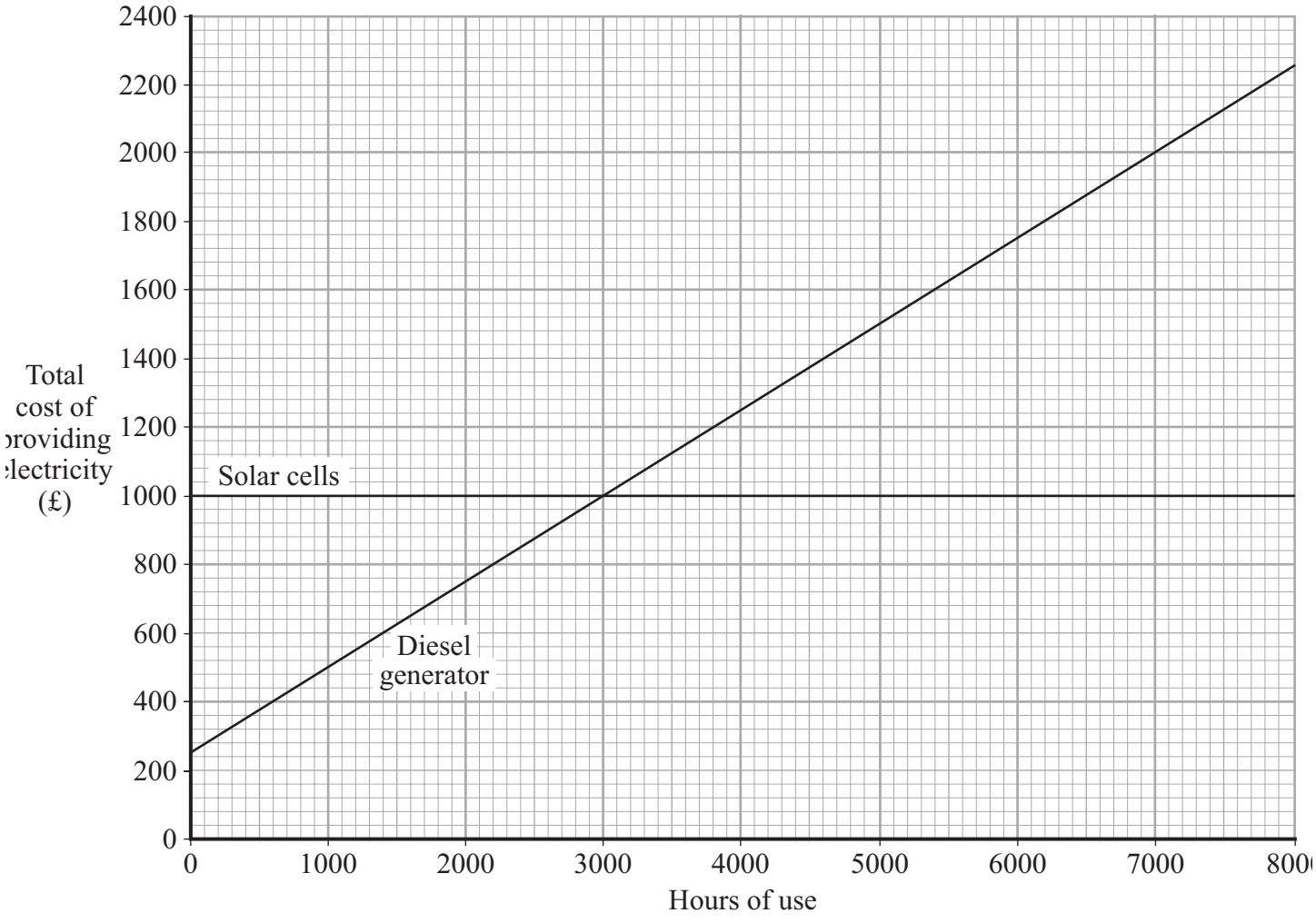
QUESTION NINE

A remote village in South America is many kilometres from a mains electricity supply.

The villagers plan to pump water from the river and to use some of the water to irrigate fields.

They need an electricity supply to operate the pump.

The graph shows the total cost of two different ways of providing this electricity over time.



9A The graph shows that . . .

1 there are fuel costs but no maintenance costs for the solar cells.

2 there are maintenance costs but no fuel costs for the solar cells.

3 there are no fuel costs and no maintenance costs for the solar cells.

4 there are no fuel costs and no maintenance costs for the diesel generator.

Question 15 · continued

9B The price to buy the solar cells, compared with buying the diesel generator, is . . .

1 twice as much.

2 three times as much.

3 four times as much.

4 five times as much.

9C Providing electricity by diesel generator becomes more expensive than by solar cells after . . .

1 1000 hours of use.

2 2000 hours of use.

3 3000 hours of use.

4 4000 hours of use.

9D Maintenance of solar cells costs less than maintenance of the diesel generator mainly because . . .

1 solar cells have no moving parts.

2 solar cells do not produce exhaust gases.

3 solar cells operate at lower temperatures than diesel generators.

4 solar cells work only during the day.

END OF TEST

4.1.3 National and global energy resources

Question 16

June 2007 | PHY1B | Original Q9 | Legacy

QUESTION NINE

There was an accident at the Chernobyl nuclear power station in April 1986. This resulted in the release of radioactive materials into the environment. Some of these materials may cause cancer of the thyroid gland in children.

The table shows the number of cases of thyroid cancer in children in two regions near the Chernobyl power station. It also shows the number of cases per 100 000 children in those regions.

		Childhood thyroid cancer cases per year, 1986–1998												
Region \ Year		86	87	88	89	90	91	92	93	94	95	96	97	98
Belarus	Number of cases	3	4	6	5	31	62	62	87	77	82	67	73	48
	Number of cases per 100 000 children	0.2	0.3	0.4	0.3	1.9	3.9	3.9	5.5	5.1	5.6	4.8	5.6	3.9
Ukraine	Number of cases	8	7	8	11	26	22	49	44	44	47	56	36	44
	Number of cases per 100 000 children	0.2	0.1	0.1	0.1	0.2	0.2	0.5	0.4	0.4	0.5	0.6	0.4	0.5

9A By how many did the number of cases of childhood thyroid cancer per year increase in the Belarus region between the year of the Chernobyl accident and 1995?

1 2

2 3

3 79

4 82

9B A city in Ukraine has 200 000 children.

How many cases of childhood thyroid cancer would be expected in the city in 1992?

1 1

2 2

3 5

4 49

4.1.3 National and global energy resources

Question 16 · continued

One of the radioactive materials responsible for producing childhood thyroid cancer is iodine-131. Children may take in iodine-131 in contaminated food. The iodine-131 is accumulated by the thyroid gland.

9C The half-life of iodine-131 is 8 days. 100 atoms of iodine-131 are taken into the thyroid gland.

How many of these radioactive iodine-131 atoms will there be after 16 days?

1 25

2 50

3 75

4 100

9D Which type of radiation is most likely to cause damage by ionisation once inside the body?

1 alpha radiation

2 beta radiation

3 gamma radiation

4 ultraviolet radiation

END OF TEST

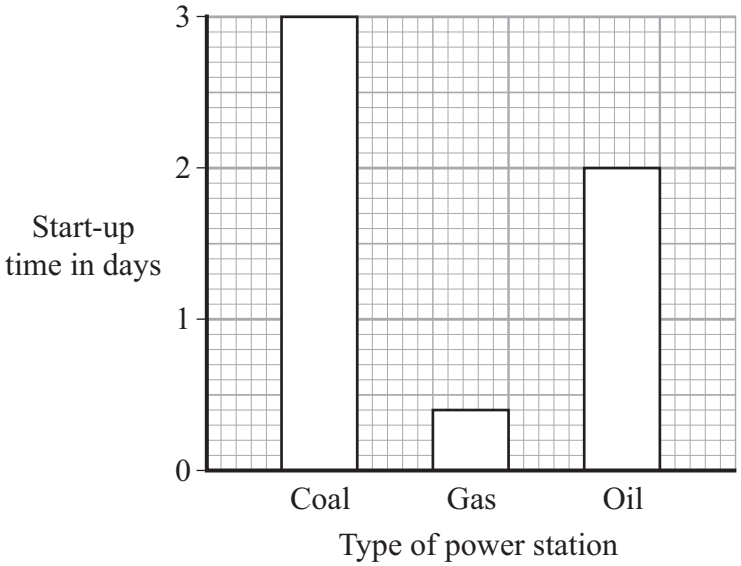
4.1.3 National and global energy resources

Question 17

June 2007 | PHY1F | Original Q2 | Legacy

2 Much of the world's electricity is generated in power stations that burn fossil fuels.

(a) The bar chart shows the start-up times for the three types of fossil fuel power station.



Which of these power stations would take the longest to start generating electricity?

.....

(1 mark)

(b) Which **two** of the following statements are good reasons for using fossil fuels to generate electricity?

Put a tick (✓) in the box next to each of your choices.

Supplies of fossil fuels are limited. ☐

Fossil fuels can be used to generate electricity at any time. ☐

Fossil fuels are non-renewable. ☐

A few large power stations can generate the electricity for a million homes. ☐

Burning fossil fuels produces carbon dioxide. ☐

(2 marks)

Question 17 · continued

BLANK

(c) Electricity can be generated using energy from the wind.

(i) Why does a wind-powered generator **not** produce carbon dioxide?

.....

.....

(1 mark)

(ii) Which form of energy is transferred from the wind to generate electricity?

Draw a ring around your answer.

heat **kinetic** **light** **sound**

(1 mark)

(iii) Many people say that wind-powered generators are a good idea because:

"**when the wind blows they generate electricity"**
"they produce no pollution"
"they generate electricity cheaply"

But not everyone wants more wind-powered generators to be built.



What reasons may be given by the people who think that wind-powered generators are **not** a good idea?

.....

.....

.....

.....

(2 marks)

7

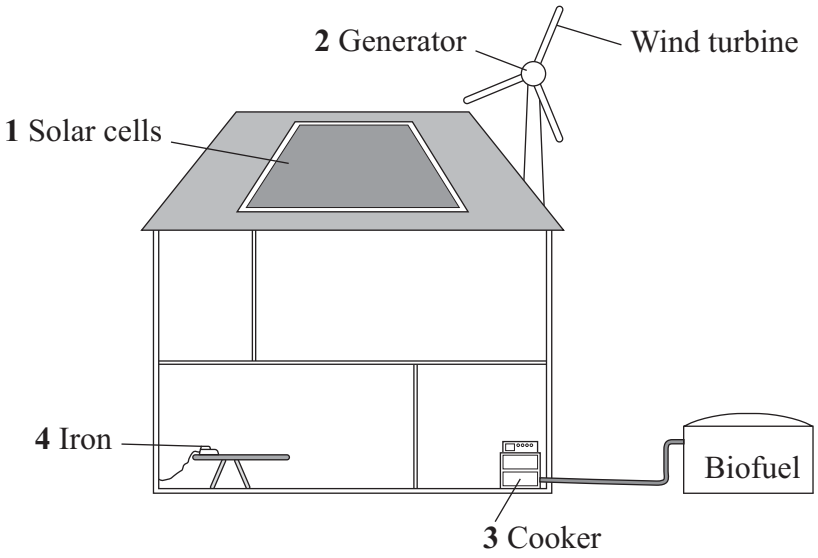
4.1.3 National and global energy resources

Question 18

November 2007 | PHY1A | Original Q1 | Legacy

QUESTION ONE

The diagram shows an eco-friendly house.



Match energy transformations, **A**, **B**, **C** and **D**, with the devices **1–4** in the diagram.

A chemical energy to heat

B electrical energy to heat

C light energy to electrical energy

D kinetic energy to electrical energy

4.1.3 National and global energy resources

Question 19

November 2007 | PHY1A | Original Q3 | Legacy

QUESTION THREE

The energy resource used to generate electricity depends on the location.

Match energy resources, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A nuclear

B solar

C tides

D wind

Generators sited on hills in the UK are most likely to use . . . **1** . . . .

A power station that includes a barrage across an estuary uses . . . **2** . . . .

The best energy resource to use in a submarine which has to spend months under water is . . . **3** . . . .

The best energy resource to recharge the batteries on a motorway sign is . . . **4** . . . .

4.1.3 National and global energy resources

Question 20

January 2008 | PHY1F | Original Q5 | Legacy

5 (a) Water waves are a renewable energy source.

The government wants more electricity to be generated from renewable energy sources. Some people do not think this is a good idea.

What reasons could a government scientist give to show people that using more renewable energy sources is a good idea?

.....

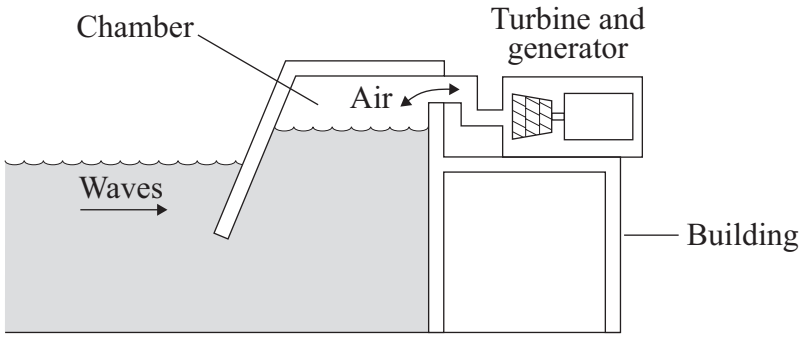
.....

.....

.....

(2 marks)

(b) The diagram shows a wave-powered generator. The generator transforms kinetic energy from the waves to electrical energy.



The following sentences describe how the wave generator works. The sentences are in the wrong order.

R Waves push air up and down a chamber inside the building.
S The turbine turns the generator.
T The generator transforms kinetic energy to electrical energy.
U The air rushes through a turbine making it spin.
V Strong waves move towards the wave-powered generator.

Arrange these sentences in the correct order. Start with letter **V**.

V → ☐ → ☐ → ☐ → ☐

(3 marks)

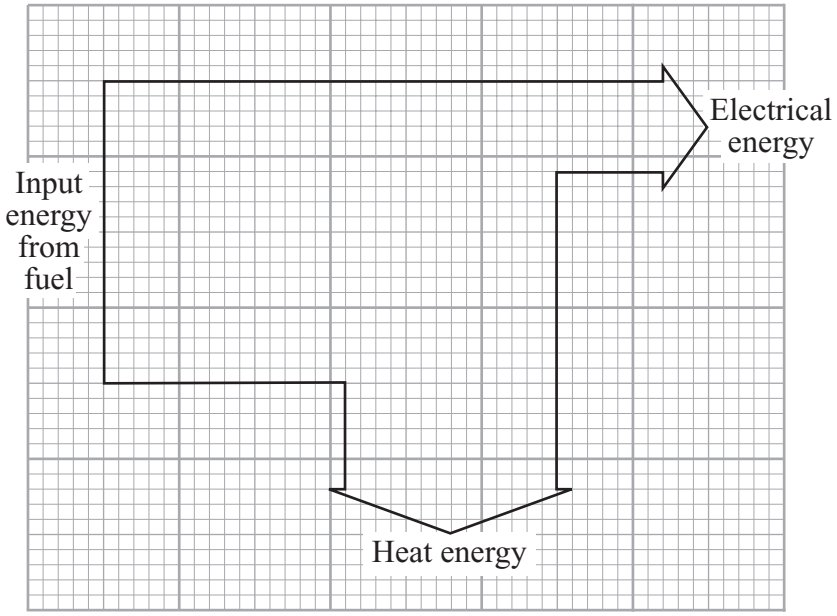
5

4.1.3 National and global energy resources

Question 21

January 2008 | PHY1F | Original Q6 | Legacy

6 (a) The diagram shows the energy transformations in a fuel burning power station.



(i) Name **one** fuel that is burned to provide the energy source for a power station.

.....

(1 mark)

(ii) Use the diagram and the equation in the box to calculate the efficiency of the power station.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

(iii) Name the process by which a nuclear fuel provides the energy needed to generate electricity in a nuclear power station.

.....

(1 mark)

Question 6 continues on the next page

4.1.3 National and global energy resources

Question 21 · continued

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(b) Electricity is distributed from power stations to consumers along the National Grid.

(i) Transformers are part of the National Grid. Transformers are *efficient* devices.

What is meant by a device being *efficient*?

.....

.....

(1 mark)

(ii) When electricity flows through a cable, some energy is transformed into heat.

Explain how the National Grid system reduces the amount of energy lost as heat.

.....

.....

.....

.....

(2 marks)

(c) Read this information taken from a recent newspaper article.

- Researchers have found that children living close to overhead power cables are more likely to develop leukaemia.
- The researchers studied two groups of children. One group had developed leukaemia, the other group was healthy.
- Although the researchers found a link, they are unable to explain why it happened. They say that the results may have happened by chance.
- Other factors that have not been investigated, such as the environment, the geographical area or the children's genes, could be important.
- A cancer research charity said that childhood leukaemia was most likely to be caused by factors that parents were unable to control.

(i) Why did the researchers study a group of healthy children?

.....

.....

(1 mark)

4.1.3 National and global energy resources

Question 21 · continued

BLANK

(ii) The information does not say how many children were studied.

Why should this data have been included in the article?

.....

.....

(1 mark)

(iii) The researchers could not be certain that the overhead power cables were responsible for the increased chance of children developing leukaemia.

Explain why.

.....

.....

.....

.....

(2 marks)

(iv) The results of the research carried out by scientists may worry some people.

What do you think scientists should do?

Put a tick (✓) in the box next to your choice.

Scientists should publish their research findings straight away.	☐
Scientists should not publish their research findings until they have found out as many facts as possible.	☐

Give a reason for your choice.

.....

.....

(1 mark)

12

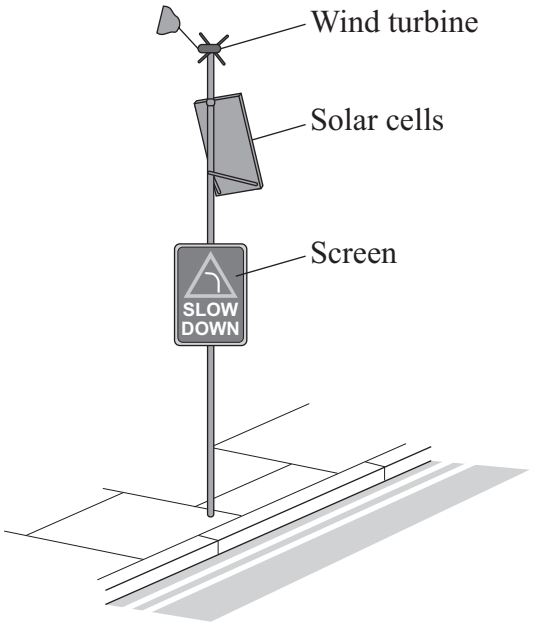
4.1.3 National and global energy resources

Question 22

March 2008 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

The diagram shows an electronic road sign.



Match types of energy, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A electrical energy

B thermal energy

C light energy

D kinetic energy

The useful energy output from the screen is . . . **1** . . . .

The energy input to the wind turbine is . . . **2** . . . .

The useful energy output from the solar cells is . . . **3** . . . .

The wasted energy output from the road sign is . . . **4** . . . .

4.1.3 National and global energy resources

Question 23

March 2008 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

Generating electricity causes problems for the environment.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A acid rain

B global warming

C noise pollution

D radioactive waste

Nuclear power stations produce . . . **1** . . . .

Wind farms produce . . . **2** . . . .

Coal-fired power stations produce sulfur dioxide which causes . . . **3** . . . .

All fossil-fuel power stations produce carbon dioxide which causes . . . **4** . . . .

4.1.3 National and global energy resources

Question 24

March 2008 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

The table shows the percentage of electricity generated from some energy sources between 1960 and 2000.

	Percentage of electricity generated from each energy source			
Year	**Coal**	**Oil**	**Natural gas**	**Renewable sources**
1960	74.0	25.4	0	0
1980	36.7	37.0	21.6	0
2000	14.7	39.2	33.2	0.7

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A coal

B natural gas

C oil

D renewable sources

1	the energy source from which most electricity was produced in 1980
2	the energy source the use of which decreased between 1960 and 2000
3	the energy source that was first used between 1980 and 2000
4	the energy source the use of which increased by approximately 50% between 1980 and 2000

4.1.3 National and global energy resources

Question 25

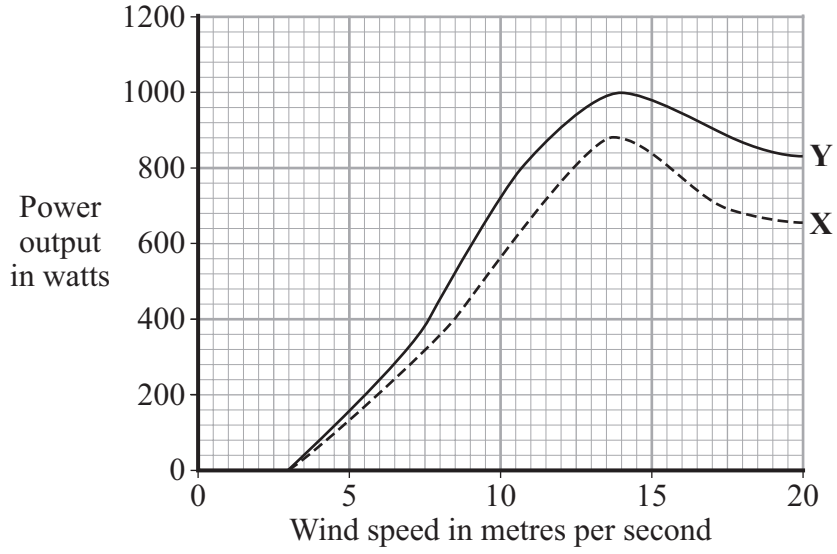
March 2008 | PHY1AP | Original Q9 | Legacy

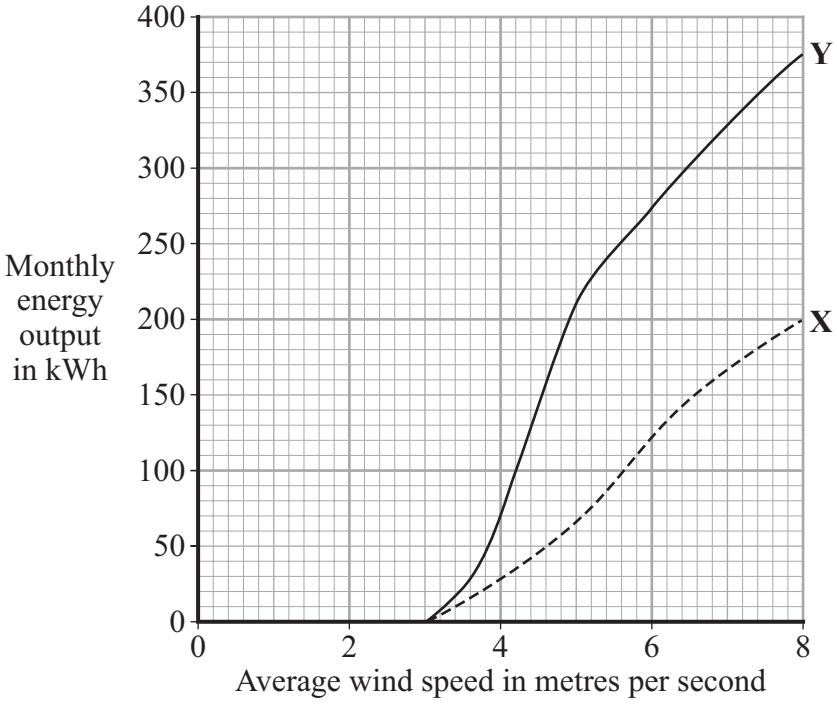
QUESTION NINE

Many people are now installing wind turbines at their homes to produce electricity.

A customer has to decide which turbine to install.

The graphs show the performance of two models of wind turbine, **X** and **Y**.





9A How much greater is the maximum power produced by turbine **Y** than that produced by turbine **X**?

1 80 W

2 120 W

3 880 W

4 1000 W

Question 25 · continued

9B Which one of the following statements about the relationship between average wind speed and monthly energy output by turbine **X** is true?

1 An increase in average wind speed always causes an increase in monthly energy output.

2 As average wind speed doubles, monthly energy output doubles.

3 Above a certain average wind speed, monthly energy output falls.

4 At average wind speeds below 2 m/s, a 10 % increase in wind speed has no effect on monthly energy output.

9C Turbine **X** can be bought and installed for £750; turbine **Y** can be bought and installed for £1500.

A person lives in an area where the maximum wind speed is 10 m/s and the average annual wind speed is 3.5 m/s. A salesman advises the person to buy turbine **Y** because it produces more power.

Is the advice given by the salesman the best advice?

1 Yes, because turbine **Y** always produces more power than turbine **X**.

2 Yes, because as wind speed increases above 3 m/s, power output increases more rapidly from turbine **Y** than from turbine **X**.

3 No, because there is very little difference between the monthly energy output of the two turbines where the person lives.

4 No, because turbine **Y** will never pay for itself.

9D A neighbour objects to planning permission being given for the turbine.

The most likely reason for this objection is that the neighbour thinks that . . .

1 the turbine may cause a decrease in property prices in the area.

2 the turbine is a health risk.

3 the turbine will cause air pollution.

4 having a turbine is a status symbol.

END OF TEST

4.1.3 National and global energy resources

Question 26

June 2008 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about generating electricity.

Match the energy sources, **A**, **B**, **C** and **D**, with the descriptions **1–4** in the table.

A coal

B wind

C sunlight

D nuclear fuel

1	a renewable energy source used to drive turbines on land or offshore
2	a fuel that is burnt in power stations
3	a source used in power stations that have high decommissioning costs
4	an energy source used in solar power stations

4.1.3 National and global energy resources

Question 27

June 2008 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

Different energy sources are used to generate electricity. Each energy source has its own problems.

Match the ways of producing electricity, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

A power stations using fossil fuels

B power stations using nuclear fuels

C solar cells

D wind turbines

1	give off polluting gases
2	useful for applications in remote regions or for small-scale uses
3	waste remains radioactive for a very long time
4	can be unsightly and cause noise pollution

4.1.3 National and global energy resources

Question 28

June 2008 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The table shows data about some energy sources used to generate electricity in the UK in 2004.

The figures in the table take into account the construction of the power station.

Energy source	Percentage of UK electricity generation	Carbon dioxide produced per kWh in grams	Construction cost in £ million	Generating cost in pence per kWh	Typical generating capacity in MW
Coal	33	1000	560	2.6	1600
Gas	40	500	300	2.2	650
Nuclear	19	5	1500	3.5	900
falling water (Hydroelectric)	1	10–30	140	3.5	55
Wind	0.4	4.6	1.3	3.3	3

9A An electricity company sells its electricity at 10 pence per kilowatt-hour (kWh).

Which energy source would the company prefer to use to make the biggest profit on its generating cost?

1 coal

2 gas

3 nuclear

4 hydroelectric

9B Which energy source has the greatest effect on global warming for every kilowatt-hour (kWh) of electricity produced?

1 coal

2 gas

3 nuclear

4 wind

4.1.3 National and global energy resources

Question 28 · continued

9C UK reserves of coal and gas are running out. Coal and gas can be provided from other countries.

Why might this be a good idea?

1 Transport costs for the fuel would be higher.

2 The UK would extend the life of its fossil fuel power stations.

3 The price of coal and gas would be out of the control of the UK.

4 The UK has the ability to develop hydroelectric and wind power stations.

9D The UK government wants to generate 10% of the country's electricity from renewable energy sources by 2010.

Which type of energy source that is renewable would you recommend in terms of generating cost?

1 gas

2 hydroelectric (falling water)

3 nuclear

4 wind

END OF TEST

4.1.3 National and global energy resources

Question 29

June 2008 | PHY1F | Original Q2 | Legacy

2 (a) Different energy sources are used to generate electricity.

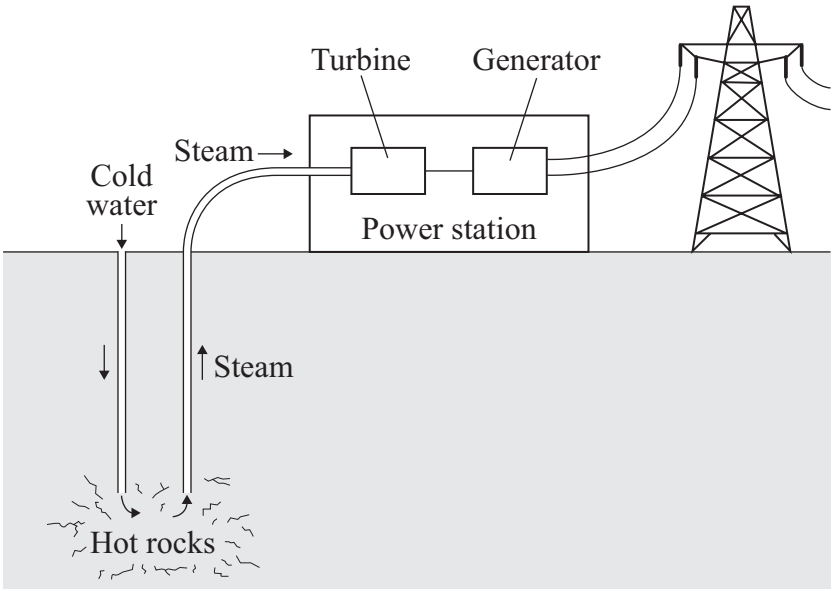
Which **two** of the energy sources in the box are likely to be used up first?

Draw a ring around each of your answers.

gas	**oil**	**Sun**	**tides**	**waves**	**wind**

(2 marks)

2 (b) The diagram shows a geothermal power station. Hot rocks in the Earth's crust heat water to produce steam. The steam is used to drive turbines that turn electrical generators.



How is the way in which a geothermal power station generates electricity the same as the way in which a coal burning power station generates electricity?

.....

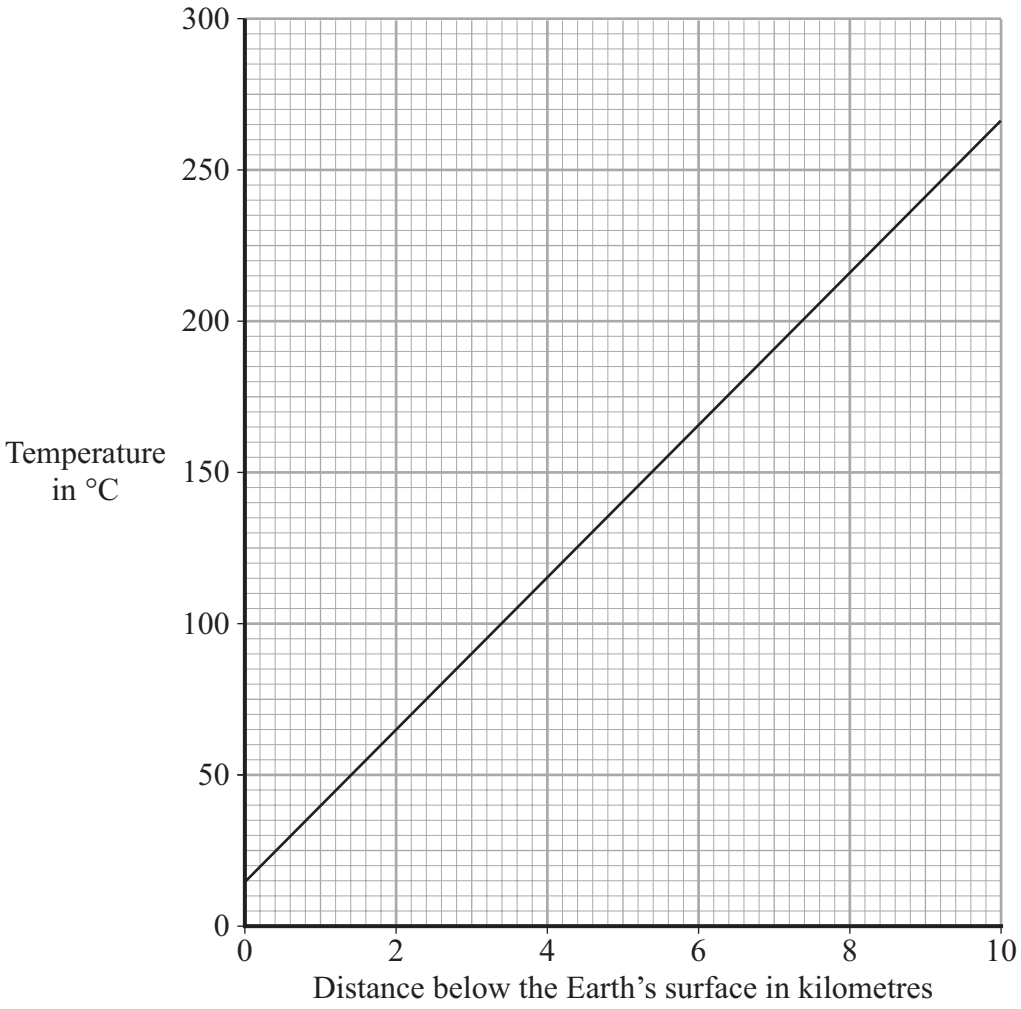
.....

(1 mark)

Question 29 · continued

for mark

2 (c) The graph shows how the temperature of the rocks in the Earth's crust depends on how far the rocks are below the Earth's surface.



Estimate the temperature of the rocks 5 kilometres below the Earth's surface.

Show clearly how you have used the graph to get your answer.

.....

.....

Temperature = ... °C

(2 marks)

Question 2 continues on the next page

4.1.3 National and global energy resources

Question 29 · continued

for mark

2 (d) Scientists have estimated that one quarter of the world's electricity could be generated using geothermal energy.

Give **one** reason that scientists might use to persuade a government to spend large amounts of money building geothermal power stations.

.....

.....

(1 mark)

6

4.1.3 National and global energy resources

Question 30

November 2008 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

Some power stations must be built in special places.

Match energy sources, **A**, **B**, **C** and **D**, with the places **1–4**.

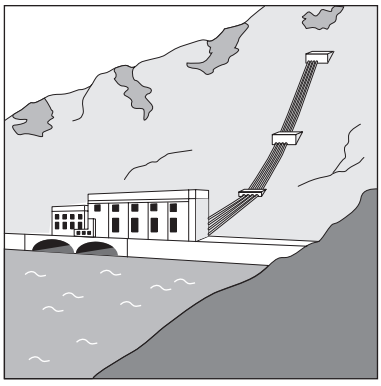
A geothermal

B falling water (hydroelectric)

C tides

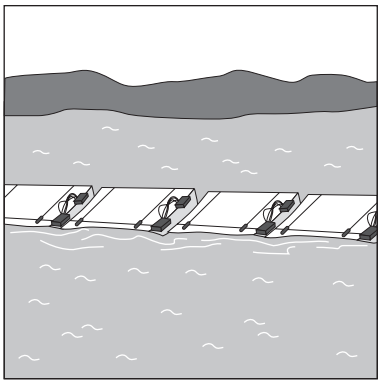
D waves

1



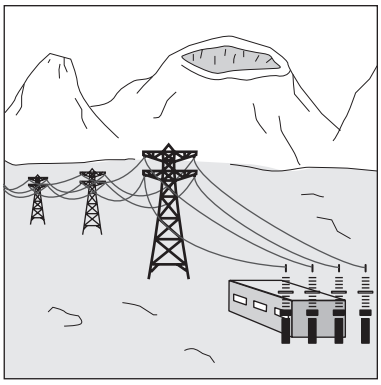
Mountainous region

2



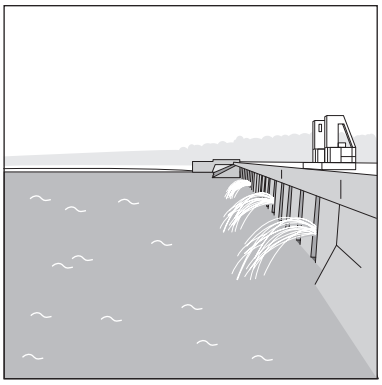
Coastal region

3



Volcanic region

4



River estuary

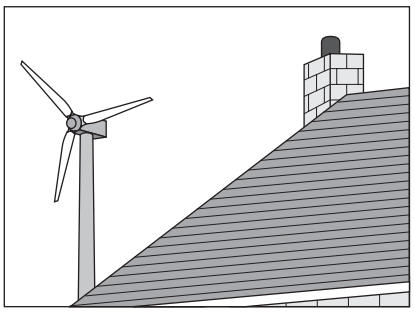
4.1.3 National and global energy resources

Question 31

November 2008 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

You can generate electricity for use in your own home using a wind turbine fixed above the roof.



6A Wind is a renewable energy source.

Which one of the following is **not** a renewable energy source?

1 biomass

2 nuclear

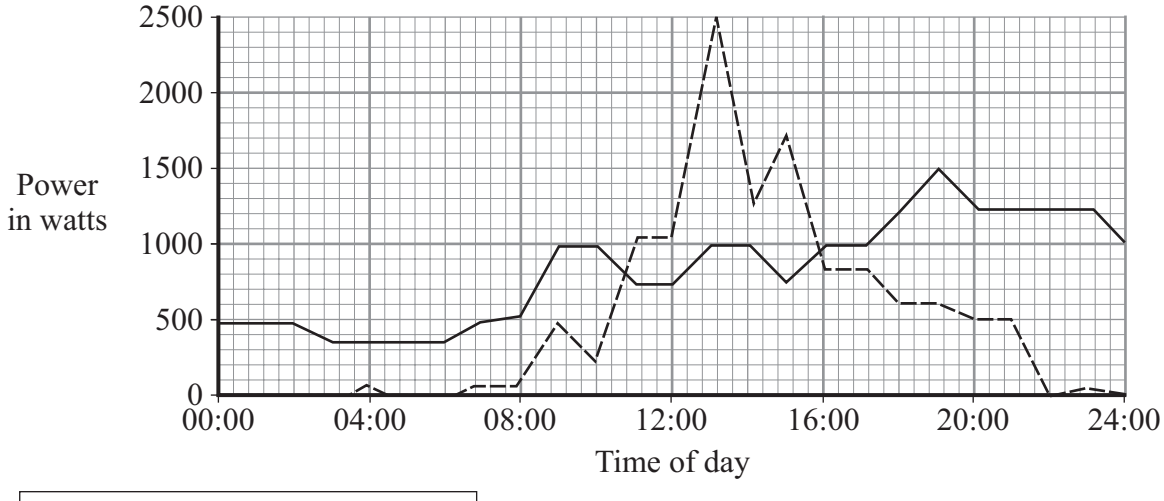
3 solar

4 wave

4.1.3 National and global energy resources

Question 31 · continued

The graph shows how the power output from a small wind turbine changes during 24 hours. It also shows how the demand for power for one household changes during the same period.



6B Which statement is correct for 12:00?

1 The demand is larger than the power output from the wind turbine.

2 The demand is a maximum.

3 The power output from the wind turbine is larger than the demand.

4 The power output from the wind turbine is the same as the demand.

6C The maximum household demand during the 24-hour period is . . .

1 1000 W

2 1500 W

3 2000 W

4 2500 W

6D For how long, approximately, during the 24-hour period, does the power output from the wind turbine exceed the household demand?

1 0 hours

2 5 hours

3 19 hours

4 24 hours

4.1.3 National and global energy resources

Question 32

November 2008 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

This is part of a report in a newspaper.

Tidal Barrage will power Britain

A 10-mile tidal barrage across the Severn Estuary could provide 5% of Britain's electricity needs. The project would cost £15 billion. It is one option being considered to reduce the use of fossil fuels in generating electricity.

7A We need to reduce the use of fossil fuels because . . .

1 burning fossil fuels releases harmful gases into the atmosphere.

2 tidal power is less expensive than fossil fuels.

3 tidal power is more efficient than fossil fuels.

4 we have no fossil fuels left.

7B Which of the following is **not** an argument in favour of building a tidal power station?

Tidal power stations . . .

1 are a predictable source of energy.

2 endanger wildlife and destroy habitats.

3 create jobs.

4 release no harmful gases in the atmosphere.

7C In a tidal barrage, the water moves through a chamber and turns a turbine.

The turbines are connected to a . . .

1 boiler.

2 generator.

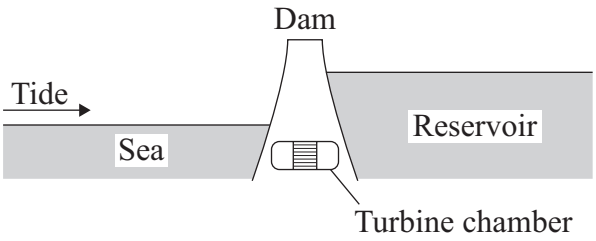
3 pump.

4 transformer.

4.1.3 National and global energy resources

Question 32 · continued

7D In some tidal power stations the water that arrives on the incoming tide is stored in a reservoir behind a dam.



Water is then allowed to flow out of the reservoir, through the turbine chamber and back out to sea.

The main useful energy transformations during this flow are . . .

1 from kinetic to gravitational potential to electrical.

2 from gravitational potential to kinetic to electrical.

3 from chemical to kinetic to electrical.

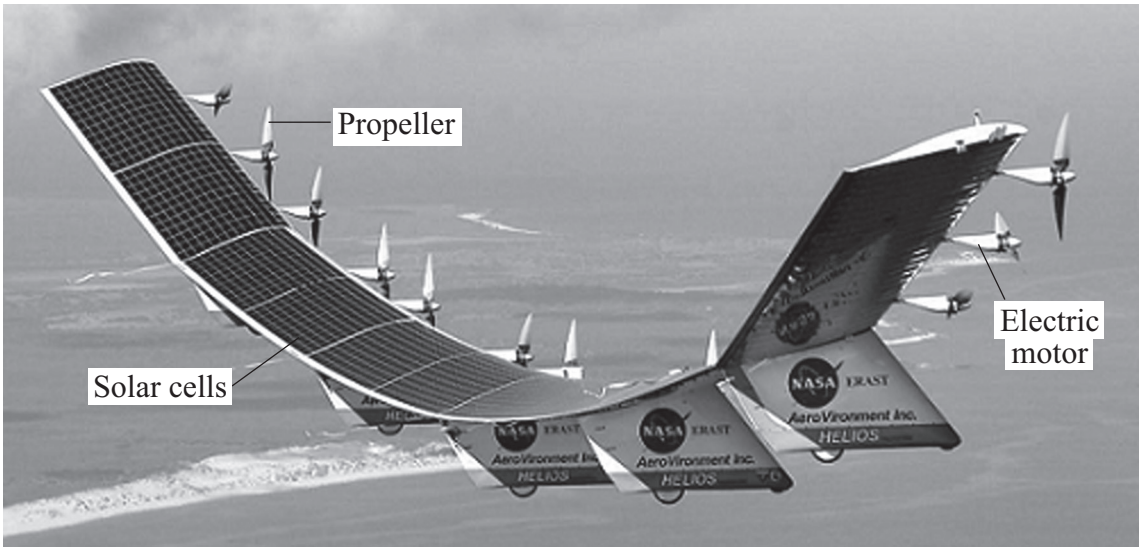
4 from kinetic to heat to electrical.

4.1.3 National and global energy resources

Question 33

January 2009 | PHY1F | Original Q3 | Legacy

3 The picture shows a solar-powered aircraft. The aircraft has no pilot.



3 (a) Use words from the box to complete the following sentence.

electrical	**heat**	**light**	**sound**

Solar cells are designed to transform ..... energy into

..... energy.

(2 marks)

3 (b) On a summer day, 175 000 joules of energy are supplied to the aircraft's solar cells every second. The useful energy transferred by the solar cells is 35 000 joules every second.

3 (b) (i) Use the equation in the box to calculate the efficiency of the solar cells.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

4.1.3 National and global energy resources

Question 33 · continued

for mark

3 (b) (ii) What happens to the energy that is **not** usefully transferred by the solar cells?

.....

(1 mark)

3 (c) The aircraft propellers are driven by electric motors. As well as the solar cells, there are fuel cells that provide additional power to the electric motors.

3 (c) (i) Suggest **one** advantage of the aircraft having fuel cells as well as the solar cells.

.....

.....

(1 mark)

3 (c) (ii) Give **one** environmental advantage of using electric motors to drive the aircraft propellers rather than motors that burn a fuel.

.....

.....

(1 mark)

3 (c) (iii) Eventually, the designers want to produce an unmanned aircraft that can fly at twice the height of a passenger jet for up to six months.

Suggest **one** possible use for an aircraft such as this.

.....

.....

(1 mark)

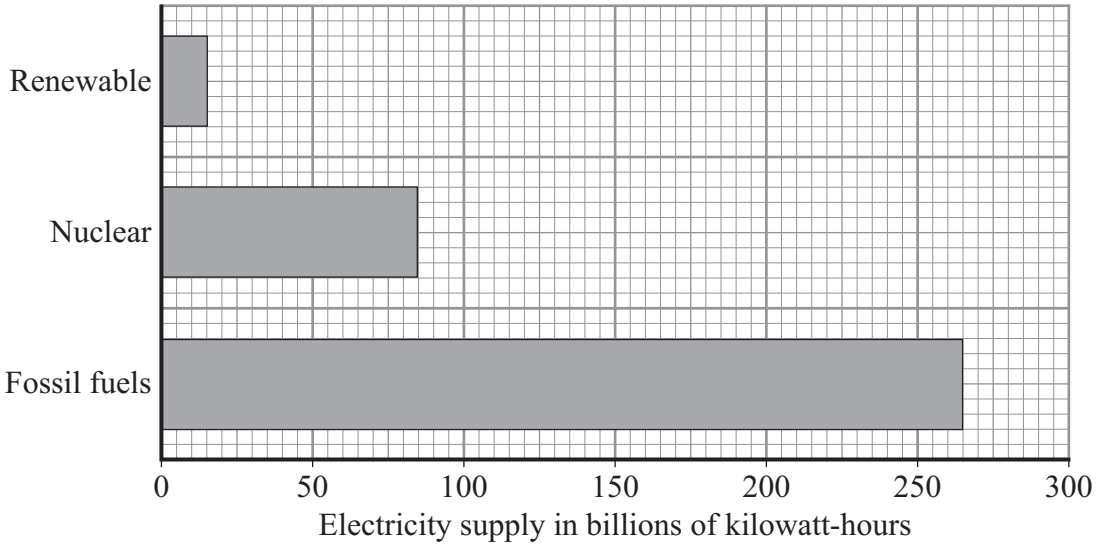
8

4.1.3 National and global energy resources

Question 34

January 2009 | PHY1F | Original Q5 | Legacy

5 The bar chart shows the different energy sources used to generate the UK's electricity in 2007.



5 (a) (i) The wind is a renewable energy source.

Name **one** more renewable energy source used to generate electricity.

.....

(1 mark)

5 (a) (ii) Complete the following sentence by drawing a ring around the correct line in the box.

Using less fossil fuels to generate electricity will

decrease
not change
increase

the amount of carbon dioxide emitted into the atmosphere.

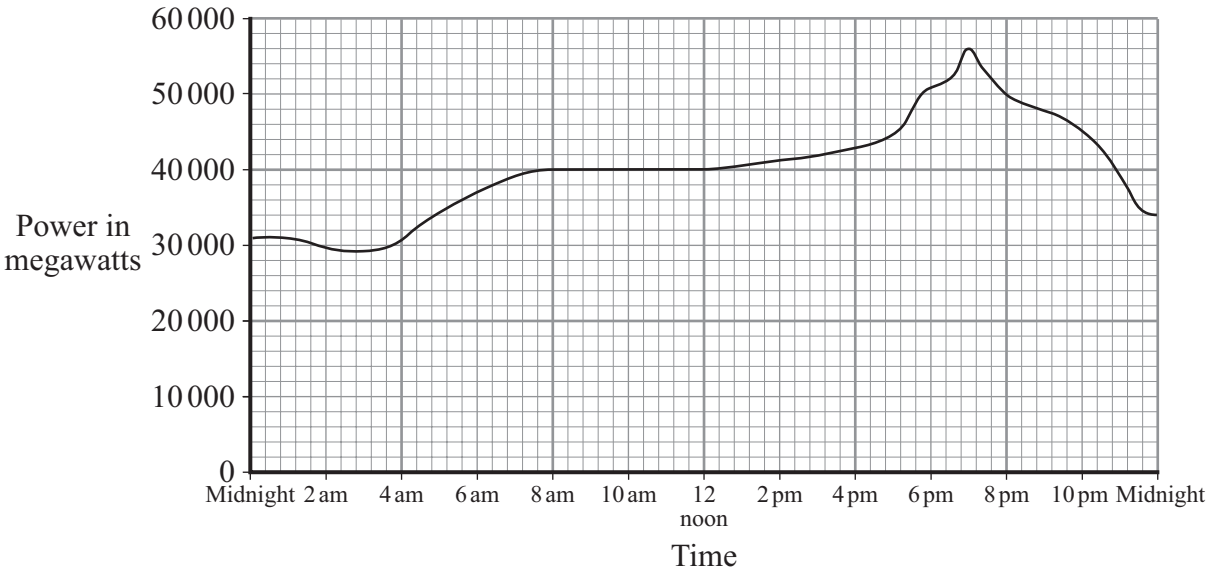
(1 mark)

4.1.3 National and global energy resources

Question 34 · continued

for mark

5 (b) The graph shows how the demand for electricity in the UK varied over one day in the winter.



5 (b) (i) Describe how the demand for electricity varied between 4.00 am and 10.00 am.

.....

.....

.....

.....

(2 marks)

5 (b) (ii) Which type of power station has the fastest start-up time?

Draw a ring around your answer.

coal **natural gas** **nuclear** **oil**

(1 mark)

5

4.1.3 National and global energy resources

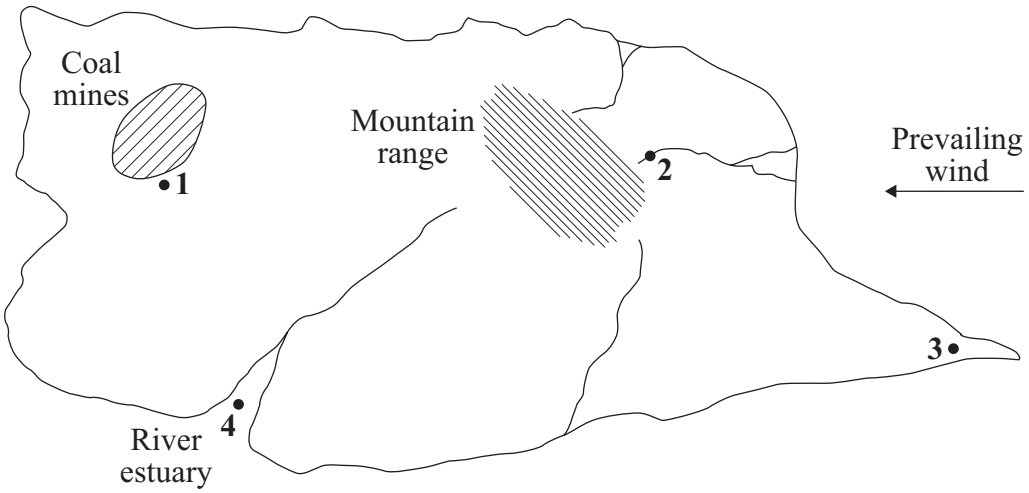
Question 35

March 2009 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

The map shows some features of a large island.

It also shows four places, **1**, **2**, **3** and **4**, where electricity could be generated.



Match energy sources, **A**, **B**, **C** and **D**, with the labels **1–4** on the map.

A falling water (hydroelectric)

B fossil fuel

C tides

D wind

4.1.3 National and global energy resources

Question 36

March 2009 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

Some people feel strongly about the environment. They can use posters to protest against the location of new power stations.



Match energy sources, **A**, **B**, **C**, and **D**, with the protesters' posters **1–4**.

A fossil fuels

B nuclear

C tides

D wind

4.1.3 National and global energy resources

Question 37

March 2009 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

Various energy sources can be used to generate electricity.

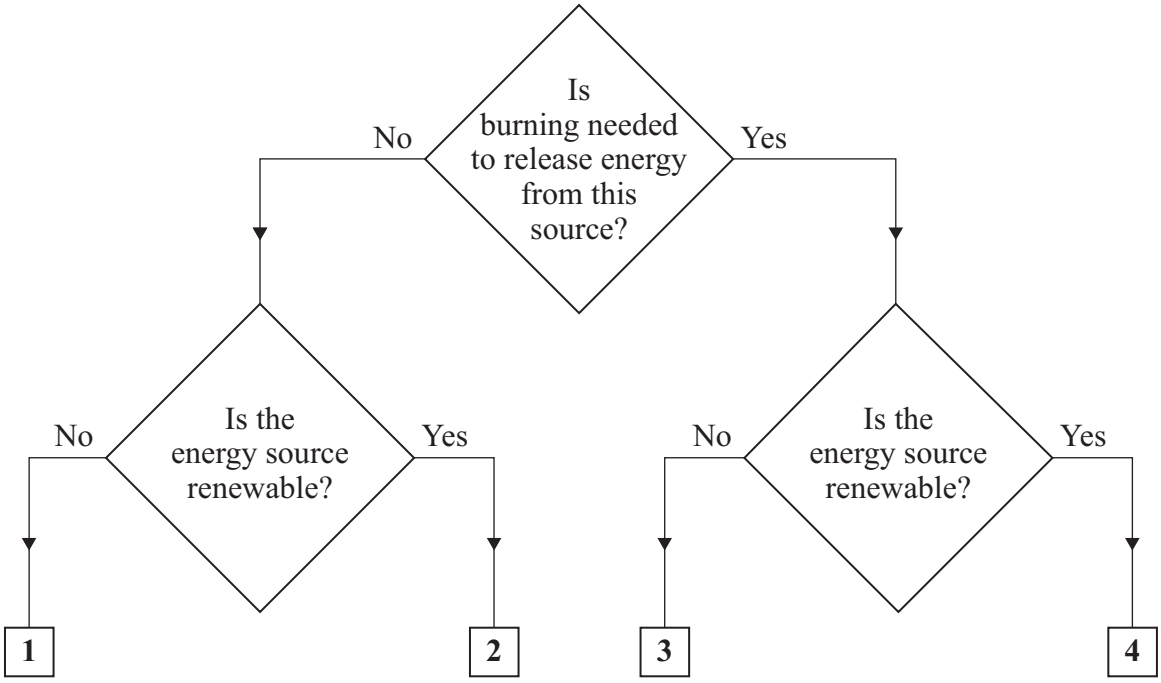
Match energy sources, **A**, **B**, **C**, and **D**, with the numbers **1–4** in the flow chart.

A coal

B biofuel

C geothermal

D uranium



4.1.3 National and global energy resources

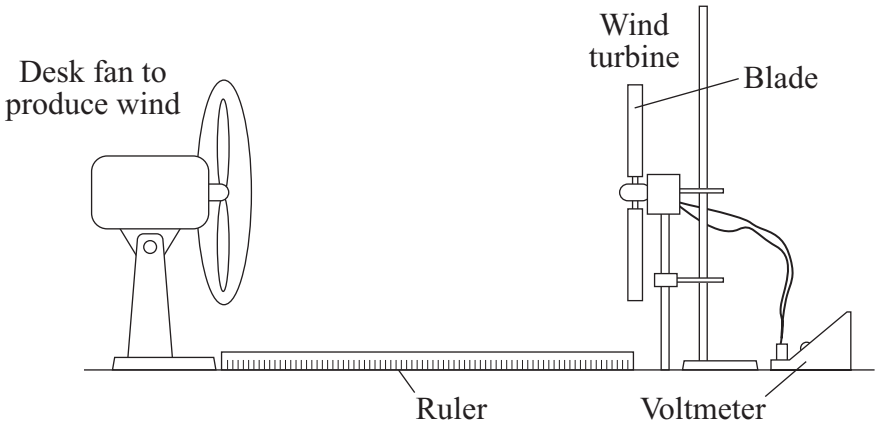
Question 38

March 2009 | PHY1AP | Original Q8 | Legacy

QUESTION EIGHT

A student investigated a model wind turbine.

The diagram shows the apparatus he used.



8A He noticed that most real wind turbines have three blades. He thought that a model wind turbine with three blades would give the best output.

This thought is known as a . . .

1 conclusion.

2 phenomenon.

3 fair test.

4 prediction.

Question 38 · continued

8B The student wanted to know if the output of the model wind turbine depends on the number of blades.

Which row of the table shows the correct combination of variables?

	Independent variable	Dependent variable	Control variables
1	wind speed	number of blades	distance from fan to turbine, angle of blades to wind, voltage
2	wind speed	voltage	distance from fan to turbine, angle of blades to wind, number of blades
3	number of blades	voltage	distance from fan to turbine, angle of blades to wind, wind speed
4	number of blades	wind speed	distance from fan to turbine, angle of blades to wind, voltage

8C The student took each of his measurements three times and then calculated a mean.

His reason for this was to improve the . . .

1 reliability.

2 sensitivity.

3 validity.

4 calibration.

8D When he had completed his measurements, the student wanted to display his results.

He chose a bar chart because one of the variables was . . .

1 continuous.

2 controlled.

3 discrete.

4 independent.

4.1.3 National and global energy resources

Question 39

June 2009 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

Four students are discussing ways in which electricity could be generated in their home countries.

Match sources of energy, **A**, **B**, **C** and **D**, with the students' descriptions of their countries **1**–**4**.

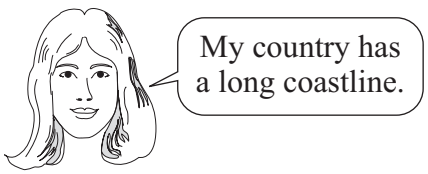
A falling water (hydroelectric)

B geothermal

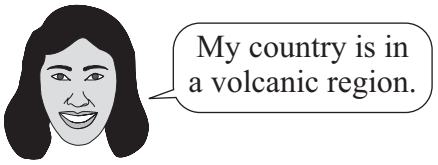
C solar

D wave

1



2



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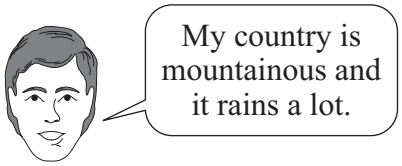

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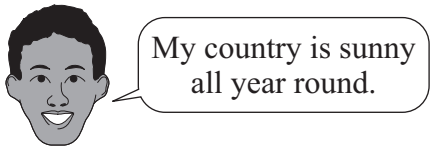


4.1.3 National and global energy resources

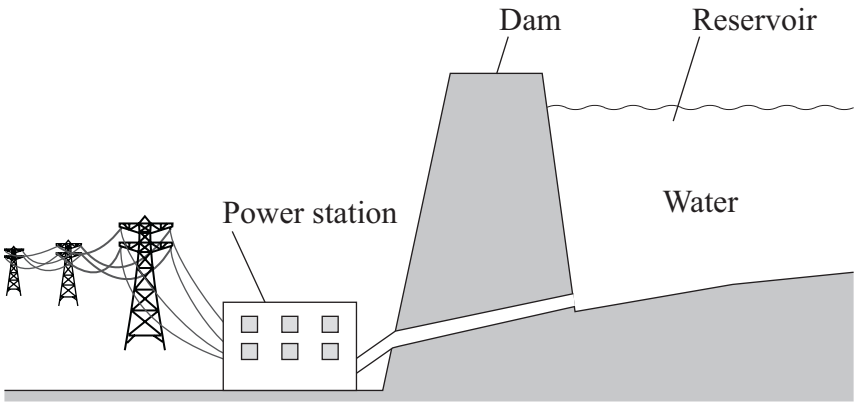
Question 40

June 2009 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

Useful energy can be obtained from falling water.

The diagram shows one way of doing this.



Match energy types, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences.

A electrical

B gravitational potential

C heat (thermal energy)

D kinetic

Large amounts of . . . **1** . . . energy are stored in the water in the reservoir.

Water flowing down from this reservoir has . . . **2** . . . energy which can turn a turbine.

The turbine can power a generator which produces useful . . . **3** . . . energy.

Some energy is wasted in the power station as . . . **4** . . . .

4.1.3 National and global energy resources

Question 41

June 2009 | PHY1F | Original Q2 | Legacy

2 Wind and tides are renewable energy sources that are used to generate electricity.

2 (a) Complete each sentence by putting a tick (✓) in the box next to the correct answer.

2 (a) (i) The wind is:

a predictable energy source. ☐

a constant energy source. ☐

an unreliable energy source. ☐

(1 mark)

2 (a) (ii) The tides are:

a predictable energy source. ☐

a constant energy source. ☐

an unreliable energy source. ☐

(1 mark)

2 (b) If wood is to be used as a renewable energy source, what must be done each time a tree is chopped down?

.....

.....

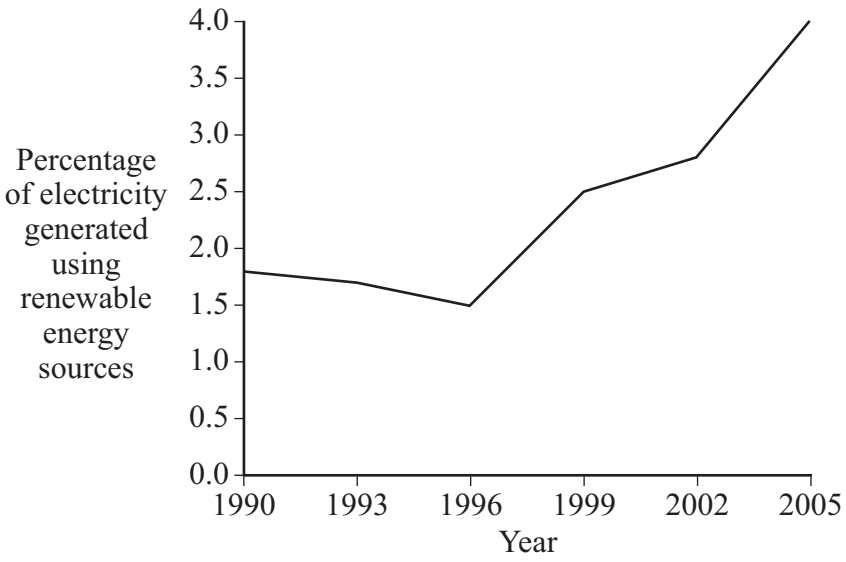
(1 mark)

4.1.3 National and global energy resources

Question 41 · continued

for mark

2 (c) In the UK, electricity is generated using renewable and non-renewable energy sources. The graph shows the percentage of electricity generated using renewable energy sources between 1990 and 2005.



Complete the following sentence by drawing a ring around the correct line in the box.

In 2015, the percentage of electricity generated using renewable energy sources is most likely to be

greater than 4%
equal to 4%
less than 4%

.

(1 mark)

4

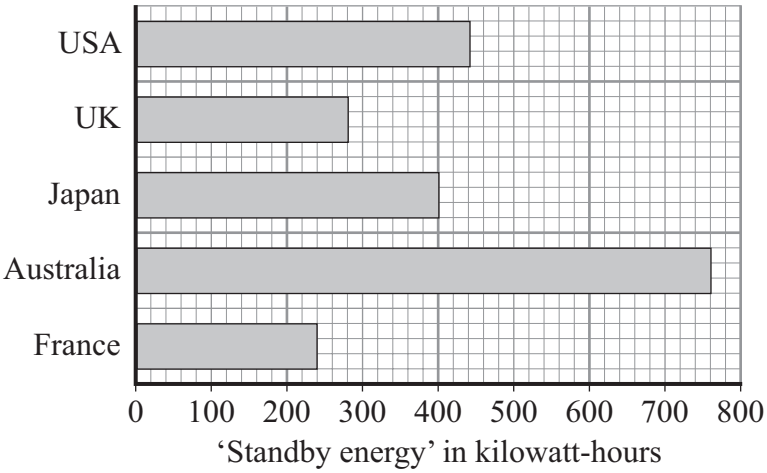
4.1.3 National and global energy resources

Question 42

June 2009 | PHY1F | Original Q5 | Legacy

5 Electrical appliances that are left on standby still use energy.

The bar chart compares the *average* amount of 'standby energy' wasted each year in every home in five countries.



5 (a) (i) In which country are the homes that waste, on average, the smallest amount of 'standby energy'?

Draw a ring around your answer.

Australia **France** **Japan** **UK** **USA**

(1 mark)

5 (a) (ii) Suggest a reason why an *average* value is used for the 'standby energy' wasted in the homes.

.....

.....

(1 mark)

5 (b) (i) Australia has one of the lowest electricity prices in the world.

How does this low price seem to affect the amount of 'standby energy' wasted?

.....

.....

(1 mark)

Question 42 · continued

for mark

5 (b) (ii) In Australia, most electricity is generated in coal-burning power stations. The Australian government wants less electricity to be wasted.

Wasting less electricity would be good for the Australian environment.

Explain why.

.....

.....

.....

.....

(2 marks)

5 (c) Energy is not usually measured in kilowatt-hours.

Which **one** of the following units is usually used to measure energy?

Draw a ring around your answer.

hertz **joule** **watt**

(1 mark)

5 (d) (i) Electricity in Japan costs the equivalent of 17 pence per kilowatt-hour.

Use the information in the bar chart and the equation in the box to calculate how much the 'standby energy' used in an average Japanese home costs each year.

total cost = number of kilowatt-hours × cost per kilowatt-hour

Show clearly how you work out your answer.

Give your answer in pence.

.....

.....

Cost = ... pence

(3 marks)

Question 5 continues on the next page

4.1.3 National and global energy resources

Question 42 · continued

for mark

5 (d) (ii) In Japan, the largest proportion of electricity is generated using nuclear fuels.

Which **one** of the following statements gives a good reason for using nuclear fuels to generate electricity?

Put a tick (✓) in the box next to your answer.

A nuclear power station is very expensive to build. ☐

A small amount of nuclear fuel generates a large amount of electricity. ☐

It is easy to store nuclear waste safely. ☐

(1 mark)

10

4.1.3 National and global energy resources

Question 43

November 2009 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

This question is about different ways of producing electrical energy.

6A Which of the following fuels used for producing electricity is **not** a fossil fuel?

1 coal

2 natural gas

3 oil

4 uranium

6B Which of the following is a renewable energy source?

1 coal

2 falling water (hydroelectric)

3 plutonium

4 uranium

6C Where is a geothermal power station most likely to be sited?

1 along a coastline

2 in hot countries

3 in large cities

4 near volcanoes

4.1.3 National and global energy resources

Question 43 · continued

6D Which of the following methods of producing electricity always causes atmospheric pollution?

1 burning fossil fuels

2 solar cells

3 nuclear energy

4 wind turbines

Turn over for the next question

4.1.3 National and global energy resources

Question 44

November 2009 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

Biodiesel is a biofuel.

- Biodiesel can be made from the waste products from the manufacture of chocolate.
- The chocolate waste products would otherwise be sent to landfill sites.
- Biodiesel can also be made from crops such as oilseed rape and palm trees.
- Biodiesel can be mixed with ordinary diesel and used to run vehicles.

7A It is better to make biodiesel from chocolate waste than from crops because this biodiesel . . .

1 can be mixed with ordinary diesel.

2 can be used to run vehicles.

3 makes use of a waste product.

4 requires the use of agricultural land.

7B Cars can run on different fuels.

- In the early 20th century, the Model T Ford car ran on ethanol, a biofuel.
- Large reserves of crude oil were discovered in America in the 1920s. As a result, cars were made to run on petrol.
- After World War II, oil from the Middle East was cheap, so cars continued to run on petrol.

What was the biggest influence in producing the change of fuel from ethanol to petrol?

1 environmental concerns

2 the price of the fuel

3 wars between countries

4 whether the fuel was renewable

4.1.3 National and global energy resources

Question 44 · continued

7C A farm is located on a hillside. There are no rivers or streams near the farm. The farmer wants to help the environment by generating his electricity from a renewable source.

Which of these sources is he most likely to choose?

1 a hydroelectric generator

2 a petrol generator

3 a wave generator

4 a wind generator

7D A renewable energy source is one that . . .

1 can be used again.

2 will not run out.

3 does not pollute the atmosphere.

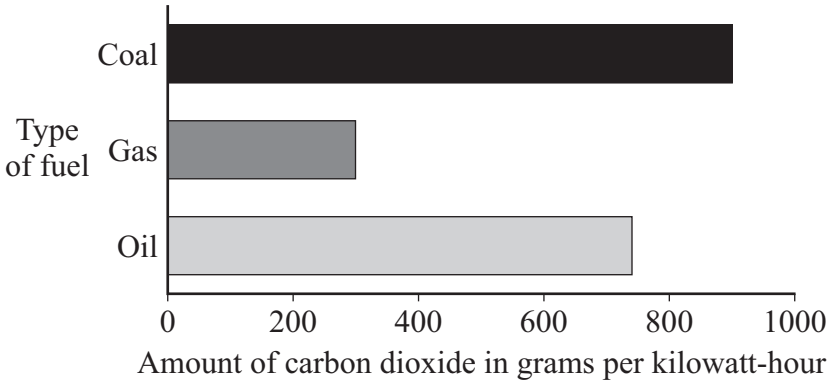
4 is always available.

4.1.3 National and global energy resources

Question 45

2 (a) Most electricity in the UK is generated in power stations that burn fossil fuels.

The bar chart shows how much carbon dioxide is produced for each kilowatt-hour of electricity generated using a fossil fuel.



2 (a) (i) Which fossil fuel produces the smallest amount of carbon dioxide for each kilowatt-hour of electricity generated?

.....

(1 mark)

2 (a) (ii) Which **one** of the following statements gives the reason why the data has been shown as a bar chart and not as a line graph?

Put a tick (✓) in the box next to your answer.

Both variables are categoric. ☐

Both variables are continuous. ☐

One variable is categoric, the other is continuous. ☐

(1 mark)

2 (a) (iii) Why does a nuclear power station **not** produce any carbon dioxide?

.....

.....

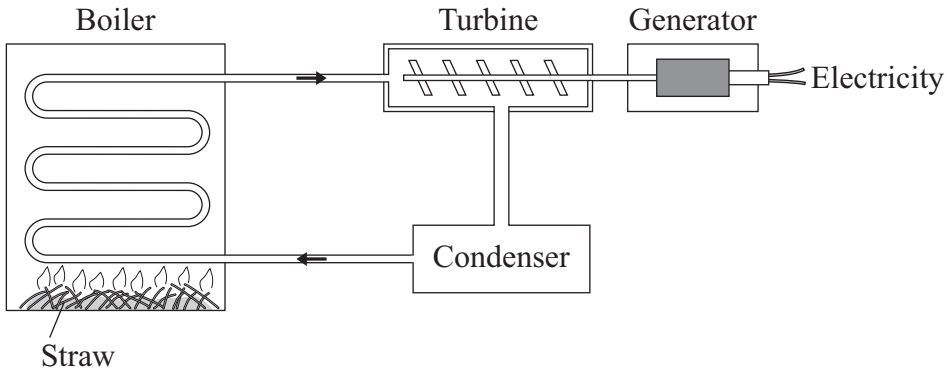
(1 mark)

4.1.3 National and global energy resources

Question 45 · continued

for mark

2 (b) Some types of power station generate electricity by burning straw.



2 (b) (i) Use words from the box to complete the following sentences.

boiler	**gas**	**generator**	**steam**	**turbine**	**water**

Straw is burned in a ..... . Water is heated to make

..... which is used to drive a ..... .

This turns a ..... to produce electricity.

(4 marks)

2 (b) (ii) Straw is a type of renewable energy source known as a biofuel.

Name **one** other type of renewable energy source used to produce electricity.

.....

(1 mark)

2 (b) (iii) A power station generates 36 000 000 watts (36 MW) of electrical power by burning straw. The average power used in each home in the UK over one year is 2000 watts.

Calculate the number of homes that the power station could supply electricity to.

Show clearly how you work out your answer.

.....

.....

Number of homes = ...

(2 marks)

10

4.1.3 National and global energy resources

Question 46

7 (a) The process of nuclear fusion results in the release of energy.

7 (a) (i) Describe the process of nuclear fusion.

.....

.....

.....

.....

(2 marks)

7 (a) (ii) Where does nuclear fusion happen naturally?

.....

(1 mark)

7 (b) For many years, scientists have tried to produce a controlled nuclear fusion reaction that lasts long enough to be useful. However, the experimental fusion reactors use more energy than they produce.

7 (b) (i) From the information given, suggest **one** reason why nuclear fusion reactors are not used to produce energy in a nuclear power station.

.....

.....

(1 mark)

7 (b) (ii) Suggest **one** reason why scientists continue to try to develop a practical nuclear fusion reactor.

.....

.....

(1 mark)

4.1.3 National and global energy resources

Question 46 · continued

for mark

7 (c) In 1989, two scientists claimed in a daily newspaper that they had produced nuclear fusion reactions in normal laboratory conditions. The process became known as 'cold fusion'. Other scientists thought that the evidence produced to support 'cold fusion' was unreliable.

7 (c) (i) Suggest **one** reason why other scientists thought that the evidence to support 'cold fusion' was unreliable.

.....

.....

(1 mark)

7 (c) (ii) In 2007, the results of a new 'cold fusion' research project were published in a respected scientific journal. This journal includes scientists such as Albert Einstein amongst its past authors.

Suggest why people may be more likely to believe an article published in a respected scientific journal than one published in a daily newspaper.

.....

.....

.....

(1 mark)

7

4.1.3 National and global energy resources

Question 47

March 2010 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about nuclear power stations.

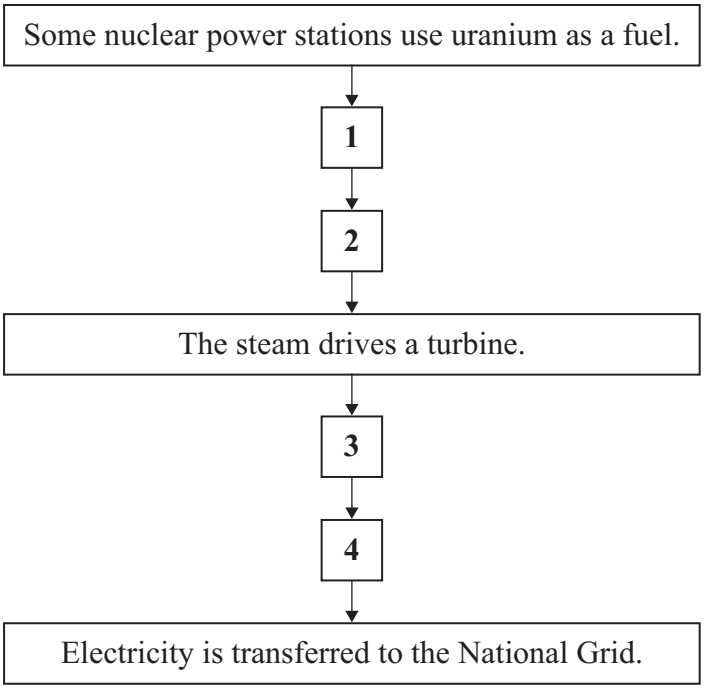
Match statements, **A**, **B**, **C** and **D**, with the boxes **1–4** in the flow chart to describe how nuclear power stations work.

A Electricity is produced.

B Fission of uranium produces heat.

C The heat is used to produce steam.

D The turbine drives a generator.



4.1.3 National and global energy resources

Question 48

March 2010 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

In the past fifty years, electricity has become the most important source of energy in the home.

6A Which of the following is a **disadvantage** of using electricity in the home compared with using natural gas or heating oil?

1 Electricity can be switched on and off easily.

2 Electricity can be transferred into many different types of energy.

3 Electricity cannot be stored in the home.

4 Devices using electricity can be moved from place to place easily.

The diagrams show the readings on a domestic electricity meter in May and August.

82913
May

83713
August

6B The electrical energy used between May and August is . . .

1 600 kWh

2 650 kWh

3 700 kWh

4 800 kWh

Question 48 · continued

March 2010 | PHY1AP | Original Q6 | Legacy

6C During the next three-month period, the householder used 600 kWh.

Electricity costs 15 pence per kilowatt-hour.

total cost	=	number of kilowatt-hours	×	cost per kilowatt-hour

What was the total cost of the electricity for this period?

1 £80

2 £90

3 £100

4 £110

6D Television advertisements encourage people to compare the prices charged by electricity companies. Many people change their electricity provider after they have looked at the websites.

People usually make this change for . . .

1 economic reasons.

2 environmental reasons.

3 ethical reasons.

4 social reasons.

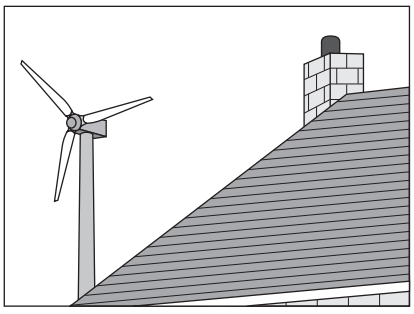
4.1.3 National and global energy resources

Question 49

March 2010 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

A newspaper reports that small wind turbines for home use have a long pay-back time.



Energy experts say that the turbines produce less energy than householders expect.

7A Neighbours of people who have installed a wind turbine are most likely to be annoyed because they think that wind turbines . . .

1 are noisy and unsightly.

2 are unreliable.

3 have a long pay-back time.

4 produce less energy than expected.

7B The turbines do not produce power all of the time because the wind . . .

1 cannot reach the turbines.

2 is renewable.

3 is too noisy.

4 is unreliable.

7C A wind turbine for a house costs £1500. The manufacturer claims that householders can save £100 a year on electricity bills.

If this claim is correct, the pay-back time for the wind turbine is . . .

1 1.5 years.

2 15 years.

3 150 years.

4 1500 years.

Question 49 · continued

7D One householder does not believe the manufacturer's claim. He calculated that his wind turbine saved less than £10 a year on his electricity bill.

What is the likely reason for this?

1 The amount of electricity generated by the wind turbine is less than the manufacturer's claim.

2 The amount of electricity generated by the wind turbine is more than the manufacturer's claim.

3 The energy source is renewable.

4 The price of electricity has risen.

Turn over for the next question

4.1.3 National and global energy resources

Question 50

June 2010 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

Various sources of energy can be used to produce electricity.

Match sources of energy, **A**, **B**, **C** and **D**, with the methods of producing electricity **1–4** in the table.

A fossil fuels

B hot rocks

C moving air

D sunlight

	Method of producing electricity
1	coal-fired power station
2	geothermal power station
3	solar cells
4	wind farm

4.1.3 National and global energy resources

Question 51

QUESTION FOUR

The use of various types of power station raises different environmental issues.

Match types of power station, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A gas-fired

B hydroelectric

C nuclear

D wind farm

	Environmental issue
1	large areas of land are flooded to form reservoirs
2	pollutes the atmosphere with carbon dioxide
3	produces radioactive waste
4	rotating blades may kill birds

4.1.3 National and global energy resources

Question 52

June 2010 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The table gives data for some energy sources used to generate electricity in the UK.

	Energy source	Generating cost in pence per kWh	Number of grams of carbon dioxide produced per kWh
A	Coal	2.6	1000
B	Gas	2.2	500
C	Hydroelectric (falling water)	3.4	20
D	Nuclear	3.5	5

Use the data in the table above to match energy sources, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

1	produces the cheapest electricity
2	is renewable
3	contributes least to global warming
4	contributes most to global warming

4.1.3 National and global energy resources

Question 53

June 2010 | PHY1F | Original Q1 | Legacy

1 Four students are talking about the different energy sources used to generate electricity in the areas where they live.

1 (a) Draw **one** line from where each student lives (**List A**) to the energy source in their area (**List B**).

Draw only **four** lines.

List A Where each student lives	**List B** Energy source
Where I live is the sunniest part of the country.	Wind
Where I live, the land is very flat and it always seems to be windy.	Waves
Where I live, it is not safe to swim. The sea is always too rough.	Solar
Where I live, you can see steam coming out of the ground.	Tides
	Geothermal

(4 marks)

1 (b) All of the energy sources given in part **(a)** can be used to generate electricity.

What else do all these energy sources have in common?

.....

.....

(1 mark)

4.1.3 National and global energy resources

Question 53 · continued

1 (c) In a hydroelectric power station, the energy from falling water is used to generate electricity.

Which **one** of the following gives a **disadvantage** of a hydroelectric power station?

Put a tick (✓) in the box next to your answer.

has a fast start-up time ☐

large areas of land are flooded ☐

polluting gases are produced ☐

(1 mark)

6

Turn over for the next question

4.1.3 National and global energy resources

Question 54

November 2010 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about generating electricity.

Match energy sources, **A**, **B**, **C** and **D**, with the descriptions **1**–**4** in the table.

A gas

B geothermal

C moving water

D uranium

	Description
1	produces energy from fission
2	is used in hydroelectric schemes
3	energy from underground hot rocks
4	is burnt in some power stations

4.1.3 National and global energy resources

Question 55

November 2010 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

Power stations used to generate electricity affect the environment in different ways.

Match types of power station, **A**, **B**, **C** and **D**, with effects on the environment **1**–**4** in the table.

A coal-fired

B hydroelectric

C nuclear

D tidal barrage

	Effect on environment
1	destroys the habitats of wading birds
2	produces waste that is radioactive
3	destroys large areas of farmland by flooding
4	produces gases that pollute the atmosphere

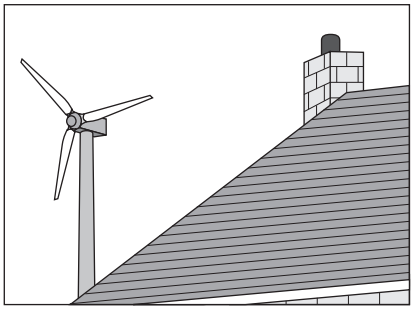
4.1.3 National and global energy resources

Question 56

November 2010 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

A householder is thinking about buying and installing a wind turbine on his roof.
The turbine costs £3000 to buy and install.



9A The householder estimates that the wind turbine would generate electricity worth an average of £1.50 each day.

What would be the pay-back time?

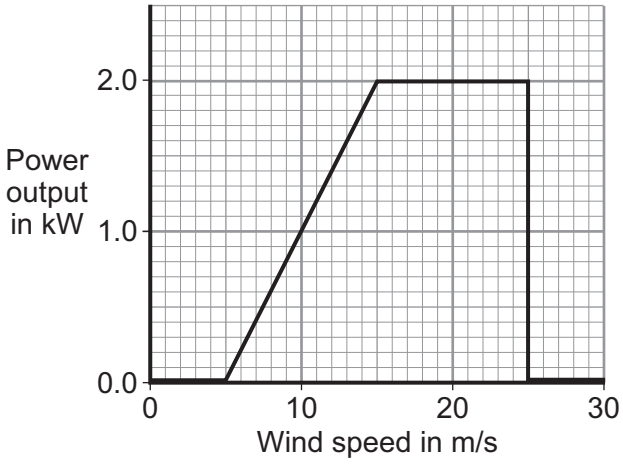
1 1000 days

2 2000 days

3 3000 days

4 4000 days

The graph shows how the power produced by the wind turbine changes with the wind speed.
The wind turbine shuts down at high wind speeds.



9B The maximum power output occurs when the wind speed reaches . . .

1 5 m/s

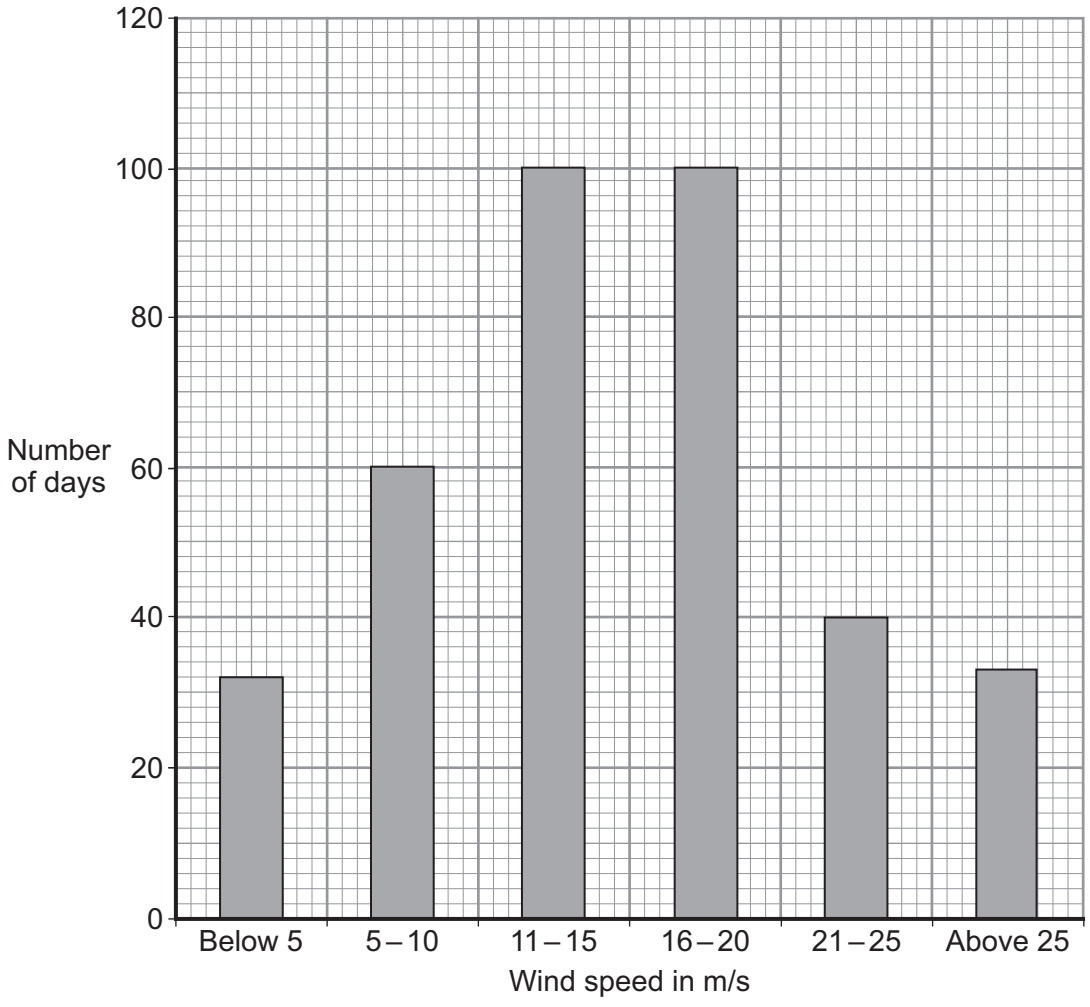
2 10 m/s

3 15 m/s

4 20 m/s

Question 56 · continued

9C The bar chart shows the wind speed at the house and the number of days in the year on which the wind has that speed.



For how many days in the year could the householder get some energy from the wind turbine?

1 160

2 260

3 300

4 330

9D The householder decides not to buy the wind turbine.

The most likely reason for his decision is that the wind turbine . . .

1 has fuel costs that are too high.

2 produces no greenhouse gases.

3 uses a non-renewable energy source.

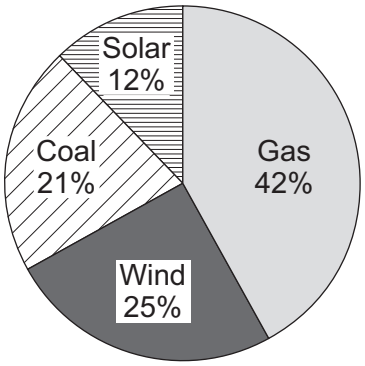
4 uses an unreliable energy source.

END OF TEST

4.1.3 National and global energy resources

Question 57

1 (a) The pie chart shows the energy sources used by one company to generate electricity.



1 (a) (i) Which two energy sources used by the company do **not** produce any polluting gases?

..... and .....

(1 mark)

1 (a) (ii) Calculate the percentage (%) of electricity that is generated using energy sources that do **not** produce any polluting gases.

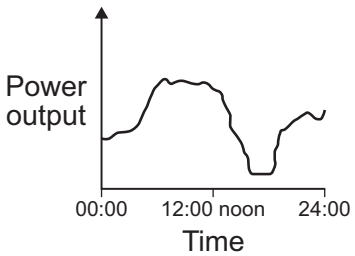
.....

Percentage = ...

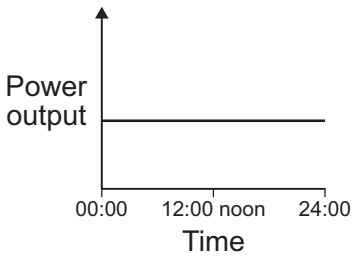
(1 mark)

1 (b) Which graph, **A**, **B** or **C**, is most likely to show the electrical power output from a wind turbine over one day?

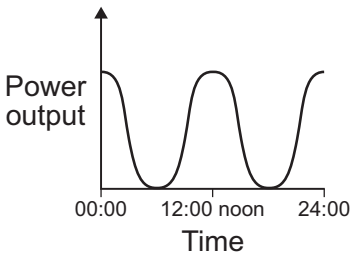
Write your answer, **A**, **B** or **C**, in the box.



Graph **A**



Graph **B**



Graph **C**

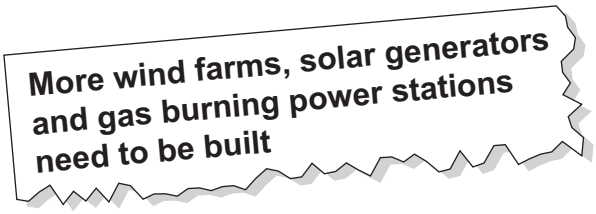
Graph

(1 mark)

4.1.3 National and global energy resources

Question 57 · continued

1 (c) The government has said that more electricity must be generated from renewable energy sources. A newspaper reported that:



Why is the statement in the newspaper incorrect?

.....

.....

(1 mark)

4

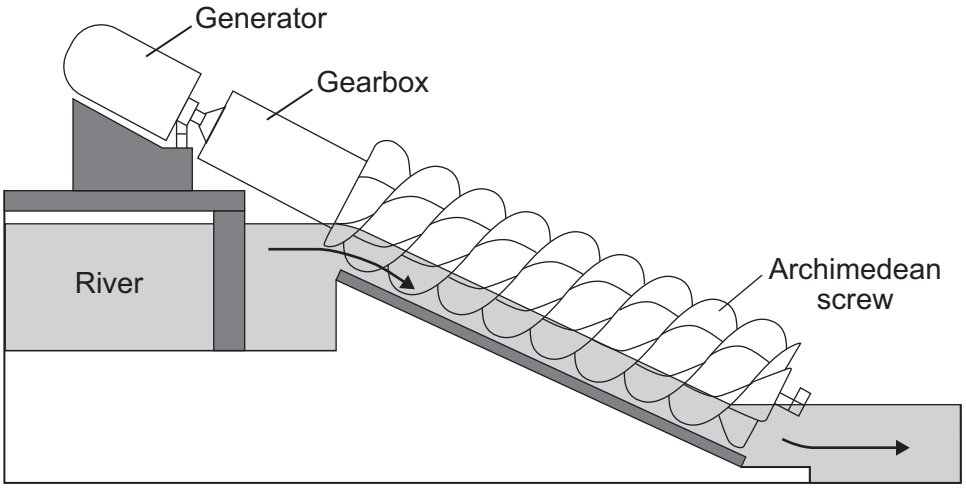
Turn over for the next question

4.1.3 National and global energy resources

Question 58

January 2011 | PHY1F | Original Q5 | Legacy

5 The diagram shows a small-scale, *micro-hydroelectricity* generator which uses the energy of falling river water to generate electricity. The water causes a device, called an Archimedean screw, to rotate.
The Archimedean screw is linked to the generator by a gearbox.



5 (a) Complete the following sentence by drawing a ring around the correct word in the box.

The gravitational potential energy of the falling water is transformed

into the | chemical / electrical / kinetic | energy of the Archimedean screw.

(1 mark)

4.1.3 National and global energy resources

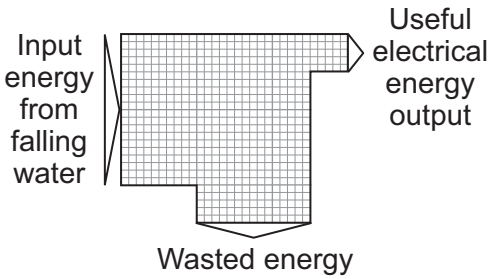
Question 58 · continued

5 (b) A micro-hydroelectric generator is very efficient. Most of the input energy from the falling water is transformed into useful electrical energy.

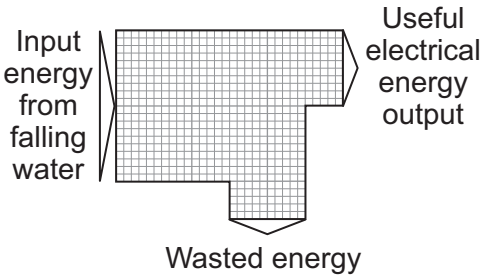
Which **one** of the following Sankey diagrams, **X**, **Y** or **Z**, shows the energy transformations produced by this generator?

Write your answer, **X**, **Y**, or **Z**, in the box.

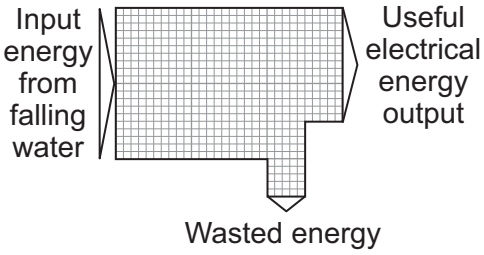
Sankey diagram **X**



Sankey diagram **Y**



Sankey diagram **Z**



Sankey diagram ☐

(1 mark)

Question 5 continues on the next page

4.1.3 National and global energy resources

Question 58 · continued

5 (c) A micro-hydroelectric system generates about 60 kW of electricity, enough for 50 homes. A conventional large-scale hydroelectric power station may generate more than 5 000 000 kW of electricity.

5 (c) (i) Give **one** advantage of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system.

.....

.....

(1 mark)

5 (c) (ii) Which **one** of the following statements gives a **disadvantage** of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system?

Put a tick (✓) in the box next to your answer.

Energy is wasted as heat and sound. ☐

Large areas of land are flooded. ☐

A constant flow of water is needed. ☐

(1 mark)

5 (d) The electricity generated by the micro-hydroelectric system is transferred directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to homes anywhere in the country through a system of cables and transformers.

5 (d) (i) What name is given to the system of cables and transformers used to transfer electricity to homes anywhere in the country?

.....

(1 mark)

5 (d) (ii) Using short cables to transfer electricity to local homes is much more efficient than using very long cables to transfer electricity to homes anywhere in the country.

Why?

.....

.....

(1 mark)

4.1.3 National and global energy resources

Question 58 · continued

5 (e) Nepal is a mountainous country with over 6000 rivers. In Nepal, 9000 kW of electricity are generated using micro-hydroelectric generators.

Suggest **one** reason why in the UK much less electricity is generated using micro-hydroelectric generators, than in Nepal.

.....

.....

(1 mark)

7

Turn over for the next question

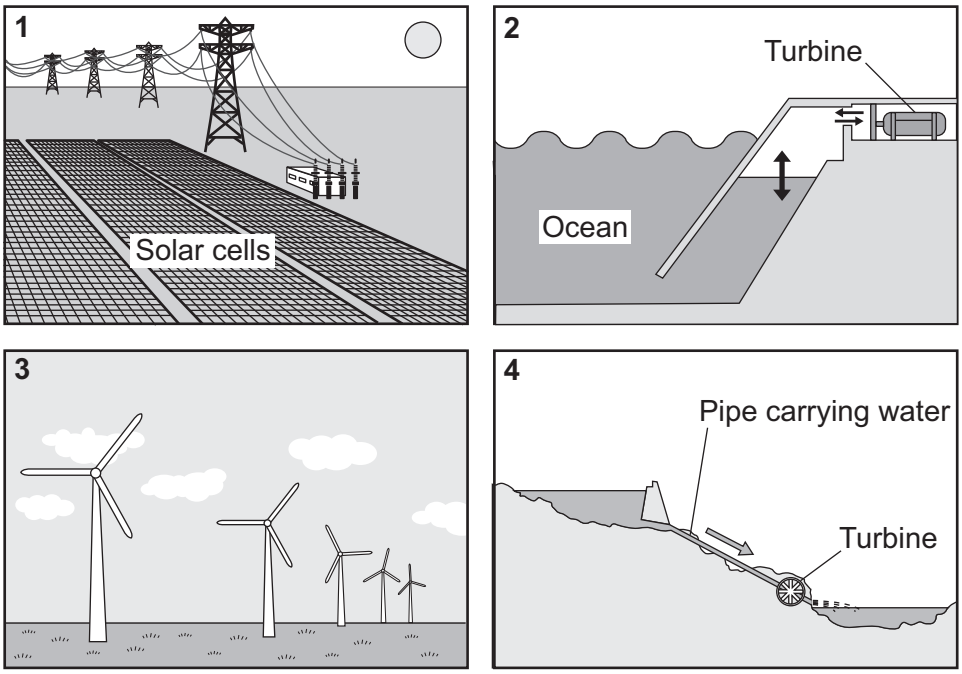
4.1.3 National and global energy resources

Question 59

March 2011 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

The diagrams show four types of power station. Each power station uses a different energy source to produce electricity.



Match energy sources, **A**, **B**, **C** and **D**, with the power stations **1**–**4**.

A falling water

B sunlight

C waves

D wind

4.1.3 National and global energy resources

Question 60

March 2011 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about different types of power station.

Match power station types, **A**, **B**, **C** and **D**, with the statements **1**–**4** in the table.

A coal-fired

B geothermal

C nuclear

D wind farm

1	produces greenhouse gases
2	produces long-lasting radioactive waste
3	uses heat from underground
4	the energy source drives a turbine directly

4.1.3 National and global energy resources

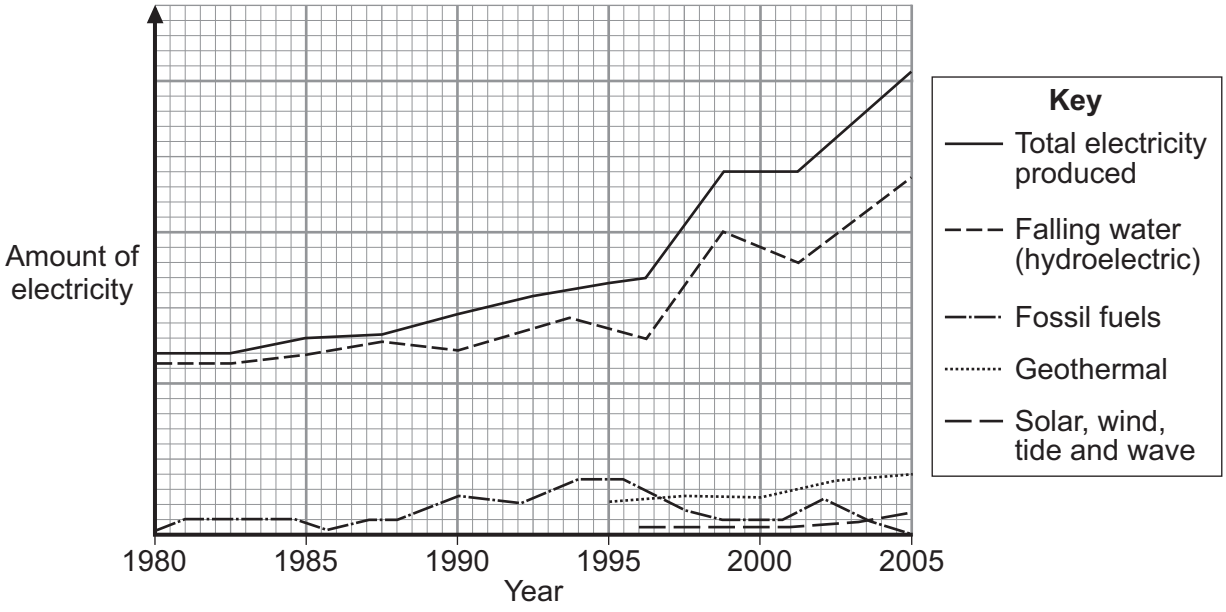
Question 61

March 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

Costa Rica is a country in Central America.

The graph shows how the sources used for generating electricity in Costa Rica have changed since 1980. It also shows how the total amount of electricity produced has changed.



7A Which of the following has been the main energy source since 1980?

1 falling water (hydroelectric)

2 fossil fuels

3 geothermal

4 solar, wind, tide and wave

7B Which energy source was first used in 1995?

1 falling water (hydroelectric)

2 fossil fuels

3 geothermal

4 solar, wind, tide and wave

4.1.3 National and global energy resources

Question 61 · continued

7C The graph shows . . .

1 a decrease in the total amount of electricity produced.

2 an increase in the total amount of electricity produced.

3 that the total amount of electricity produced has remained unchanged.

4 no clear trend in the total amount of electricity produced.

7D We can conclude from the graph that in producing electricity, Costa Rica . . .

1 does not produce much polluting gas.

2 does not use renewable energy sources.

3 has very few mountains.

4 uses mainly fossil fuels.

Turn over for the next question

4.1.3 National and global energy resources

Question 62

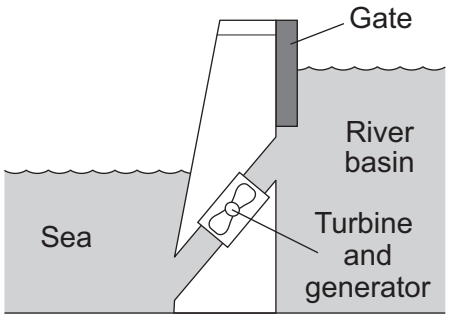
March 2011 | PHY1AP | Original Q8 | Legacy

QUESTION EIGHT

It is estimated that the total energy available from the world's tides could provide about 5 % of the electricity generated worldwide.

One method of using the energy of tides is to build a barrage across a river.

The diagram shows a tidal barrage.



Tide going out

- As the tide rises, the gate is opened to let seawater into the river basin.
- At high tide the gate is closed, trapping water in the river basin.
- As the tide goes out, the gate is opened and water flows through the turbine.

8A Which energy transformations take place as the water flows from the river basin through the turbine and the generator to the sea?

1 gravitational potential to electrical to kinetic

2 gravitational potential to kinetic to electrical

3 kinetic to electrical to gravitational potential

4 kinetic to gravitational potential to electrical

8B From the information above, one of the advantages of a tidal barrage over a wind farm is that it . . .

1 can be built anywhere.

2 generates electricity all the time.

3 has low building costs.

4 uses a predictable energy source.

4.1.3 National and global energy resources

Question 62 · continued

8C Environmentalists claim that one of the **disadvantages** of tidal power stations is that they . . .

1 cause noise pollution.

2 destroy the habitat of wading birds.

3 produce gases that pollute the atmosphere.

4 produce radioactive waste.

8D A cheaper way to use tidal energy is to use underwater currents to drive turbines. This is the same idea as a wind farm, but it works under water.

One report states that electricity generated by underwater currents would be four times as expensive as electricity generated by a wind farm.

The cost of electricity, from cheapest to most expensive, would be . . .

1 tidal barrage, underwater current, wind farm.

2 underwater current, wind farm, tidal barrage.

3 wind farm, tidal barrage, underwater current.

4 wind farm, underwater current, tidal barrage.

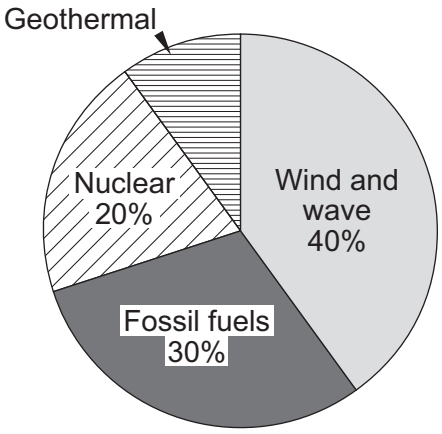
4.1.3 National and global energy resources

Question 63

June 2011 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The pie chart shows how a country's electricity demands are met using different energy sources.



Match percentages, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences.

A 10 %

B 20 %

C 40 %

D 50 %

The percentage of electricity generated from non-renewable sources is . . . **1** . . . .

The percentage of electricity generated from geothermal sources is . . . **2** . . . .

The percentage of electricity generated using a source that produces radioactive waste is . . . **3** . . . .

The percentage of electricity generated using the kinetic energy of the source directly is . . . **4** . . . .

4.1.3 National and global energy resources

Question 64

June 2011 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

The following is an extract from a newspaper in 2008.

Renewable energy projects at risk

The 'credit crunch' is making it difficult for companies to borrow money for large building projects.

6A Which of the following energy sources is renewable?

1 coal

2 nuclear

3 oil

4 tides

6B The newspaper reported that groups of people around the country were protesting about plans to build wind farms. The protestors said that wind farms are noisy and a danger to birds.

The reasons for the protests are . . .

1 economic.

2 environmental.

3 ethical.

4 political.

4.1.3 National and global energy resources

Question 64 · continued

6C Some wind energy companies had to delay their building plans because of the difficulty in raising money.

The reason for the delay was . . .

1 economic.

2 environmental.

3 ethical.

4 political.

6D There was a sharp fall in the price of oil towards the end of 2008.

Despite this fall, there were no suggestions that any new oil-fired power stations should be built.

This was because . . .

1 oil reserves are decreasing.

2 oil-fired power stations produce radioactive waste.

3 oil-fired power stations produce waste heat.

4 oil is difficult to transport.

4.1.3 National and global energy resources

Question 65

June 2011 | PHY1AP | Original Q8 | Legacy

QUESTION EIGHT

Some dairy farmers have installed electrical generators that run on methane gas.

- Methane gas is produced from rotting vegetation and animal waste.
- On farms, the rotting process takes place in a digester.
- Methane produced in this way is a biofuel called biogas.
- Burning methane produces carbon dioxide and water.
- The electrical generators can be installed in a farm building.

8A Methane is called a biofuel because . . .

1 it is a renewable fuel.

2 it comes from living things.

3 it produces carbon dioxide and water.

4 it is made in a digester.

8B Farmers have been encouraged to install their own biogas generators because . . .

1 this would reduce the amount of fuel used in power stations.

2 this would reduce the amount of animal waste produced.

3 biogas is a non-renewable fuel.

4 this would use less electricity.

8C A farmer's weekly electricity bill using the mains supply is £290. The biogas generator costs £15 000 to install.

The biogas generator provides all of the farmer's electricity.

What is the pay-back time?

1 1.0 years

2 4.3 years

3 5.2 years

4 52 years

4.1.3 National and global energy resources

Question 65 · continued

8D It would have been cheaper for the farmer to install a wind turbine generator.

What is the advantage of the biogas generator over the wind turbine generator?

1 It uses a renewable energy source.

2 It produces water.

3 It can work all the time.

4 It does not require any space.

Turn over for the next question

4.1.3 National and global energy resources

Question 66

June 2011 | PHY1F | Original Q8 | Legacy

8 (a) By 2023, nearly all of the existing nuclear power stations in the UK will be closed down.

8 (a) (i) Before a nuclear power station can be demolished, the remaining nuclear fuel, radioactive waste materials and reactor must be carefully removed.

What is this process called?

Put a tick (✓) in the box next to your answer.

decommissioning ☐

decontaminating ☐

dismantling ☐

(1 mark)

8 (a) (ii) The workers are exposed to radiation as they remove the reactor. One of the biggest risks is from the isotope cobalt-60, which has a half-life of 5.3 years.

Explain the advantage of waiting 11 years after a nuclear power station has closed down before starting to remove the reactor.

.....

.....

.....

.....

(2 marks)

4.1.3 National and global energy resources

Question 66 · continued

8 (b) It is almost certain that new nuclear power stations will be built in the UK.

The table shows the results of surveys asking people in the UK whether they were in favour of, or against, the building of new nuclear power stations.

	2001	2005	2007
Percentage (%) in favour	20	41	65
Percentage (%) against	60	28	20
Percentage (%) not sure	20	31	15

8 (b) (i) From these surveys, how did public opinion on the building of new nuclear power stations change between 2001 and 2007?

.....

.....

(1 mark)

8 (b) (ii) Suggest a reason why some people may think that the results from these surveys are unreliable.

.....

.....

(1 mark)

8 (b) (iii) Give **one** reason in favour of building new nuclear power stations.

.....

.....

(1 mark)

Question 8 continues on the next page

4.1.3 National and global energy resources

Question 66 · continued

8 (c) The government of one Middle Eastern country has decided to build its first nuclear power station. The oil that would have been used to generate electricity can then be sold to other countries.

On what is this decision based?

Put a tick (✓) in the box next to your answer.

economic issues ☐

ethical issues ☐

social issues ☐

(1 mark)

7

4.1.3 National and global energy resources

Question 67

November 2011 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

This question is about energy sources that are used to produce electricity.

Match energy sources, **A**, **B**, **C** and **D**, with the descriptions **1–4** in the table.

A geothermal

B hydroelectric

C nuclear fuel

D wind

	Description
1	can be used only where there is a fast flow of water
2	is an unreliable energy source
3	uses heat produced under the ground
4	is a non-renewable energy source

4.1.3 National and global energy resources

Question 68

November 2011 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

The energy from various sources can be used to drive turbines in power stations.

Match power station types, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A coal-fired

B geothermal

C nuclear

D tidal

	The turbines are driven by . . .
1	moving water.
2	steam produced from water heated by burning a fuel.
3	steam produced from water heated by hot rocks.
4	steam produced from water heated by the fission of uranium.

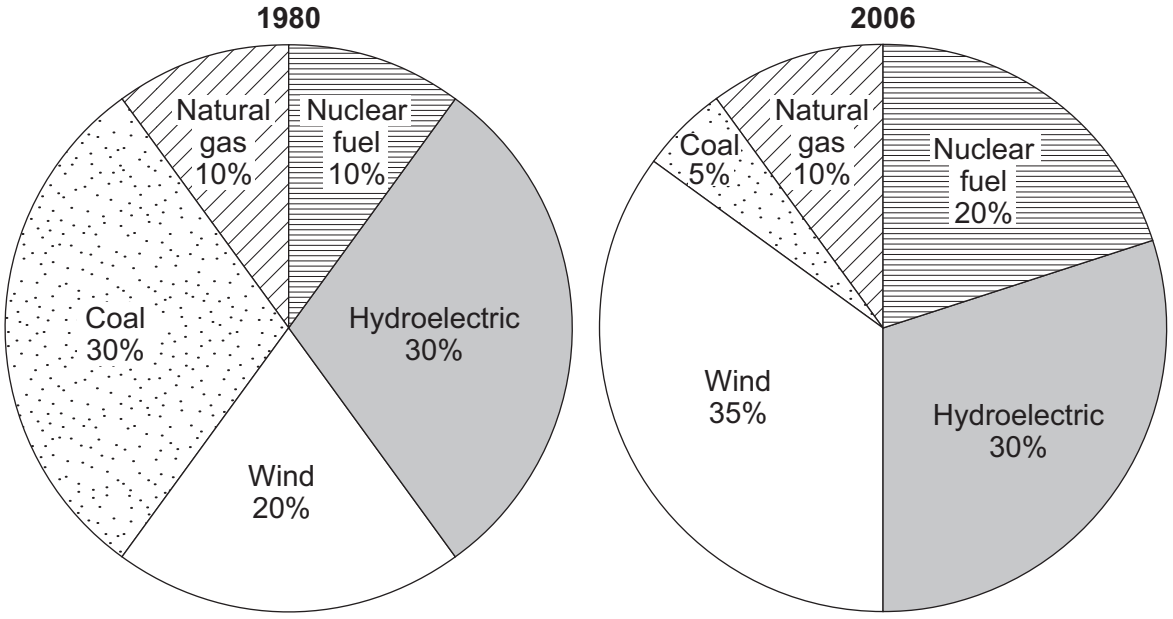
4.1.3 National and global energy resources

Question 69

November 2011 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The two pie charts show the relative proportions of energy sources used to generate electricity in a European country. One is for 1980; the other one is for 2006.



Match energy sources, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A coal

B natural gas

C nuclear fuel

D wind

	Between 1980 and 2006, the relative proportion of . . .
1	this non-renewable energy source decreased in use.
2	this non-renewable energy source doubled in use.
3	this non-renewable energy source was unchanged in use.
4	this renewable energy source had the greatest increase in use.

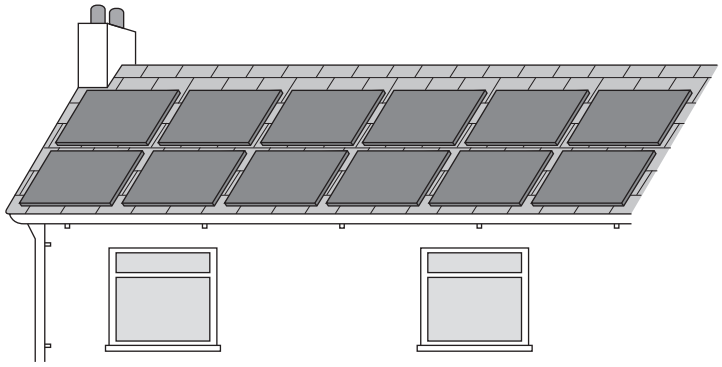
4.1.3 National and global energy resources

Question 70

November 2011 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

The diagram shows a group of solar cells on the roof of a building.



6A The energy transformation in a solar cell is . . .

1 electrical to light.

2 electrical to heat.

3 heat to electrical.

4 light to electrical.

6B There are twelve 180 watt solar cells on the roof.

The maximum power output of the group of solar cells is . . .

1 15 W

2 15 kW

3 2160 W

4 2160 kW

4.1.3 National and global energy resources

Question 70 · continued

6C The solar cells will provide 1600 kilowatt-hours (kWh) of electrical energy per year.

total cost	=	number of kilowatt-hours	×	cost per kilowatt-hour

Electricity from the mains supply costs 15 p per kWh

How much money will be saved per year by using the solar cells rather than the mains supply?

1 £2.40

2 £24

3 £240

4 £24 000

6D Energy from the solar cells is cheaper than energy from the mains supply because there are no . . .

1 fuel costs.

2 habitats destroyed.

3 polluting gases given off.

4 radioactive waste products.

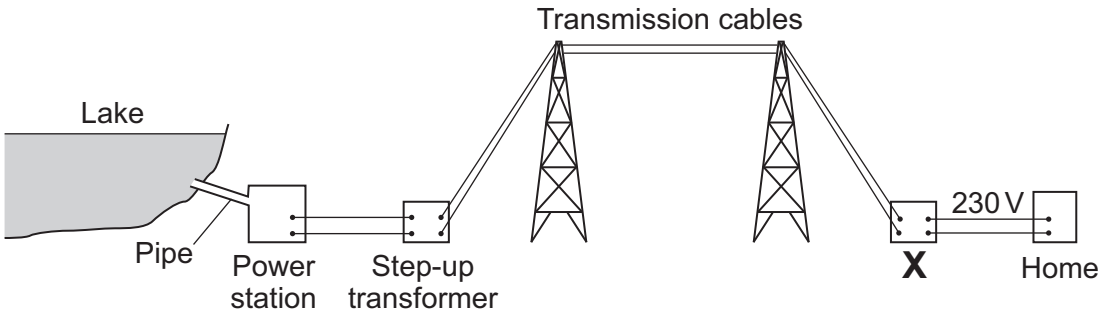
4.1.3 National and global energy resources

Question 71

November 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows a hydroelectric power station connected to the National Grid.



7A The step-up transformer increases the . . .

1 current.

2 energy.

3 power.

4 voltage.

7B Using a step-up transformer . . .

1 makes the transmission cables warmer.

2 makes the electricity move faster.

3 reduces the energy loss in the transmission cables.

4 reduces the risk of electrocution.

7C The voltage across the transmission cables is 400 000 volts. Before the electricity can be used in homes, it is reduced to 230 volts. The device that does this is labelled **X** on the diagram.

Device **X** is a . . .

1 boiler.

2 generator.

3 step-down transformer.

4 thermal circuit breaker.

4.1.3 National and global energy resources

Question 71 · continued

7D Each second, the water taken from the lake supplies 4 200 000 joules of energy to the power station.

The power station produces 2 520 000 joules of electrical energy each second.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

The efficiency of the power station is . . .

1 0.2

2 0.4

3 0.6

4 1.7

Turn over for the next question

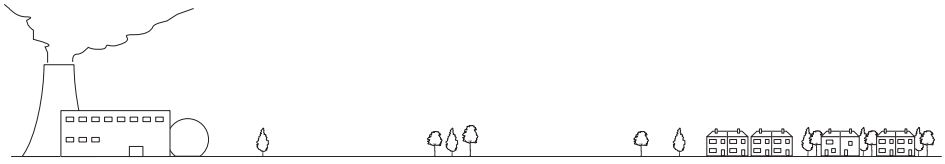
4.1.3 National and global energy resources

Question 72

November 2011 | PHY1BP | Original Q9 | Legacy

QUESTION NINE

A nuclear power station is built a few miles away from a village.



The nuclear power station uses radioactive uranium as its fuel. After a few years, there are more cases of cancer than usual occurring in the village. The villagers think that this is because of radiation from the power station.

9A Any radiation reaching the village directly from the power station will be . . .

1 alpha radiation only.

2 beta radiation only.

3 gamma radiation only.

4 alpha, beta and gamma radiation.

9B The increased number of cancer cases near the power station . . .

1 proves that the power station is the only cause of these cancers.

2 proves that the power station is one possible cause of these cancers.

3 suggests that the power station is the only cause of these cancers.

4 suggests that the power station is one possible cause of these cancers.

9C Checks are to be made for any link between the power station and the increased number of cancer cases in the village.

This is most likely to be done by . . .

1 shutting down the power station to see if the number of cases decreases.

2 re-housing the villagers away from the power station to see if the number of cancer cases decreases.

3 re-housing the villagers closer to the power station to see if the number of cancer cases increases.

4 comparing the villagers' health records with those of people who do not live near nuclear power stations.

4.1.3 National and global energy resources

Question 72 · continued

9D Exposure to radiation from radioactive sources used in schools must be kept to a minimum.

The best way to do this is to store the source in a box lined with . . .

1 aluminium.

2 glass.

3 lead.

4 wood.

END OF TEST

4.1.3 National and global energy resources

Question 73

June 2012 | PH1FP | Original Q5 | Legacy

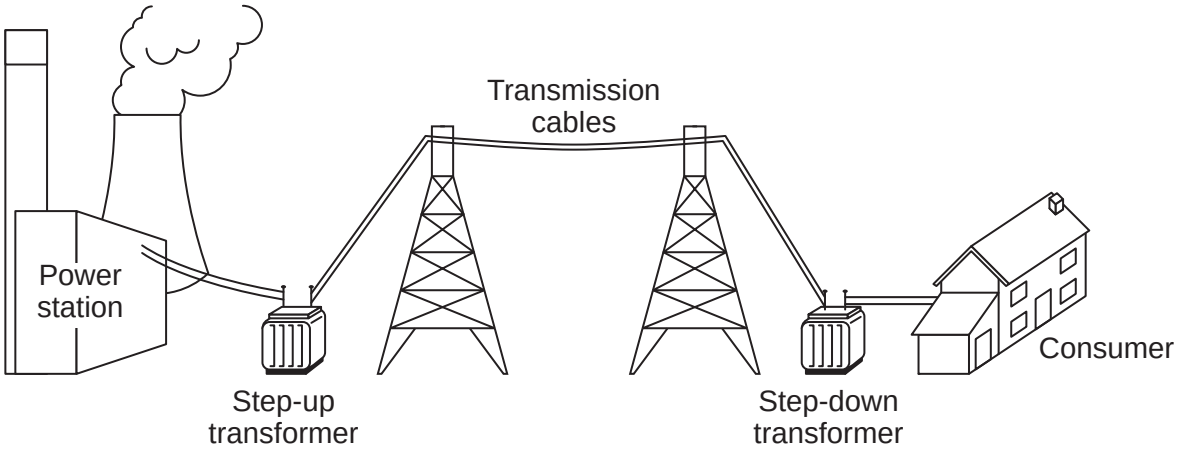
5 In the UK, most electricity is generated in power stations that burn fossil fuels.

5 (a) Which type of fossil fuel power station has the shortest start-up time?

.....

(1 mark)

5 (b) The diagram shows how electricity is distributed around the UK.



5 (b) (i) Which of the parts labelled in the diagram form the National Grid?

.....

(1 mark)

5 (b) (ii) A step-up transformer is used near the power station.

Draw a ring around the correct answer in each box to complete each sentence.

A step-up transformer increases the

current.
power.
voltage.

Using a step-up transformer makes the distribution of electricity

less dangerous.
more efficient.
work faster.

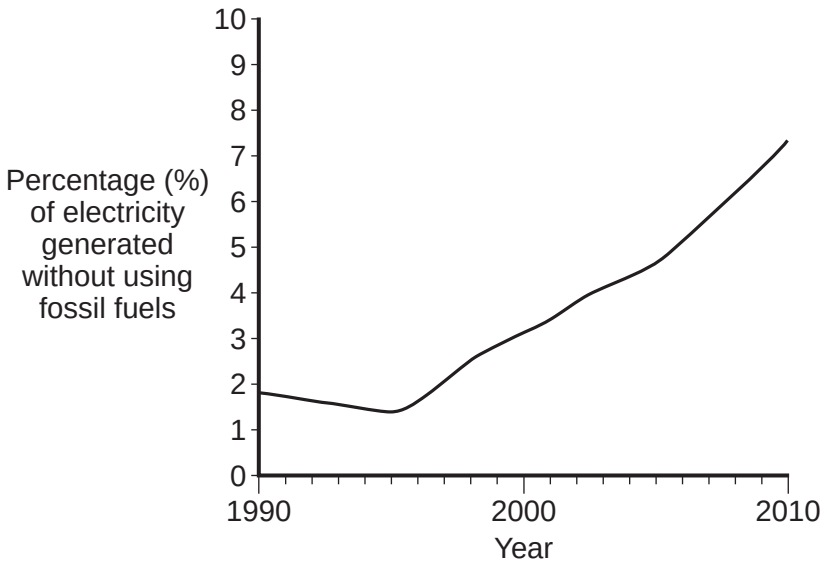
(2 marks)

4.1.3 National and global energy resources

Question 73 · continued

5 (c) Electricity in the UK is also generated without using fossil fuels.

The graph shows how the percentage of electricity generated in the UK without using fossil fuels changed between 1990 and 2010.



What does the data in the graph suggest will probably happen to the percentage of electricity generated in the UK without using fossil fuels over the next 10 years?

.....

.....

(1 mark)

5

4.1.3 National and global energy resources

Question 74

June 2012 | PH1FP | Original Q7 | Legacy

7 A wood burning stove is used to heat a room.



The fire in the stove uses wood as a fuel. The fire heats the matt black metal case of the stove.

7 (a) The air next to the stove is warmed by infrared radiation.

How does the design of the stove help to improve the rate of energy transfer by infrared radiation?

.....

.....

.....

.....

(2 marks)

4.1.3 National and global energy resources

Question 74 · continued

7 (b) Burning 1 kg of wood transfers 15 MJ of energy to the stove. The stove then transfers 13.5 MJ of energy to the room.

Calculate the efficiency of the stove.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

Efficiency = ...

(2 marks)

7 (c) Some of the energy from the burning wood is wasted as the hot gases leave the chimney and warm the air outside the house.

Name **one** other way energy is wasted by the stove.

.....

(1 mark)

7 (d) Some people heat their homes using electric heaters. Other people heat their homes using a wood burning stove.

Give **two** environmental advantages of using a wood burning stove to heat a home rather than heaters that use electricity generated from fossil fuels.

1 .....

.....

2 .....

.....

(2 marks)

Question 7 continues on the next page

4.1.3 National and global energy resources

Question 74 · continued

7 (e) The metal case of the stove gets hot when the fire is lit.

Here is some information about the stove.

Mass of metal case	100 kg
Starting temperature of metal case	20 °C
Final temperature of metal case	70 °C
Specific heat capacity of metal case	510 J/kg °C

Calculate the energy required to raise the temperature of the metal case to 70 °C.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer and give the unit.

.....

.....

.....

.....

Energy required = ...

(3 marks)

10

4.1.3 National and global energy resources

Question 75

June 2012 | PH1FP | Original Q8 | Legacy

8 (a) Geothermal energy and the energy of falling water are two resources used to generate electricity.

8 (a) (i) What is geothermal energy?

.....

.....

(1 mark)

8 (a) (ii) Hydroelectric systems generate electricity using the energy of falling water.

A pumped storage hydroelectric system can also be used as a way of storing energy for future use.

Explain how.

.....

.....

.....

.....

.....

.....

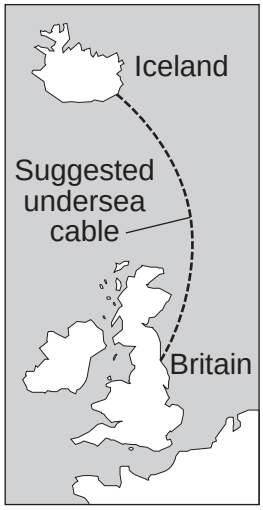
(2 marks)

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

Read the following extract from a newspaper.

Britain may be switched on by Iceland

Iceland is the only country in the world generating all of its electricity from a combination of geothermal and hydroelectric power stations. However, Iceland is using only a small fraction of its energy resources. It is estimated that using only these resources, the amount of electricity generated could be increased by up to four times.



To help supply the future demand for electricity in Britain, there are plans to build thousands of new offshore wind turbines. It has also been suggested that the National Grid in Britain could be linked to the electricity generating systems in Iceland. This would involve laying a 700 mile undersea electricity cable between Iceland and Britain.

4.1.3 National and global energy resources

Question 75 · continued

Discuss the advantages and disadvantages of the plan to build thousands of offshore wind turbines around Britain **and** the suggested electricity power link between Britain and Iceland.

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(6 marks)

9

4.1.3 National and global energy resources

Question 76

January 2013 | PH1FP | Original Q1 | Legacy

1 Three energy sources used to generate electricity are given in **List A**.
Statements about the energy sources used to generate electricity are given in **List B**.

Draw **one** line from each energy source in **List A** to the statement about the energy source in **List B**.

List A Energy source	List B Statement about energy source
Geothermal	Uses energy from falling water
Hydroelectric	Uses energy from inside the Earth
Nuclear	Is unpredictable
	Produces dangerous waste

(3 marks)

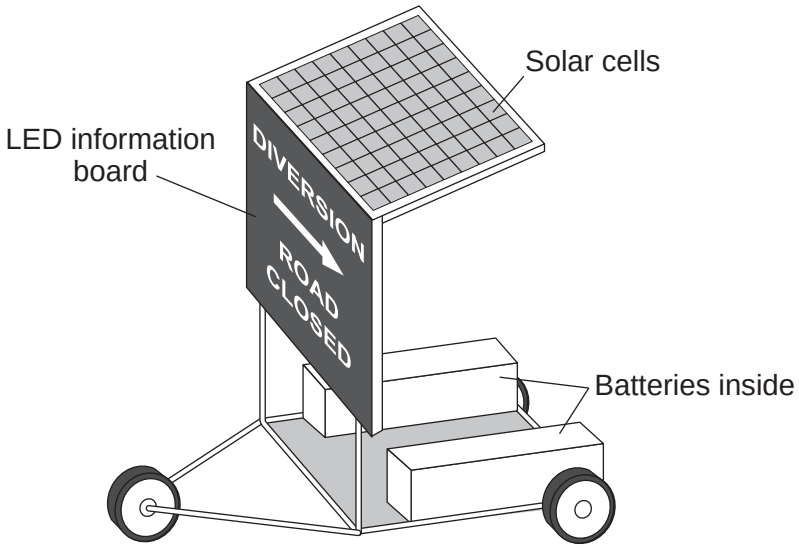
3

4.1.3 National and global energy resources

Question 77

January 2013 | PH1FP | Original Q2 | Legacy

2 The picture shows a temporary road traffic information board.



The batteries power the LEDs used in the information board.
The solar cells keep the batteries charged.

2 (a) Use words from the box to complete each of the following sentences.

chemical	**electrical**	**light**	**sound**

The solar cells transfer light energy to ..... energy.

The batteries transfer ..... energy to electrical energy.

The LEDs transfer electrical energy to ..... energy.

(3 marks)

4.1.3 National and global energy resources

Question 77 · continued

2 (b) When the total energy input to the solar cells is 200 joules, the useful energy output from the solar cells to the batteries is 50 joules.

Calculate the efficiency of the solar cells.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Efficiency = ...

(2 marks)

2 (c) Which **one** of the following statements gives the reason for using solar cells to charge the batteries?

Tick (✓) **one** box.

Solar cells will charge the batteries day and night. ☐

The information board can be used anywhere it is needed. ☐

A small number of solar cells produce a lot of electricity. ☐

(1 mark)

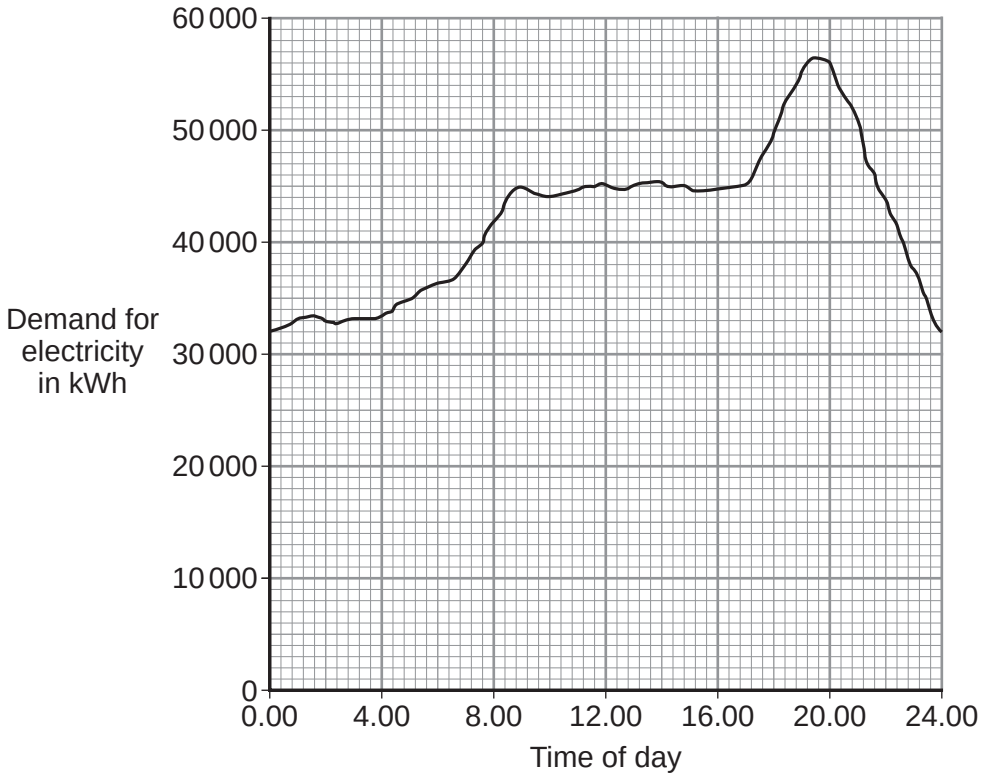
6

4.1.3 National and global energy resources

Question 78

January 2013 | PH1FP | Original Q8 | Legacy

8 (a) The graph shows how the demand for electricity in the UK changes during one 24-hour period.



The table gives the start-up times for two types of power station.

Type of power station	Start-up time
Gas	A few minutes
Nuclear	Several days

How would these two types of power station be used to meet the demand for electricity during this 24-hour period?

.....

.....

.....

.....

.....

.....

(3 marks)

4.1.3 National and global energy resources

Question 78 · continued

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

A farmer plans to generate all the electricity needed on her farm, using either a biogas generator or a small wind turbine.

The biogas generator would burn methane gas. The methane gas would come from rotting the animal waste produced on the farm. When burnt, methane produces carbon dioxide.

The biogas generator would cost £18 000 to buy and install. The wind turbine would cost £25 000 to buy and install.

The average power output from the wind turbine would be the same as the continuous output from the biogas generator.

Evaluate the advantages and disadvantages of the two methods of generating electricity.

Conclude, with a reason, which system would be better for the farmer to buy and install.

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(6 marks)

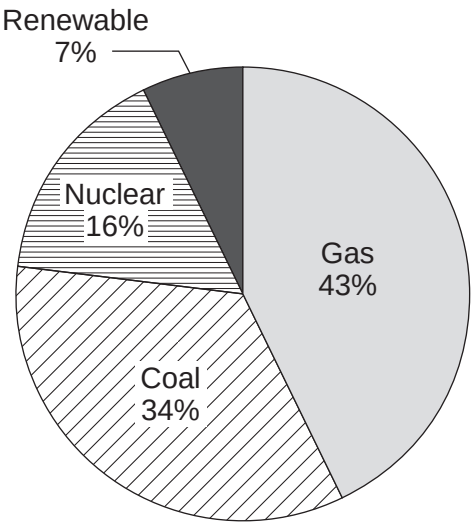
9

4.1.3 National and global energy resources

Question 79

June 2013 | PH1FP | Original Q1 | Legacy

1 (a) The pie chart shows the proportions of electricity generated in the UK from different energy sources in 2010.



1 (a) (i) Calculate the percentage of electricity generated using fossil fuels.

.....

Percentage = ... %

(1 mark)

1 (a) (ii) The pie chart shows that 7% of electricity was generated using renewable energy sources.

Which **one** of the following is **not** a renewable energy source?

Tick (✓) **one** box.

Oil ☐

Solar ☐

Wind ☐

(1 mark)

4.1.3 National and global energy resources

Question 79 · continued

1 (b) Complete the following sentence.

In some types of power station, fossil fuels are burned to heat ..... to produce steam.

(1 mark)

1 (c) Burning fossil fuels releases carbon dioxide into the atmosphere.

Why do many scientists think adding carbon dioxide to the atmosphere is harmful to the environment?

Tick (✓) **one** box.

Carbon dioxide is the main cause of acid rain. ☐

Carbon dioxide causes global warming. ☐

Carbon dioxide causes visual pollution. ☐

(1 mark)

4

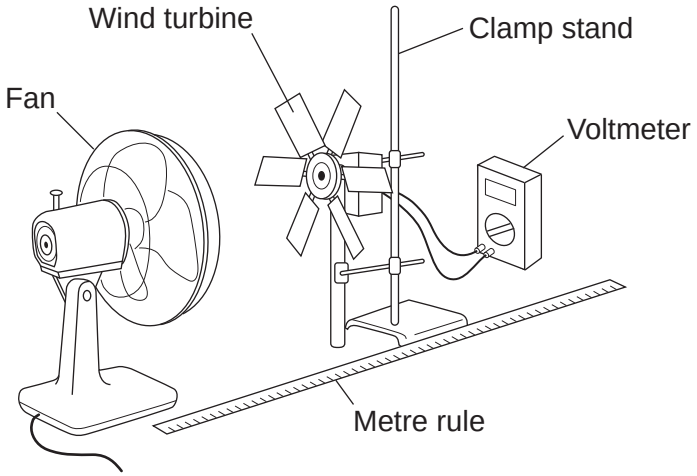
4.1.3 National and global energy resources

Question 80

June 2013 | PH1FP | Original Q4 | Legacy

4 (a) A student investigated how the number of blades on a wind turbine affects the output voltage of the turbine.

The student used the apparatus shown in the diagram.



The fan was used to turn the wind turbine.

4 (a) (i) The fan was always the same distance from the wind turbine.

Why?

.....

.....

(1 mark)

4 (a) (ii) After switching the fan on, the student waited 20 seconds before taking the voltmeter reading.

Suggest why.

.....

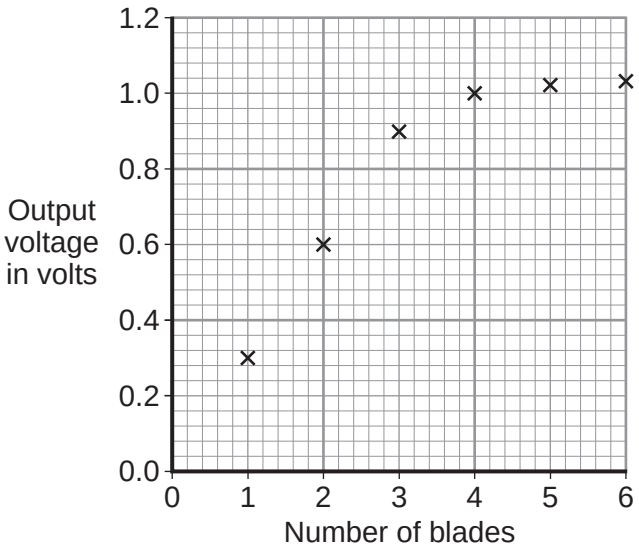
.....

(1 mark)

Question 80 · continued

4 (a) (iii) The student changed the number of blades on the wind turbine.

The student's results are shown in the scatter graph.



What conclusion can be made from the results in the scatter graph?

.....

.....

.....

.....

(2 marks)

Question 4 continues on the next page

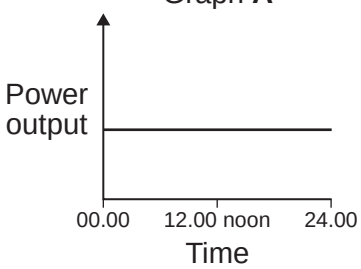
4.1.3 National and global energy resources

Question 80 · continued

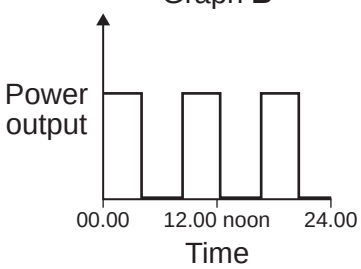
4 (b) The amount of electricity generated using wind turbines is increasing.

Which graph, **A**, **B** or **C**, is most likely to show the electrical power output from a wind turbine over one day?

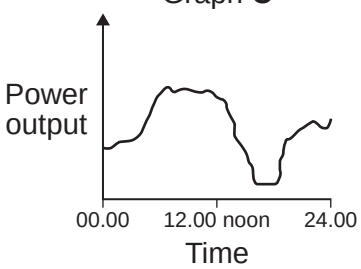
Graph **A**



Graph **B**



Graph **C**



Write the correct answer, **A**, **B** or **C**, in the box.

Give a reason for your answer.

.....

.....

.....

(2 marks)

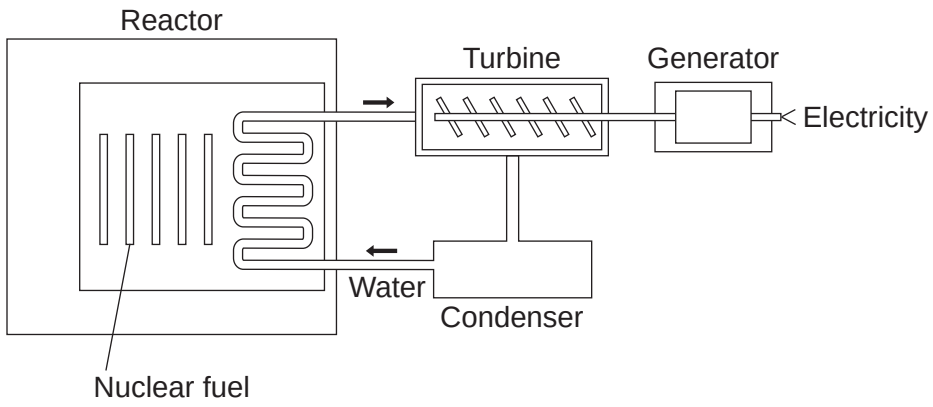
6

4.1.3 National and global energy resources

Question 81

June 2013 | PH2FP | Original Q5 | Legacy

5 Nuclear power stations use the energy released from nuclear fuels to generate electricity.



5 (a) Which substance do the majority of nuclear reactors use as fuel?

Draw a ring around your answer.

plutonium-239 **thorium-232** **uranium-235**

(1 mark)

5 (b) Energy is released from nuclear fuels by the process of nuclear fission.

Describe what happens to the nucleus of an atom during nuclear fission.

.....

.....

.....

.....

(2 marks)

5 (c) Use words from the box to complete each sentence.

condenser	**gas**	**generator**	**reactor**	**steam**	**turbine**

The energy released from the nuclear fuel is used to heat water. The water turns into

..... and this is used to drive a ..... .

This turns a ..... to produce electricity.

(3 marks)

6

4.1.3 National and global energy resources

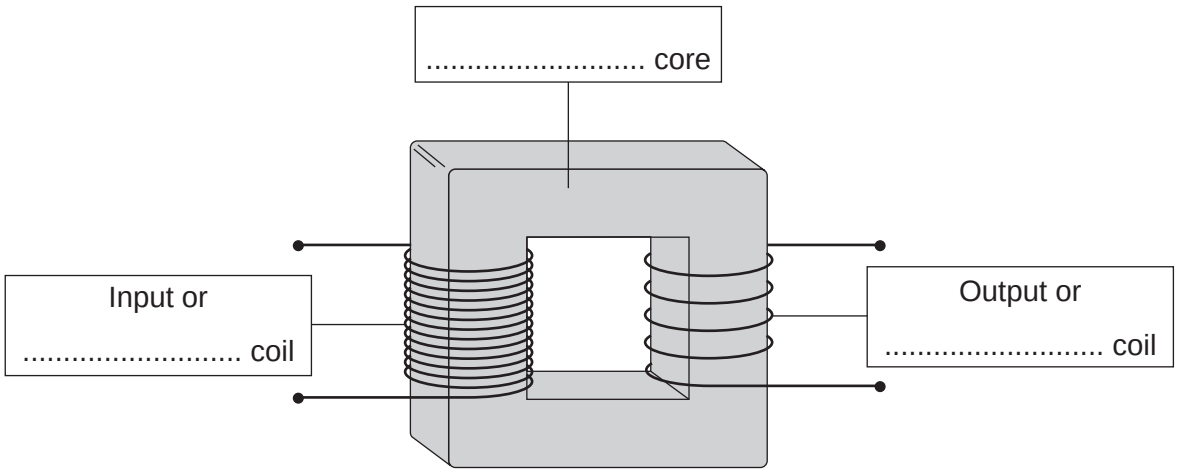
Question 82

June 2013 | PH3FP | Original Q2 | Legacy

2 (a) The diagram shows the structure of a traditional transformer.

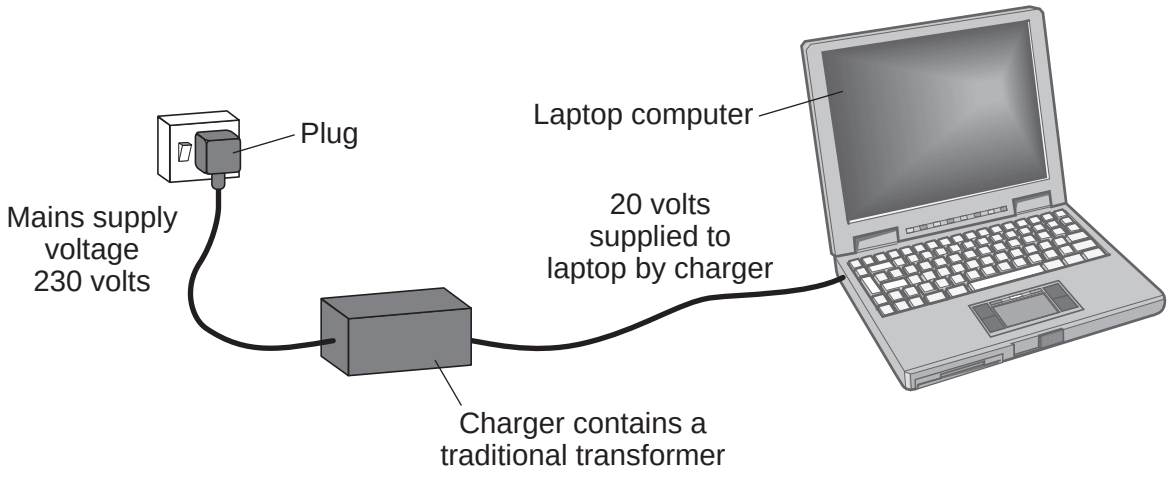
Use words from the box to label the diagram.

aluminium	**brass**	**iron**	**large**	**primary**	**secondary**



(3 marks)

2 (b) Batteries inside laptop computers are charged using laptop chargers. The laptop charger contains a traditional transformer.



Question 82 · continued

The laptop charger contains a step-down transformer.

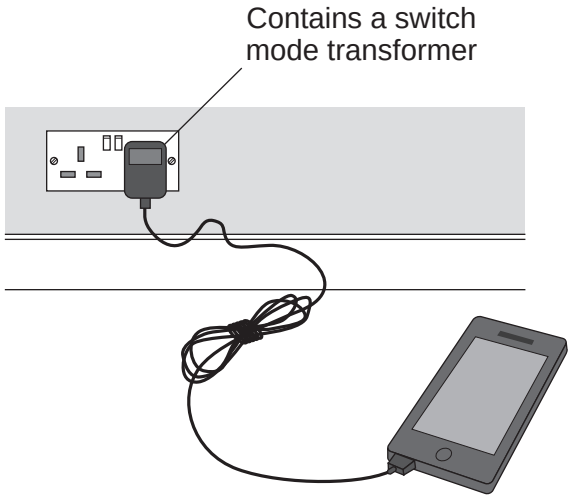
What does a step-down transformer do?

.....

.....

(1 mark)

2 (c) The transformer used in a modern mobile phone charger is a switch mode transformer. This is different to the traditional transformer used in the laptop charger.



Give **one** advantage of using a switch mode transformer, rather than a traditional transformer.

.....

.....

(1 mark)

2 (d) Laptop batteries and mobile phone batteries can only be recharged a limited number of times. When a battery cannot be recharged, it is better to recycle the battery than to throw it away.

Draw a ring around the correct answer to complete the sentence.

The batteries are recycled mainly due to

an environmental
a political
a social

consideration.

(1 mark)

6

4.1.3 National and global energy resources

Question 83

June 2014 | PH1FP | Original Q4 | Legacy

4 Iceland is a country that generates most of its electricity using geothermal power stations and hydroelectric power stations.

4 (a) (i) Complete the following sentences to describe how some geothermal power stations work.

[3 marks]

In regions where volcanoes are active, the ground is hot.

Cold ..... is pumped down into the ground

and is ..... by hot rocks.

It returns to the surface as steam. The steam is used to turn a turbine.

The turbine drives a ..... to produce electricity.

4 (a) (ii) Which **one** of the following statements about geothermal power stations is true?

Tick (✓) **one** box.

[1 mark]

Geothermal power stations use fossil fuels. ☐

Geothermal power stations produce carbon dioxide. ☐

Geothermal power stations provide a reliable source of electricity. ☐

4.1.3 National and global energy resources

Question 83 · continued

4 (b) What is needed for a hydroelectric power station to be able to generate electricity?

Tick (✓) **one** box.

[1 mark]

Falling water ☐

A long coastline ☐

Lots of sunny days ☐

5

Turn over for the next question

4.1.3 National and global energy resources

Question 84

June 2014 | PH1FP | Original Q7 | Legacy

7 Electricity can be generated using various energy sources.

7 (a) Give **one** advantage and **one** disadvantage of using nuclear power stations rather than gas-fired power stations to generate electricity.

[2 marks]

Advantage .....

.....

Disadvantage .....

.....

7 (b) (i) A single wind turbine has a maximum power output of 2 000 000 W.

The wind turbine operated continuously at maximum power for 6 hours.

Calculate the energy output in kilowatt-hours of the wind turbine.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy output = ... kWh

7 (b) (ii) Why, on average, do wind turbines operate at maximum power output for only 30% of the time?

[1 mark]

.....

.....

7 (c) An on-shore wind farm is made up of many individual wind turbines.

They are connected to the National Grid using underground power cables.

Give **one** advantage of using underground power cables rather than overhead power cables.

[1 mark]

.....

.....

6

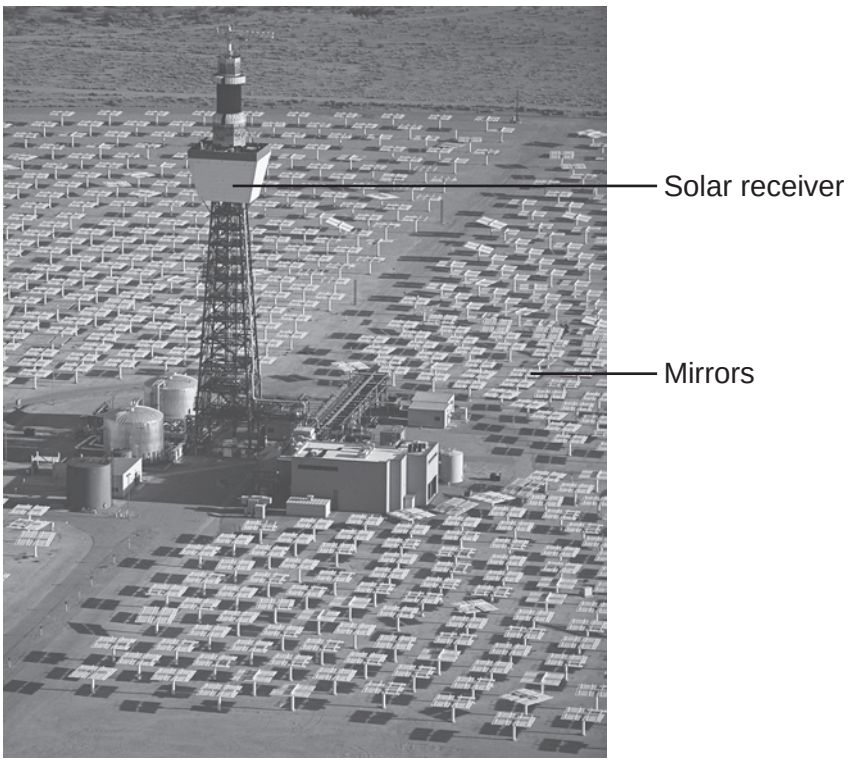
4.1.3 National and global energy resources

Question 85

June 2015 | PH1FP | Original Q5 | Legacy

5 **Figure 8** shows a solar thermal power station.

Figure 8



Energy from the Sun is directed at the solar receiver by many mirrors.

5 (a) (i) Suggest **one** reason why a solar thermal power station is built in a hot desert.

[1 mark]

.....

.....

5 (a) (ii) Complete the following sentence to describe how the mirrors direct energy from the Sun towards the solar receiver.

[1 mark]

Energy from the Sun is ..... by the mirrors towards the solar receiver.

Question 5 continues on the next page

4.1.3 National and global energy resources

Question 85 · continued

5 (a) (iii) Heated water is used to generate electricity in the solar thermal power station.
Choose the correct answer from the box to complete each sentence.

[3 marks]

boiler	**motor**	**transformer**	**turbine**

At the solar receiver, water is heated in a ..... which turns the water into steam. The steam turns a ..... which is connected to a generator. The generator produces electricity. A ..... is used to change the voltage for transmission along power lines.

5 (b) A solar storage power station is a new type of solar power station.
It is able to store energy from the Sun to generate electricity at night.

The solar storage power station can supply a town with a maximum electrical power of 140 000 kW for 15 hours.

Calculate the maximum energy, in kWh, stored by the solar storage power station.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy = ... kWh

4.1.3 National and global energy resources

Question 85 · continued June 2015 | PH1FP | Original Q5 | Legacy

5 (c) A different method of generating electricity uses wind turbines.
A student researching a wind farm wrote the following.

> Top Hill Wind Farm has 25 wind turbines.
> Last week, one of the wind turbines generated electricity for only 42 hours out of a possible 168 hours.
> My conclusion is that all wind turbines operate for only 25% of the time.

5 (c) (i) Give **two** reasons why the student is **not** correct in reaching his conclusion.

[2 marks]

1 .....

.....

2 .....

.....

5 (c) (ii) Give **one** reason why wind turbines do not generate electricity all the time.

[1 mark]

.....

.....

5 (c) (iii) Give **one** advantage of using wind turbines to generate electricity compared with using fossil fuel power stations.

[1 mark]

.....

.....

11

4.1.3 National and global energy resources

Question 86

June 2016 | PH1FP | Original Q1 | Legacy

1 Different energy sources are used to generate electricity.

1 (a) Use words from the box to match the correct energy source to each of the descriptions given in **Table 1**.

[3 marks]

biofuel	coal	geothermal	nuclear	waves

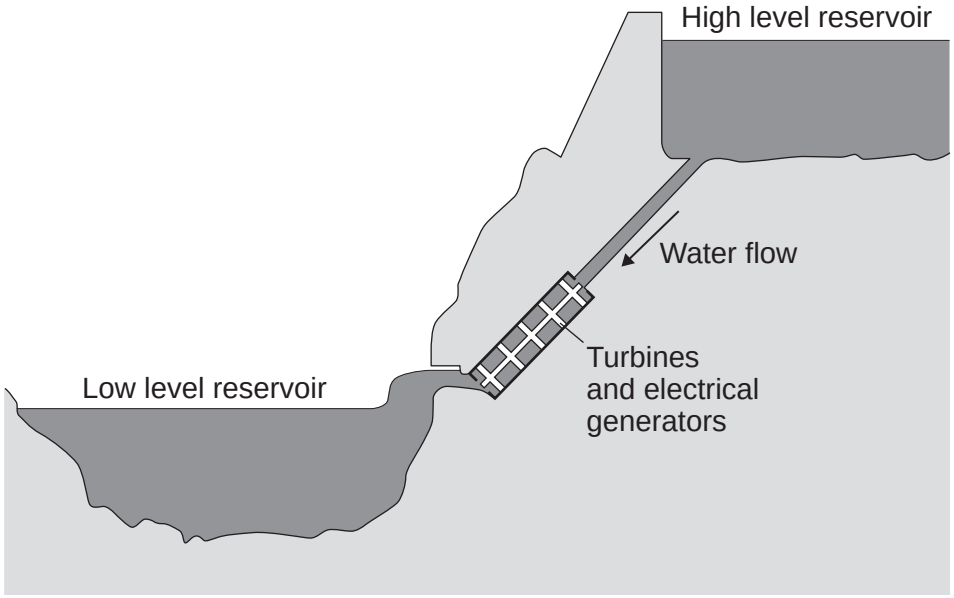
Table 1

Description	Energy source
Energy from the Earth's core is used to heat water.	
Fission of uranium nuclei is used to heat water.	
Gases from rotting plant material are burned to heat water.	

1 (b) Energy can be stored in a pumped storage power station.

Figure 1 shows a pumped storage power station.

Figure 1



Question 86 · continued

When electricity is needed, the water in the high level reservoir is allowed to flow to the low level reservoir. The flowing water generates electricity.

Use the correct answer from the box to complete each sentence.

[3 marks]

electrical	**gravitational potential**	**kinetic**	**nuclear**	**sound**

The water in the high level reservoir stores _____ energy.

The flowing water has _____ energy.

The water turns the turbine which is connected to the generator.

The generator produces some _____, this is wasted energy.

1 (c) The total power input to a pumped storage power station is 600 MW.

The useful power output is 540 MW.

1 (c) (i) Calculate the efficiency of this pumped storage power station.
Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Efficiency = _____

1 (c) (ii) Calculate how much power is wasted by the pumped storage power station.

[1 mark]

_____

Power = _____ MW

1 (c) (iii) How is the temperature of the surroundings affected by the energy wasted by the pumped storage power station?

[1 mark]

_____

10

4.1.3 National and global energy resources

Question 87

June 2016 | PH1FP | Original Q7 | Legacy

7 A small community of people live in an area in the mountains.
The houses are not connected to the National Grid.

The people plan to buy an electricity generating system that uses either the wind or the flowing water in a nearby river.

Figure 11 shows where these people live.

Figure 11



7 (a) It would not be economical to connect the houses to the National Grid.
Give **one** reason why.

[1 mark]

_____

_____

_____

_____

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

Information about the two electricity generation systems is given in **Figure 12**.

Figure 12

The wind turbine costs £50 000 to buy and install. The hydroelectric generator costs £20 000 to buy and install. The average power output from the wind turbine is 10 kW. The hydroelectric generator will produce a constant power output of 8 kW.

4.1.3 National and global energy resources

Question 87 · continued

Compare the advantages and disadvantages of the two methods of generating electricity.

Use your knowledge of energy sources as well as information from **Figure 12**.

[6 marks]

Extra space

7

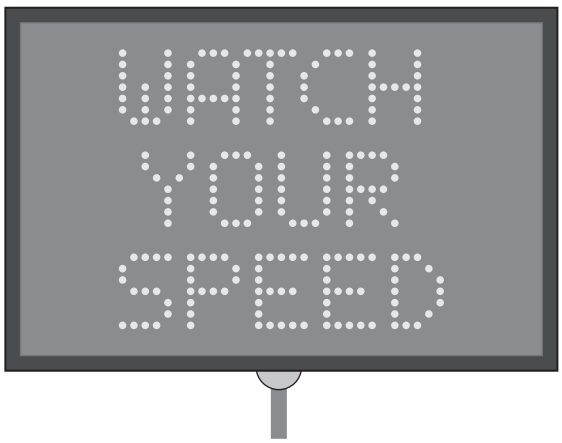
4.1.3 National and global energy resources

Question 88

June 2017 | PH1FP | Original Q2 | Legacy

2 **Figure 2** shows an electric road sign.

Figure 2

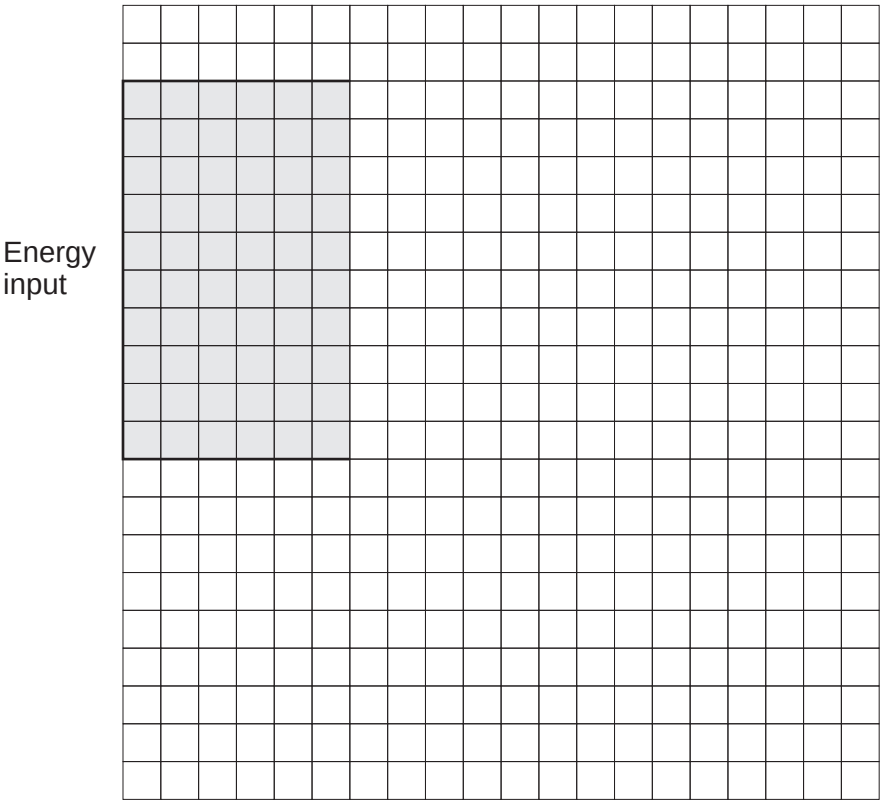


2 (a) The road sign is powered by an electrical generator which has an efficiency of 40%.

Complete the Sankey diagram in **Figure 3** for an electrical generator which has an efficiency of 40%.

[2 marks]

Figure 3



4.1.3 National and global energy resources

Question 88 · continued

2 (b) The road sign uses high efficiency LED bulbs. What does high efficiency mean?

Tick (✓) **one** box.

[1 mark]

	Tick (✓)
the bulbs have a high energy input	
a high proportion of the energy output is useful	
a high proportion of the energy output is wasted	

2 (c) Some road signs are powered by batteries recharged by solar cells.

In one sign the solar cells have a total power output of 200 W

Calculate the energy that the solar cells will transfer in 3600 seconds.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ J

2 (d) Some road signs are powered by batteries recharged by **both** solar cells and wind turbines.

Give **two** advantages of having **both** solar cells and wind turbines available to recharge the batteries.

[2 marks]

1 _____

2 _____

7

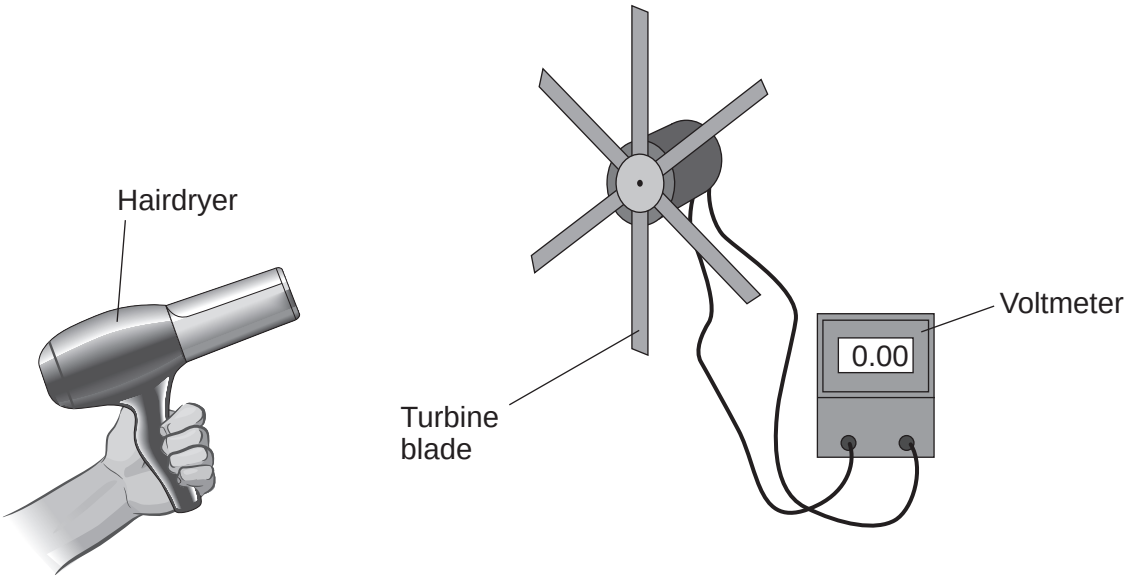
4.1.3 National and global energy resources

Question 89

June 2017 | PH1FP | Original Q7 | Legacy

7 A student investigated how the output voltage of a model wind turbine was affected by the number of turbine blades. The equipment he used is shown in **Figure 11**.

Figure 11



7 (a) Suggest **two** factors, other than the number of turbine blades, that will affect the output voltage of the model wind turbine.

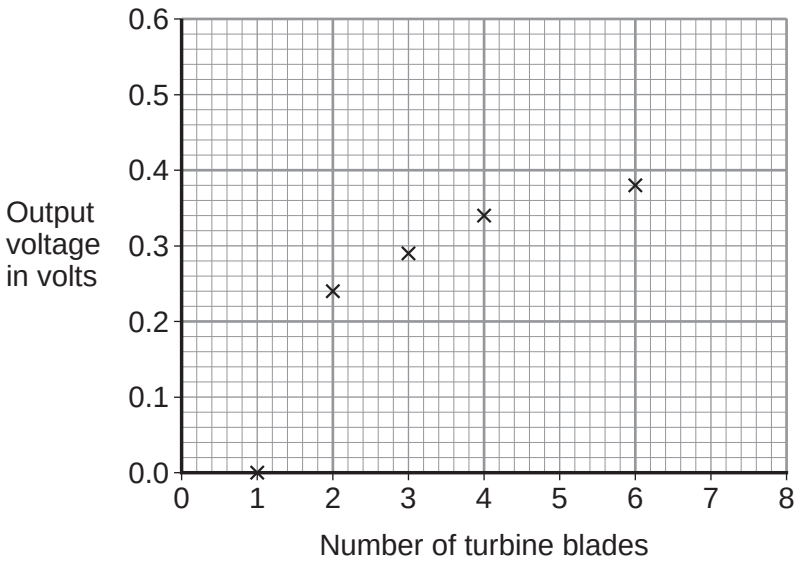
[2 marks]

1 _____

2 _____

7 (b) Some of the student's results are shown in **Figure 12**.

Figure 12



Question 89 · continued

7 (b) (i) Plot the remaining results in **Figure 12** using the data in **Table 2**.

[2 marks]

Table 2

Number of turbine blades	Output Voltage in volts
5	0.39
7	0.50
8	0.56

7 (b) (ii) The output voltage for 6 turbine blades is lower than expected. The low value was caused by a measurement error.

State the name of this type of measurement error.

[1 mark]

_____

7 (b) (iii) What **two** conclusions can be made from the student's results as the number of blades is increased from 1 to 4?

[2 marks]

1 _____

_____

2 _____

_____

7 (c) Commercial wind turbines can be manufactured with a number of blades between 2 and 8.

Suggest **two** factors that manufacturers would need to consider when designing and constructing commercial wind turbines.

[2 marks]

1 _____

_____

2 _____

_____

9

4.1.3 National and global energy resources

Question 90

June 2017 | PH1FP | Original Q9 | Legacy

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

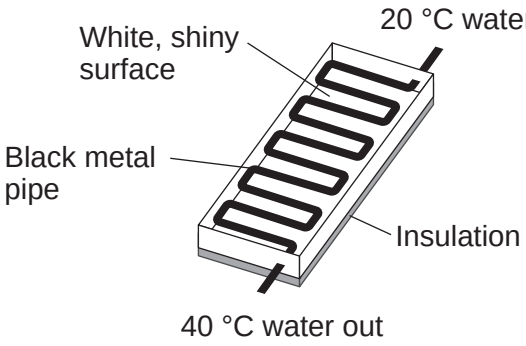
Solar panels use energy from the Sun to heat water.

Two different designs of solar panel are shown in **Figure 14**.

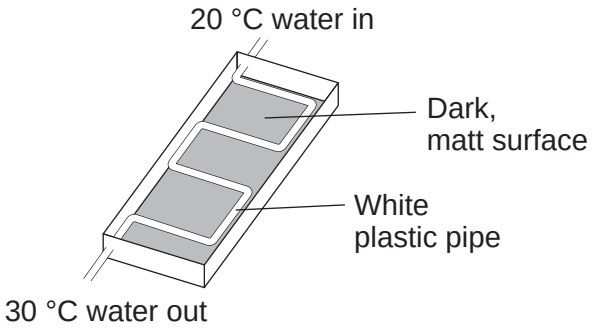
Both designs have the same water flow rate.

Figure 14

Design A



Design B



Explain why **Design A** is better than **Design B** at heating water.

[6 marks]

4.1.3 National and global energy resources

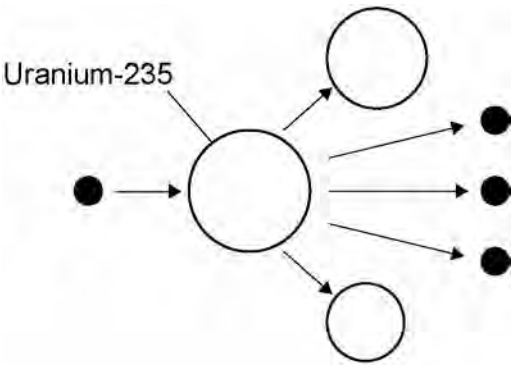
Question 91

June 2018 | 8463/1F | Original Q6

0 6 Nuclear power can be used to generate electricity through nuclear fission.

Figure 6 shows the process of nuclear fission.

Figure 6



0 6 . 1 Complete the sentences.

Choose answers from the box.

[3 marks]

gamma rays	**light rays**	**proton**	**neutron**	**nucleus**	**X-rays**

During the process of nuclear fission a uranium _____

absorbs a _____ .

Electromagnetic radiation is released in the form of _____ .

0 6 . 2 The UK needs at least 25 000 000 kW of electrical power at any time.

A nuclear power station has an electrical power output of 2 400 000 kW

Calculate how many nuclear power stations are needed to provide 25 000 000 kW of electrical power.

[2 marks]

_____

_____

_____

_____

Number of nuclear power stations = _____

4.1.3 National and global energy resources

Question 91 · continued

0 6 . 3 State **two** environmental issues caused by generating electricity using nuclear power stations.

[2 marks]

1 _____

_____

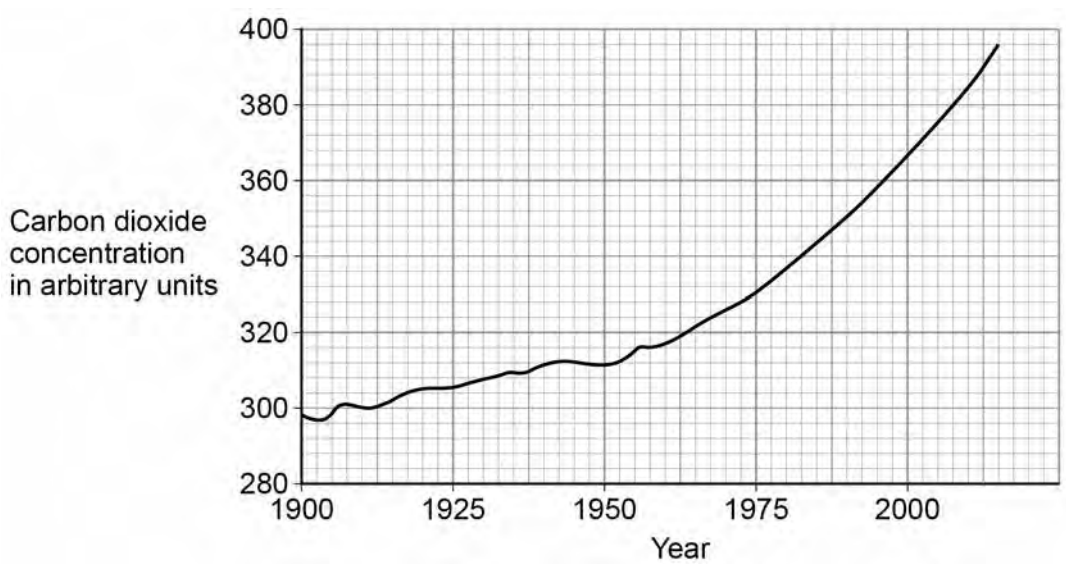
2 _____

_____

0 6 . 4 The UK currently generates a lot of electricity by burning natural gas. This process releases carbon dioxide into the atmosphere.

Figure 7 shows how the concentration of carbon dioxide in the atmosphere has changed over the past 115 years.

Figure 7

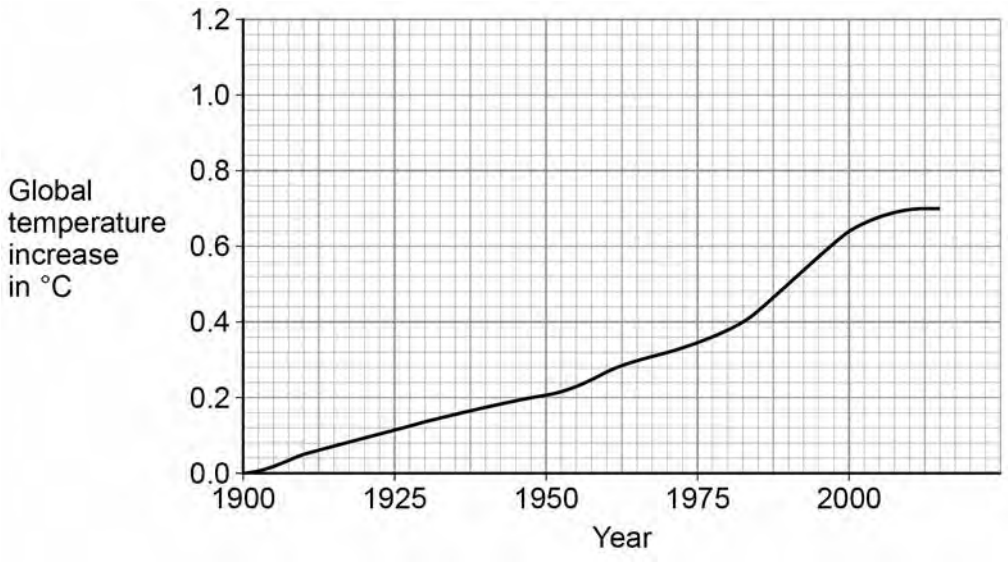


4.1.3 National and global energy resources

Question 91 · continued

Figure 8 shows how the global temperature has changed over the past 115 years.

Figure 8



Give **one** similarity and **one** difference between the data in **Figure 7** and **Figure 8**.

[2 marks]

Similarity _____

_____

_____

Difference _____

_____

_____

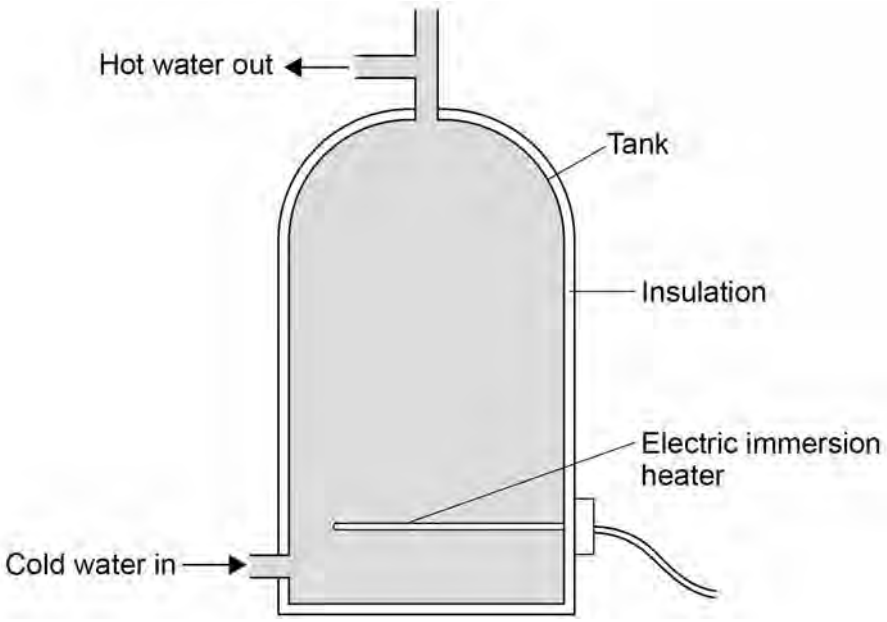
9

4.1.3 National and global energy resources

Question 92

0 8 **Figure 10** shows a hot water tank made of copper.

Figure 10



0 8 . 1 Copper has a higher thermal conductivity than most metals.

How does the rate of energy transfer through copper compare with the rate of energy transfer through most metals?

Tick **one** box.

[1 mark]

Higher ☐

Lower ☐

The same ☐

4.1.3 National and global energy resources

Question 92 · continued

0 8 . 2 The tank is insulated. When the water is hot, the immersion heater switches off.

Complete the sentences.

[2 marks]

Compared to a tank with no insulation, the rate of energy transfer from the water in an insulated tank is _____ .

This means that the water in the insulated tank stays _____ for longer.

Question 8 continues on the next page

Question 92 · continued

Figure 11 shows how temperature varies with time for water in a tank heated with an immersion heater.

Figure 12 shows how temperature varies with time for water in a tank heated with a solar panel.

Figure 11

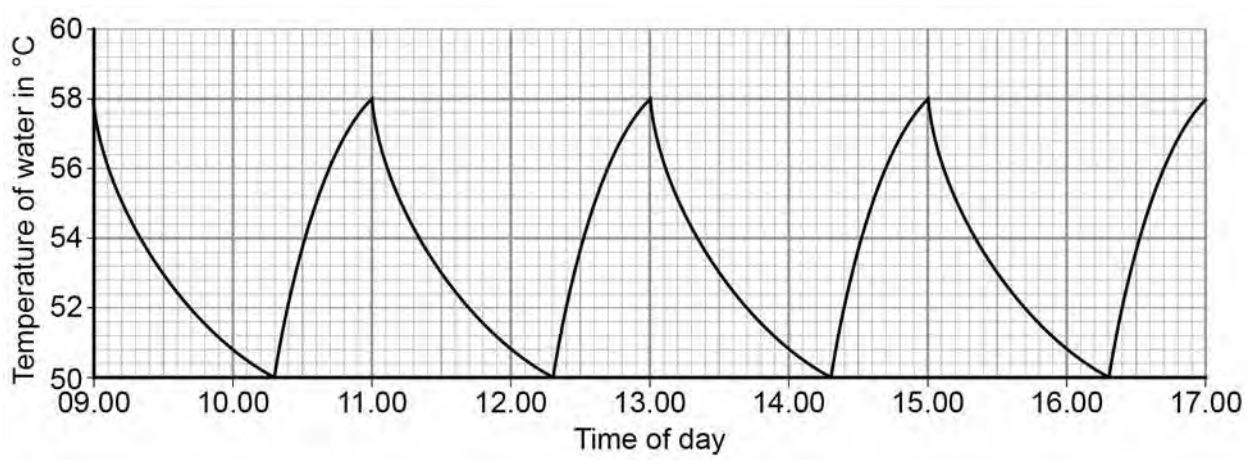
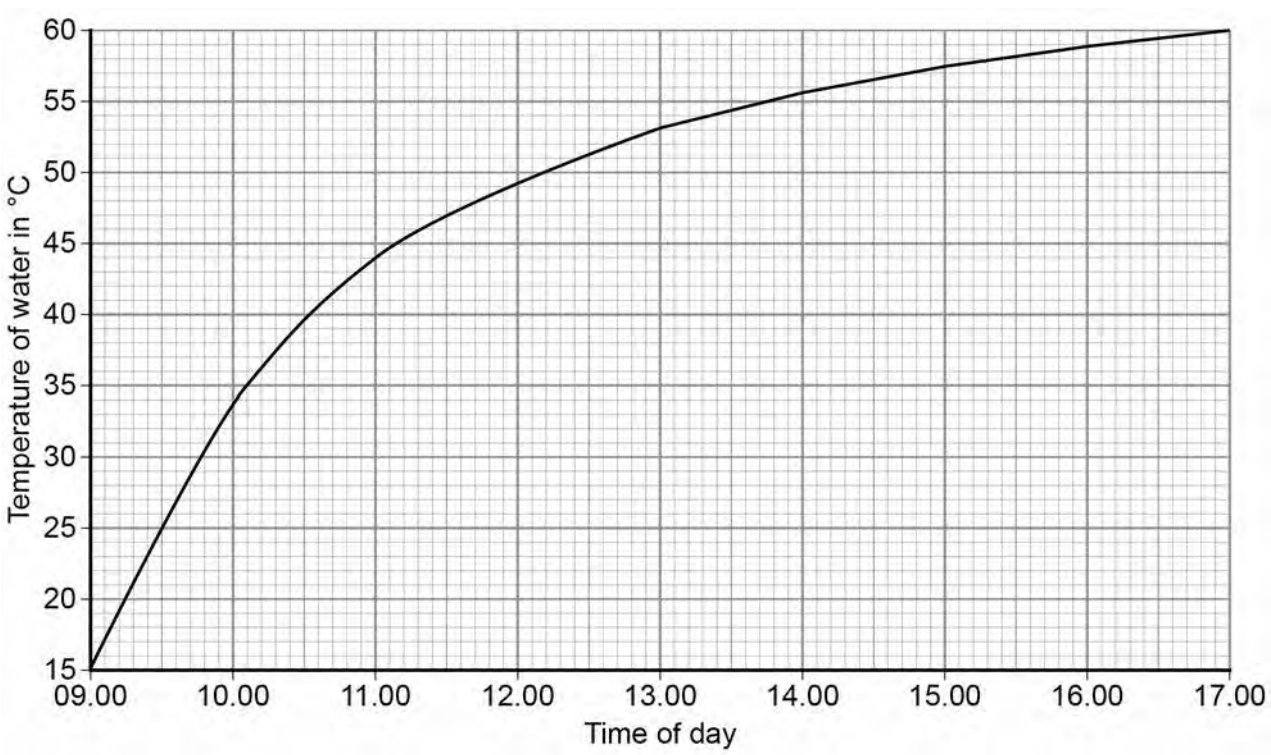


Figure 12



4.1.3 National and global energy resources

Question 92 · continued

0 8 . 3 Give **one** advantage and **one** disadvantage of heating the water using solar panels rather than an immersion heater.

Use only information from **Figure 11** and **Figure 12**.

[2 marks]

Advantage of solar panels _____

_____

_____

Disadvantage of solar panels _____

_____

_____

0 8 . 4 During one morning, a total of 4 070 000 J of energy is transferred from the electric immersion heater.

4 030 000 J of energy are transferred to the water.

Calculate the proportion of the total energy transferred to the water.

[2 marks]

_____

_____

_____

_____

Proportion of total energy = _____

Question 8 continues on the next page

4.1.3 National and global energy resources

Question 92 · continued

0 8 . 5 Write down the equation that links energy transferred, power and time.

[1 mark]

0 8 . 6 The power output of the immersion heater is 5000 W.

Calculate the time taken for the immersion heater to transfer 4 070 000 J of energy.

Give the unit.

[4 marks]

Time = _____ Unit _____

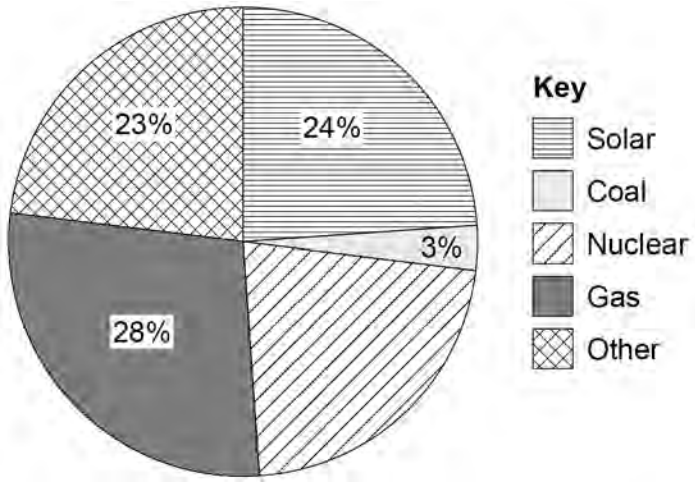
4.1.3 National and global energy resources

Question 93

June 2019 | 8463/1F | Original Q5

0 5 **Figure 6** shows how different energy resources were used in the United Kingdom (UK) to generate electricity on one day in June 2018.

Figure 6



0 5 . 1 The UK government plans to stop using coal-fired power stations by 2025.

Explain **one** environmental problem caused when electricity is generated by burning coal.

[2 marks]

0 5 . 2 Give **two** renewable energy resources that could make up the 'Other' energy resources in **Figure 6**.

[2 marks]

1

2

4.1.3 National and global energy resources

Question 93 · continued

0 5 . 3 Determine the percentage of electricity generated in nuclear power stations that day.

Use data from **Figure 6**.

[2 marks]

Percentage of electricity generated in nuclear power stations = _____ %

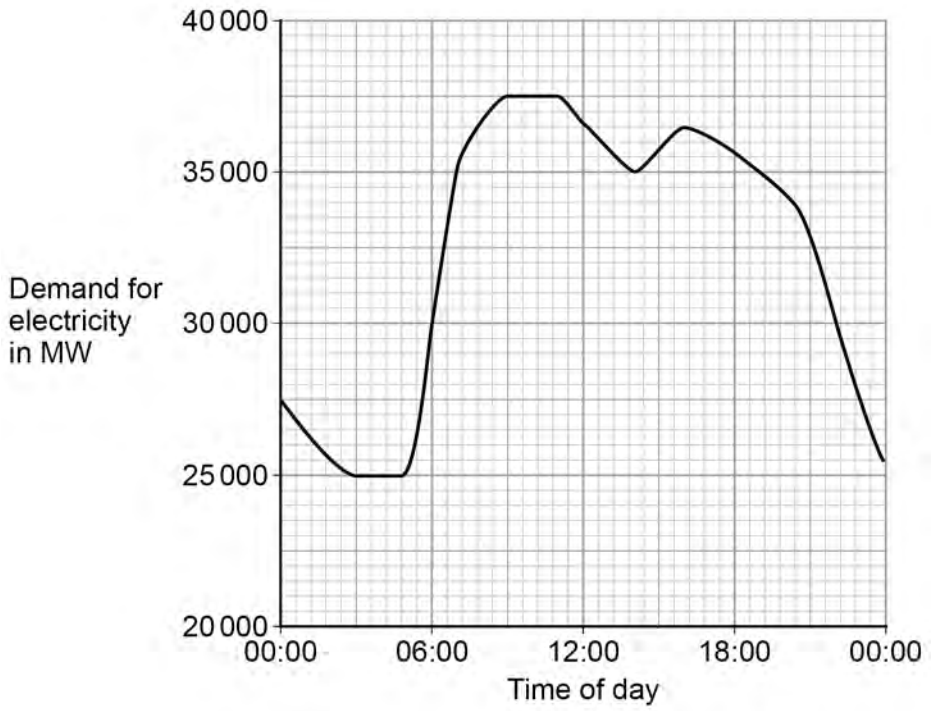
Question 5 continues on the next page

4.1.3 National and global energy resources

Question 93 · continued

Figure 7 shows how the demand for electricity varied with the time of day.

Figure 7



0 5 . 4 What was the difference between the maximum demand and minimum demand for electricity during this day?

[2 marks]

Difference = _____ MW

4.1.3 National and global energy resources

Question 93 · continued

0 5 . 5 **Figure 7** shows that the demand for electricity increased between 06:00 and 09:00

Solar power could have met the demand if there were enough solar panels installed in the UK.

Explain why.

[2 marks]

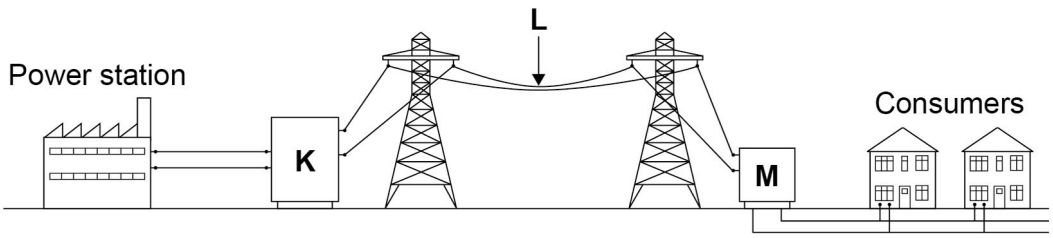
Turn over for the next question

4.1.3 National and global energy resources

Question 94

0 1 **Figure 1** shows how the National Grid connects power stations to consumers.

Figure 1



0 1 . 1 Name the parts of the National Grid labelled K, L and M.

[3 marks]

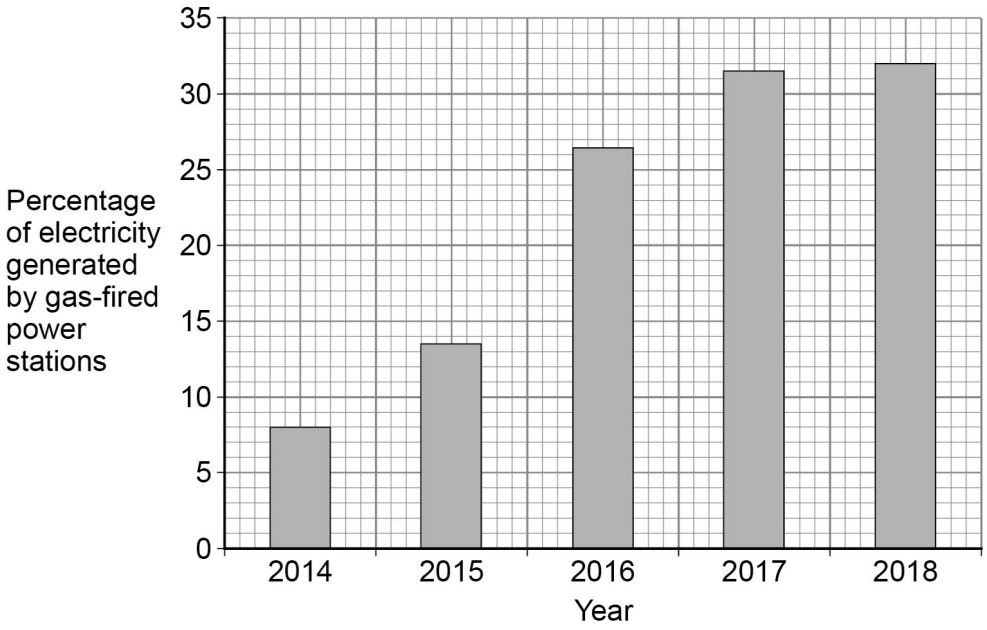
K = _____

L = _____

M = _____

Figure 2 shows how the percentage of electricity generated by gas-fired power stations changed in the UK over 5 years.

Figure 2



4.1.3 National and global energy resources

Question 94 · continued

0 1 . 2 Calculate how many times greater the percentage of electricity generated by gas-fired power stations was in 2018 than in 2014.

[2 marks]

Number of times greater = _____

0 1 . 3 Explain **one** environmental effect of generating electricity using a gas-fired power station.

[2 marks]

0 1 . 4 The UK government wants more electricity to be generated using renewable energy resources.

What is a renewable energy resource?

[1 mark]

Tick (✓) **one** box.

- An energy resource that can be burned ☐
- An energy resource that can be recycled ☐
- An energy resource that can be replenished quickly ☐
- An energy resource that can be reused ☐

Question 1 continues on the next page

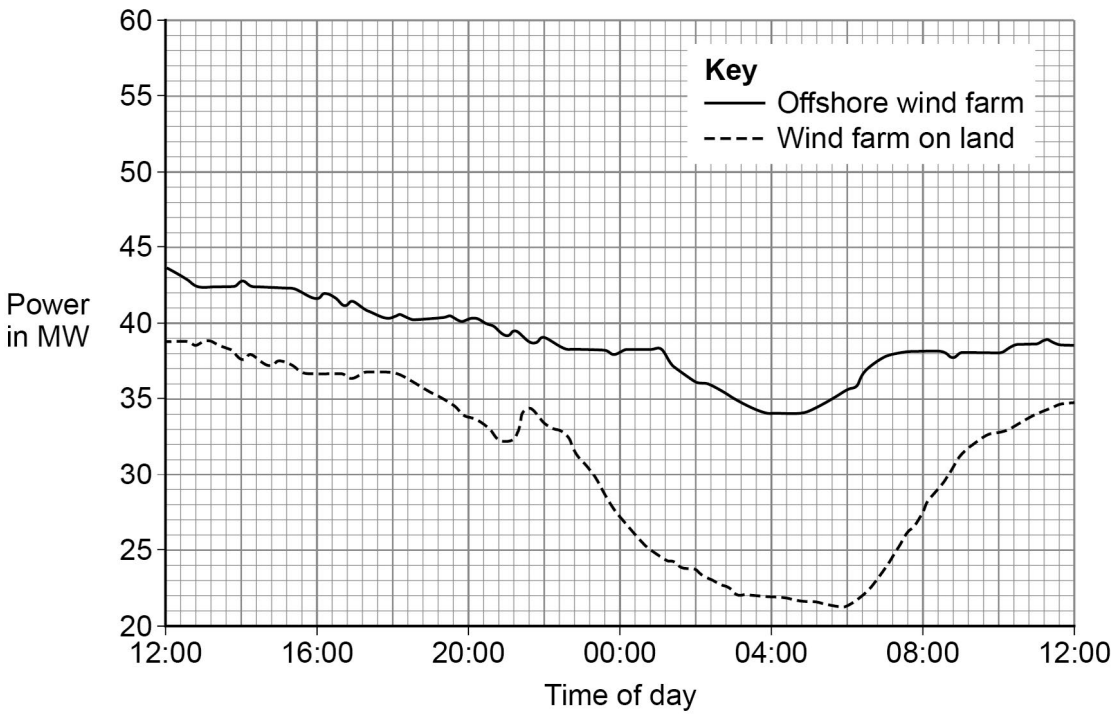
4.1.3 National and global energy resources

Question 94 · continued

0 1 . 5 An offshore wind farm is a group of wind turbines that are placed out at sea.

Figure 3 shows the power output of an offshore wind farm compared with a wind farm on land for a 24-hour period.

Figure 3



Give **two** advantages of the offshore wind farm compared with the wind farm on land.

Use information from **Figure 3**.

[2 marks]

1 _____

_____

2 _____

_____

10

4.1.3 National and global energy resources

Question 95

November 2020 | 8463/1F | Original Q5

0 5 Radioactive waste from nuclear power stations is a man-made source of background radiation.

0 5 . 1 Which of the following is also a man-made source of background radiation?

[1 mark]

Tick (✓) **one** box.

- cosmic rays ☐
- radiotherapy ☐
- rocks ☐
- stars ☐

0 5 . 2 Nuclear power stations use the process of nuclear fission.

Complete the sentences to describe the process of nuclear fission.

Choose answers from the box.

[3 marks]

a neutron	**a proton**		**an electron**
cosmic rays	**energy**	**gamma rays**	**x-rays**

An unstable nucleus absorbs _____ and splits into two parts.

Two or three neutrons are released, as well as _____

and _____ .

Question 95 · continued

0 5 . 3 Plutonium-239 is one type of radioactive waste from nuclear power stations.

The following nuclear equation represents the decay of plutonium-239 (Pu-239).

$$^{239}_{94}Pu \rightarrow {}^{235}_{92}U + {}^{4}_{2}He$$

How does the nuclear equation show that alpha radiation is emitted when plutonium-239 decays?

[1 mark]

Tick (✓) **one** box.

An alpha particle contains 92 protons. ☐

An alpha particle has a mass number of 235. ☐

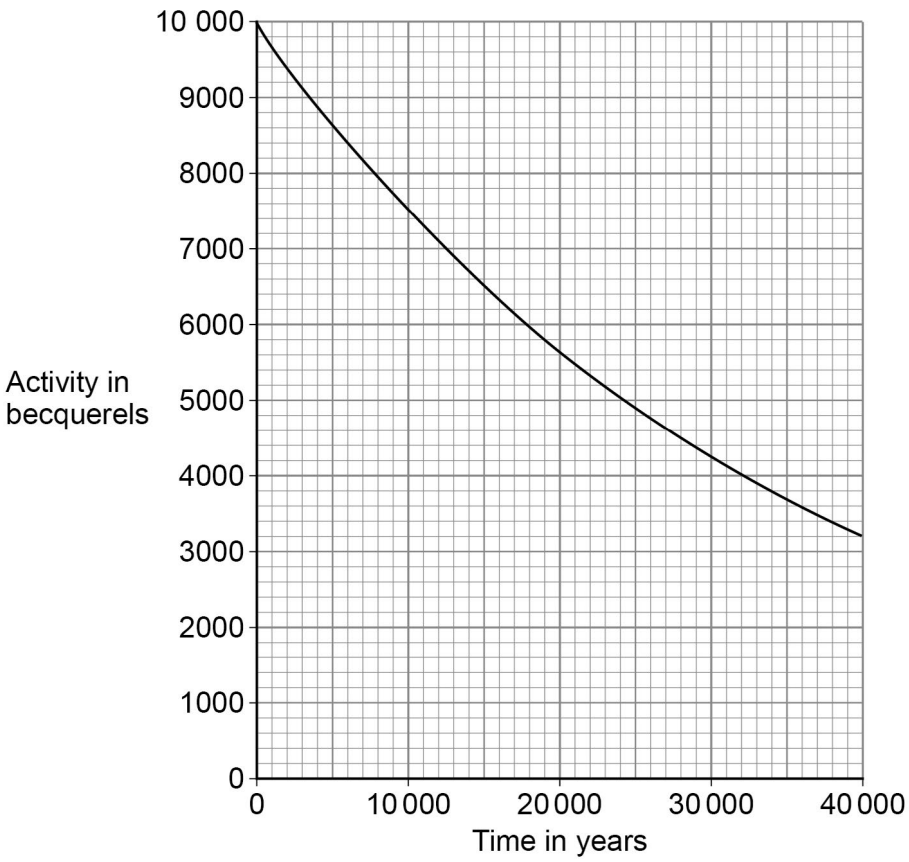
An alpha particle is the same as a helium nucleus. ☐

Question 5 continues on the next page

Question 95 · continued

Figure 8 shows how the activity of a sample of plutonium-239 varies with time.

Figure 8



0 5 . 4 How much time will it take for the activity of the sample of plutonium-239 to fall to half of its initial activity?

[1 mark]

Time = _____ years

0 5 . 5 What is the half-life of plutonium-239?

[1 mark]

Half-life = _____ years

4.1.3 National and global energy resources

Question 95 · continued

0 5 . 6 The radioactive waste from a nuclear power station is buried underground.

People are warned to stay away from places where radioactive waste is buried.

Suggest **one** risk of going near the place where radioactive waste is buried.

[1 mark]

8

Turn over for the next question

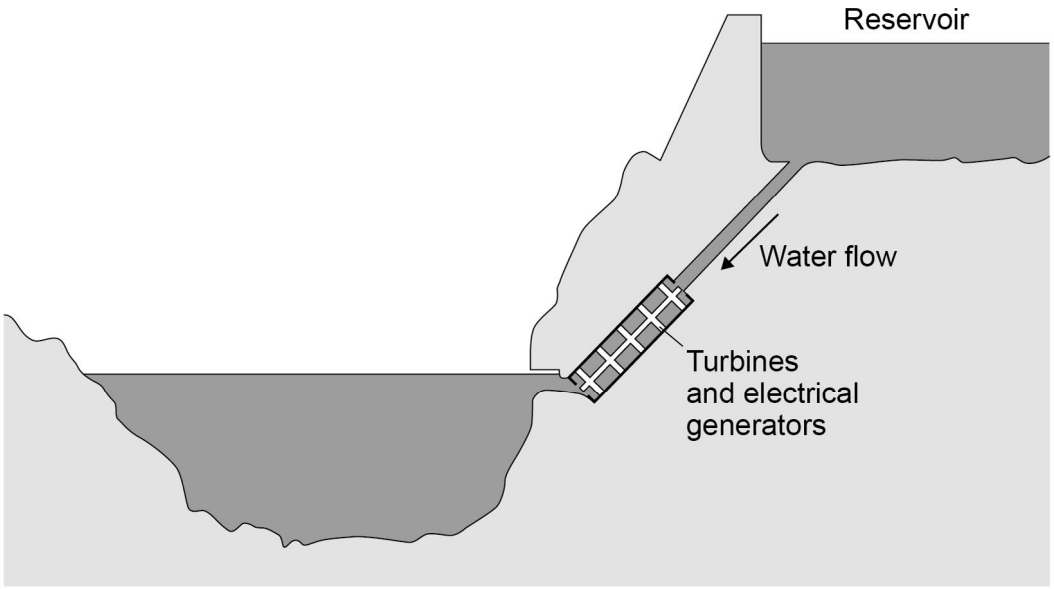
4.1.3 National and global energy resources

Question 96

November 2020 | 8463/1F | Original Q10

1 0 **Figure 14** shows a hydroelectric power station.

Figure 14



Electricity is generated when water from the reservoir flows through the turbines.

1 0 . 1 Write down the equation which links density (ρ), mass (m) and volume (V).

[1 mark]

1 0 . 2 The reservoir stores 6 500 000 m^3 of water.

The density of the water is 998 kg/m^3.

Calculate the mass of water in the reservoir.

Give your answer in standard form.

[4 marks]

Mass (in standard form) = _____ kg

4.1.3 National and global energy resources

Question 96 · continued

10.3 Write down the equation which links energy transferred (E), power (P) and time (t).

[1 mark]

10.4 The electrical generators can provide 1.5×10^9 W of power for a maximum of 5 hours.

Calculate the maximum energy that can be transferred by the electrical generators.

[3 marks]

Energy transferred = _____ J

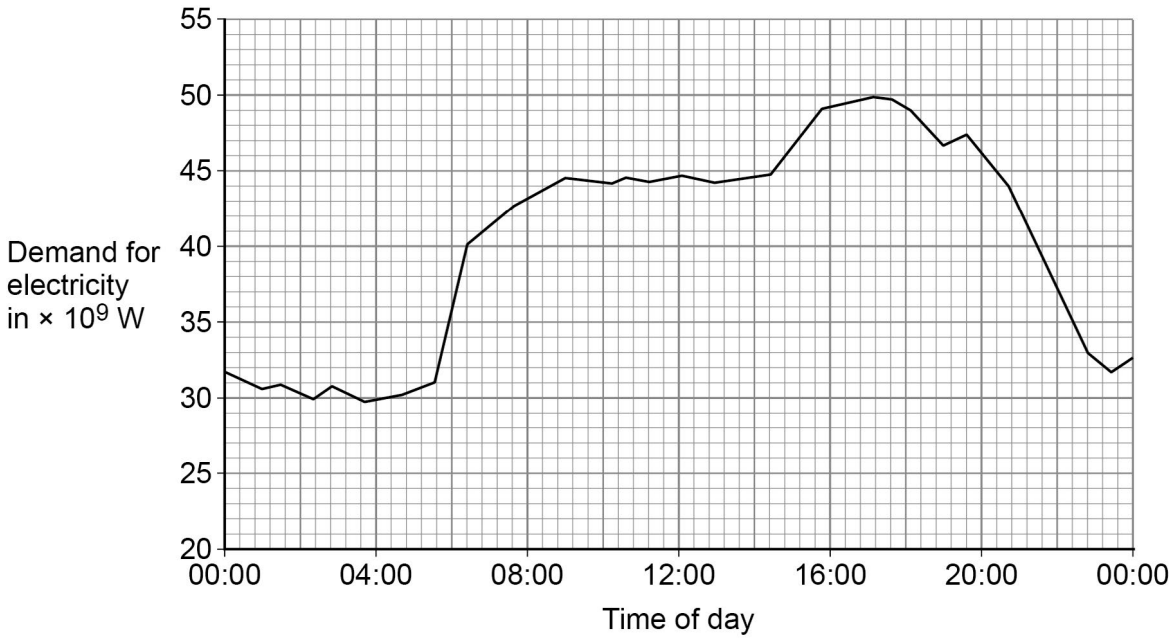
Question 10 continues on the next page

4.1.3 National and global energy resources

Question 96 · continued

1 0 . 5 **Figure 15** shows how the UK demand for electricity increases and decreases during one day.

Figure 15



The hydroelectric power station in **Figure 14** can provide 1.5×10^9 W of power for a maximum of 5 hours.

Give **two** reasons why this hydroelectric power station is not able to meet the increase in demand shown between 04:00 and 16:00 in **Figure 15**.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

11

4.1.3 National and global energy resources

Question 97

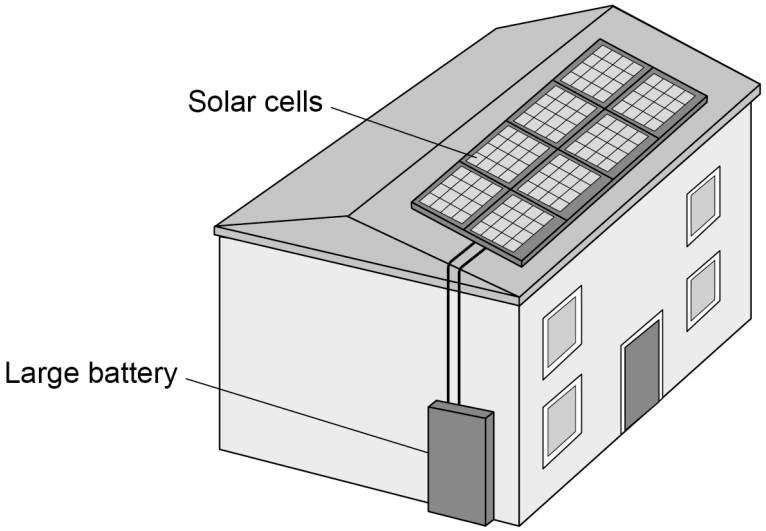
November 2021 | 8463/1F | Original Q6

0 6 **Figure 10** shows a house with a solar power system.

The solar cells generate electricity.

When the electricity generated by the solar cells is not needed, the energy is stored in a large battery.

Figure 10



0 6 . 1 The solar cells on the roof of the house always face in the same direction.

Explain **one** disadvantage caused by the solar cells only facing in one direction.

[2 marks]

4.1.3 National and global energy resources

Question 97 · continued

0 6 . 2 The mean current from the solar cells to the battery is 3.5 A.

Calculate the charge flow from the solar cells to the battery in 3600 seconds.

Use the equation:

charge flow = current × time

[2 marks]

Charge flow = _____ C

0 6 . 3 Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

0 6 . 4 At one time in the day, the total power input to the solar cells was 7500 W.

The efficiency of the solar cells was 0.16

Calculate the useful power output of the solar cells.

[3 marks]

Useful power output = _____ W

Question 6 continues on the next page

4.1.3 National and global energy resources

Question 97 · continued

0 6 . 5 The wasted energy that is **not** usefully transferred by the solar cells is dissipated.

What happens to energy that has been dissipated?

[1 mark]

Tick (✓) **one** box.

- The energy becomes less useful. ☐
- The energy is destroyed. ☐
- The energy is used to generate electricity. ☐

0 6 . 6 Why is it unlikely that all the UK's electricity needs could be met by solar power systems?

[1 mark]

Tick (✓) **one** box.

- A very large area would need to be covered with solar cells. ☐
- Solar power is a non-renewable energy resource. ☐
- The efficiency of solar cells is too high. ☐

10

4.1.3 National and global energy resources

Question 98

1 0 Energy from the Sun is released by nuclear fusion.

1 0 . 1 Complete the sentences.

[2 marks]

Nuclear fusion is the joining together of _____.

During nuclear fusion the total mass of the particles _____.

1 0 . 2 Nuclear fusion of deuterium is difficult to achieve on Earth because of the high temperature needed.

Electricity is used to increase the temperature of 4.0 g of deuterium by 50 000 000 °C.

specific heat capacity of deuterium = 5200 J/kg °C

Calculate the energy needed to increase the temperature of the deuterium by 50 000 000 °C.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

4.1.3 National and global energy resources

Question 98 · continued

10.3 The idea of obtaining power from nuclear fusion was investigated using models.

The models were tested before starting to build the first commercial nuclear fusion power station.

Suggest **two** reasons why models were tested.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

10.4 Generating electricity using nuclear fusion will have fewer environmental effects than generating electricity using fossil fuels.

Explain **one** environmental effect of generating electricity using fossil fuels.

[2 marks]

_____

_____

_____

_____

_____

9

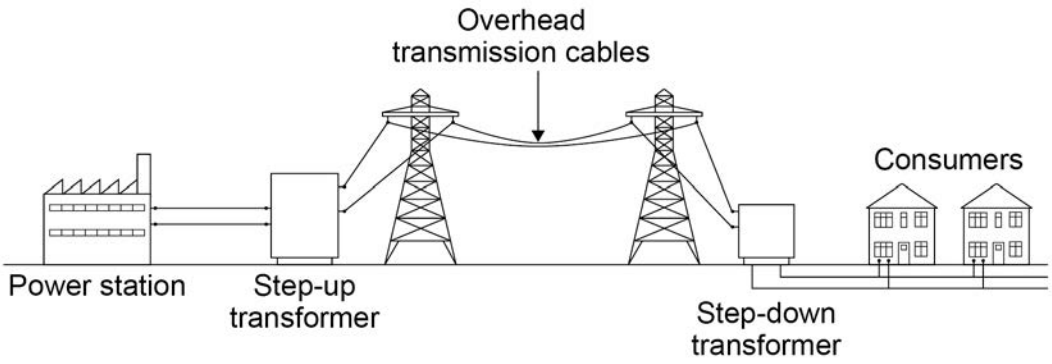
4.1.3 National and global energy resources

Question 99

June 2022 | 8463/1F | Original Q7

0 7 **Figure 8** shows how electricity is supplied to consumers.

Figure 8



0 7 . 1 Electricity from the power station can be generated using renewable or non-renewable energy resources.

Complete **Table 2** to show which energy resources are renewable and which are non-renewable.

[2 marks]

Tick (✓) **one** box in **each** row.

Table 2

Energy resource	Renewable	Non-renewable
biofuel		
coal		
nuclear		
tides		

Question 7 continues on the next page

4.1.3 National and global energy resources

Question 99 · continued

0 7 . 2 Transformers are used to make power transmission an efficient process.

Complete the sentences.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

[4 marks]

charge	**current**	**energy**
potential difference	**resistance**	

The step-up transformer increases the _____ and decreases the _____ .

Using the transformers decreases the _____ transfer from the overhead transmission cables to the surroundings.

The step-down transformer decreases the _____ .

4.1.3 National and global energy resources

Question 99 · continued

Use the Physics Equations Sheet to answer questions **07.3** and **07.4**.

0 7 . 3 Write down the equation which links charge flow (Q), current (I) and time (t).

[1 mark]

0 7 . 4 The town of Hornsdale in Australia has electricity supplied by a huge battery.

The battery supplies a current of 130 000 A.

Calculate the charge flow from the battery in 5 minutes.

Choose the unit from the box.

[4 marks]

coulombs	newtons	watts

Charge flow = _____ Unit _____

11

4.1.3 National and global energy resources

Question 100

June 2022 | 8463/1F | Original Q9

0 9 **Figure 13** shows a large wind farm off the coast of the UK.

Figure 13



The mean power output of the wind farm is 696 MW, which is enough power for 580 000 homes.

0 9 . 1 Calculate the mean power needed for 1 home.

Give your answer in watts.

[2 marks]

Mean power needed for 1 home = _____ W

4.1.3 National and global energy resources

Question 100 · continued

0 9 . 2 On one day the demand for electricity in the UK was 34 000 MW.

Suggest **two** reasons why wind power was not able to meet this demand.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

0 9 . 3 Some of the energy from the wind used to rotate a wind turbine is wasted.

An engineer oils the mechanical parts of a wind turbine.

Explain how oiling would affect the efficiency of the wind turbine.

[3 marks]

_____

_____

_____

_____

_____

0 9 . 4 In most homes in the UK there are many different electrical devices.

Explain why people should be encouraged to use energy efficient electrical devices.

[2 marks]

_____

_____

_____

_____

_____

9

4.1.3 National and global energy resources

Question 101

June 2023 | 8463/1F | Original Q3

0 3 Some isotopes emit nuclear radiation.

0 3 . 1 Carbon-12 and carbon-14 are both isotopes of carbon.

Complete the sentences.

Choose answers from the box.

[2 marks]

alpha particles	**electrons**	**neutrons**	**protons**

The nucleus of a carbon-12 atom and the nucleus of a carbon-14 atom have the **same** number of _____ .

The nucleus of a carbon-12 atom and the nucleus of a carbon-14 atom have a **different** number of _____ .

0 3 . 2 Different radioactive isotopes have different half-lives.

What does 'half-life' mean?

[1 mark]

Tick (✓) **one** box.

- Half the time taken for all of the nuclei in a sample to decay. ☐
- The time taken for half the nuclei in a sample to decay. ☐
- The time taken for one nucleus to split in half. ☐

Question 3 continues on the next page

4.1.3 National and global energy resources

Question 101 · continued

0 3 . 3 **Table 2** shows the half-life of some different isotopes of carbon.

Table 2

Isotope	Half-life in seconds
Carbon-15	2.45
Carbon-16	0.75
Carbon-17	0.19
Carbon-18	0.09

Which isotope is the least stable?

[1 mark]

Tick (✓) **one** box.

Carbon-15 ☐

Carbon-16 ☐

Carbon-17 ☐

Carbon-18 ☐

4.1.3 National and global energy resources

Question 101 · continued

0 3 . 4 Workers in nuclear power stations must be aware of nuclear irradiation and radioactive contamination.

Draw **one** line from each term to an example of the term.

[2 marks]

Term	Example
	Exposure to a beam of gamma rays
Radioactive contamination	Exposure to ultraviolet radiation from the Sun
Nuclear irradiation	Accidental transfer of plutonium onto a human body
	Using a mobile phone

Question 3 continues on the next page

4.1.3 National and global energy resources

Question 101 · continued

0 3 . 5 Why are workers required to walk across a sticky floor before leaving the nuclear power station?

[1 mark]

Tick (✓) **one** box.

To remove alpha particles from their shoes. ☐

To remove gamma radiation from their shoes. ☐

To remove radioactive dust from their shoes. ☐

0 3 . 6 The places where people work and live contribute to the nuclear radiation they are exposed to.

Table 3 shows the mean daily dose of radiation caused by two different jobs.

Table 3

Job	Mean daily dose in mSv
Aeroplane pilot	0.072
Nuclear power station worker	0.00050

Calculate the number of days a nuclear power station worker must work before receiving the same dose that an aeroplane pilot receives in one day.

[2 marks]

Number of days = _____

4.1.3 National and global energy resources

Question 101 · continued

0 3 . 7 The process of nuclear fission takes place in nuclear power stations.

The process of nuclear fusion takes place in the Sun.

Draw **one** line from each process to its fuel.

[2 marks]

Process	Fuel
	Hydrogen
Nuclear fission	Iron
Nuclear fusion	Lead
	Uranium

11

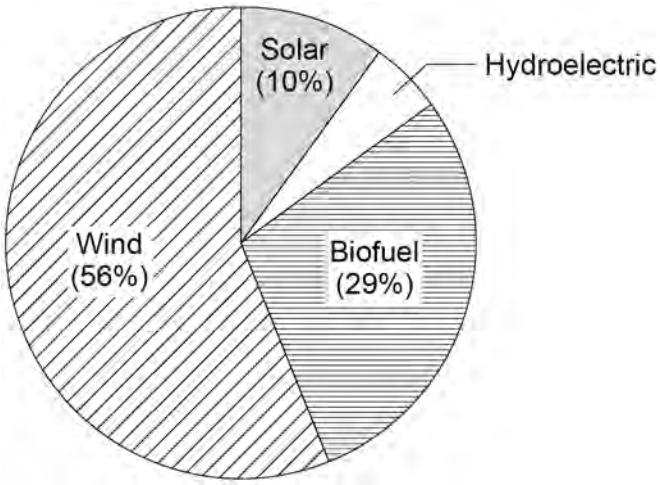
4.1.3 National and global energy resources

Question 102

0 4 The UK uses renewable energy resources to generate some of its electricity.

Figure 4 shows the proportion of electricity generated by different renewable energy resources in the UK in 2020.

Figure 4



0 4 . 1 Calculate the percentage of electricity generated using hydroelectric power.

[2 marks]

Percentage = _____ %

Question 102 · continued

A remote village in the UK uses a hydroelectric generator to provide electricity.

0 4 . 2 The mass of water that passes through the hydroelectric generator each day is 2 500 000 kg.

The change in vertical height of the water is 15.0 m.

gravitational field strength = 9.8 N/kg

Calculate the decrease in gravitational potential energy of the water.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Decrease in gravitational potential energy = _____ J

Question 4 continues on the next page

4.1.3 National and global energy resources

Question 102 · continued

Use the Physics Equations Sheet to answer questions **04.3** and **04.4**.

0 4 . 3 Write down the equation which links energy (*E*), power (*P*) and time (*t*).

[1 mark]

0 4 . 4 The hydroelectric generator transfers electrical power of 3000 W to the village.

Calculate the energy transferred to the village in 60 minutes.

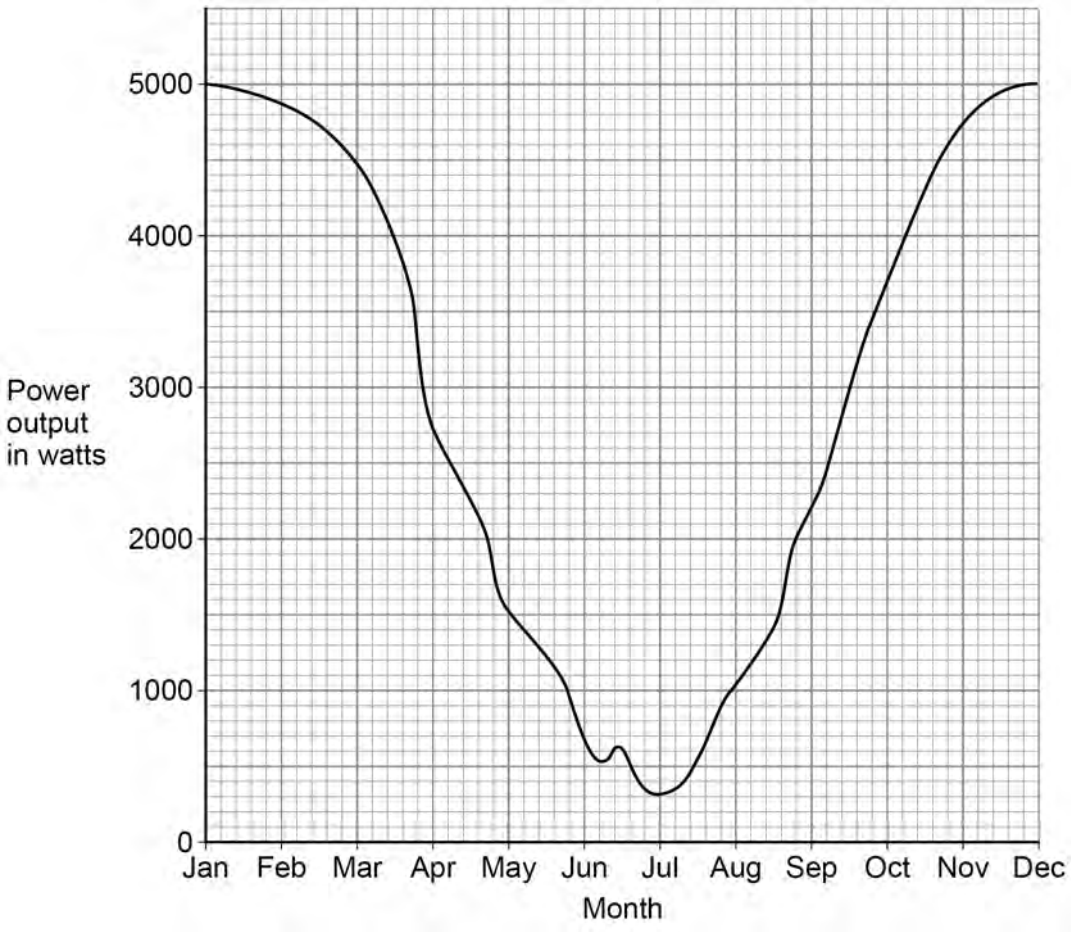
[3 marks]

Energy transferred = _____ J

0 4 . 5 The hydroelectric generator is turned by falling river water.

Figure 5 shows how the power output of the hydroelectric generator varied during one year.

Figure 5



Explain **one** reason why the power output varied.

[2 marks]

10

4.1.3 National and global energy resources

Question 103

June 2024 | 8463/1F | Original Q9

0 9 **Figure 16** shows a wind turbine.

Figure 16



Wind turbines may generate electricity when the electricity is not needed.

Two methods that can be used to store the energy from the turbine are:

Method A: Heating water to a high temperature.

Method B: Pumping water uphill into a reservoir.

0 9 . 1 Which energy store increases when water is heated?

[1 mark]

0 9 . 2 Which energy store increases when water is pumped uphill into a reservoir?

[1 mark]

0 9 . 3 **Table 4** shows information about the two methods of storing energy.

Table 4

Method	Energy stored per 100 kg of water in kJ	Percentage of stored energy wasted	Installation
A: Increasing water temperature by 80 °C	33 600	40%	Anywhere
B: Pumping water uphill to a height of 500 m	490	25%	High mountains

Compare the advantages and disadvantages of the two methods of storing energy.

Include calculations in your answer.

[4 marks]

Question 9 continues on the next page

4.1.3 National and global energy resources

Question 103 · continued

0 9 . 4 Decreasing the amount of carbon dioxide released by different activities will help slow down climate change.

Transport and generating electricity are the two activities that released the largest amounts of carbon dioxide in the UK in 2018.

Explain **one** change that would reduce the amount of carbon dioxide released by **each** activity.

[4 marks]

Transport _____

Generating electricity _____

10

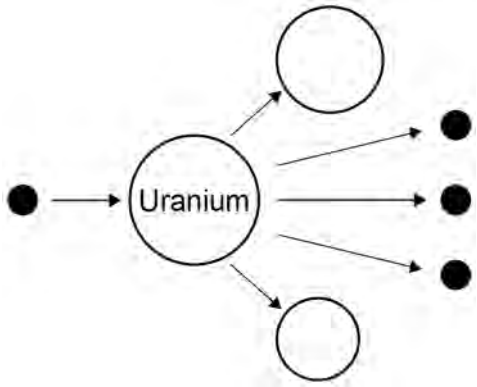
4.1.3 National and global energy resources

Question 104

1 0 The process of nuclear fission is used in nuclear power stations.

Figure 17 shows the process of nuclear fission.

Figure 17



1 0 . 1 Complete the sentences.

Choose answers from the box.

[3 marks]

electrons	**gamma rays**	**neutrons**	**nuclei**	**protons**

In nuclear power stations, energy is released from

uranium _____.

The uranium in **Figure 17** splits into two parts and

releases three _____.

The process of nuclear fission releases electromagnetic radiation in the

form of _____.

4.1.3 National and global energy resources

Question 104 · continued

Use the Physics Equations Sheet to answer questions **10.2** and **10.3**.

10.2 Write down the equation which links energy (*E*), power (*P*) and time (*t*).

[1 mark]

10.3 A nuclear power station has a power output of 500 MW.

Calculate the energy output in 3600 s.

Give your answer in J.

[3 marks]

Energy output = _____ J

10.4 Radioactive waste produced by nuclear power stations has a long half-life.

Suggest **one** precaution taken to reduce the hazard caused by radioactive waste from power stations.

[1 mark]

4.1.3 National and global energy resources

Question 104 · continued

1 0 . 5 Nuclear power stations do **not** generate electricity every day of the year.

One nuclear power station generated electricity for 92% of a year.

one year = 365 days

Calculate the number of days during the year that the nuclear power station generated electricity.

[2 marks]

Number of days = _____

10

Turn over for the next question

4.1.3 National and global energy resources

Question 105

June 2025 | 8463/1F | Original Q1

0 1 Manufacturing a petrol car causes carbon dioxide to be emitted into the atmosphere.

Driving a petrol car also causes carbon dioxide to be emitted.

0 1 . 1 Which of the following is an environmental problem caused by the emission of carbon dioxide?

[1 mark]

Tick (✓) **one** box.

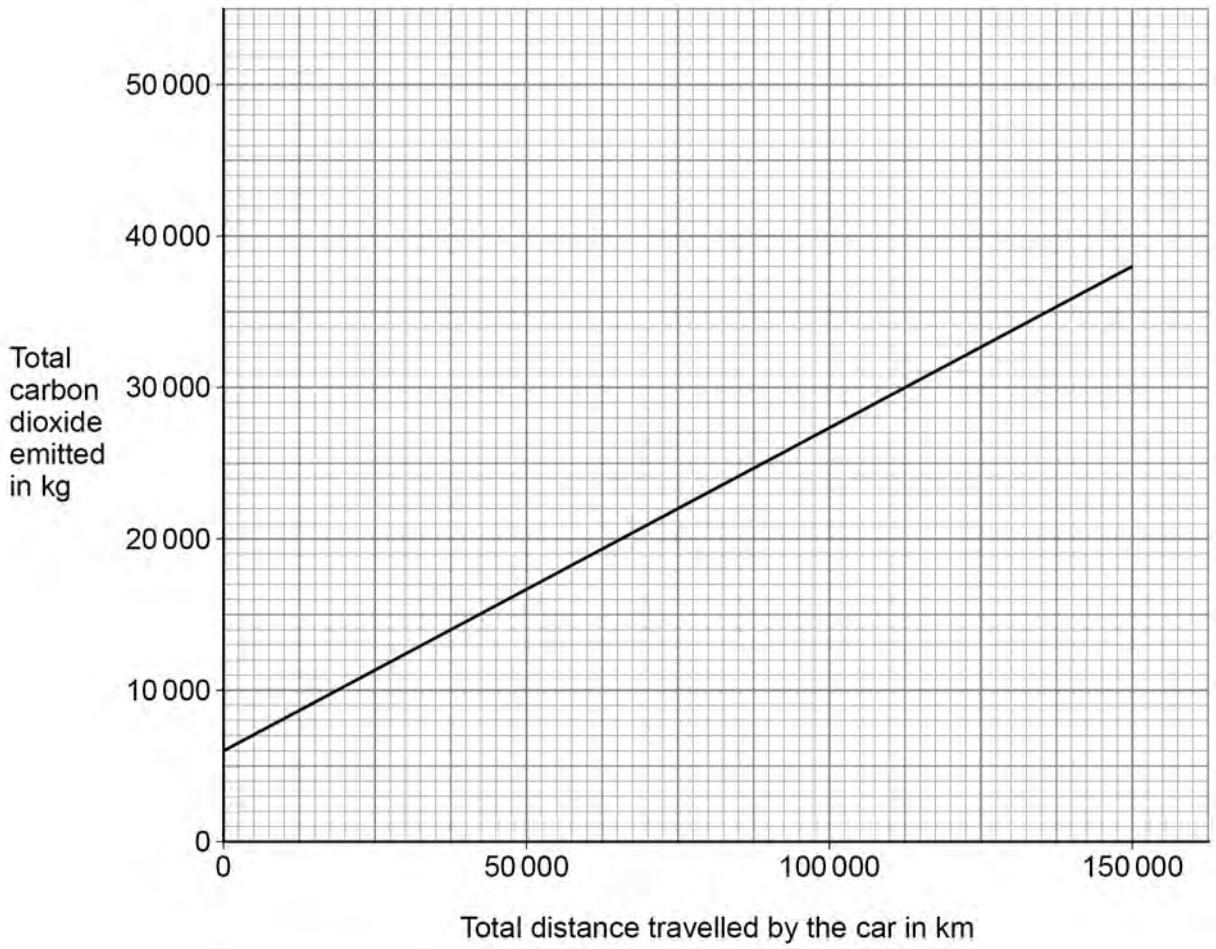
- Acid rain ☐
- Damage to the ozone layer ☐
- Global warming ☐

Question 105 · continued

Carbon dioxide is emitted during the manufacture of the car before the car has been driven.

Figure 1 shows the relationship between the total distance travelled by a petrol car and the total carbon dioxide emitted.

Figure 1



0 1 . 2 How much carbon dioxide is emitted during the manufacture of the car?

Use **Figure 1**.

[1 mark]

Carbon dioxide emitted = _____ kg

Question 1 continues on the next page

4.1.3 National and global energy resources

Question 105 · continued

0 1 . 3 How does the total carbon dioxide emitted change as the total distance travelled by the car increases?

Use **Figure 1**.

[1 mark]

0 1 . 4 An electric car does **not** emit carbon dioxide as it is driven.

Choose **one** reason why.

[1 mark]

Tick (✓) **one** box.

Electric cars are powered by a battery. ☐

Electric cars are powered by nuclear energy. ☐

Electric cars use diesel fuel. ☐

4.1.3 National and global energy resources

Question 105 · continued

0 1 . 5 Some energy resources used to generate electricity cause environmental issues.

Draw **one** line from each method of generating electricity to the environmental issue it causes.

[3 marks]

Method of generating electricity	Environmental issue
Hydroelectric dam	Affects habitats of sea creatures
Nuclear power station	Emits carbon dioxide
Wave power	Produces radioactive waste
	Valley needs flooding

7

4.1.3 National and global energy resources

Question 106

June 2025 | 8463/1F | Original Q8

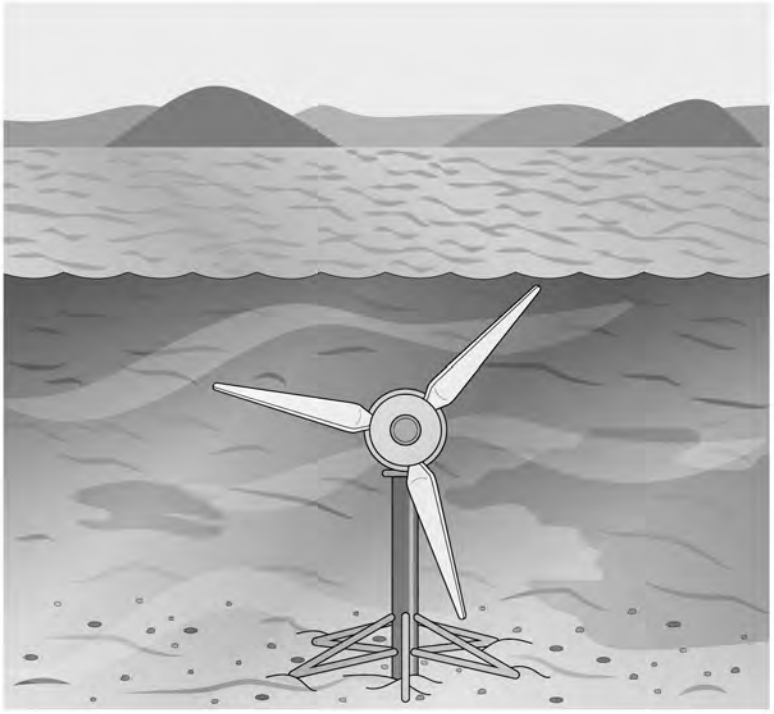
0 8 Tides and wind are two renewable energy resources.

0 8 . 1 Describe the difference between renewable energy resources and non-renewable energy resources.

[2 marks]

Figure 14 shows a new design of tidal turbine to generate electricity using the tides.

Figure 14



Use the Physics Equations Sheet to answer questions **08.2** and **08.3**.

0 8 . 2 Write down the equation which links density (ρ), mass (m) and volume (V).

[1 mark]

0 8 . 3 The mass of seawater passing through the tidal turbine each second is 824 000 kg.

The density of seawater is 1030 kg/m^3.

Calculate the volume of seawater passing through the tidal turbine each second.

[3 marks]

Volume = _____ m^3

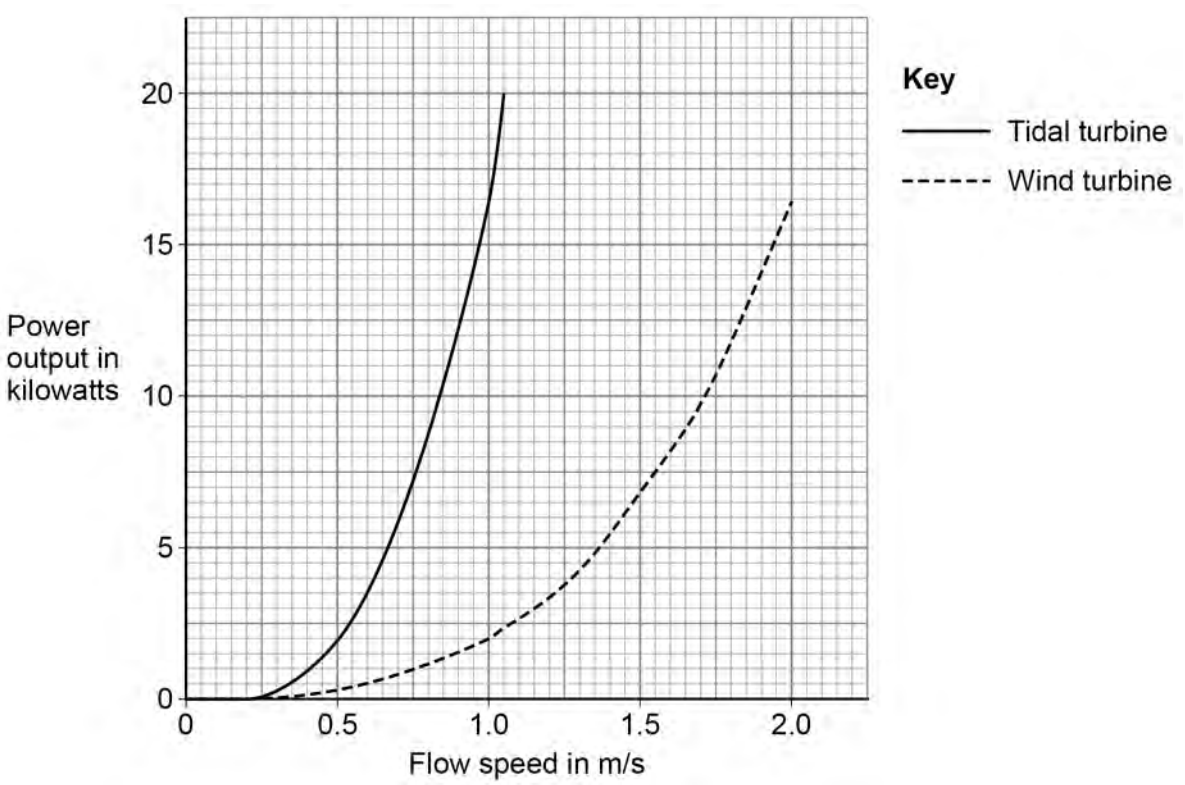
Question 8 continues on the next page

Question 106 · continued

The speed of the tide or the speed of the wind past a turbine is called the 'flow speed'.

Figure 15 shows how the power output of a tidal turbine compares with a wind turbine for different flow speeds.

Figure 15



0 8 . 4 As flow speed increases, power output increases.

Give **two** other conclusions that can be made using information from **Figure 15**.

[2 marks]

1 _____

_____

2 _____

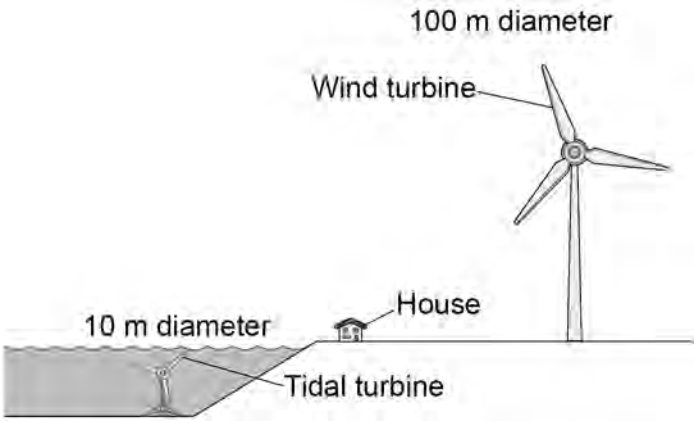
_____

4.1.3 National and global energy resources

Question 106 · continued

0 8 . 5 **Figure 16** shows the turbines used to obtain the data for **Figure 15**.

Figure 16



Compare the environmental impacts of the wind turbine and the tidal turbine in **Figure 16**.

[4 marks]

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