AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.4.3

The National Grid

Past-paper questions

Tier	**Foundation**
Question groups	**28**
Available paper years	**2006–2023**

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.

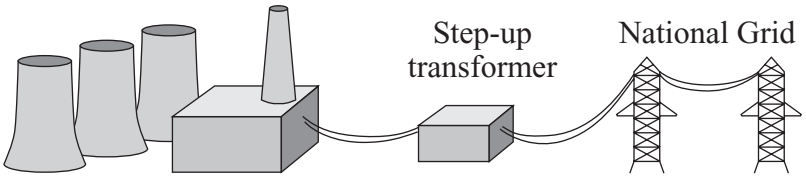
4.2.4.3 The National Grid

Question 01

November 2006 | PHY1A | Original Q4 | Legacy

QUESTION FOUR

Power stations supply electricity to the National Grid.



Coal-burning power station

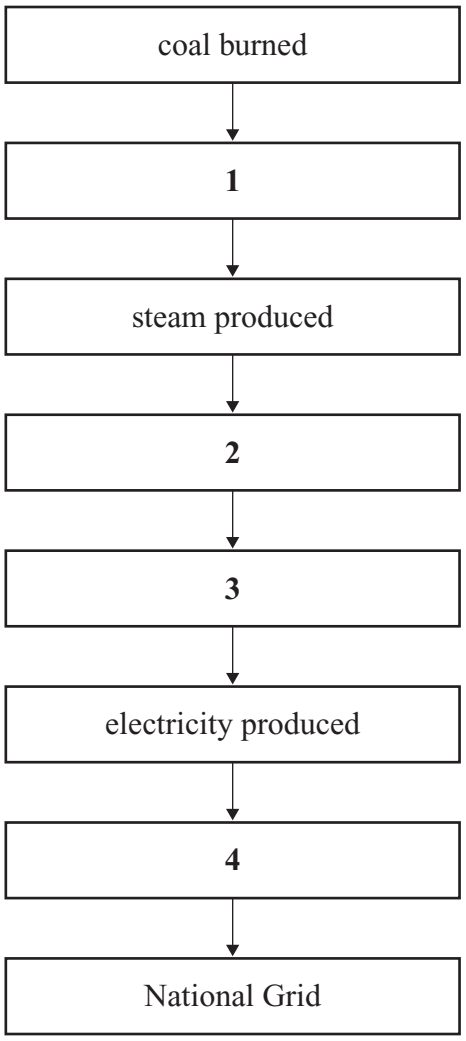
Match names of parts, **A**, **B**, **C** and **D**, with the numbers **1 – 4** in the flow chart for a coal-burning power station.

A boiler

B generator

C transformer

D turbine

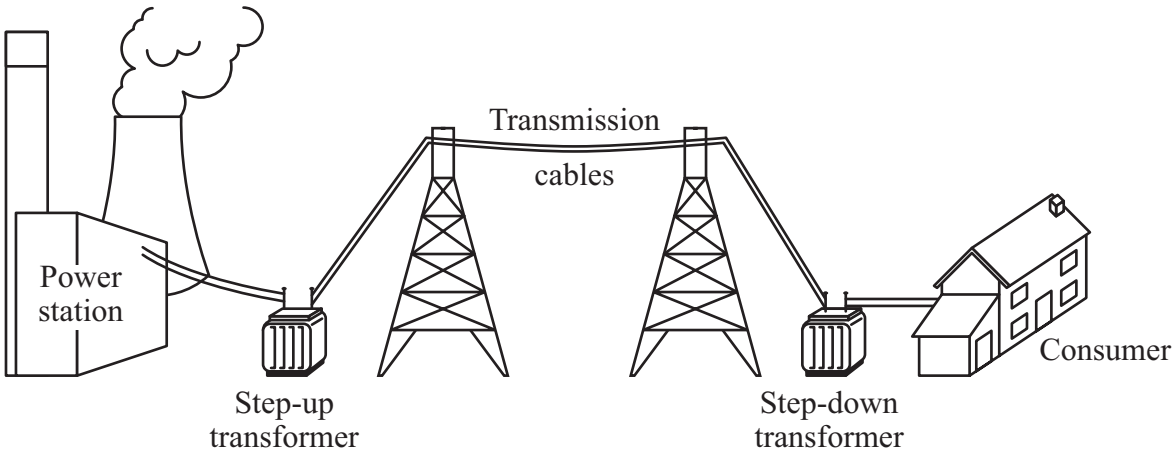


4.2.4.3 The National Grid

Question 02

June 2007 | PHY1F | Original Q1 | Legacy

1 The diagram shows how electricity gets from power stations to consumers.



(a) Complete the following sentences by drawing a ring around the correct line in each box.

(i) The network of cables and transformers linking power stations to consumers is called the national [grid / line / network].

(1 mark)

(ii) A step-up transformer [decreases voltage / increases current / increases voltage].

(1 mark)

(iii) Electricity is supplied to consumers' homes at [230 V / 25 000 V / 400 000 V].

(1 mark)

(iv) Making the current in the cables smaller will [increase / make no difference to / reduce] the energy lost in the cables.

(1 mark)

4.2.4.3 The National Grid

Question 02 · continued

BLANK

(b) Transformers always waste some energy.

(i) What effect does the waste energy from a transformer have on the air around the transformer?

.....

(1 mark)

(ii) Which **one** of the following describes the efficiency of a transformer?

Draw a ring around your answer.

always 100 % **less than 100 %** **more than 100 %**

(1 mark)

6

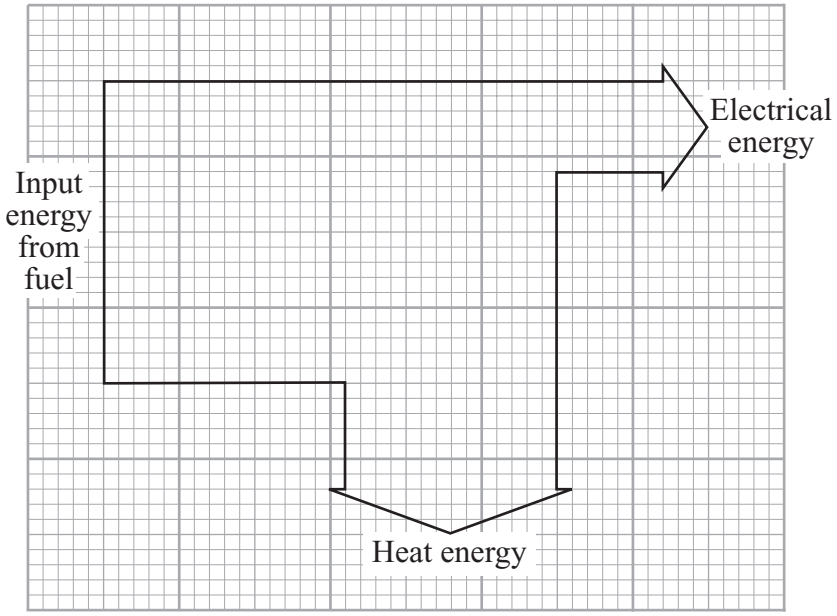
Turn over for the next question

4.2.4.3 The National Grid

Question 03

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

4.2.4.3 The National Grid

Question 03 · 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)

4.2.4.3 The National Grid

Question 03 · 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

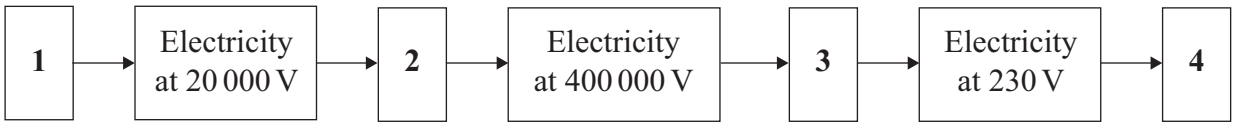
4.2.4.3 The National Grid

Question 04

March 2008 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

The block diagram shows how electricity is distributed in this country.



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

A house

B power station

C step-down transformer

D step-up transformer

Turn over for the next question

4.2.4.3 The National Grid

Question 05

June 2008 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

The flow chart shows how one type of power station produces electricity for the National Grid.

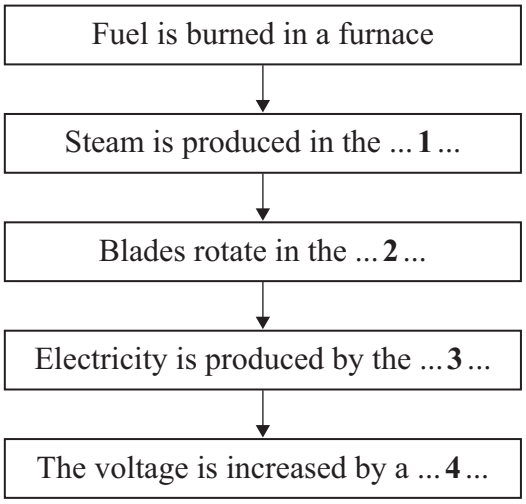
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** on the flow chart.

A boiler

B generator

C transformer

D turbine



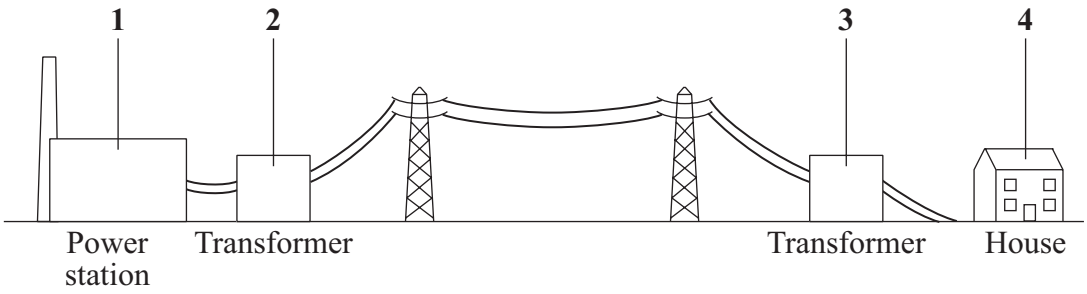
4.2.4.3 The National Grid

Question 06

November 2008 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows part of the National Grid.



Match statements, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

A This is where the electricity is being used.

B This is where the electricity is being generated.

C This is where the voltage is increased.

D This is where the voltage is decreased.

4.2.4.3 The National Grid

Question 07

January 2009 | PHY3F | Original Q1 | Legacy

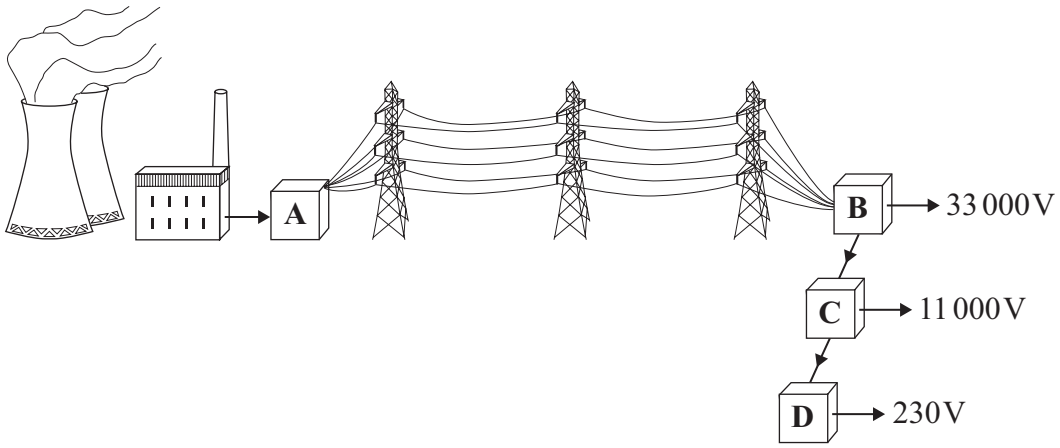
1 (a) Complete the following sentence by using **one** of the words in the box.

Grid	**Power**	**Supply**

The network is called the National ..... .

(1 mark)

1 (b) In the diagram, **A**, **B**, **C** and **D** are transformers.



1 (b) (i) Which transformer, **A**, **B**, **C** or **D**, is a step-up transformer?

Transformer .....

(1 mark)

1 (b) (ii) Which transformer, **A**, **B**, **C** or **D**, will supply homes, offices and shops?

Transformer .....

(1 mark)

4.2.4.3 The National Grid

Question 07 · continued

for mark

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

In a step-down transformer, the potential difference (p.d.) across the

primary coil is

less than
the same as
more than

the p.d. across the secondary coil.

(1 mark)

4

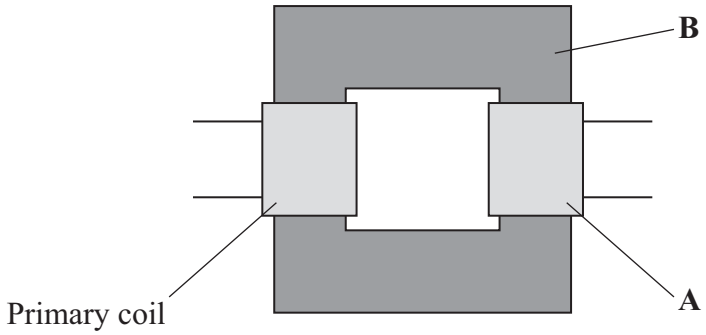
Turn over for the next question

4.2.4.3 The National Grid

Question 08

June 2009 | PHY3F | Original Q7 | Legacy

7 (a) The diagram shows a transformer.



7 (a) (i) What is part **A**?

.....

(1 mark)

7 (a) (ii) What is part **B** and what is it made of?

.....

.....

(2 marks)

7 (a) (iii) When there is an alternating current in the primary coil, what is produced in part **B**?

.....

.....

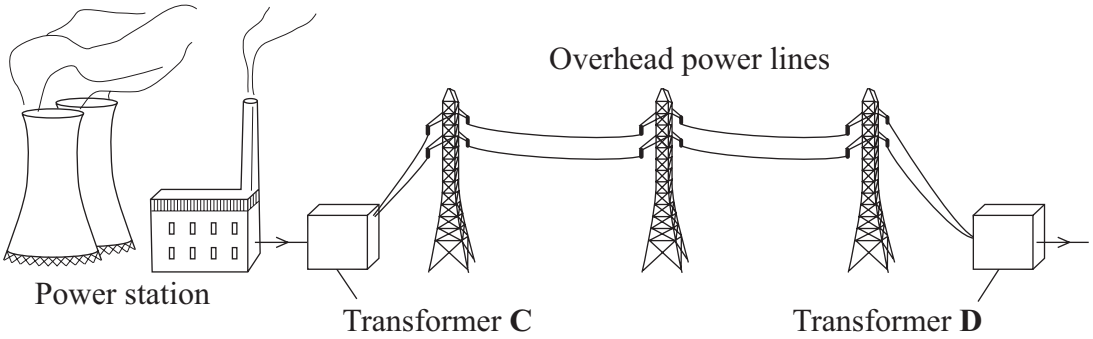
(2 marks)

4.2.4.3 The National Grid

Question 08 · continued

for mark

7 (b) Transformers are used in the National Grid. The diagram shows part of the National Grid.



Complete the **two** spaces in the sentence.

Transformer **C** is a ..... transformer and transformer **D** is

a ..... transformer. *(1 mark)*

7 (c) This is an item from a newspaper.

Health at risk from power lines?

Are high voltage power lines a health risk to people who live near them?

Some scientists think that scientific evidence shows that they are.

Other scientists do not think that the scientific evidence supports this conclusion.

Which **two** suggestions would reduce the possible risk to people's health?
Put a tick (✓) in the box next to your answers.

Do not build new houses near to existing power lines. ☐

Move the power lines so that they take the shortest routes. ☐

Move each power station to the centre of the nearest city. ☐

Build new power lines away from where people live. ☐

Use more transformers in the National Grid. ☐

(2 marks)

8

4.2.4.3 The National Grid

Question 09

November 2009 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

The flow chart shows the steps involved in producing electricity in a coal-fired power station. It also shows the steps involved in transferring the electricity to the National Grid.

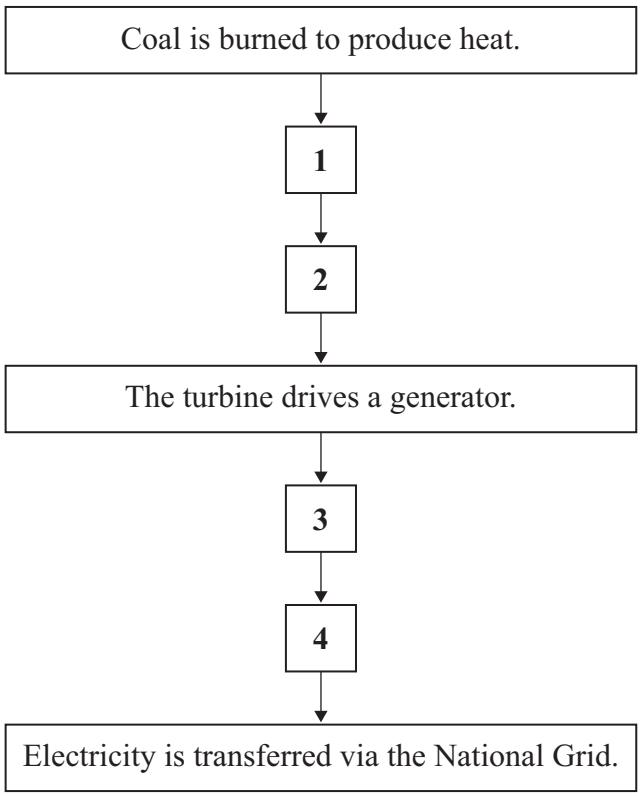
Match stages, **A**, **B**, **C** and **D**, with the boxes **1–4** in the flow chart.

A A step-up transformer increases the voltage.

B Steam drives a turbine.

C The generator produces electricity.

D Water is heated to produce steam.



4.2.4.3 The National Grid

Question 10

March 2010 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about nuclear power stations.

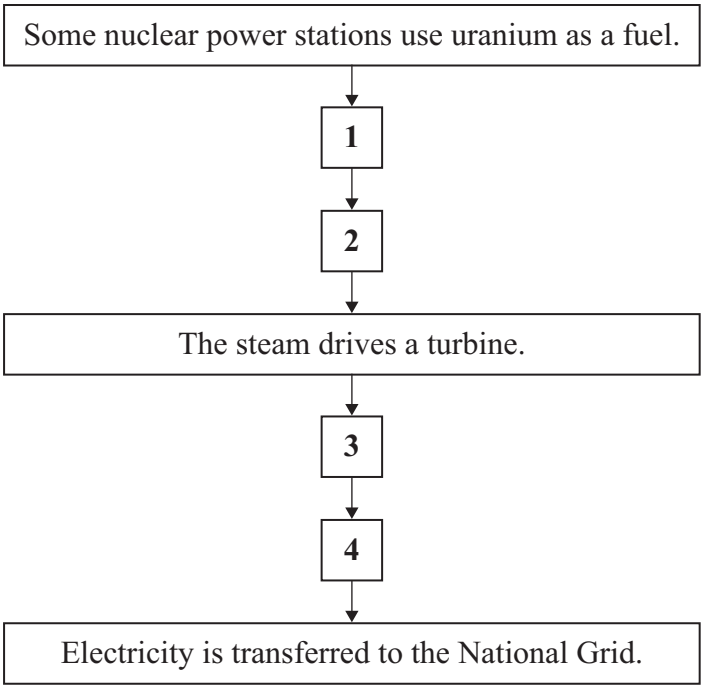
Match statements, **A**, **B**, **C** and **D**, with the boxes **1–4** in the flow chart to describe how nuclear power stations work.

A Electricity is produced.

B Fission of uranium produces heat.

C The heat is used to produce steam.

D The turbine drives a generator.



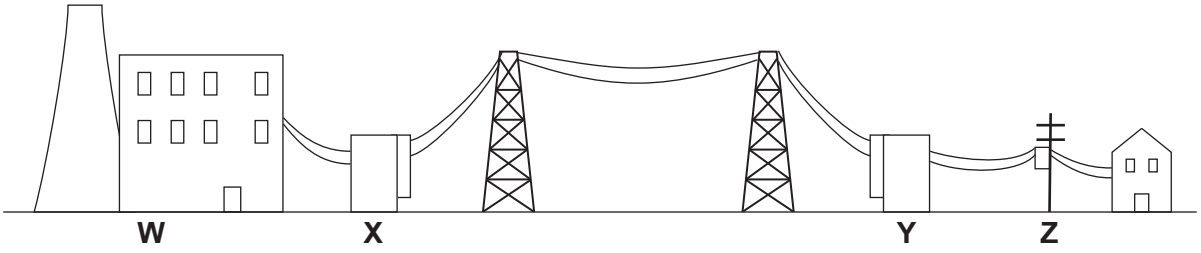
4.2.4.3 The National Grid

Question 11

June 2010 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows how electricity is transferred from a power station to consumers.



7A Which labelled part, **W**, **X**, **Y** or **Z**, is a step-up transformer?

1 **W**

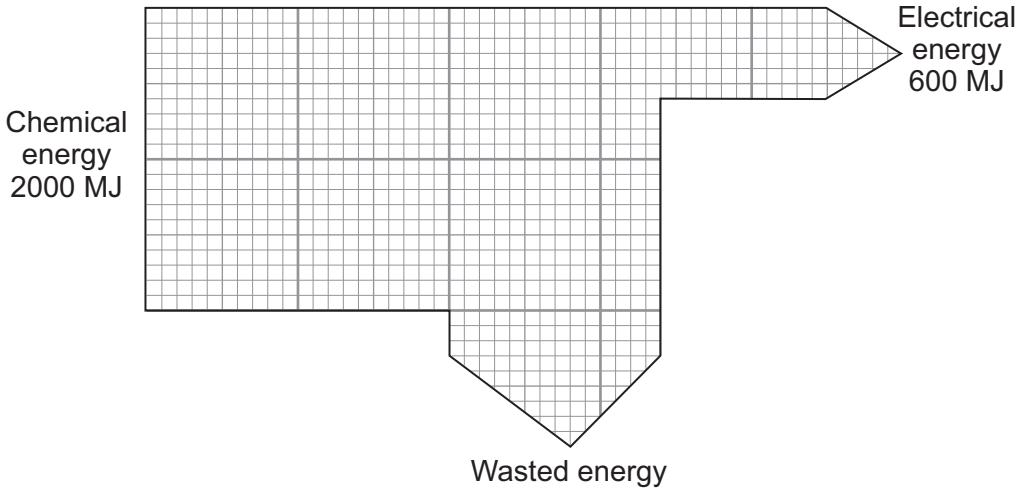
2 **X**

3 **Y**

4 **Z**

Fuel is burned in this power station.

The Sankey diagram shows the energy transformations for this power station.



7B How much energy is wasted?

1 30 MJ

2 600 MJ

3 1400 MJ

4 2600 MJ

4.2.4.3 The National Grid

Question 11 · continued

7C The efficiency of the power station can be calculated using this equation.

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

What is the efficiency of this power station?

1 0.30

2 0.33

3 0.60

4 0.70

7D What happens to the energy that is wasted?

1 It is transferred into useful energy.

2 It warms up the surroundings.

3 It is recycled.

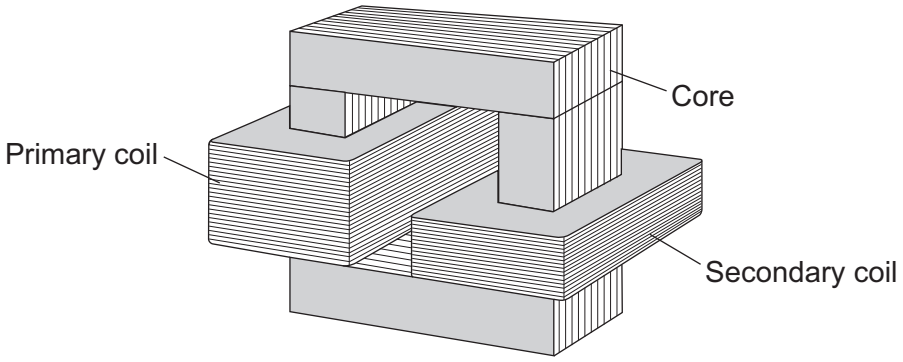
4 It is stored until needed.

4.2.4.3 The National Grid

Question 12

June 2010 | PHY3F | Original Q4 | Legacy

4 A teacher demonstrates a small transformer.



4 (a) (i) What is the core made of?

Draw a ring around the correct word in the box.

aluminium	**copper**	**iron**

(1 mark)

4 (a) (ii) The potential difference (p.d.) across the secondary coil is less than the p.d. across the primary coil.

What sort of transformer is it?

.....

(1 mark)

4 (b) Where is a step-up transformer used as part of the National Grid?

.....

(1 mark)

4.2.4.3 The National Grid

Question 12 · continued

4 (c) The teacher writes a note about the transformer but leaves **five** spaces.

Use the correct words from the box to complete the spaces.

coil	**core**	**current**	**ends**	**field**	**wire**

A transformer works because an alternating ..... in the primary ..... produces a changing magnetic ..... in the ..... and then in the secondary coil.

This induces an alternating potential difference across the ..... of the secondary coil.

(5 marks)

8

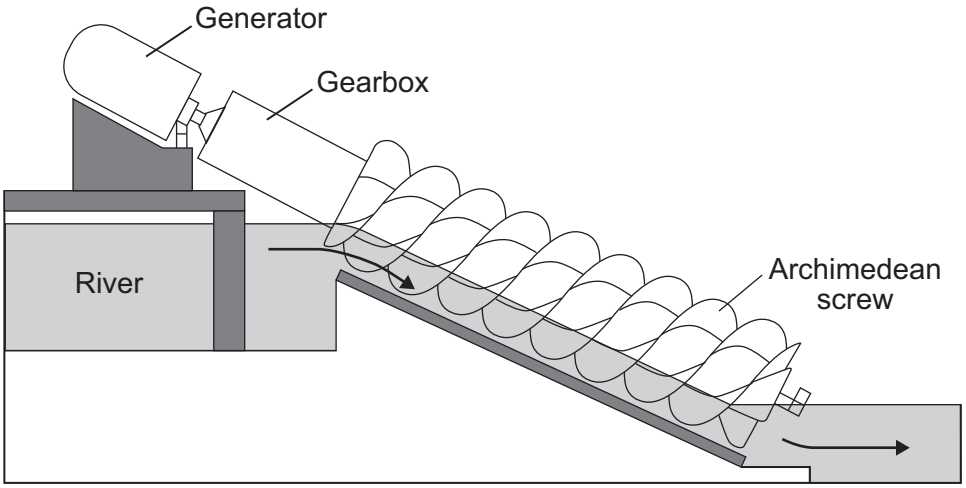
Turn over for the next question

4.2.4.3 The National Grid

Question 13

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)

4.2.4.3 The National Grid

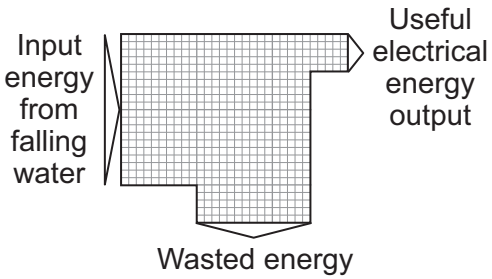
Question 13 · continued

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

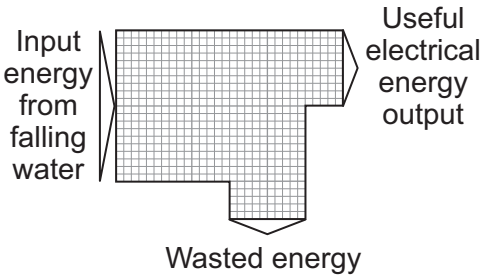
Which **one** of the following Sankey diagrams, **X**, **Y** or **Z**, shows the energy transformations produced by this generator?

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

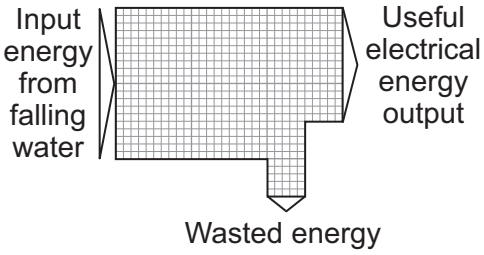
Sankey diagram **X**



Sankey diagram **Y**



Sankey diagram **Z**



Sankey diagram ☐

(1 mark)

Question 5 continues on the next page

4.2.4.3 The National Grid

Question 13 · 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)

4.2.4.3 The National Grid

Question 13 · 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

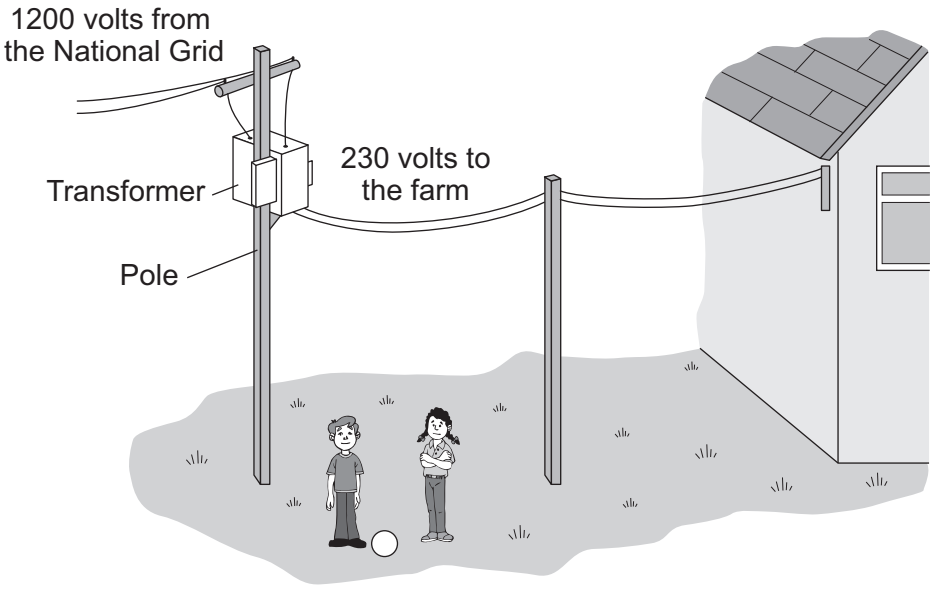
Turn over for the next question

4.2.4.3 The National Grid

Question 14

January 2011 | PHY3F | Original Q1 | Legacy

1 The diagram shows part of the system used to supply a farm with electricity.



1 (a) The core of the transformer is made of metal.

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

The metal used for the core of the transformer is

copper.
iron.
steel.

(1 mark)

1 (b) (i) What sort of transformer is shown in the diagram?

.....

(1 mark)

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

In this transformer, the number of turns on the secondary coil is

less than
the same as
greater than

the number of turns on the primary coil.

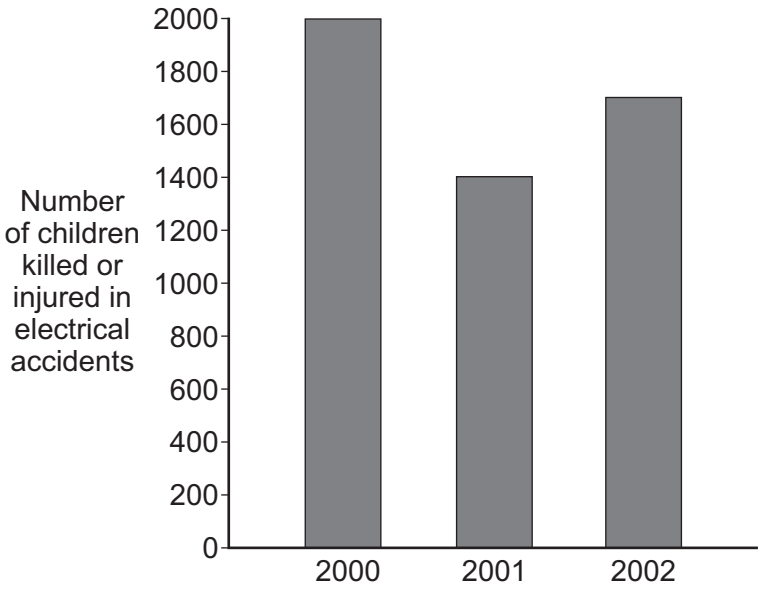
(1 mark)

4.2.4.3 The National Grid

Question 14 · continued

1 (c) Transformers and other electrical equipment can be dangerous.

The following bar chart shows the numbers of children, aged 14 or under, killed or injured in electrical accidents in the UK in 2000, 2001 and 2002.



1 (c) (i) In which of these years were most children killed or injured in electrical accidents?

.....

(1 mark)

1 (c) (ii) A newspaper claims that the number of children killed or injured by electrical accidents will increase in 2011.

Which of the following gives a reason why the information given in the graph does not support this claim.

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

The pattern shows an upward trend. ☐

The pattern shows a downward trend. ☐

There is no pattern. ☐

(1 mark)

5

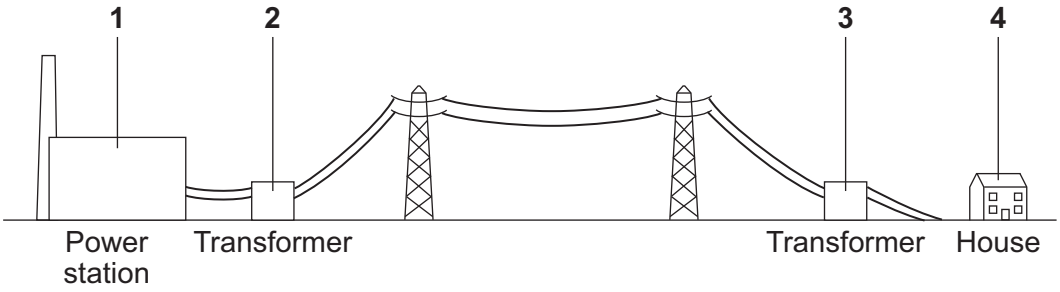
4.2.4.3 The National Grid

Question 15

June 2011 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows part of the National Grid.



Match statements, **A**, **B**, **C** and **D**, with the labels **1**–**4** on the diagram.

A This is where the electricity is being generated.

B This is where the electricity is being used.

C This is where the voltage is decreased.

D This is where the voltage is increased.

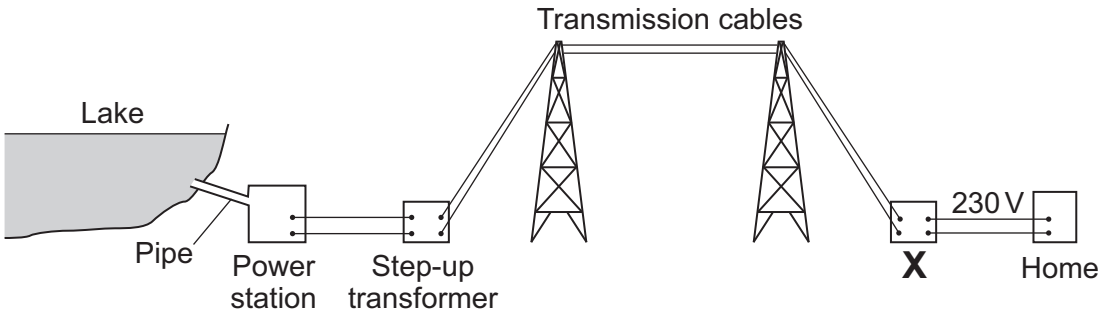
4.2.4.3 The National Grid

Question 16

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.

4.2.4.3 The National Grid

Question 16 · 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

4.2.4.3 The National Grid

Question 17

June 2012 | PH1FP | Original Q5 | Legacy

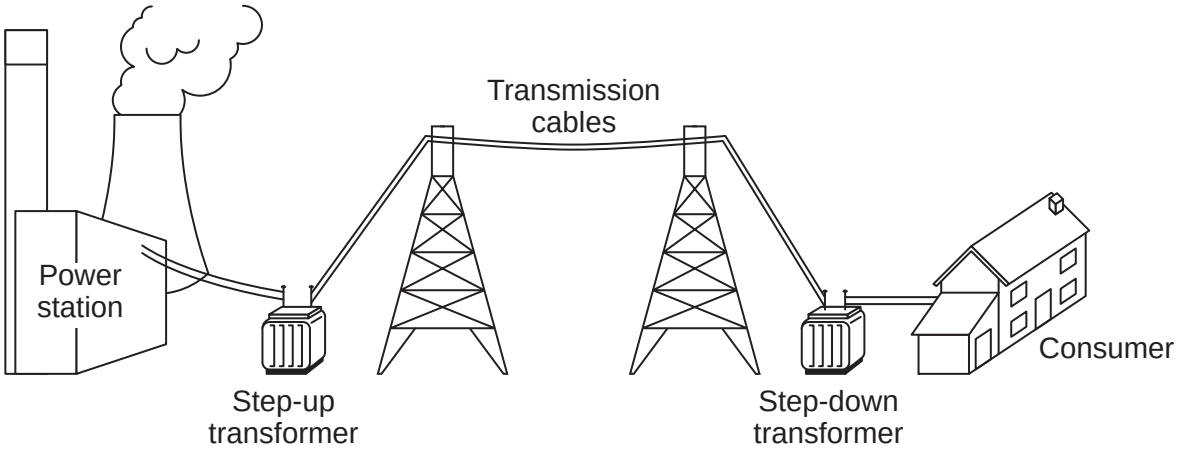
5 In the UK, most electricity is generated in power stations that burn fossil fuels.

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.

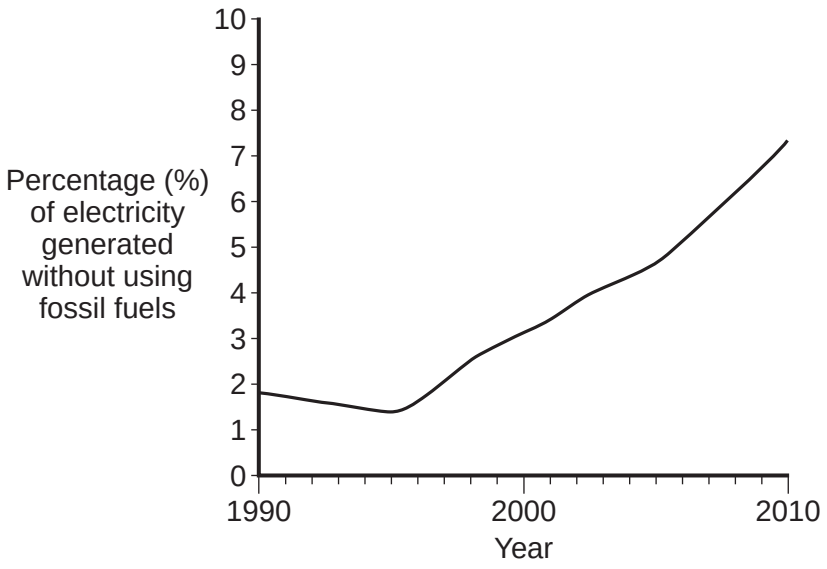
(2 marks)

4.2.4.3 The National Grid

Question 17 · 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

4.2.4.3 The National Grid

Question 18

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.

.....

.....

.....

.....

.....

.....

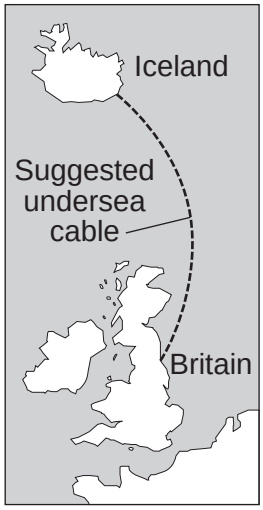
(2 marks)

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.

4.2.4.3 The National Grid

Question 18 · 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)

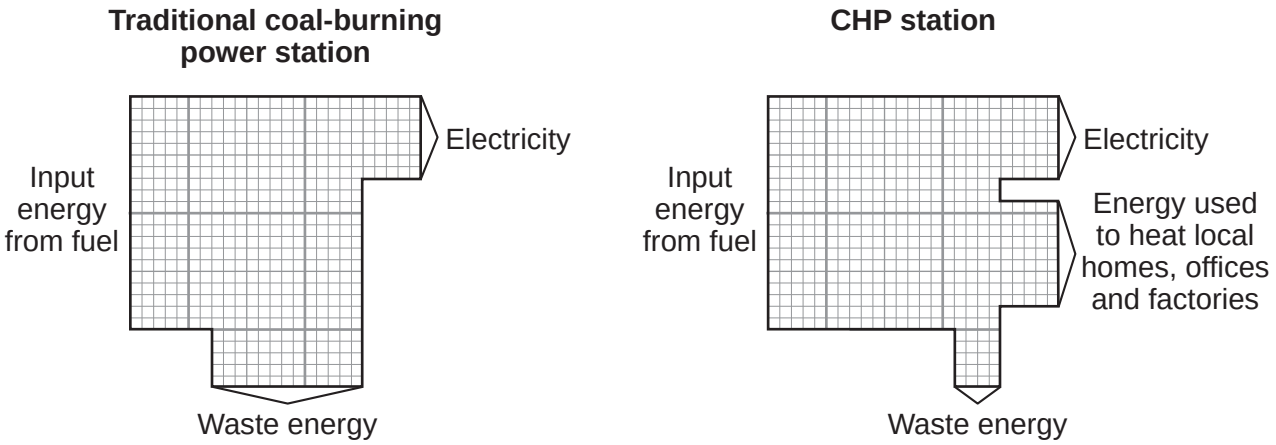
9

4.2.4.3 The National Grid

Question 19

June 2013 | PH1FP | Original Q7 | Legacy

7 The Sankey diagrams show the energy transfers in a traditional coal-burning power station and a combined heat and power (CHP) station.



7 (a) What effect does the waste energy from a power station have on the surroundings?

.....

.....

(1 mark)

7 (b) Calculate the efficiency of the CHP station.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Efficiency = ...

(2 marks)

4.2.4.3 The National Grid

Question 19 · continued

7 (c) Why is a CHP station more efficient than a traditional coal-burning power station?

.....

.....

.....

.....

(2 marks)

7 (d) A CHP station is usually used to meet the demand for electricity within the local area. The electricity is not transmitted and distributed through the National Grid.

7 (d) (i) What is the National Grid?

Tick (✓) **one** box.

A system of cables and pylons. ☐

A system of cables and transformers. ☐

A system of cables, transformers and power stations. ☐

(1 mark)

7 (d) (ii) Using the electricity locally and not transmitting it through the National Grid increases the overall efficiency of a CHP station by 7%.

Give **one** reason why.

.....

.....

(1 mark)

7

4.2.4.3 The National Grid

Question 20

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

4.2.4.3 The National Grid

Question 21

June 2014 | PH3FP | Original Q9 | Legacy

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

There are two types of traditional transformer; step-up and step-down.

Describe the similarities and differences between a step-up transformer and a step-down transformer.

You should include details of:

- construction, including materials used
- the effect the transformer has on the input potential difference (p.d.).

You should **not** draw a diagram.

[6 marks]

.....

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Extra space .....

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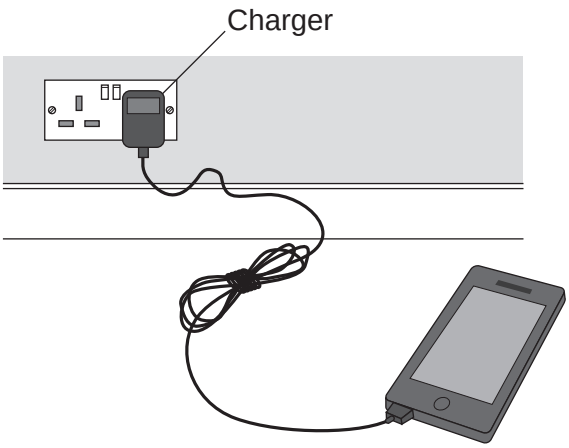
Question 9 continues on the next page

4.2.4.3 The National Grid

Question 21 · continued

9 (b) **Figure 15** shows a mobile phone and charger.

Figure 15



Mobile phone chargers use a different type of transformer, which is smaller and lighter than a traditional transformer.

What name is given to the type of transformer used in a mobile phone charger?

[1 mark]

.....

7

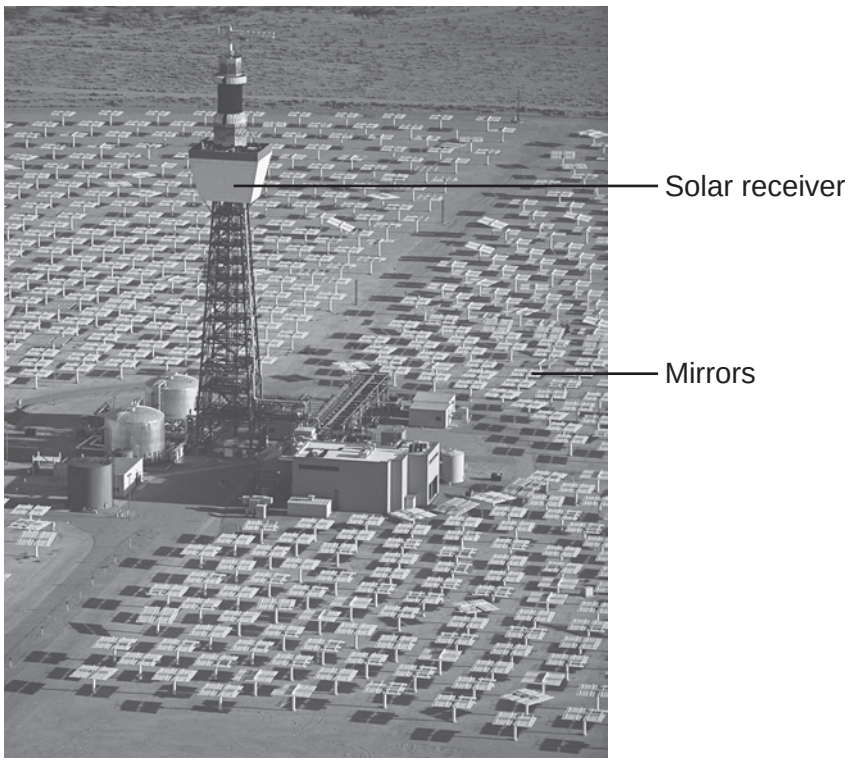
4.2.4.3 The National Grid

Question 22

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

4.2.4.3 The National Grid

Question 22 · 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

4.2.4.3 The National Grid

Question 22 · continued

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

4.2.4.3 The National Grid

Question 23

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.

4.2.4.3 The National Grid

Question 23 · 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

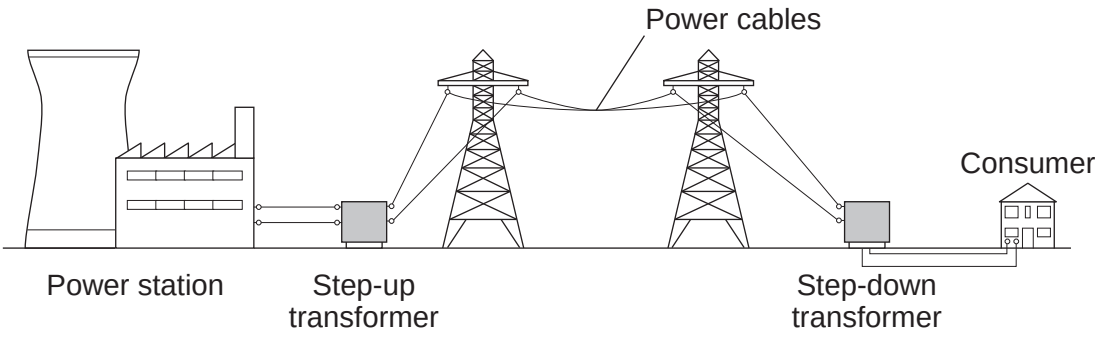
4.2.4.3 The National Grid

Question 24

June 2017 | PH1FP | Original Q4 | Legacy

4 **Figure 7** shows how electricity is distributed from power stations to consumers.

Figure 7



4 (a) Which parts of **Figure 7** form the National Grid?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
power station, transformers and power cables	
transformers and power cables	
transformers, power cables and consumer	

4 (b) The power cables in **Figure 7** are overhead power cables. Power cables can be buried underground.

Give **one disadvantage** of burying power cables underground.

[1 mark]

_____

_____

4.2.4.3 The National Grid

Question 24 · continued

4 (c) Use the correct answers from the box to complete each sentence.

Each word can be used once or not at all.

[3 marks]

energy	**current**	**efficiency**	**power**	**voltage**

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

Using a step-up transformer increases the _____ of the electricity distribution process.

4 (d) A householder reads his electricity meter at the start and at the end of a month.

Start: 34 523 (kWh) **End: 34 713 (kWh)**

The cost of 1 kWh is 15 pence.

Calculate the cost of the electricity used that month.

[2 marks]

_____

_____

_____

Cost = _____ pence

7

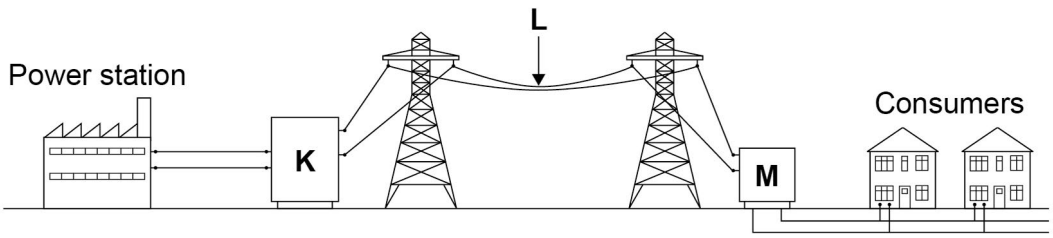
4.2.4.3 The National Grid

Question 25

November 2020 | 8463/1F | Original Q1

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]

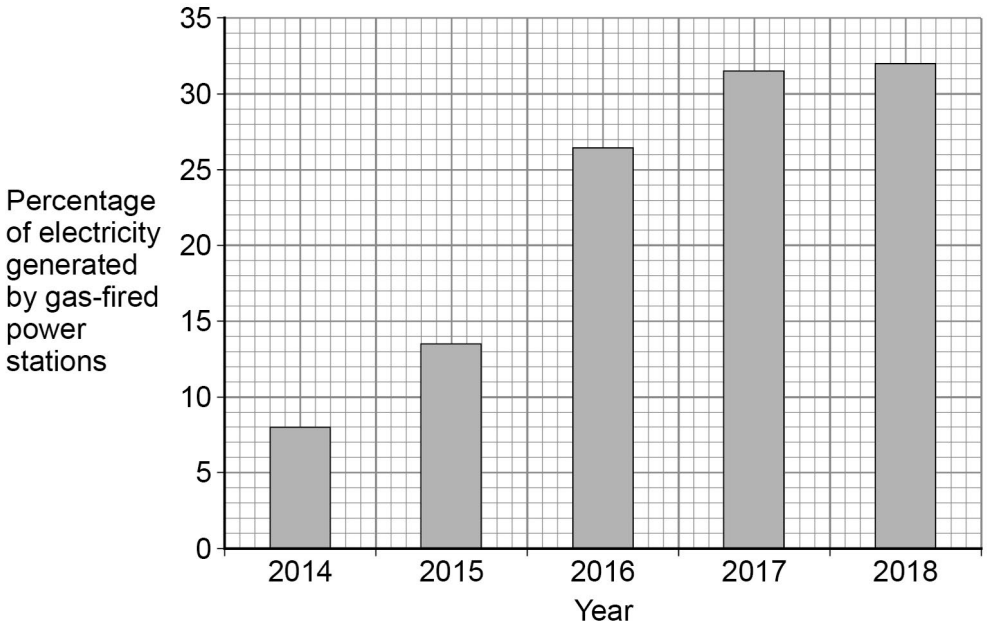
K = _____

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



4.2.4.3 The National Grid

Question 25 · 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

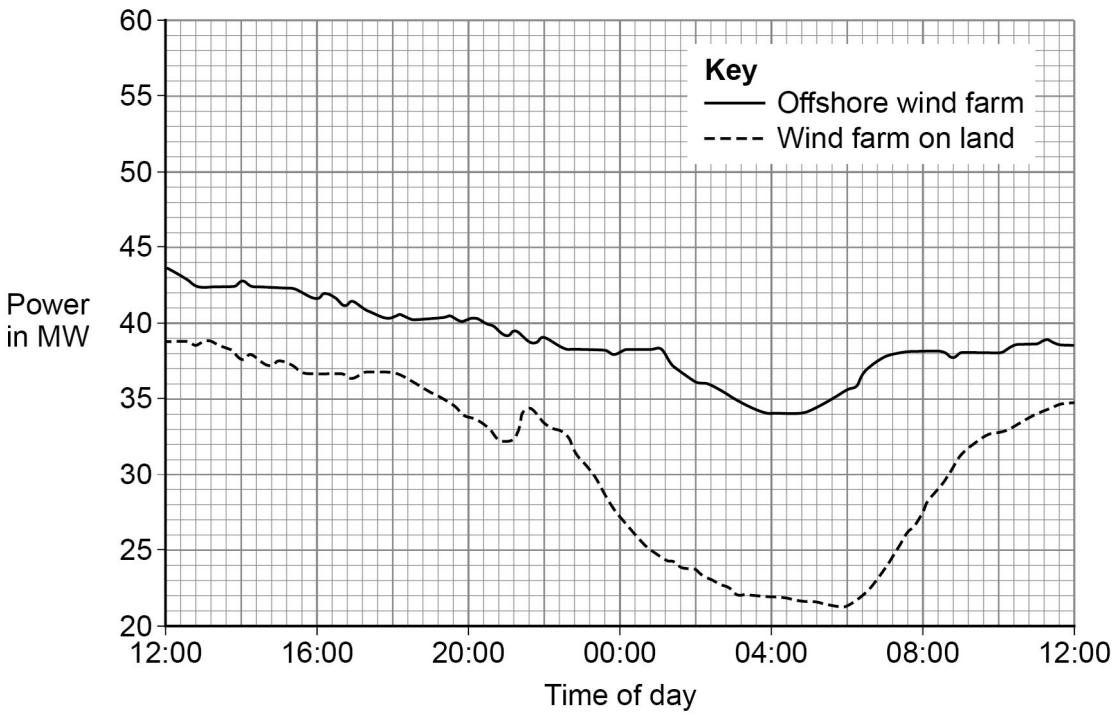
4.2.4.3 The National Grid

Question 25 · 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

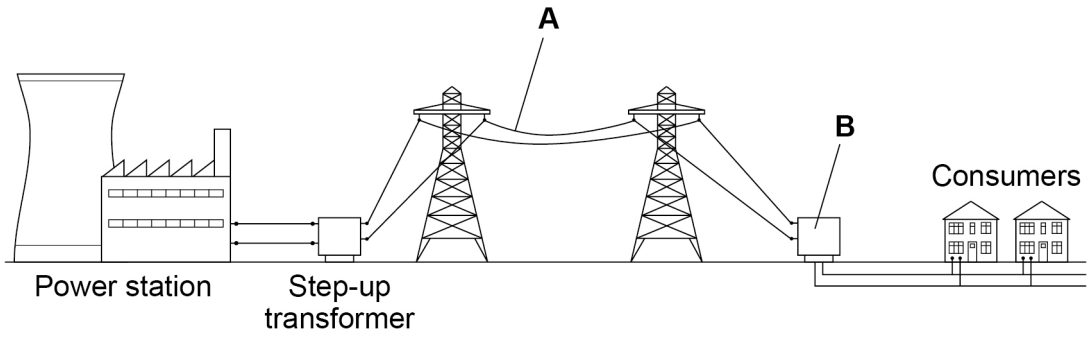
4.2.4.3 The National Grid

Question 26

November 2021 | 8463/1F | Original Q2

0 2 **Figure 2** shows part of the National Grid linking a power station to consumers.

Figure 2



0 2 . 1 Name the parts of **Figure 2** labelled **A** and **B**.

[2 marks]

A _____

B _____

0 2 . 2 Electricity is transmitted through **A** at a very high potential difference.

What is the advantage of transmitting electricity at a very high potential difference?

[1 mark]

Tick (✓) **one** box.

A high potential difference is safer for consumers. ☐

Less thermal energy is transferred to the surroundings. ☐

Power transmission is faster. ☐

4.2.4.3 The National Grid

Question 26 · continued

0 2 . 3 The power station generates electricity at a potential difference of 25 000 V.

The energy transferred by the power station in one second is 500 000 000 J.

Calculate the charge flow from the power station in one second.

Use the equation:

$$\text{charge flow} = \frac{\text{energy}}{\text{potential difference}}$$

[2 marks]

Charge flow in one second = _____ C

Question 2 continues on the next page

4.2.4.3 The National Grid

Question 26 · continued

The electricity supply to a house has a potential difference of 230 V.

Table 1 shows the current in some appliances in the house.

Table 1

Appliance	Current in amps
Dishwasher	6.50
DVD player	0.10
Lamp	0.40
TV	0.20

0 2 . 4 Calculate the total power of all the appliances in **Table 1**.

Use the equation:

power = potential difference × current

[3 marks]

Total power = _____ W

4.2.4.3 The National Grid

Question 26 · continued

0 2 . 5 Each appliance in **Table 1** is switched on for 2 hours.

Which appliance will transfer the most energy?

Give a reason for your answer.

[2 marks]

Appliance _____

Reason _____

_____

_____

0 2 . 6 The average energy transferred from the National Grid every second for each person in the UK is 600 J.

There are 32 000 000 seconds in one year.

Calculate the average energy transferred each year from the National Grid for each person in the UK.

[2 marks]

_____

_____

_____

Average energy transferred = _____ J

12

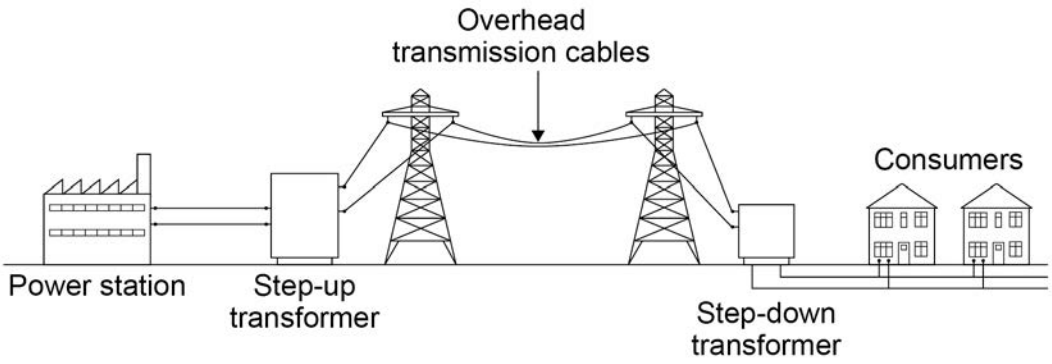
4.2.4.3 The National Grid

Question 27

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

4.2.4.3 The National Grid

Question 27 · 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 _____ .

4.2.4.3 The National Grid

Question 27 · 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

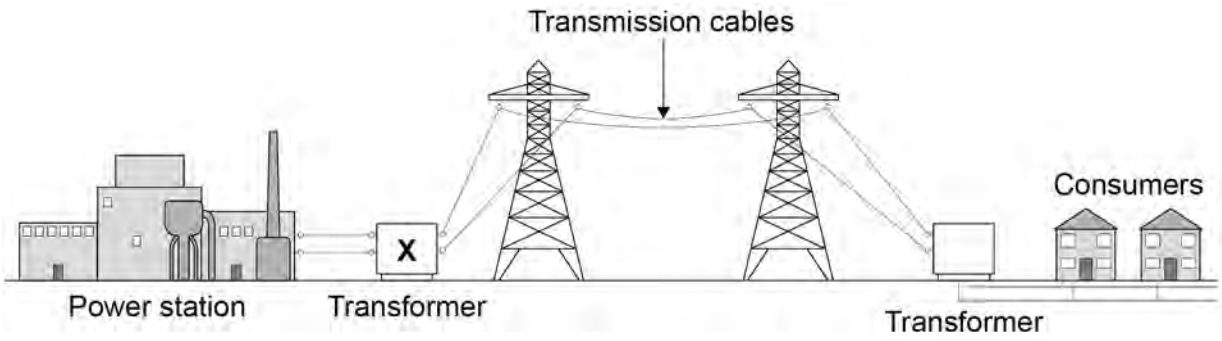
4.2.4.3 The National Grid

Question 28

June 2023 | 8463/1F | Original Q8

0 8 **Figure 11** shows how the National Grid connects a power station to consumers.

Figure 11



0 8 . 1 Complete the sentences.

[2 marks]

Transformer **X** causes the potential difference to _____ .

Transformer **X** causes the current to _____ .

Use the Physics Equations Sheet to answer questions **08.2** and **08.3**.

0 8 . 2 Which equation links current (I), power (P) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{I}{R}$ ☐

$P = \frac{I}{R^2}$ ☐

$P = I^2 R$ ☐

$P = IR$ ☐

4.2.4.3 The National Grid

Question 28 · continued

0 8 . 3 A transmission cable has a power loss of 1.60×10^9 W.

The current in the cable is 2000 A.

Calculate the resistance of the cable.

[3 marks]

Resistance = _____ Ω

Use the Physics Equations Sheet to answer questions **08.4** and **08.5**.

0 8 . 4 Write down the equation which links efficiency, total energy input and useful energy output.

[1 mark]

0 8 . 5 The total energy input to the National Grid from one power station is 34.2 GJ.

The National Grid has an efficiency of 0.992

Calculate the useful energy output from this power station to consumers in GJ.

[3 marks]

Useful energy output = _____ GJ

10