AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.1.4

Power

Past-paper questions

Tier	**Foundation**
Question groups	**156**
Available paper years	**2003–2025**

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:** _____

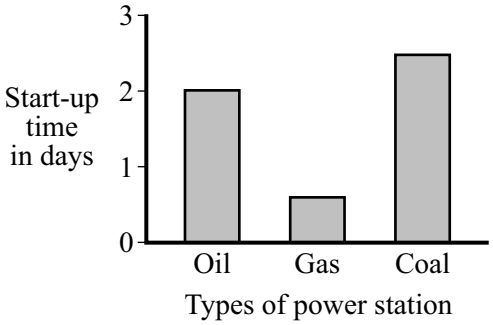
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.1.1.4 Power

Question 01

June 2003 | 3451F | Original Q2 | Legacy

2 (a) The bar chart shows the start-up time for different types of fuel-burning power stations.



Which type of power station would be the quickest to start producing electricity?

.....

(1 mark)

(b) A fuel-burning power station is more reliable than a wind generator at producing electricity. Explain why.

.....

.....

.....

.....

(2 marks)

(c) Fuel-burning power stations may produce air pollution. Why does a wind generator not produce any air pollution?

.....

.....

(1 mark)

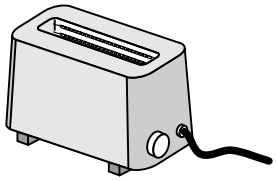
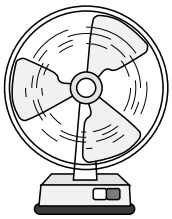
4

4.1.1.4 Power

Question 02

June 2003 | 3451F | Original Q7 | Legacy

7 (a) List **A** shows three electrical devices. List **B** gives different forms of useful energy. Draw a straight line from each of the devices in List **A** to the useful energy form it produces in List **B**. Draw only **three** lines.

List A Device	**List B Useful energy**
Toaster 	Light
Fan 	Kinetic
Personal stereo 	Sound
	Heat

(3 marks)

(b) The power of each device is given in the table.

Device	**Power**
Toaster	1.2 kW
Fan	30 W
Personal Stereo	10 W

Which **one** of the devices will transfer the most energy in 10 minutes?

.....

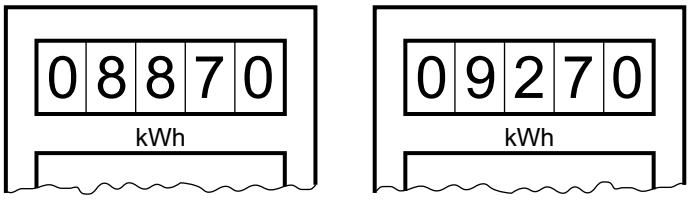
(1 mark)

4.1.1.4 Power

Question 02 · continued

MARGIN BLANK

(c) The diagrams show the readings on a domestic electricity meter in April and July.



April July

(i) How many Units (kWh) of electricity were used between the two meter readings?

.....

.....

Number of Units = ...

(1 mark)

(ii) One Unit costs 6p.

Use the following equation to calculate the cost of the electrical energy used between the two meter readings. Show clearly how you work out your answer.

total cost = number of Units × cost per Unit

.....

.....

Cost = ...

(2 marks)

(d) A 3000 watt electric cooker is switched on for 2 hours.

Use the following equation to calculate the number of Units of energy transferred by the cooker. Show clearly how you work out your answer.

energy transferred	=	power	×	time
(kilowatt-hour, kWh)		(kilowatt, kW)		(hour, h)

.....

.....

Energy transferred = ...kWh

(2 marks)

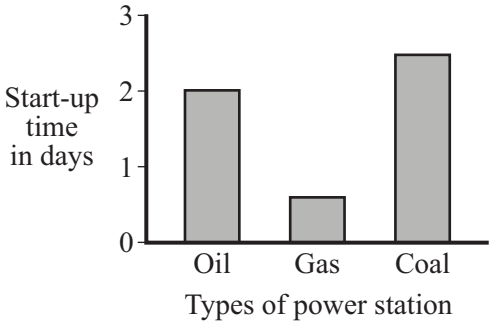
9

4.1.1.4 Power

Question 03

June 2003 | 3462F3 | Original Q2 | Legacy

2 (a) The bar chart shows the start-up time for different types of fuel-burning power stations.



Which type of power station would be the quickest to start producing electricity?

.....

(1 mark)

(b) A fuel-burning power station is more reliable than a wind generator at producing electricity. Explain why.

.....

.....

.....

.....

(2 marks)

(c) Fuel-burning power stations may produce air pollution. Why does a wind generator not produce any air pollution?

.....

.....

(1 mark)

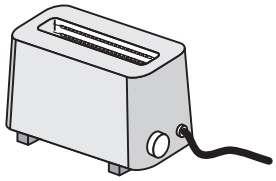
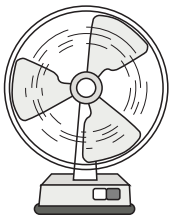
4

4.1.1.4 Power

Question 04

June 2003 | 3462F3 | Original Q7 | Legacy

7 (a) List **A** shows three electrical devices. List **B** gives different forms of useful energy. Draw a straight line from each of the devices in List **A** to the useful energy form it produces in List **B**. Draw only **three** lines.

List A Device	**List B Useful energy**
Toaster 	Light
Fan 	Kinetic
Personal stereo 	Sound
	Heat

(3 marks)

(b) The power of each device is given in the table.

Device	**Power**
Toaster	1.2 kW
Fan	30 W
Personal Stereo	10 W

Which **one** of the devices will transfer the most energy in 10 minutes?

.....

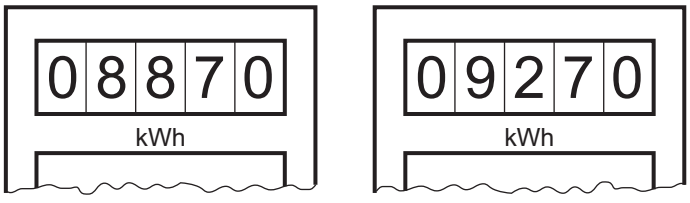
(1 mark)

4.1.1.4 Power

Question 04 · continued

MARGIN BLANK

(c) The diagrams show the readings on a domestic electricity meter in April and July.



April July

(i) How many Units (kWh) of electricity were used between the two meter readings?

.....

.....

Number of Units = ...

(1 mark)

(ii) One Unit costs 6p.

Use the following equation to calculate the cost of the electrical energy used between the two meter readings. Show clearly how you work out your answer.

total cost = number of Units × cost per Unit

.....

.....

Cost = ...

(2 marks)

(d) A 3000 watt electric cooker is switched on for 2 hours.

Use the following equation to calculate the number of Units of energy transferred by the cooker. Show clearly how you work out your answer.

energy transferred	=	power	×	time
(kilowatt-hour, kWh)		(kilowatt, kW)		(hour, h)

.....

.....

Energy transferred = ...kWh

(2 marks)

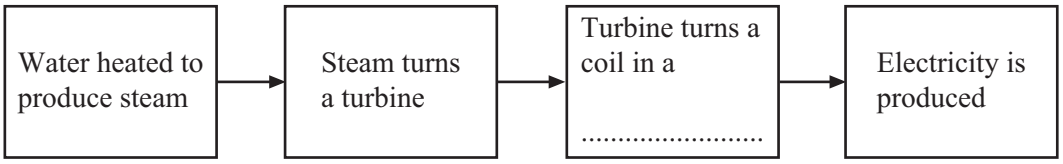
9

4.1.1.4 Power

Question 05

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

4.1.1.4 Power

Question 05 · continued

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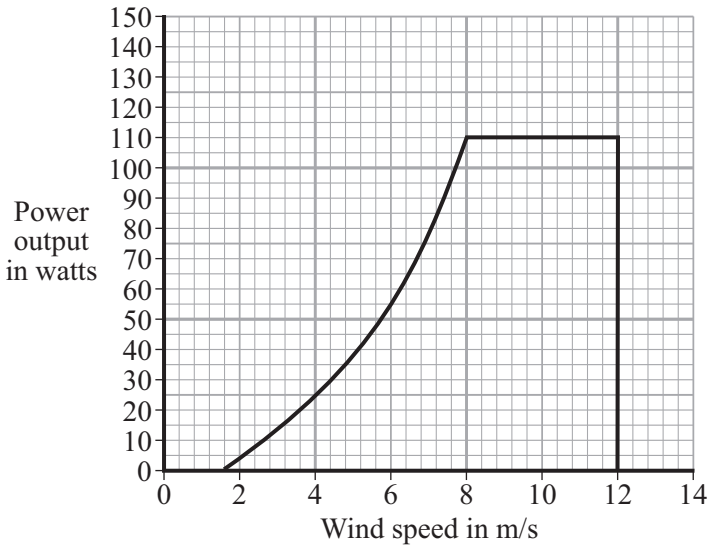
(d) A small wind generator is used to charge a battery. The graph shows the power output of the generator at different wind speeds.



(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

4.1.1.4 Power

Question 06

June 2004 | 3451F | Original Q11 | Legacy

11 The diagram represents the electromagnetic spectrum.

Gamma rays	X-rays	Ultraviolet	Visible light	Infra red	Microwaves	Radio waves

(a) Name the type of electromagnetic radiation that is used:

(i) to sterilise surgical instruments;

.....

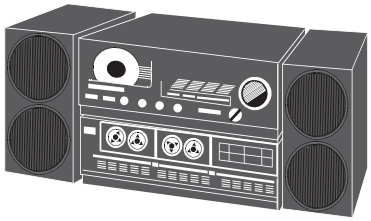
(1 mark)

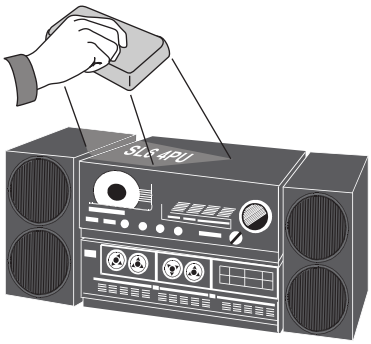
(ii) to send a signal to a TV from a remote control.

.....

(1 mark)

(b) Valuable items can be security marked using special ink. The ink can only be seen in ultraviolet radiation.





Explain what happens to make the ink visible.

.....

.....

.....

.....

(2 marks)

4.1.1.4 Power

Question 06 · continued

MARGIN BLANK

(c) Explain why skin cells need to be protected from ultraviolet radiation.

.....

.....

.....

.....

(2 marks)

(d) The following information is from an oven that combines a microwave and a grill.

Voltage	230 V
Microwave power	0.65 kW
Grill power	1.15 kW

(i) Name the **two** types of electromagnetic radiation that the oven can use to cook food.

..... and .....

(1 mark)

(ii) A joint of meat is cooked using both the microwave and the grill. Both are switched on at full power for half an hour.

Use the following equation to calculate the energy transferred, in kilowatt-hours, by the oven. Show clearly how you obtain your answer.

energy transferred = power × time

.....

.....

.....

energy transferred =.....kWh

(2 marks)

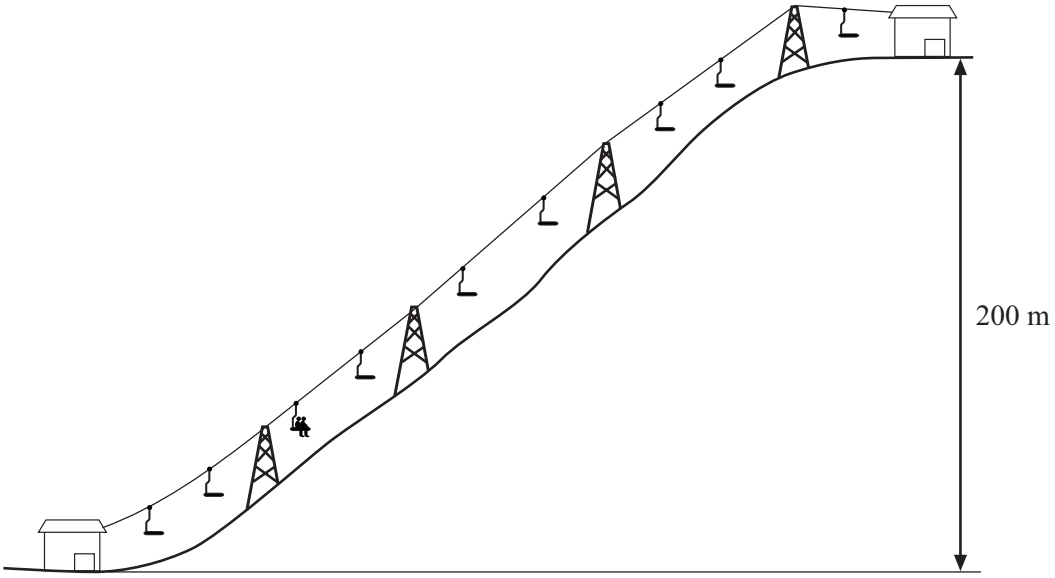
9

4.1.1.4 Power

Question 07

June 2004 | 3451F | Original Q13 | Legacy

13 (a) A chair lift carries two skiers, Greg and Jill, to the top of a ski slope. Greg weighs 700 N and Jill weighs 500 N.



(i) Write down the equation that links distance moved, force applied and work done.

.....

(1 mark)

(ii) Calculate the work done to lift Greg and Jill through a vertical height of 200 m.
Show clearly how you work out your answer and give the unit.

.....

.....

.....

work done =.....

(3 marks)

4.1.1.4 Power

Question 07 · continued

MARGIN
BLANK

(b) The chair takes 5 minutes to move from the bottom to the top of the ski slope.

Use the following equation to calculate the power required to lift Greg and Jill to the top of the ski slope. Show clearly how you work out your answer.

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

.....

.....

power = ...watts

(2 marks)

(c) The chair lift is driven by an electric motor.

(i) Why would the power output of the electric motor need to be larger than your answer to part (b)?

.....

.....

(1 mark)

(ii) Complete the following sentence.

When the ski lift is working ..... energy supplied to the motor is usefully transferred as gravitational ..... energy. *(1 mark)*

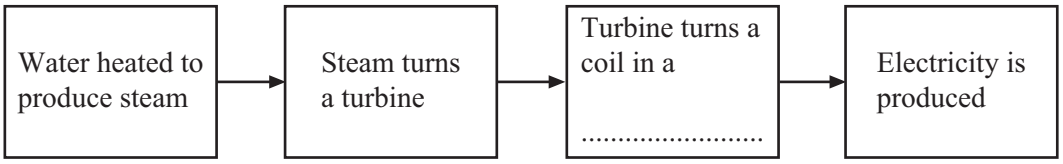
8

4.1.1.4 Power

Question 08

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.

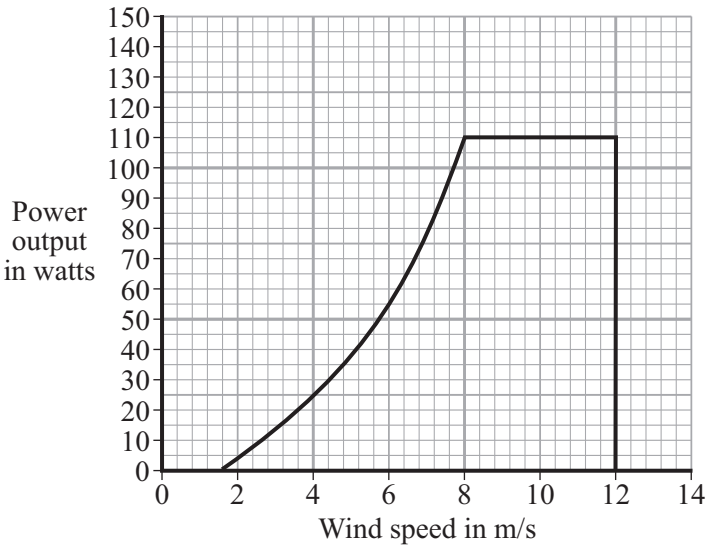
List A **Energy resource**	**List B** **Environmental problem that may be caused**
Wind	Destroys the habitat of wading birds in river estuaries
Tides	Produces a lot of noise
Falling water (hydroelectricity)	Produces the gas sulphur dioxide
	Floods land used for farming or forestry

4.1.1.4 Power

Question 08 · 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

4.1.1.4 Power

Question 09

June 2004 | 3462F3 | Original Q9 | Legacy

9 The diagram represents the electromagnetic spectrum.

Gamma rays	X-rays	Ultraviolet	Visible light	Infra red	Microwaves	Radio waves

(a) Name the type of electromagnetic radiation that is used:

(i) to sterilise surgical instruments;

.....

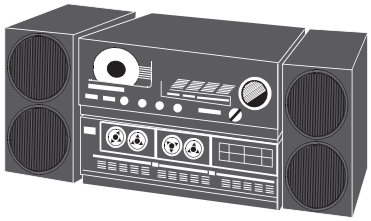
(1 mark)

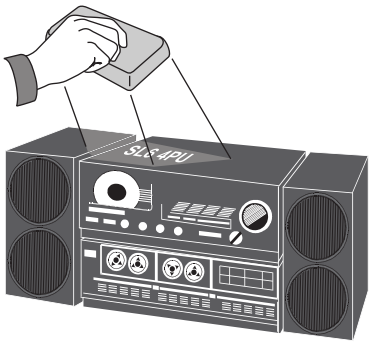
(ii) to send a signal to a TV from a remote control.

.....

(1 mark)

(b) Valuable items can be security marked using special ink. The ink can only be seen in ultraviolet radiation.





Explain what happens to make the ink visible.

.....

.....

.....

.....

(2 marks)

4.1.1.4 Power

Question 09 · continued

MARGIN BLANK

(c) Explain why skin cells need to be protected from ultraviolet radiation.

.....

.....

.....

.....

(2 marks)

(d) The following information is from an oven that combines a microwave and a grill.

Voltage	230 V
Microwave power	0.65 kW
Grill power	1.15 kW

(i) Name the **two** types of electromagnetic radiation that the oven can use to cook food.

..... and .....

(1 mark)

(ii) A joint of meat is cooked using both the microwave and the grill. Both are switched on at full power for half an hour.

Use the following equation to calculate the energy transferred, in kilowatt-hours, by the oven. Show clearly how you obtain your answer.

energy transferred = power × time

.....

.....

.....

energy transferred =.....kWh

(2 marks)

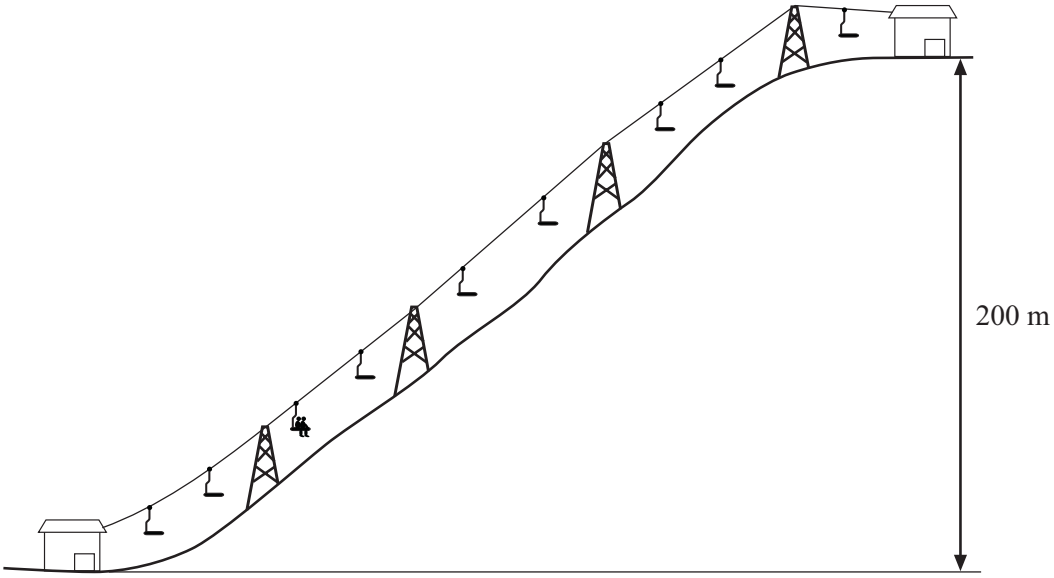
9

4.1.1.4 Power

Question 10

June 2004 | 3462F3 | Original Q11 | Legacy

11 (a) A chair lift carries two skiers, Greg and Jill, to the top of a ski slope. Greg weighs 700 N and Jill weighs 500 N.



(i) Write down the equation that links distance moved, force applied and work done.

.....

(1 mark)

(ii) Calculate the work done to lift Greg and Jill through a vertical height of 200 m.
Show clearly how you work out your answer and give the unit.

.....

.....

.....

work done =.....

(3 marks)

4.1.1.4 Power

Question 10 · continued

MARGIN
BLANK

(b) The chair takes 5 minutes to move from the bottom to the top of the ski slope.

Use the following equation to calculate the power required to lift Greg and Jill to the top of the ski slope. Show clearly how you work out your answer.

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

.....

.....

power = ...watts
(2 marks)

(c) The chair lift is driven by an electric motor.

(i) Why would the power output of the electric motor need to be larger than your answer to part (b)?

.....

.....
(1 mark)

(ii) Complete the following sentence.

When the ski lift is working ..... energy supplied to the motor is usefully transferred as gravitational ..... energy. *(1 mark)*

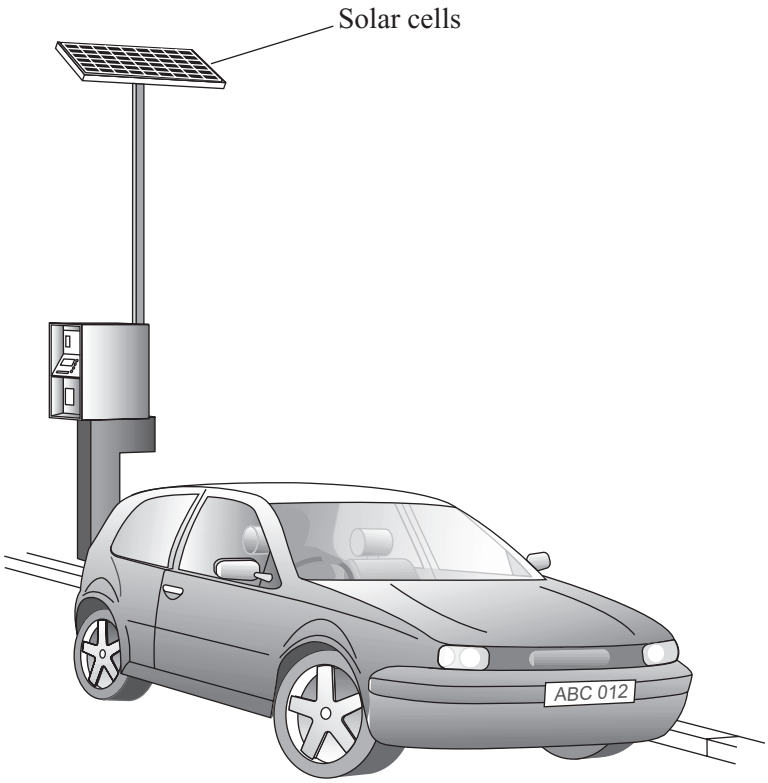
8

4.1.1.4 Power

Question 11

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)

4.1.1.4 Power

Question 11 · 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.

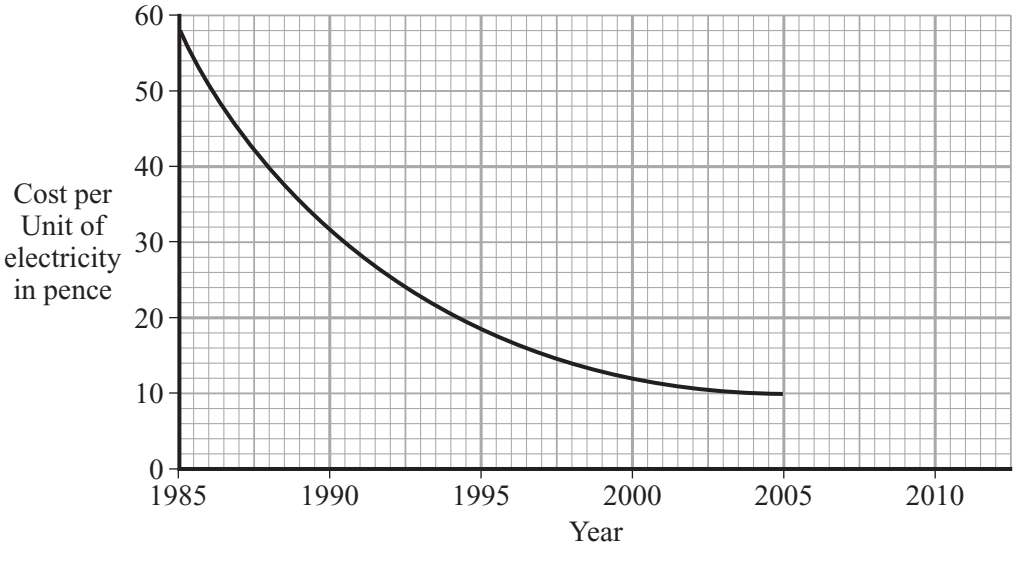
Solar cells give a constant supply of electricity. ☐

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)

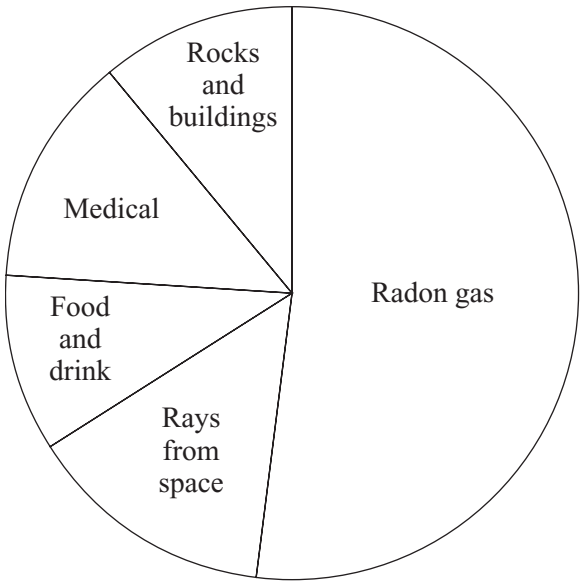
6

4.1.1.4 Power

Question 12

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?

.....

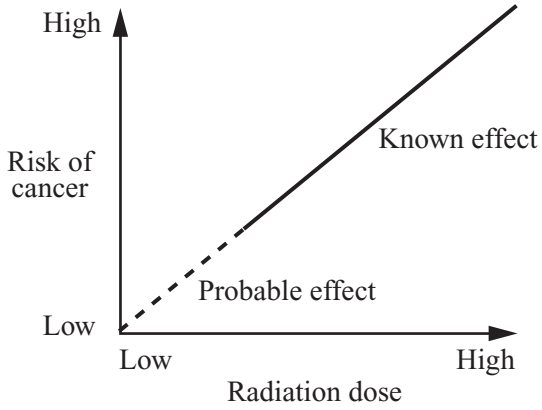
(1 mark)

(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.

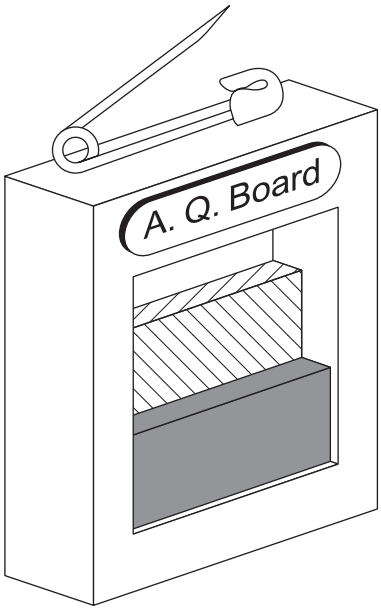


Diagram 1

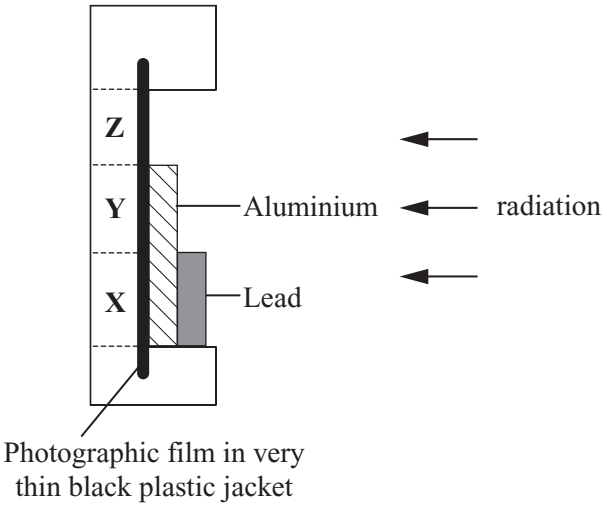


Diagram 2

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

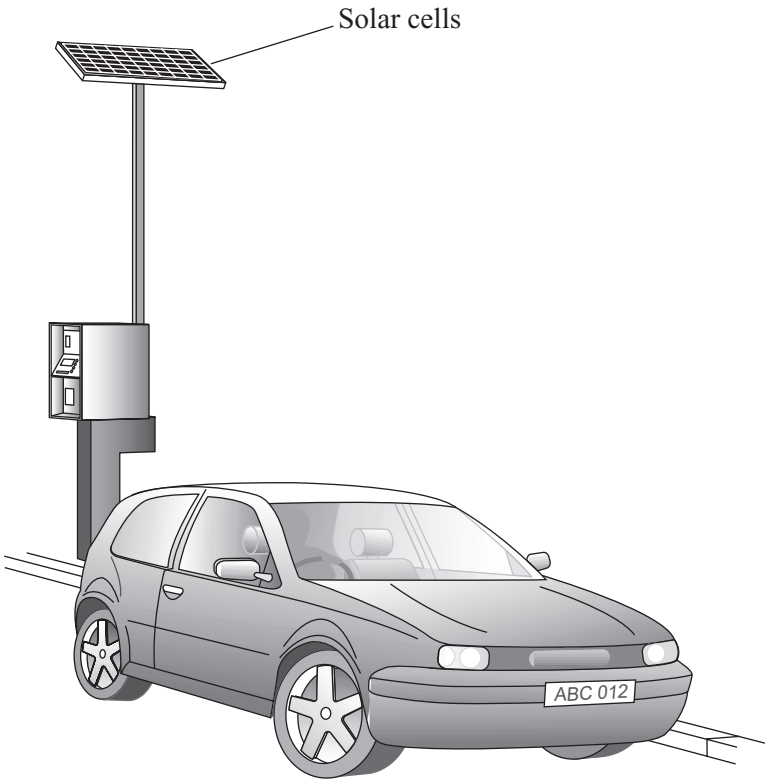
TURN OVER FOR THE NEXT QUESTION

4.1.1.4 Power

Question 13

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)

4.1.1.4 Power

Question 13 · 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.

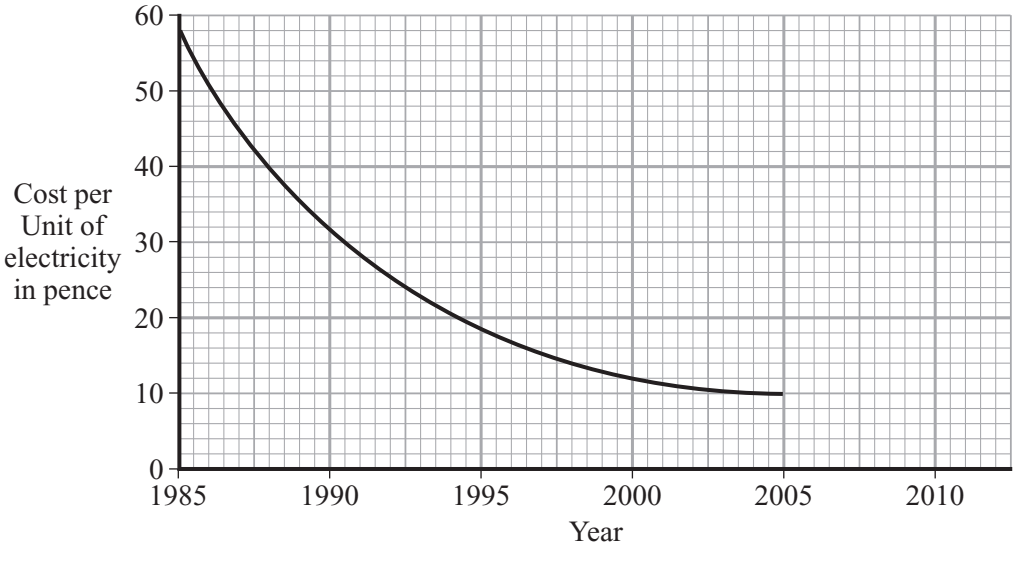
Solar cells give a constant supply of electricity. ☐

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)

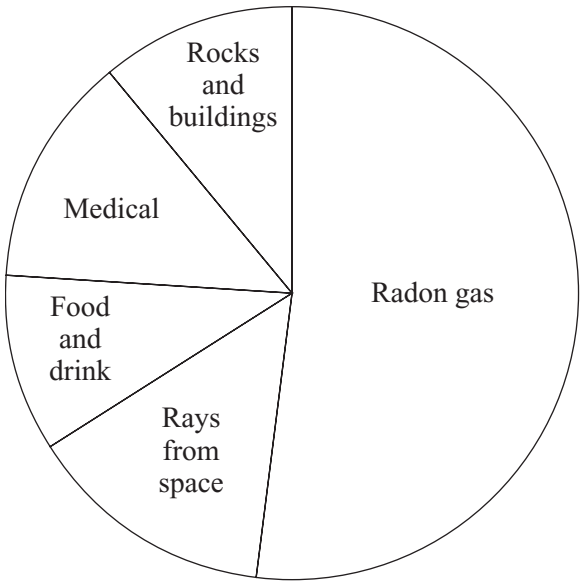
6

4.1.1.4 Power

Question 14

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?

.....

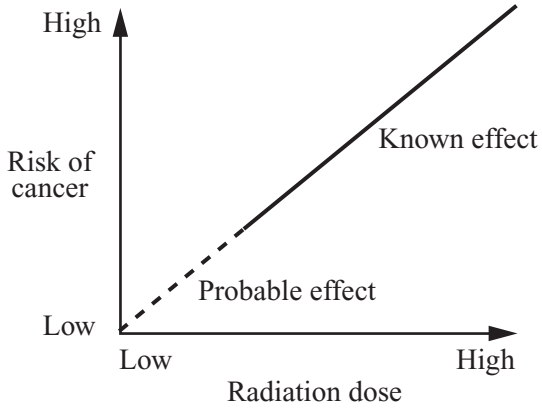
(1 mark)

(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)

Question 14 · continued

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.

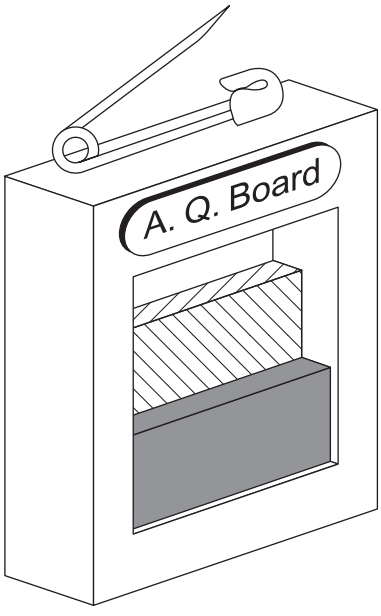


Diagram 1

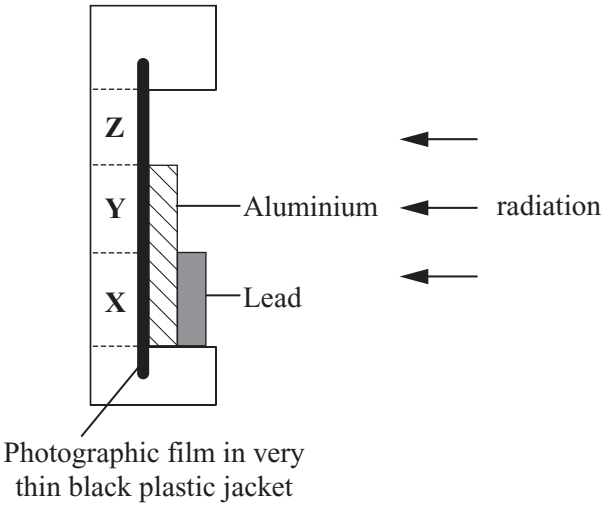


Diagram 2

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

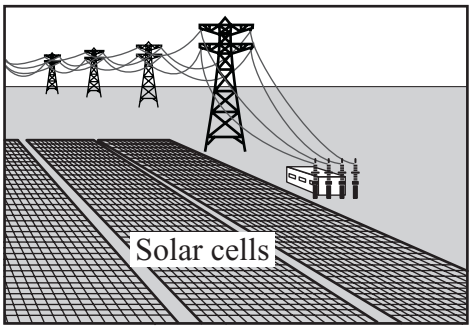
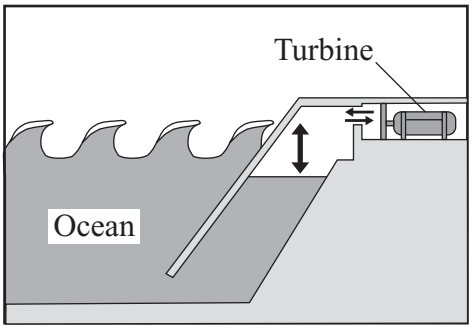
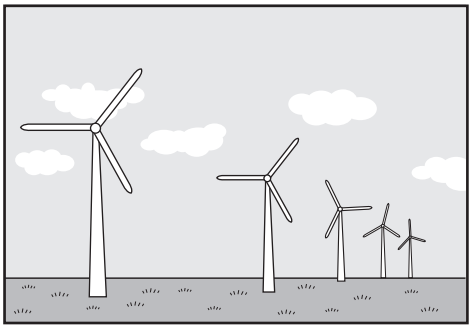
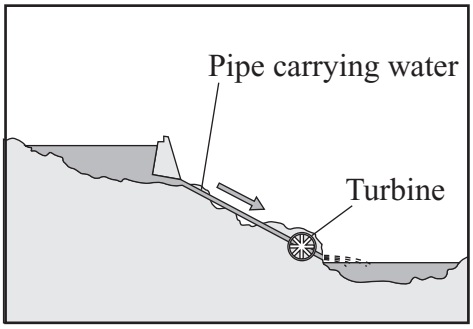
4.1.1.4 Power

Question 15

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
	Wave
	Wind

(4 marks)

4.1.1.4 Power

Question 15 · 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

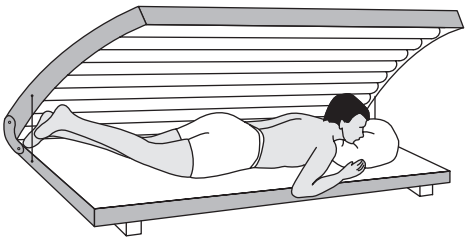
Turn over for the next question

4.1.1.4 Power

Question 16

June 2006 | 3451 | Original Q2 | Legacy

2 (a) The diagram shows a person using a sunbed.



(i) Which type of radiation is used in a sunbed to give a suntan?

Draw a ring around your answer.

infra red **light** **microwave** **ultraviolet**

(1 mark)

(ii) What can a high dose of radiation from a sunbed do to living cells?

.....

.....

(1 mark)

Question 16 · continued

BLANK

(b) The box contains the information shown on the side of a sunbed.

230 V	**1.8 kW**
50 Hz	**7.8 A**

(i) Which **one** of the following statements is true? Put a tick (✓) in the box next to your choice.

The sunbed uses an alternating current (a.c.) electricity supply. ☐

A 5 amp fuse should be used in the plug of the sunbed. ☐

The sunbed transfers 1.8 joules of energy every second. ☐

(1 mark)

(ii) In one week the sunbed is used for a total of 6 hours.

Use the following equation to calculate the number of units of energy transferred by the sunbed in 6 hours.

Show clearly how you work out your answer.

energy transferred (kilowatt-hour, kWh) = power (kilowatt, kW) × time (hour, h)

.....

.....

Energy transferred = ... kWh

(2 marks)

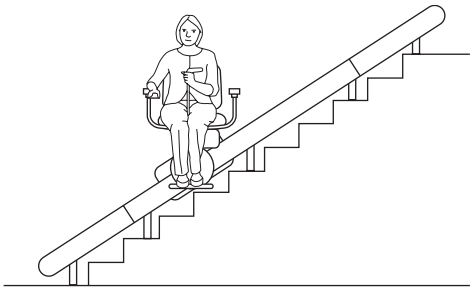
5

4.1.1.4 Power

Question 17

June 2006 | 3451 | Original Q7 | Legacy

7 A person uses a stairlift to go upstairs. The stairlift is worked by an electric motor.



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

Each word may be used once or not at all.

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

(i) The electric motor is designed to transfer .....

energy to ..... energy.

(2 marks)

(ii) When the electric motor is working, the main energy wastages are

..... and ..... .

(2 marks)

Question 17 · continued

BLANK

(b) To lift the person and the chair, the electric motor does 2880 joules of work in 8 seconds.

(i) Use the following equation to calculate the useful power output of the electric motor. Show clearly how you work out your answer.

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

.....

.....

Power = ... J/s

(2 marks)

(ii) The answer to part (b)(i) is in J/s; this is not the usual unit for power. Which **one** of the following units is usually used for power?

Draw a ring around your answer.

coulomb (C) **joule (J)** **newton (N)** **watt (W)**

(1 mark)

(c) The forces on the stairlift are balanced.

Put a tick (✓) in the boxes next to the **two** statements that describe what the stairlift could be doing.

The stairlift is not moving. ☐

The stairlift is moving at a constant speed. ☐

The stairlift is speeding up. ☐

The stairlift is slowing down. ☐

(1 mark)

8

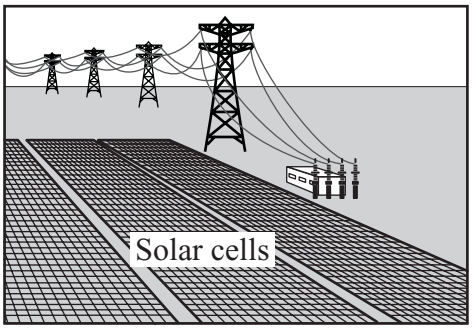
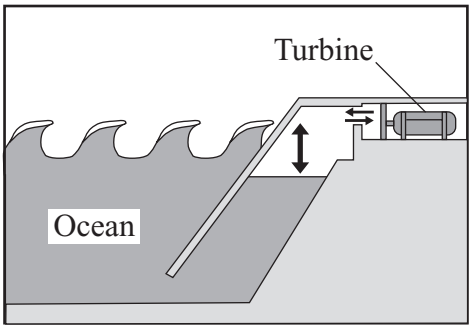
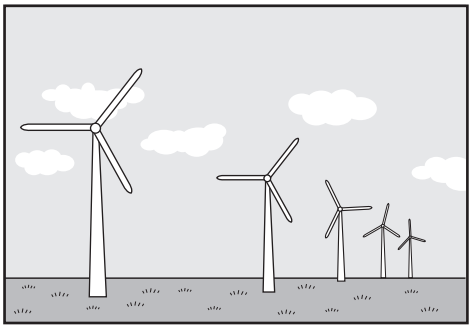
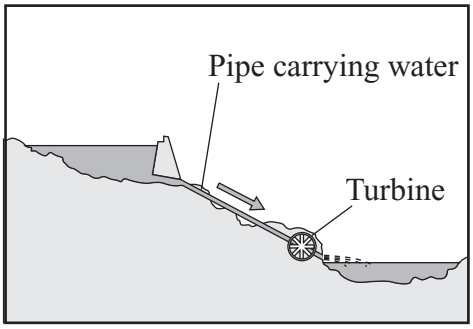
4.1.1.4 Power

Question 18

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)

4.1.1.4 Power

Question 18 · 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

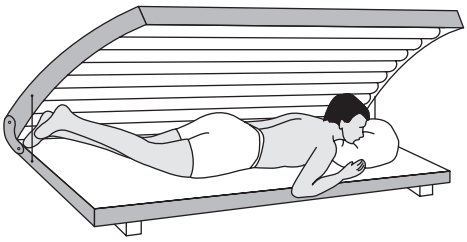
Turn over for the next question

4.1.1.4 Power

Question 19

June 2006 | 3462 | Original Q2 | Legacy

2 (a) The diagram shows a person using a sunbed.



(i) Which type of radiation is used in a sunbed to give a suntan?

Draw a ring around your answer.

infra red **light** **microwave** **ultraviolet**

(1 mark)

(ii) What can a high dose of radiation from a sunbed do to living cells?

.....

.....

(1 mark)

Question 19 · continued

BLANK

(b) The box contains the information shown on the side of a sunbed.

230 V	**1.8 kW**
50 Hz	**7.8 A**

(i) Which **one** of the following statements is true? Put a tick (✓) in the box next to your choice.

The sunbed uses an alternating current (a.c.) electricity supply. ☐

A 5 amp fuse should be used in the plug of the sunbed. ☐

The sunbed transfers 1.8 joules of energy every second. ☐

(1 mark)

(ii) In one week the sunbed is used for a total of 6 hours.

Use the following equation to calculate the number of units of energy transferred by the sunbed in 6 hours.

Show clearly how you work out your answer.

energy transferred (kilowatt-hour, kWh) = power (kilowatt, kW) × time (hour, h)

.....

.....

Energy transferred = ... kWh

(2 marks)

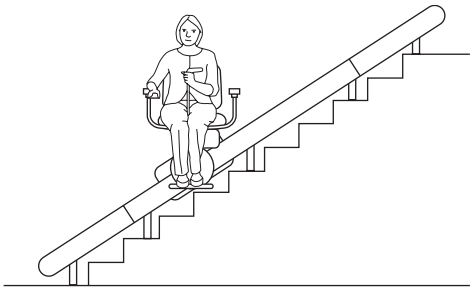
5

4.1.1.4 Power

Question 20

June 2006 | 3462 | Original Q7 | Legacy

7 A person uses a stairlift to go upstairs. The stairlift is worked by an electric motor.



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

Each word may be used once or not at all.

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

(i) The electric motor is designed to transfer .....

energy to ..... energy.

(2 marks)

(ii) When the electric motor is working, the main energy wastages are

..... and ..... .

(2 marks)

Question 20 · continued

BLANK

(b) To lift the person and the chair, the electric motor does 2880 joules of work in 8 seconds.

(i) Use the following equation to calculate the useful power output of the electric motor. Show clearly how you work out your answer.

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

.....

.....

Power = ... J/s

(2 marks)

(ii) The answer to part (b)(i) is in J/s; this is not the usual unit for power. Which **one** of the following units is usually used for power?

Draw a ring around your answer.

coulomb (C) **joule (J)** **newton (N)** **watt (W)**

(1 mark)

(c) The forces on the stairlift are balanced.

Put a tick (✓) in the boxes next to the **two** statements that describe what the stairlift could be doing.

The stairlift is not moving. ☐

The stairlift is moving at a constant speed. ☐

The stairlift is speeding up. ☐

The stairlift is slowing down. ☐

(1 mark)

8

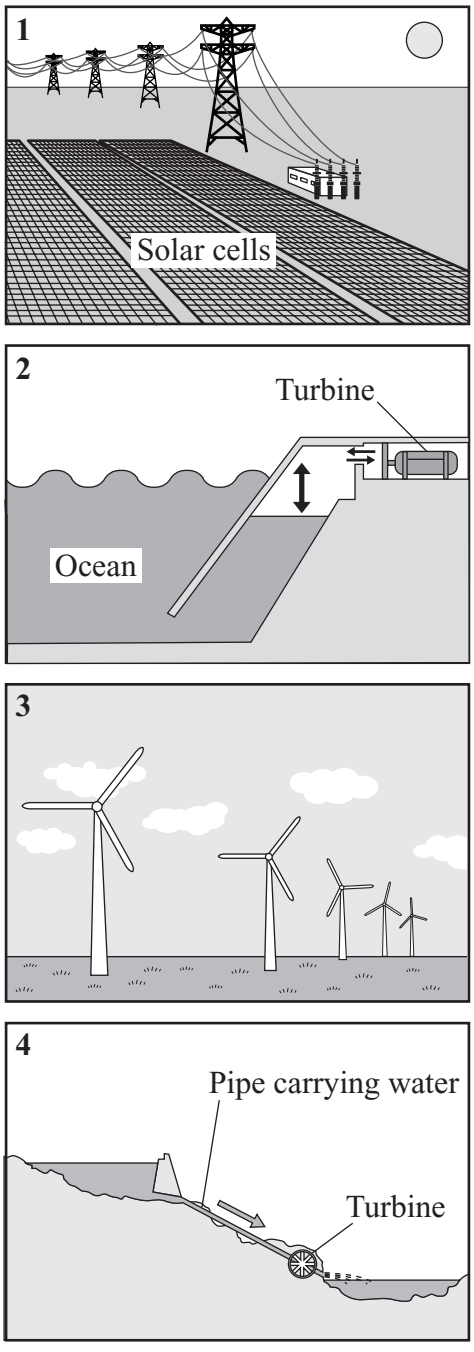
4.1.1.4 Power

Question 21

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

4.1.1.4 Power

Question 22

November 2006 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

A family needs to replace their old washing machine. They go to look at some new models.



7A One model has a sticker which reads:

More efficient than any other washing machine at this price

If this is scientifically true, it means that, compared with other washing machines, this washing machine must . . .

1 cost less to run.

2 use less electrical energy.

3 usefully transform a larger percentage of the electrical energy supplied to it.

4 usefully transform a smaller fraction of the electrical energy supplied to it.

7B More efficient washing machines will benefit society by . . .

1 being easier to recycle in the future.

2 having less impact on the environment.

3 using less water.

4.1.1.4 Power

Question 22 · continued

7C The average power of one washing machine is 2400 watts.

2400 watts is equal to . . .

1 0.24 kW

2 2.40 kW

3 24 kW

4 240 kW

7D

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

How much energy, in kilowatt-hours, is transferred when a 2400 watt washing machine is used for 60 minutes?

1 2.4

2 40

3 144

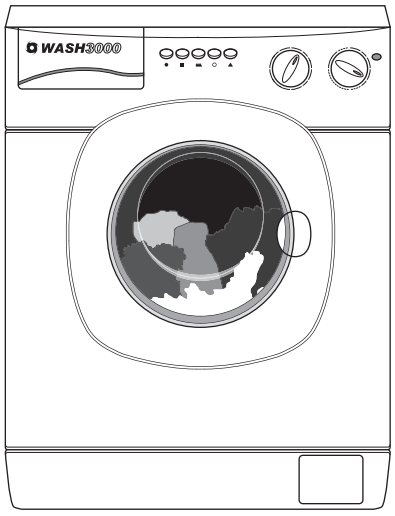
4 144 000

4.1.1.4 Power

Question 23

January 2007 | PHY1F | Original Q5 | Legacy

5 (a) The picture shows a new washing machine.



Complete the following sentence using **one** of the words in the box.

kinetic	**light**	**sound**

A washing machine is designed to transform electrical energy into heat and

..... energy.

(1 mark)

(b) The instruction booklet for the washing machine contains the following information.

Wash cycle	Average power during cycle	Time taken to run cycle
HOT	1.5 kW	2 hours
COOL	1.1 kW	1½ hours
FAST	1.0 kW	¾ hour

4.1.1.4 Power

Question 23 · continued

BLANK

(i) Use the following equation to calculate the energy transferred, in kilowatt-hours, to the washing machine during the HOT wash cycle. Show how you work out your answer.

energy transferred = power × time

.....

.....

Energy transferred = ... kWh

(2 marks)

(ii) Why does it cost more to use the washing machine on the HOT cycle than on the COOL or FAST cycle?

.....

.....

(1 mark)

(iii) Before buying a washing machine, a householder researched several makes to find out which washing machine was the most energy efficient.

Write down **one** way that he could have done this research.

.....

.....

(1 mark)

5

4.1.1.4 Power

Question 24

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.

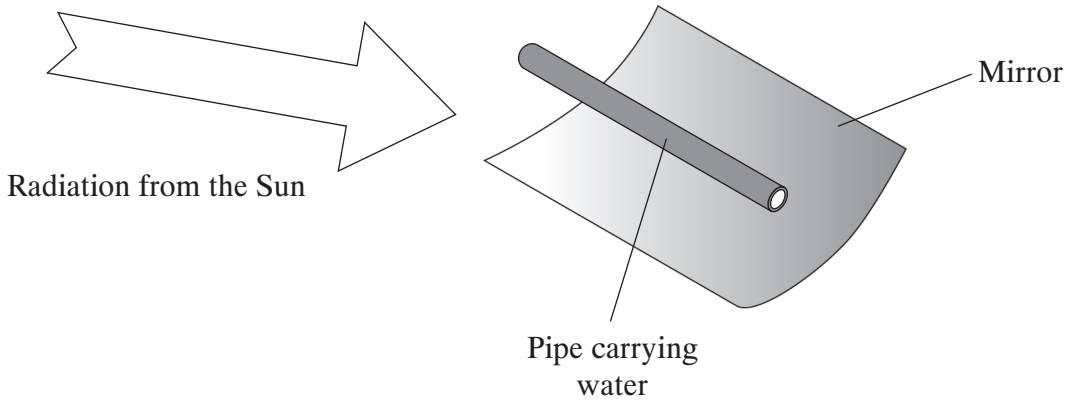
4.1.1.4 Power

Question 25

March 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

The diagram shows part of a solar-powered power station.



Match stages, **A**, **B**, **C** and **D**, with the boxes **1–4** in the flow chart on the next page to explain how the power station works.

A The turbine turns the generator.

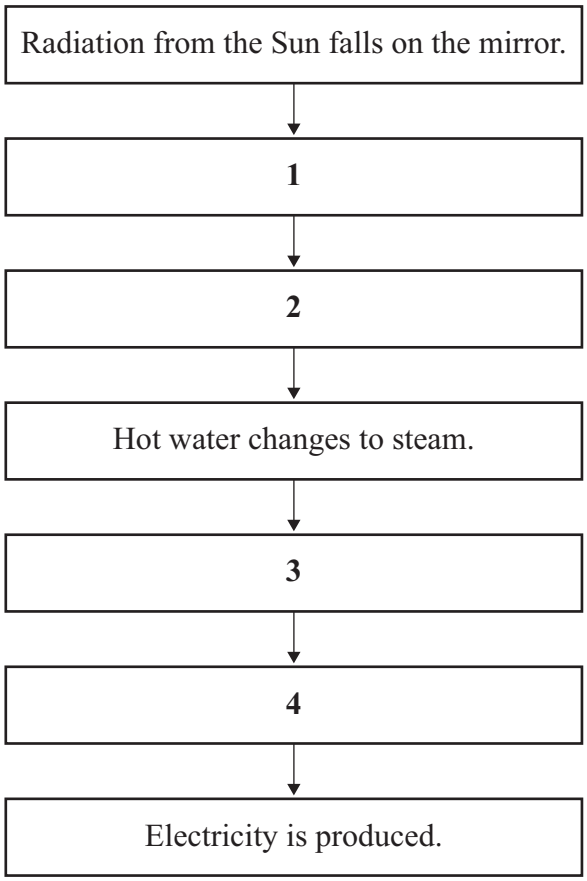
B Radiation is reflected onto the pipe.

C Steam drives the turbine.

D Water in the pipe absorbs energy.

4.1.1.4 Power

Question 25 · continued



4.1.1.4 Power

Question 26

March 2007 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

An electricity company plans to build a new power station and it is in the process of consulting local people.

The decisions are not straightforward because various points need to be considered.

7A Every type of energy source for a power station is unreliable in some circumstances.

Which energy source is unreliable on a day-to-day basis?

1 coal

2 oil

3 uranium

4 wind

7B Every type of power station makes some contribution to global warming.

Which type of power station makes the **least** contribution?

1 a coal-fired power station

2 a gas-fired power station

3 a nuclear power station

4 an oil-fired power station

4.1.1.4 Power

Question 26 · continued

7C Every type of power station changes the local environment in some way.

Which type of power station involves the damming of an upland river valley?

1 a geothermal power station

2 a hydroelectric power station

3 a tidal barrage

4 a wind farm

7D Which type of power station can also be used to store energy from surplus electricity?

1 a coal-fired power station

2 a gas-fired power station

3 a hydroelectric power station

4 a nuclear power station

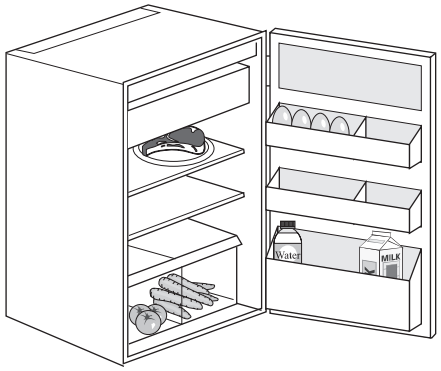
4.1.1.4 Power

Question 27

June 2007 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

The electricity supplied to a fridge costs 11p for each kilowatt-hour (kWh).



energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)
total cost	=	number of kilowatt-hours	×	cost per kilowatt-hour

During one summer month, the fridge used 20 kWh of electricity.

7A How much did this electricity cost?

1 20 p

2 £2.00

3 £2.20

4 £220.00

Question 27 · continued

7B The fridge has a power of 50 W.

How much energy does it transfer in 24 hours?

1 1.2 kWh

2 2.4 kWh

3 50 kWh

4 1200 kWh

UK households spend £1.2 billion on electricity every year, just on refrigeration and freezing. Buying a new *Energy Efficiency Recommended* fridge can save each household up to £35 a year.

7C An *Energy Efficiency Recommended* fridge will be better than an older fridge because . . .

1 it will keep food colder.

2 it will keep food fresh longer.

3 it will use less electricity.

4 it will not break down.

7D The Government is encouraging people to use *Energy Efficiency Recommended* electrical appliances so that . . .

1 people will be better off.

2 less carbon dioxide will be released into the atmosphere.

3 less food will be wasted.

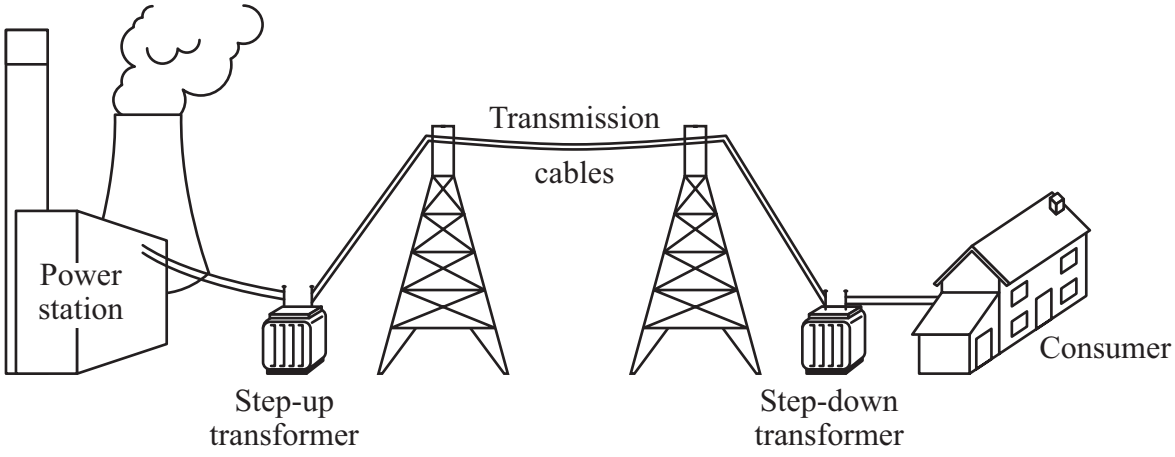
4 more jobs will be created.

4.1.1.4 Power

Question 28

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)

4.1.1.4 Power

Question 28 · 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

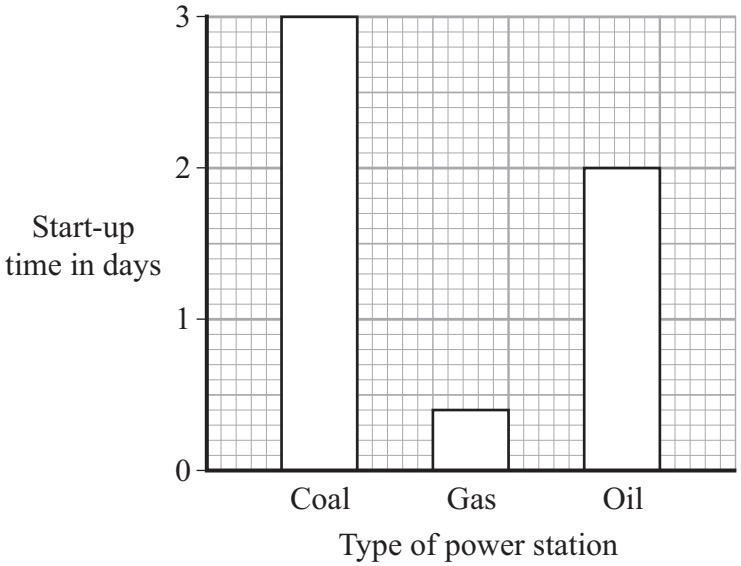
4.1.1.4 Power

Question 29

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 29 · 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

4.1.1.4 Power

Question 30

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** . . . .

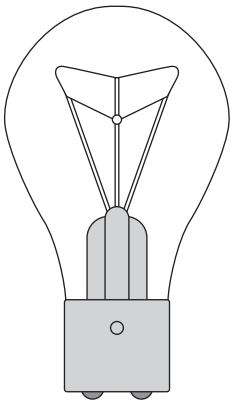
4.1.1.4 Power

Question 31

November 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a lamp.



The lamp has a power of 100 watts (W).
It gives out light at a rate of 5 watts.

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

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

A 0.05

B 5

C 95

D 100

1	amount of energy supplied to the lamp each second in joules
2	amount of energy transferred as light each second in joules
3	amount of energy wasted each second in joules
4	efficiency of the lamp

4.1.1.4 Power

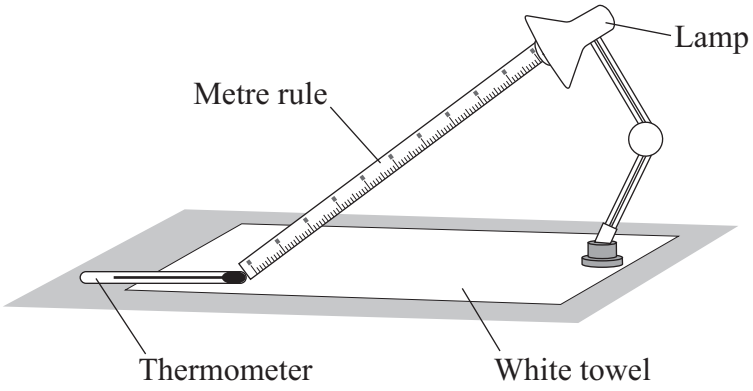
Question 32

November 2007 | PHY1A | Original Q8 | Legacy

QUESTION EIGHT

A student investigated the heat output from four different makes of lamp, **W**, **X**, **Y** and **Z**. Each lamp had the same power.

The diagram shows the apparatus she used.



- She recorded the initial temperature shown by the thermometer.
- She then switched on lamp **W**.
- Five minutes later, she recorded the final temperature shown by the thermometer.
- She repeated this procedure for lamps **X**, **Y** and **Z**.

The table shows her results.

Lamp	Initial temperature in °C	Final temperature in °C
W	17	27
X	18	26
Y	20	28
Z	22	29

8A What kind of variable was the make of lamp?

1 categoric

2 continuous

3 dependent

4 ordered

4.1.1.4 Power

Question 32 · continued

8B Which of these was **not** a control variable in this investigation?

1 make of lamp

2 distance of thermometer from lamp

3 length of time the lamp was switched on

4 the white towel

8C Which lamp caused the largest rise in temperature in the thermometer?

1 **W**

2 **X**

3 **Y**

4 **Z**

8D Which lamp seems to be the most efficient in producing light?

1 **W**

2 **X**

3 **Y**

4 **Z**

4.1.1.4 Power

Question 33

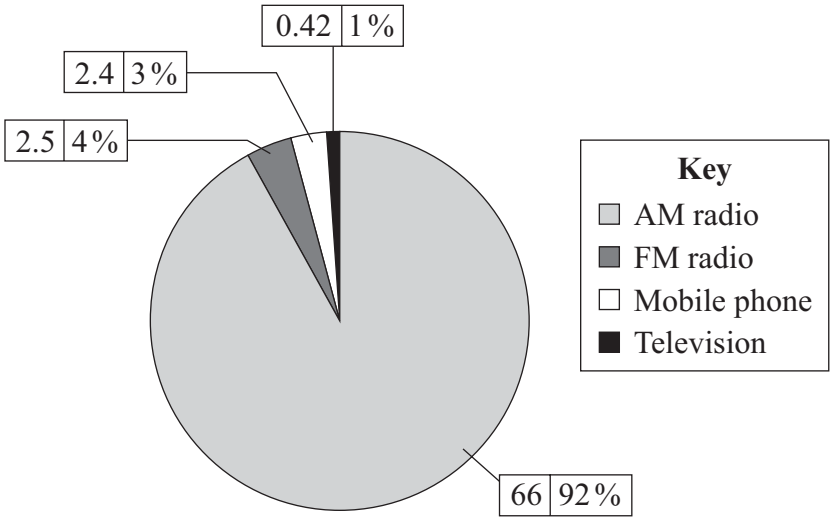
November 2007 | PHY1B | Original Q5 | Legacy

QUESTION FIVE

The pie chart shows the power of four types of electromagnetic radiation received by people living in a small town near both a radio/TV mast and a mobile phone mast. It also shows the percentage of the total power from each source.

The units for the power are microwatts per m^2 of skin surface.

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



A 0.42

B 3

C 27.5

D 68.5

1	the power of the radiation received from TV in microwatts per m^2
2	the percentage of the radiation received from mobile phones
3	the total power received from AM and FM radio waves in microwatts per m^2
4	the number of times greater the power received from AM radio is than that received from mobile phones

4.1.1.4 Power

Question 34

January 2008 | PHY1F | Original Q1 | Legacy

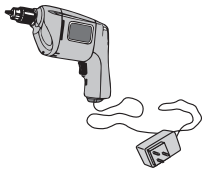
1 (a) Each letter **A**, **B**, **C**, **D** and **E** represents an energy transformation.

A electrical to gravitational potential
B electrical to heat
C electrical to kinetic
D electrical to light
E electrical to sound

Match each of the following devices to the useful energy transformation that it is designed to make.

Write the correct letter, **A**, **B**, **C**, **D** or **E**, in the box below the device. Use each letter once or not at all.

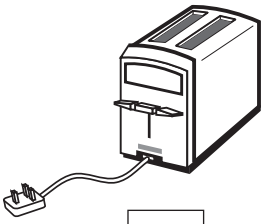
Drill



MP3 player



Toaster



(3 marks)

Question 1 continues on the next page

4.1.1.4 Power

Question 34 · continued

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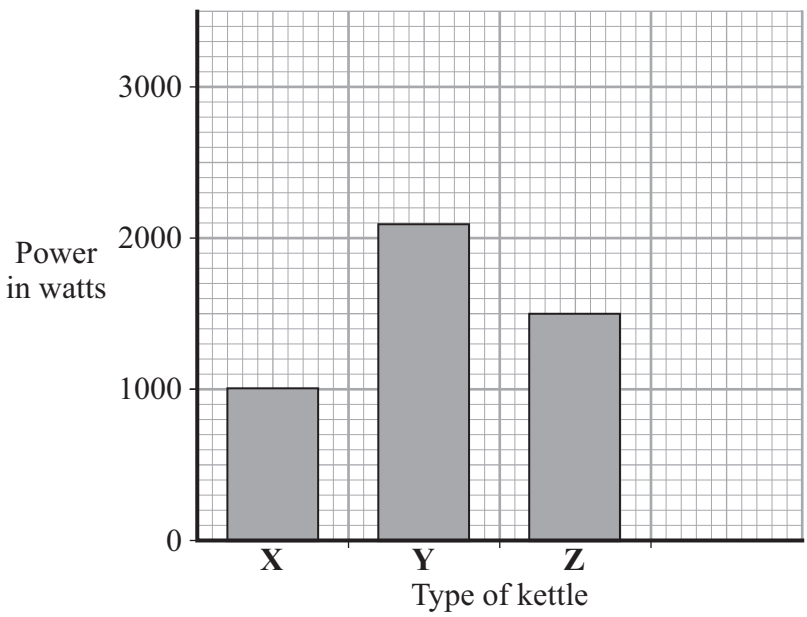
(b) The bar chart shows the power of three electric kettles.



(i) What is the power of kettle **Y**?

.....

(1 mark)

(ii) In one week each kettle is used for a total of 30 minutes.

Which kettle costs the most to use?

.....

(1 mark)

(iii) A new 'express boil' kettle boils water faster than any other kettle.

Draw a fourth bar on the chart to show the possible power of an 'express boil' kettle. *(1 mark)*

4.1.1.4 Power

Question 34 · continued

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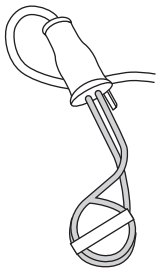
(c) Some friends are going on holiday. They want to be able to boil water to make their own hot drinks. They cannot decide which to take, a travel kettle or a small portable immersion heater that can be placed in a mug.





Travel kettle	Immersion heater
• 1 kW element • Holds 1 litre • Works on 110 V or 230 V • Washable water filter	• 0.4 kW element • Heats up to 0.5 litres of water • Works on 230 V only • Small compact size

(i) Give **one** advantage of taking the travel kettle.

.....

.....

(1 mark)

(ii) Give **one** advantage of taking the immersion heater.

.....

.....

(1 mark)

8

4.1.1.4 Power

Question 35

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?

.....

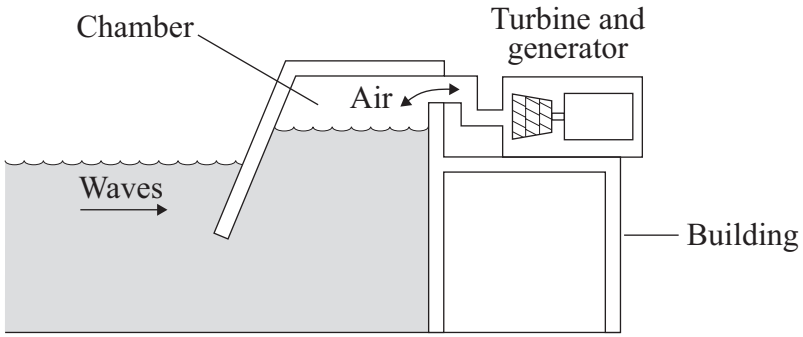
.....

.....

.....

(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)

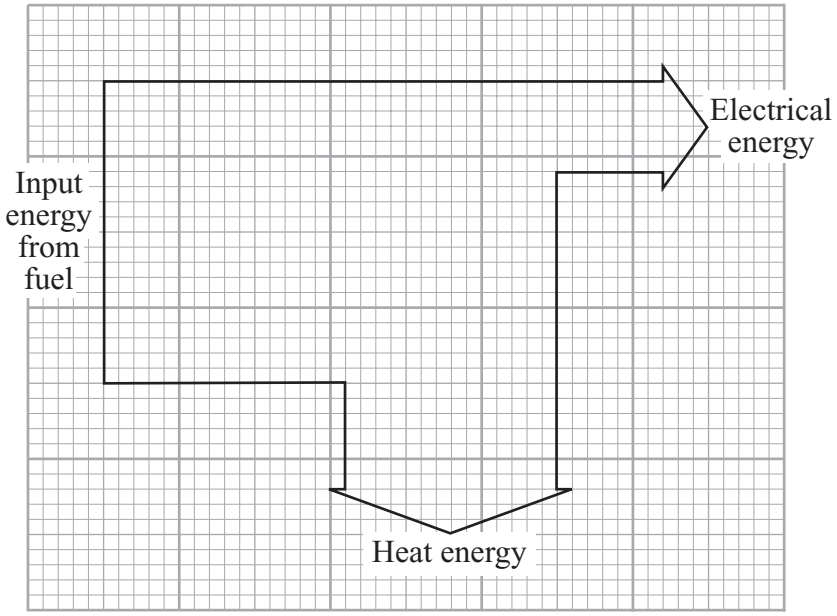
5

4.1.1.4 Power

Question 36

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

4.1.1.4 Power

Question 36 · 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)

4.1.1.4 Power

Question 36 · 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

4.1.1.4 Power

Question 37

March 2008 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)
total cost	=	number of kilowatt-hours	×	cost per kilowatt-hour

The diagram shows the readings on a household electricity meter at the start and at the end of a day.



At the start of the day

At the end of the day

Each kilowatt-hour of electricity costs 11 p.

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

A 10

B 44

C 56

D 2000

The total amount of electricity transferred during the day was . . . **1** . . . kWh.

The energy transferred by a 2 kW fire is . . . **2** . . . joules per second.

The amount of energy transferred by a 2 kW fire in 5 hours is . . . **3** . . . kWh.

The total cost of using a 2 kW fire for 2 hours is . . . **4** . . . p.

4.1.1.4 Power

Question 38

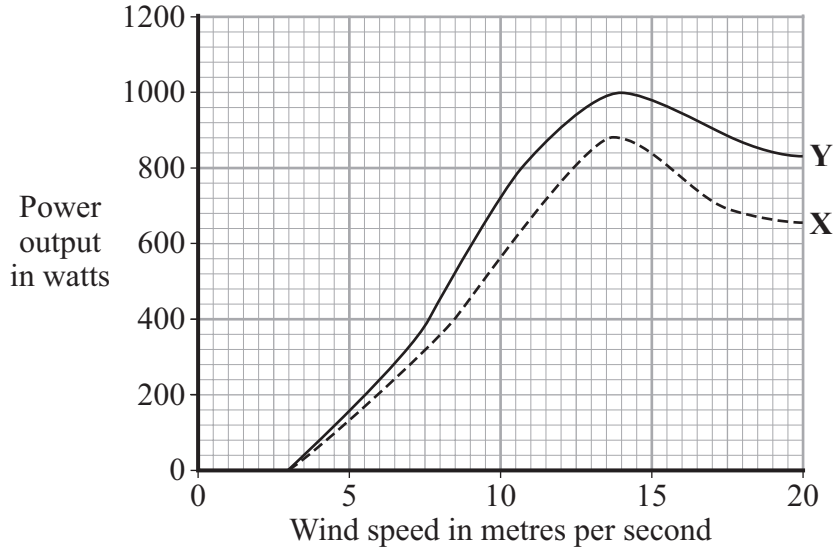
March 2008 | PHY1AP | Original Q9 | Legacy

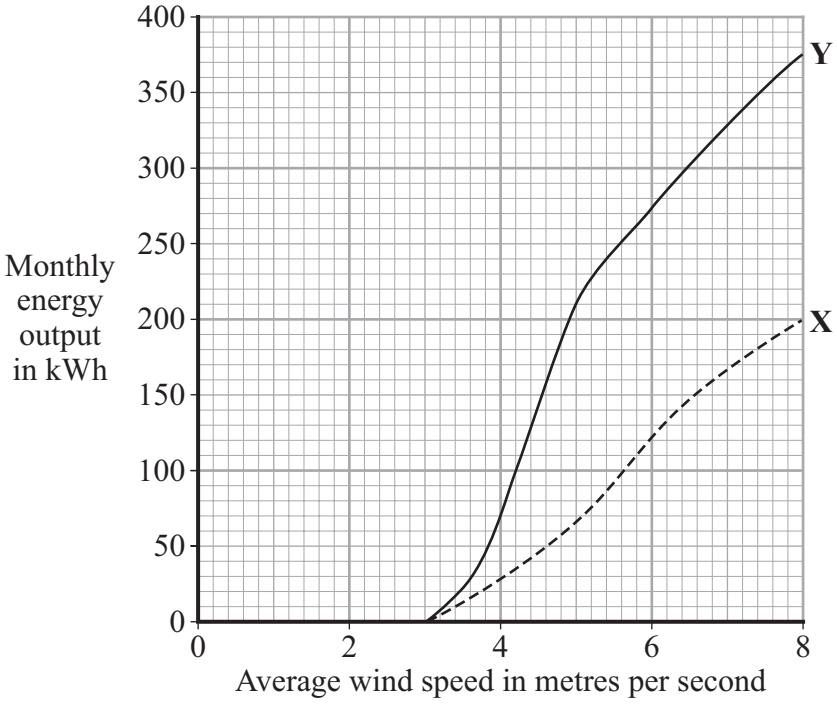
QUESTION NINE

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 38 · 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

4.1.1.4 Power

Question 39

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

4.1.1.4 Power

Question 40

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

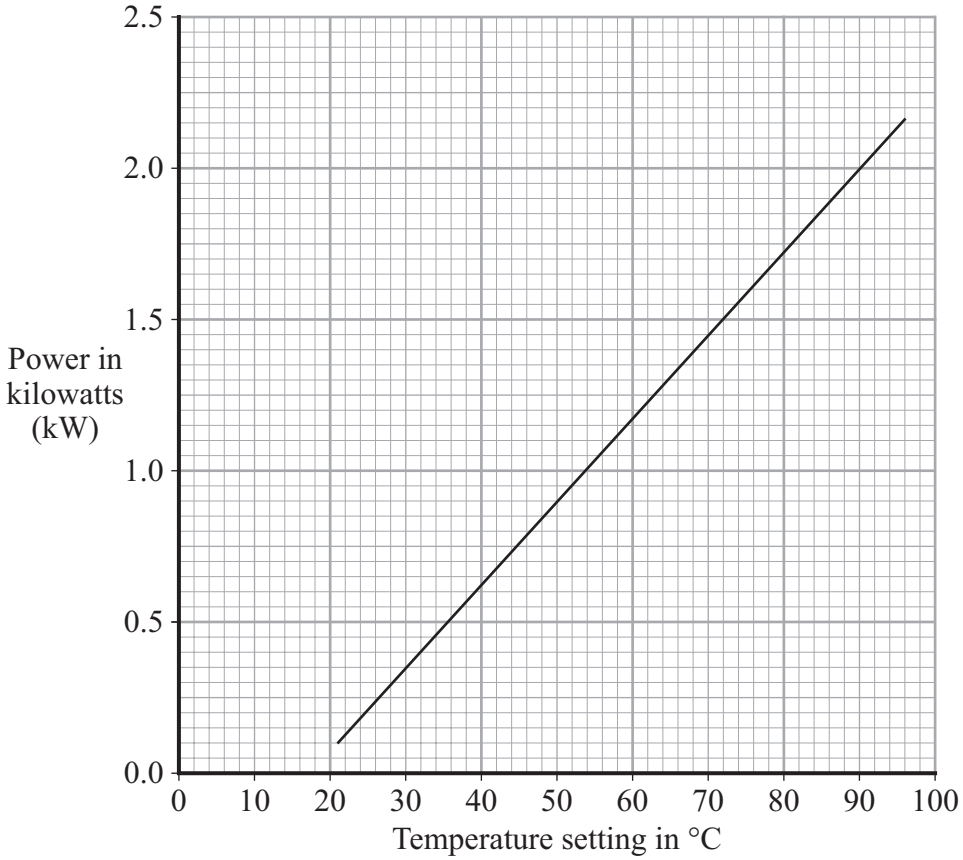
4.1.1.4 Power

Question 41

June 2008 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The graph shows how the power of a washing machine changes when it is set to different temperatures.



7A What relationship does the graph show?

1 As the temperature setting increases, the power increases.

2 As the temperature setting increases, the power decreases.

3 As the temperature setting decreases, the power increases.

4 There is no relationship.

4.1.1.4 Power

Question 41 · continued

7B Which of the following, according to the graph, is the power for a temperature setting of 90 °C?

1 1.90 kW

2 1.95 kW

3 2.00 kW

4 2.10 kW

7C Which of the following, according to the graph, is the temperature needed for 1.5 kW of power?

1 70 °C

2 71 °C

3 72 °C

4 75 °C

7D A washing machine programme uses a power of 1.5 kW and takes 2 hours to complete the wash.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

How many kilowatt-hours of energy will it use?

1 0.50

2 0.75

3 3.00

4 3.50

4.1.1.4 Power

Question 42

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

4.1.1.4 Power

Question 42 · 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

4.1.1.4 Power

Question 43

June 2008 | PHY1F | Original Q2 | Legacy

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

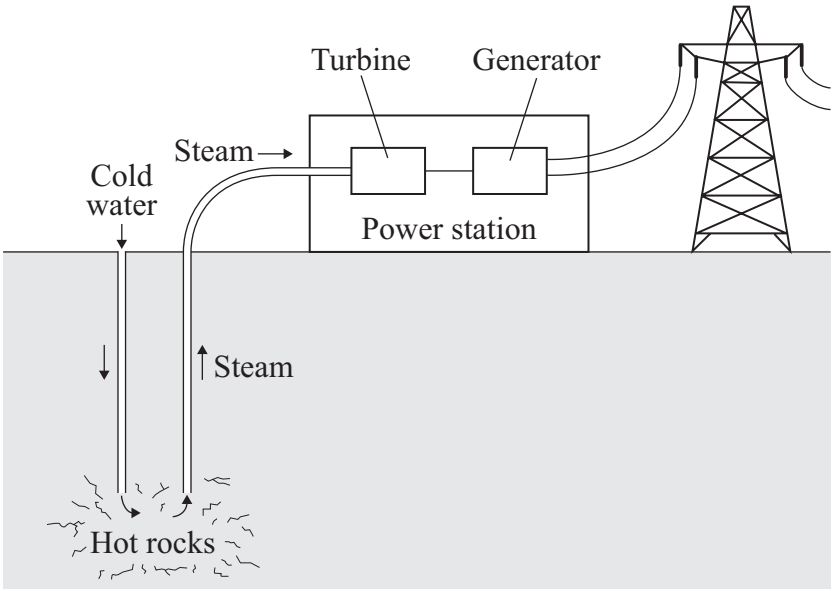
Which **two** of the energy sources in the box are likely to be used up first?

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?

.....

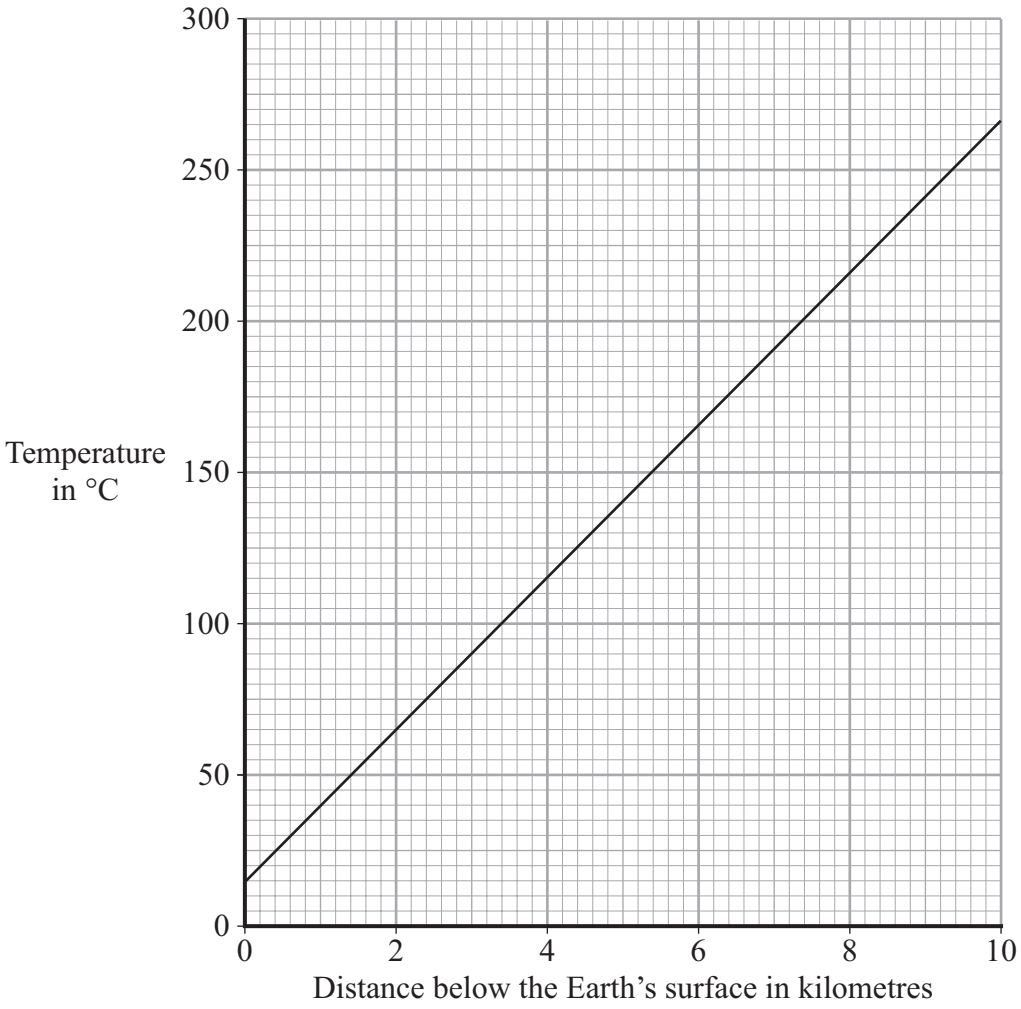
.....

(1 mark)

Question 43 · 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

4.1.1.4 Power

Question 43 · 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

4.1.1.4 Power

Question 44

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**.

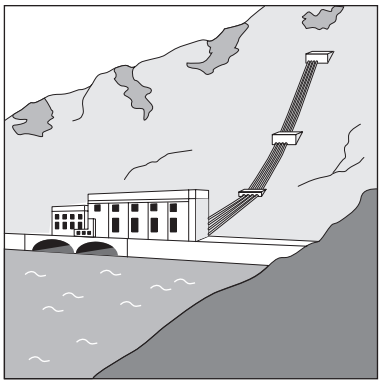
A geothermal

B falling water (hydroelectric)

C tides

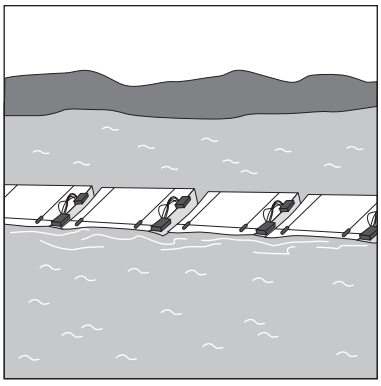
D waves

1



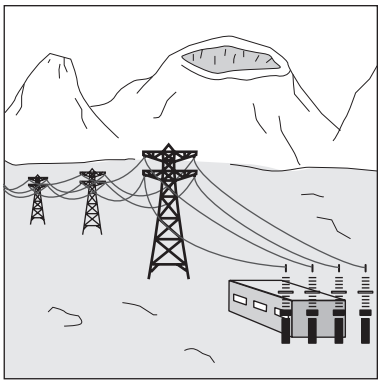
Mountainous region

2



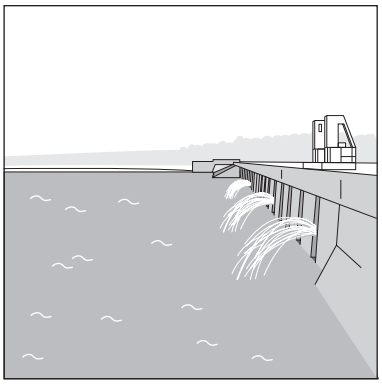
Coastal region

3



Volcanic region

4



River estuary

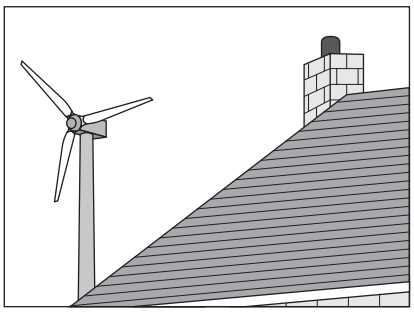
4.1.1.4 Power

Question 45

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

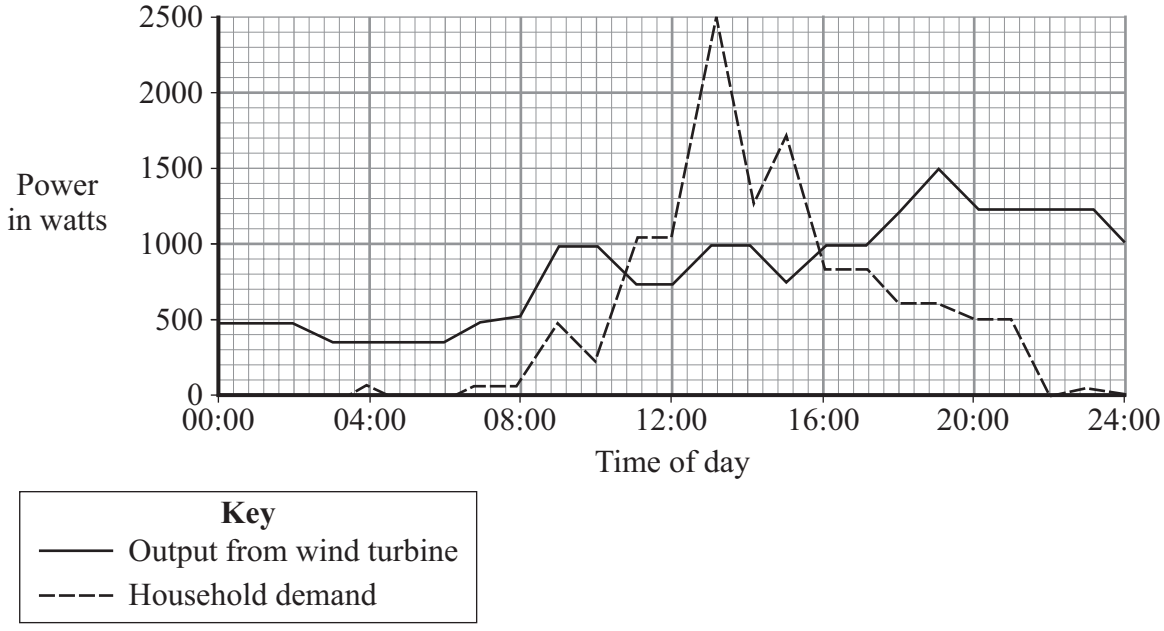
3 solar

4 wave

4.1.1.4 Power

Question 45 · 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

4.1.1.4 Power

Question 46

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.

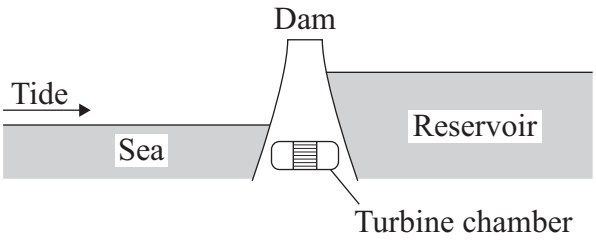
3 pump.

4 transformer.

4.1.1.4 Power

Question 46 · 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.

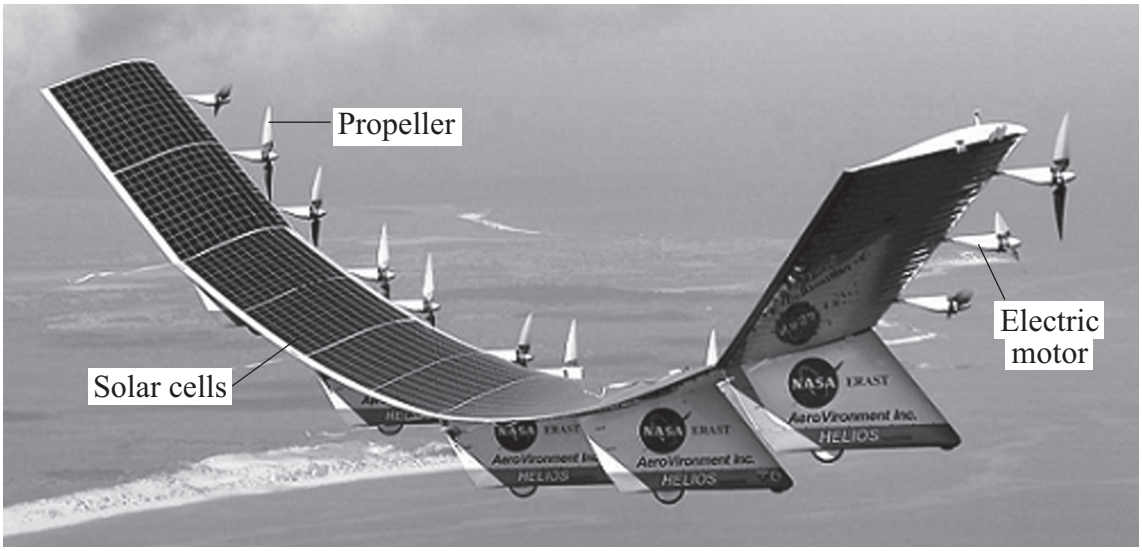
4 from kinetic to heat to electrical.

4.1.1.4 Power

Question 47

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)

4.1.1.4 Power

Question 47 · 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.

.....

.....

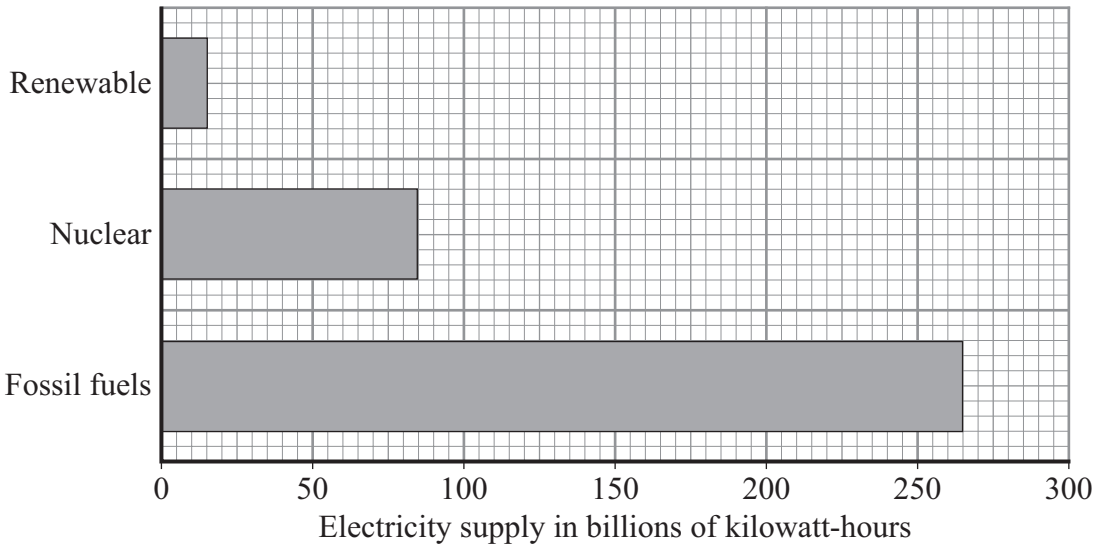
(1 mark)

8

4.1.1.4 Power

Question 48

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.

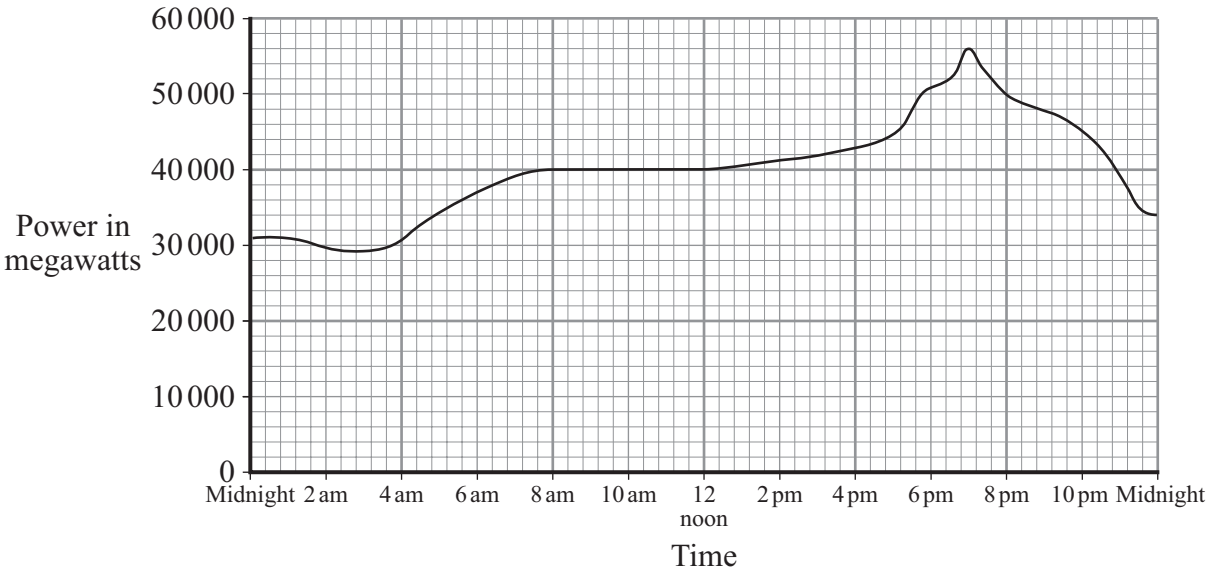
(1 mark)

4.1.1.4 Power

Question 48 · 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)

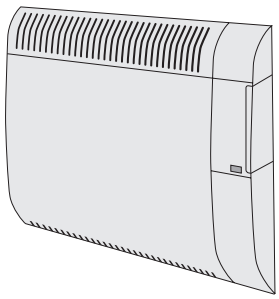
5

4.1.1.4 Power

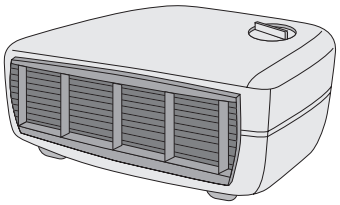
Question 49

January 2009 | PHY1F | Original Q7 | Legacy

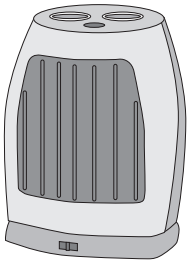
7 The pictures show three different types of electric heater.



400 W oil-filled panel heater (wall mounted)
- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out

7 (a) The ceramic heater is run on full power for 5 hours.

Use the following equation to calculate, in kilowatt-hours, the amount of energy transferred from the mains to the heater.

energy transferred = power × time

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kilowatt-hours
(2 marks)

7 (b) Which heater will be the most expensive to run on its highest heat setting?

.....
(1 mark)

4.1.1.4 Power

Question 49 · continued

for mark

7 (c) A heater is needed for a small office.

Comparing each type of heater with the other two, give **one** advantage of using each type of heater in the office.

oil-filled panel heater .....

.....

fan heater .....

.....

ceramic heater .....

.....

(3 marks)

6

4.1.1.4 Power

Question 50

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

4.1.1.4 Power

Question 51

March 2009 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

This question is about the use of energy in cars that use petrol.

6A A car engine transfers kinetic energy.

The kinetic energy is transformed from . . .

1 chemical energy.

2 electrical energy.

3 light energy.

4 sound energy.

6B Car makers are producing engines that are more efficient.

Compared with a less efficient engine of the same power, a more efficient engine always . . .

1 has a higher top speed.

2 has a lower top speed.

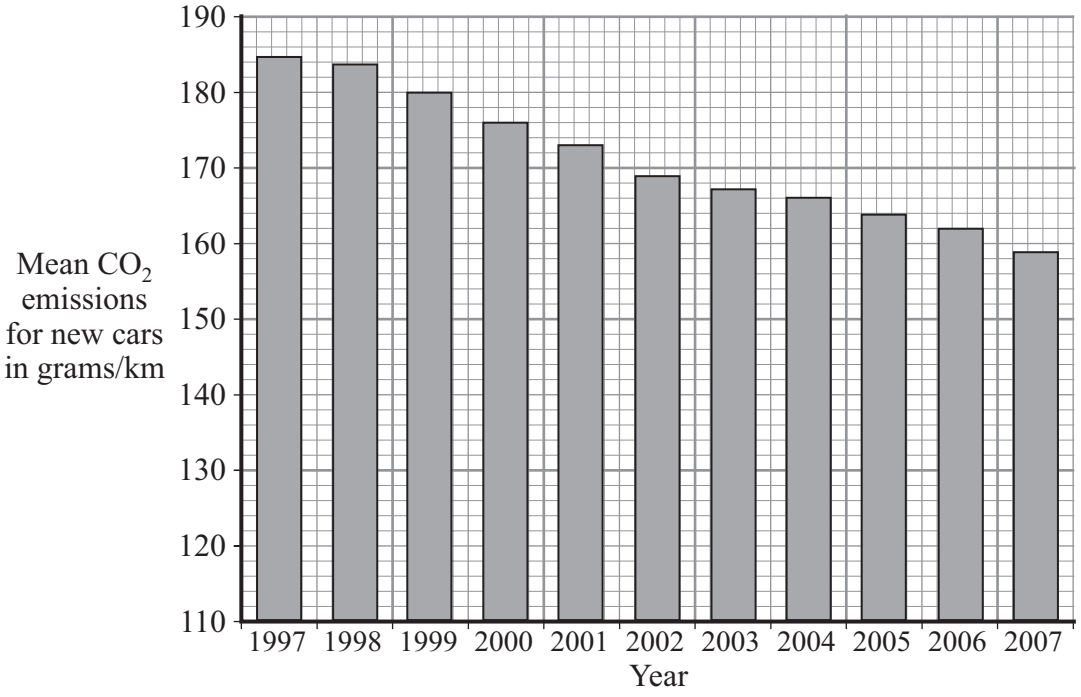
3 uses less petrol.

4 uses more petrol.

4.1.1.4 Power

Question 51 · continued

Cars release harmful gases into the atmosphere. The mean amount of carbon dioxide (CO_2) emitted by new cars for every kilometre driven has changed. The display shows how these emissions have changed since 1997.



6C The display is called a . . .

1 bar chart.

2 line graph.

3 pie chart.

4 scattergram.

6D The display shows that between 1997 and 2007, the amount of carbon dioxide released per kilometre by new cars has . . .

1 steadily increased.

2 steadily decreased.

3 decreased and then increased.

4 stayed the same.

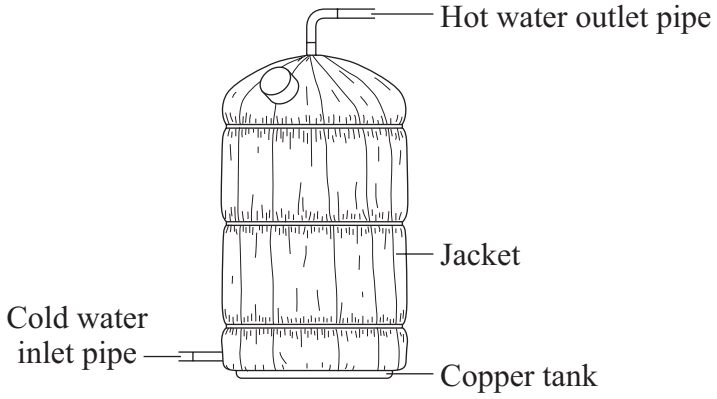
4.1.1.4 Power

Question 52

March 2009 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The diagram shows a hot water cylinder. The cylinder contains an electric heater.



9A A jacket is wrapped round the cylinder to keep the water warm. The jacket contains trapped air.

Trapped air reduces heat loss by . . .

1 conduction only.

2 conduction and radiation.

3 conduction and convection.

4 conduction, convection and radiation.

9B If a jacket is not fitted, it would be best to have a shiny surface for the cylinder rather than a dark matt one.

This is because dark matt surfaces are . . .

1 good conductors.

2 poor conductors.

3 good radiators.

4 poor radiators.

Question 52 · continued

9C The heater has a power of 3000 W. The heater is switched on for 6 hours.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

How many kilowatt-hours of energy does the heater use?

1 0.5

2 18

3 500

4 18 000

9D A household receives an electricity bill every 3 months. The total amount of electrical energy used during one 3-month period was 2000 kWh. Electricity costs 10 p per kWh.

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

How much was the bill?

1 £200

2 £600

3 £20 000

4 £60 000

END OF TEST

4.1.1.4 Power

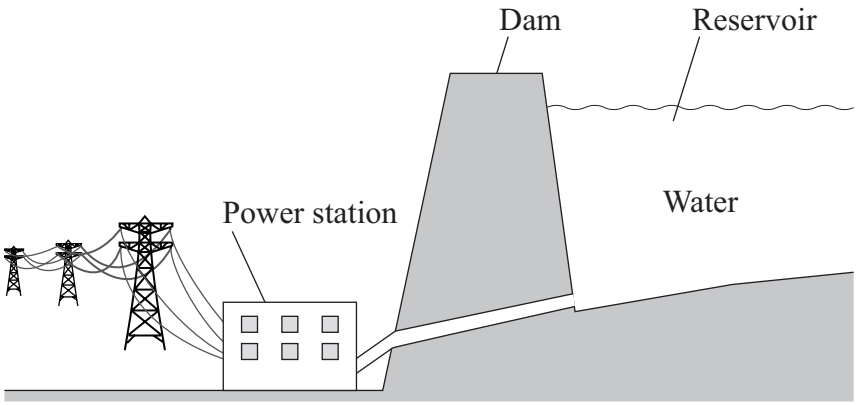
Question 53

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** . . . .

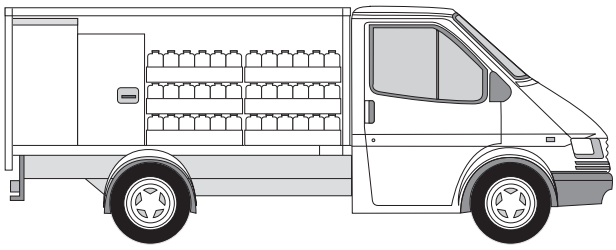
4.1.1.4 Power

Question 54

June 2009 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The diagram shows an electrically powered milk float.



In a milk float, batteries drive an electric motor.
A milk float travels 40 km a day.
The batteries are recharged overnight.

9A When the milk float is travelling along the road, the batteries transform . . .

1 electrical energy to kinetic energy.

2 kinetic energy to chemical energy.

3 chemical energy to electrical energy.

4 kinetic energy to electrical energy.

9B When charging the batteries, the battery charger transfers 1.5 kW of power for 5 hours.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

The energy transferred to the batteries is . . .

1 0.3 kWh

2 3.3 kWh

3 7.5 kWh

4 75 kWh

4.1.1.4 Power

Question 54 · continued

9C During a day, the electric motor usefully transfers 1600 kJ. The energy supplied to the electric motor is 4000 kJ.

What is the efficiency of the motor?

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

1 0.4

2 2.5

3 2400

4 5600

9D The milk float is said to be more 'environmentally friendly' than a petrol-driven vehicle.

This is because . . .

1 the batteries store energy.

2 it produces no harmful waste gases.

3 the batteries can be recharged many times.

4 the top speed is only 20 km/h.

END OF TEST

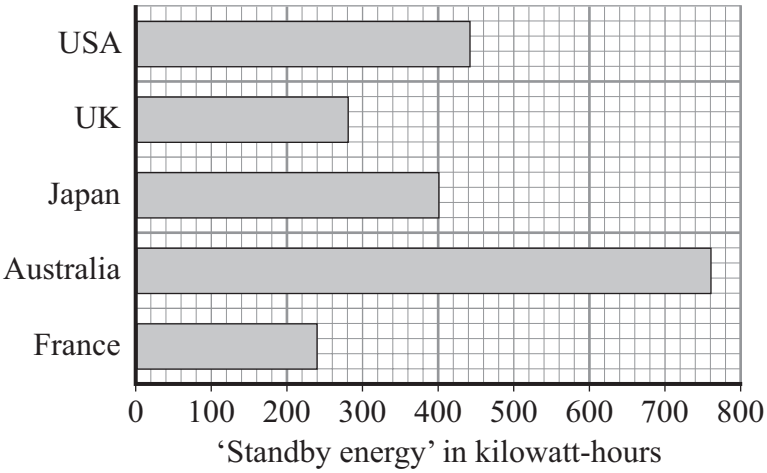
4.1.1.4 Power

Question 55

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)

4.1.1.4 Power

Question 55 · 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

4.1.1.4 Power

Question 55 · 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)

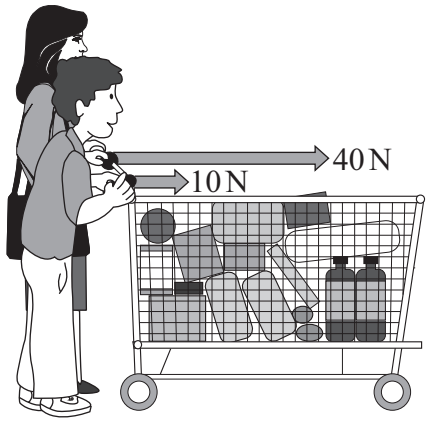
10

4.1.1.4 Power

Question 56

June 2009 | PHY2F | Original Q5 | Legacy

5 The diagram shows an adult and a child pushing a loaded shopping trolley.



5 (a) (i) What is the *total force* on the trolley due to the adult and child?

.....

(1 mark)

5 (a) (ii) Which **one** of the terms in the box means the same as *total force*?

Draw a ring around your answer.

answer force	**mean force**	**resultant force**

(1 mark)

5 (a) (iii) The trolley is pushed at a constant speed for 80 metres.

Use the equation in the box to calculate the work done to push the trolley 80 metres.

work done = force applied × distance moved in direction of force

Show clearly how you work out your answer.

.....

.....

Work done = ...

(2 marks)

4.1.1.4 Power

Question 56 · continued

for mark

5 (b) Complete the following sentences by drawing a ring around the correct word in each of the boxes.

5 (b) (i) The unit of work done is the | joule / newton / watt | .

(1 mark)

5 (b) (ii) Most of the work done to push the trolley is transformed into | heat / light / sound | .

(1 mark)

6

Turn over for the next question

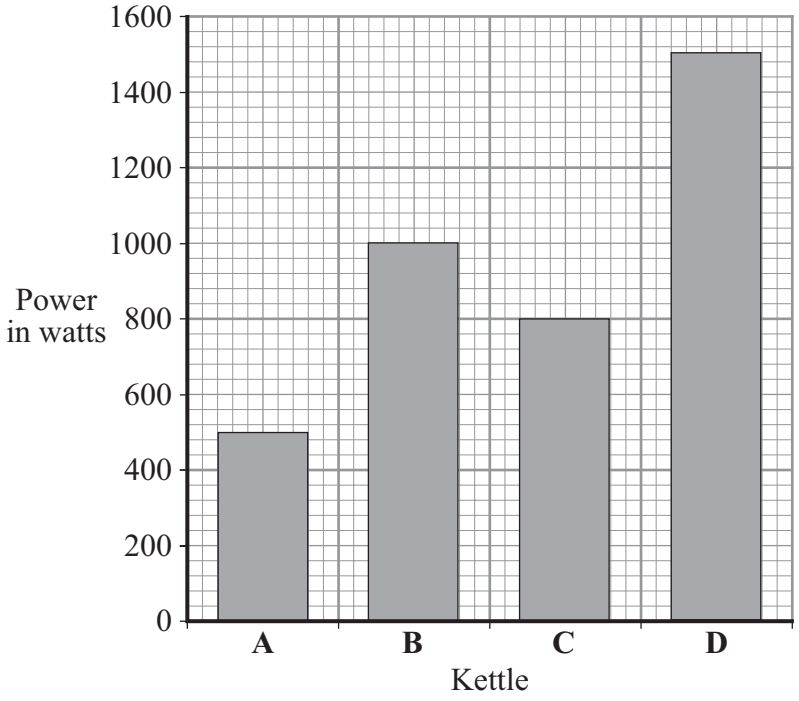
4.1.1.4 Power

Question 57

November 2009 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

The bar chart shows the power of four different electric kettles, **A**, **B**, **C** and **D**.



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

The kettle with the highest power is kettle . . . **1** . . . .

The kettle with a power of 800 W is kettle . . . **2** . . . .

The kettle with a power of 1 kW is kettle . . . **3** . . . .

Each kettle contains the same volume of water at 20 °C. The kettle that takes the longest time to boil the water is kettle . . . **4** . . . .

4.1.1.4 Power

Question 58

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

4.1.1.4 Power

Question 58 · 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

4.1.1.4 Power

Question 59

November 2009 | PHY1BP | Original Q3 | Legacy

QUESTION THREE

This question is about a radioactive isotope that emits alpha particles.

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

A count rate

B half-life

C penetrating power

D range

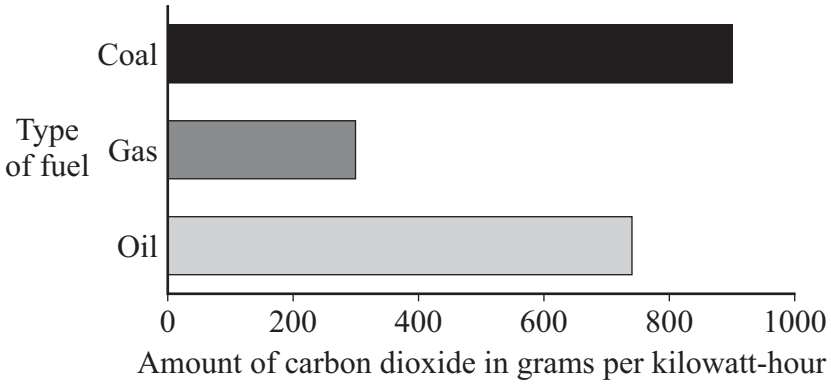
	Description
1	the number of alpha particles detected per second
2	the distance the alpha particles travel before being fully absorbed
3	the time it takes for half of the nuclei of the isotope to decay
4	the ability of the alpha particles to pass through matter

4.1.1.4 Power

Question 60

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?

.....

.....

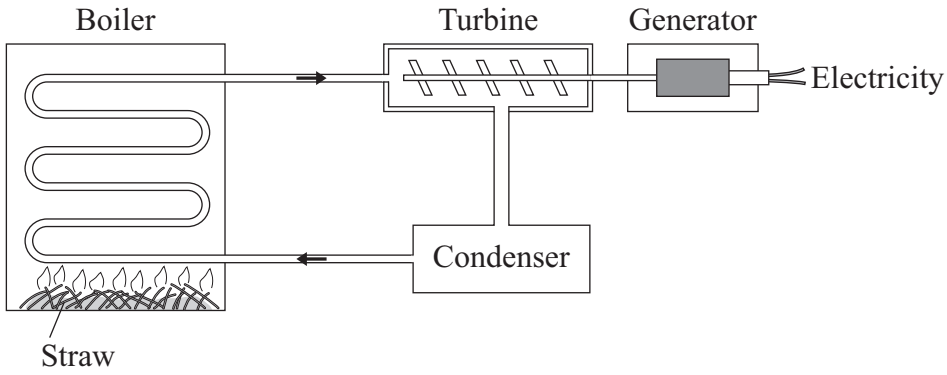
(1 mark)

4.1.1.4 Power

Question 60 · 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

4.1.1.4 Power

Question 61

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)

4.1.1.4 Power

Question 61 · 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

4.1.1.4 Power

Question 62

March 2010 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

The table shows the power of four electrical appliances found in a home.

	Appliance	Power in watts
A	electric kettle	2000
B	electric oven	4000
C	electric shower	8000
D	flat-screen television	200

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

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

Each appliance is used for 3 minutes. The one that transfers the most energy is the . . . **1** . . . .

The appliance that has a power of 2 kW is the . . . **2** . . . .

The appliance that is **not** designed to produce heat (thermal energy) is the . . . **3** . . . .

The appliance that transfers electrical energy at half the rate of the shower is the . . . **4** . . . .

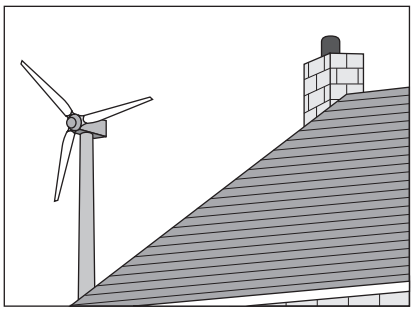
4.1.1.4 Power

Question 63

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.

4.1.1.4 Power

Question 63 · 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

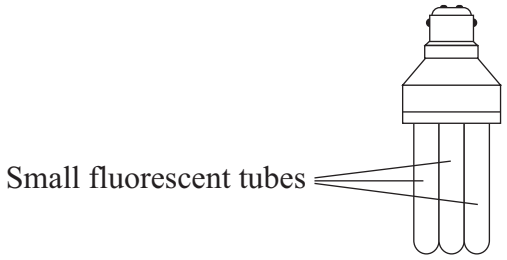
4.1.1.4 Power

Question 64

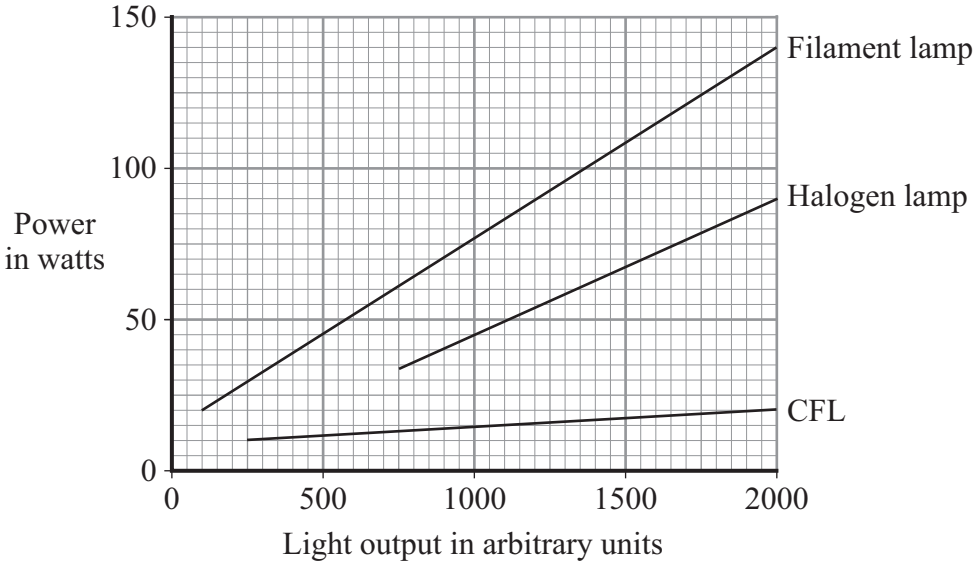
March 2010 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The diagram shows a compact fluorescent lamp (CFL).



The graph shows the electrical power of a CFL compared with a filament lamp and a halogen lamp.



9A How much power does a halogen lamp need in order to give an output of 1000 units of light?

1 40 watts

2 45 watts

3 50 watts

4 55 watts

4.1.1.4 Power

Question 64 · continued

9B How many more watts of power would a filament lamp need, compared with a halogen lamp, to produce 2000 units of light?

1 40

2 50

3 70

4 120

9C What happens to the extra energy that the filament lamp uses compared with the halogen lamp?

The extra energy . . .

1 is stored in the filament of the lamp.

2 is transferred as heat to the surroundings.

3 is used to produce a chemical reaction in the lamp.

4 returns to the electricity supply.

9D In some countries, governments are making it compulsory to use CFLs rather than filament lamps.

What is the reason for this?

1 CFLs are more powerful than filament lamps.

2 CFLs can give out much more light than filament lamps.

3 CFLs can heat the room as well as light it.

4 CFLs save energy because they are more efficient.

END OF TEST

4.1.1.4 Power

Question 65

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

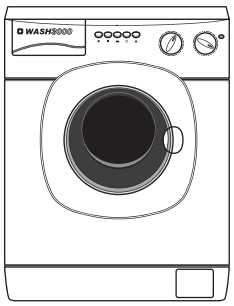
	Method of producing electricity
1	coal-fired power station
2	geothermal power station
3	solar cells
4	wind farm

4.1.1.4 Power

Question 66

June 2010 | PHY1AP | Original Q6 | Legacy

QUESTION SIX



An instruction booklet for a washing machine contains the following information.

Wash cycle	Average power during cycle	Time taken to run cycle
HOT	1.6 kW	2 hours
WARM	1.0 kW	$1\frac{1}{2}$ hours
COOL	0.8 kW	$1\frac{1}{2}$ hours

6A The washing machine is designed to transform electrical energy into heat (thermal energy) and . . .

1 chemical energy.

2 kinetic energy.

3 light energy.

4 sound energy.

Question 66 · continued

6B How much energy is transferred to the washing machine when it is used on the HOT wash cycle?

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

1 3.6 kWh

2 3.2 kWh

3 0.8 kWh

4 0.4 kWh

6C Why does it cost more to use the washing machine on the HOT cycle than on the WARM or COOL cycle?

1 The HOT cycle has the lowest average power.

2 The HOT cycle takes the shortest time to run.

3 More energy is transferred during the HOT cycle.

4 The WARM and COOL cycles both run for $1\frac{1}{2}$ hours.

6D The washing machine also has a FAST cycle setting. When used on this setting, 0.8 kWh of energy are transferred to the washing machine.

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

Electricity costs 15 p per kilowatt-hour (kWh).

How much does the washing machine cost to run on the FAST cycle?

1 £1.20

2 12 p

3 1.2 p

4 0.12 p

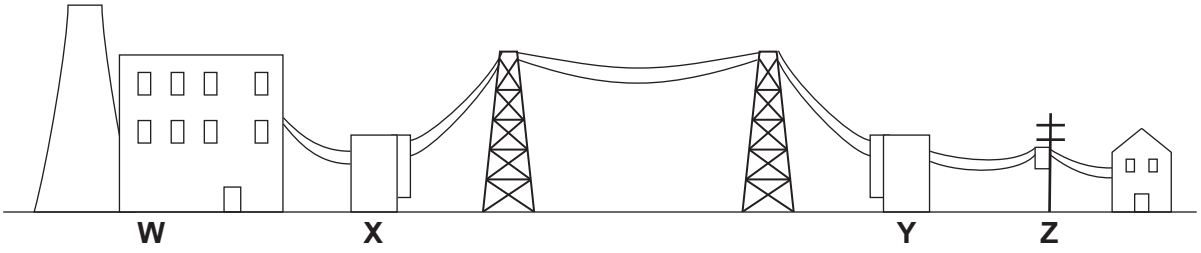
4.1.1.4 Power

Question 67

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**

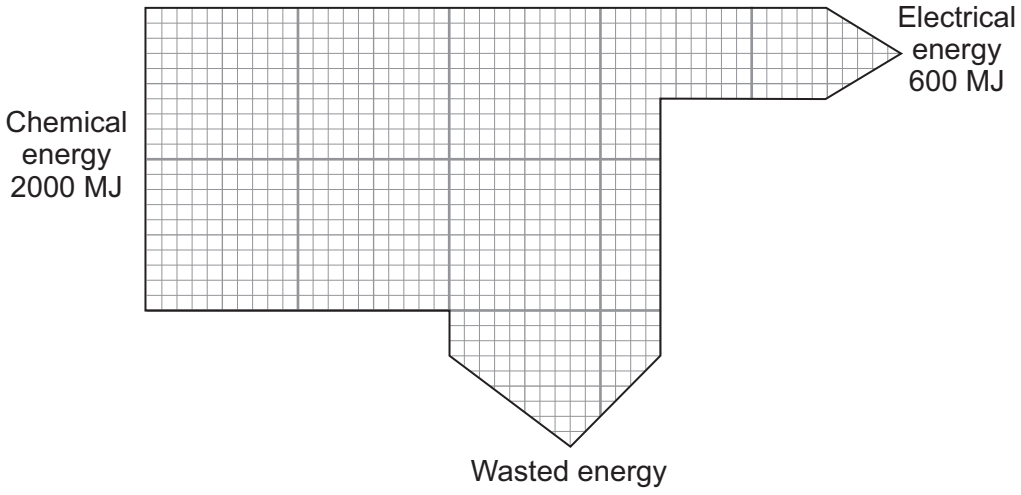
2 **X**

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

4.1.1.4 Power

Question 67 · 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.

4.1.1.4 Power

Question 68

June 2010 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The UK government has decided that filament lamps must be replaced by energy-saving lamps. Some people want to continue using filament lamps. Below are some of the arguments for using each type of lamp.

Filament lamps	Energy-saving lamps
• Filament lamps cost only 42 p; energy-saving lamps are more expensive. • Filament lamps reach full brightness almost immediately; energy-saving lamps take a long time to warm up. • The extra heat given out from a filament lamp helps to warm the room.	• An 11 watt energy-saving lamp gives as much light as a 60 watt filament lamp. • Energy-saving lamps produce very little waste energy; filament lamps have an efficiency of only 0.1. • Energy-saving lamps are cheaper to use. • Energy-saving lamps last about 7 times longer than filament lamps.

9A Filament lamps are less efficient than energy-saving lamps.

This means that they . . .

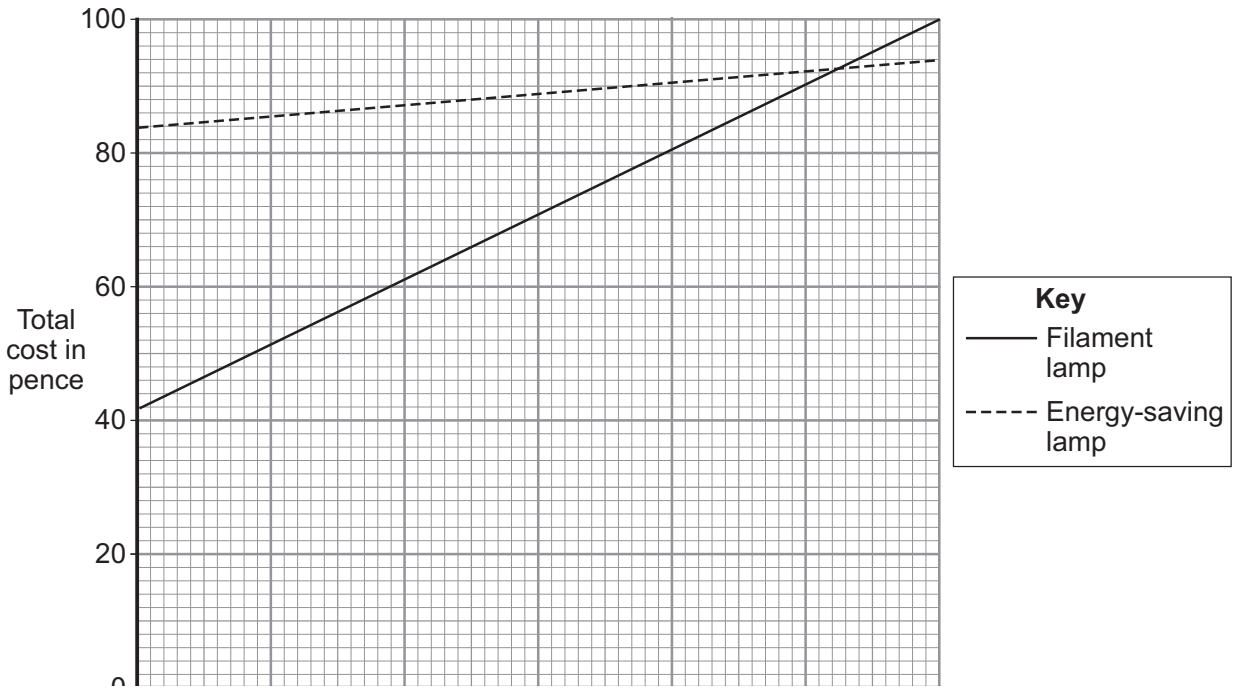
1 cost less.

2 do not last as long.

3 have a larger input power for the same light output.

4 reach full brightness straight away.

The graph shows the total cost of buying and using each type of lamp.



4.1.1.4 Power

Question 68 · continued

9B The graph shows that the cost of buying an energy-saving lamp compared with buying a filament lamp is . . .

1 half as much.

2 twice as much.

3 the same.

4 four times as much.

9C An energy-saving lamp becomes more economical than a filament lamp after . . .

1 86 hours of use.

2 93 hours of use.

3 103 hours of use.

4 105 hours of use.

9D Supporters of filament lamps believe that the 'waste' heat from each lamp is used to heat their houses. They believe that this saves on their heating costs. They say that the total energy used to **light and heat** their houses would not be reduced by using energy-saving lamps.

To find out if they are correct, it is necessary to compare the costs . . .

1 in a small house using filament lamps and in a large house using energy-saving lamps.

2 in a small house using energy-saving lamps and in a large house using filament lamps.

3 using two identical houses with filament lamps in one and energy-saving lamps in the other.

4 using some filament lamps and some energy-saving lamps in the same house.

END OF TEST

4.1.1.4 Power

Question 69

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)

4.1.1.4 Power

Question 69 · 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

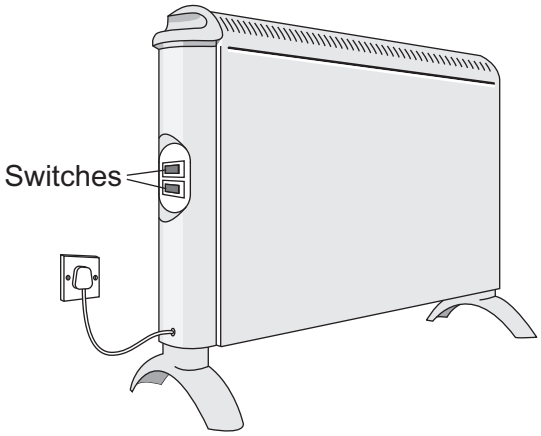
Turn over for the next question

4.1.1.4 Power

Question 70

June 2010 | PHY1F | Original Q3 | Legacy

3 (a) The diagram shows two switches on a room heater. The heater has three power settings. The power produced by two of the settings is given in the table.



Setting	Power in kW
Low	0.5
Medium	1.5
High	

3 (a) (i) When both switches are on, the heater works at the high power setting.

What is the power of the heater when it is switched to the **high** power setting?

.....

Power = ... kW

(1 mark)

3 (a) (ii) The heater is used on the **medium** power setting. It is switched on for three hours.

Use the equation in the box to work out the energy transferred from the mains to the heater in three hours.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

4.1.1.4 Power

Question 70 · continued

3 (a) (iii) Electricity costs 12 pence per kilowatt-hour.

Use the equation in the box to calculate how much the heater costs to use on **medium** power for three hours.

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

Show clearly how you work out your answer.

.....

.....

Total cost = ... pence

(2 marks)

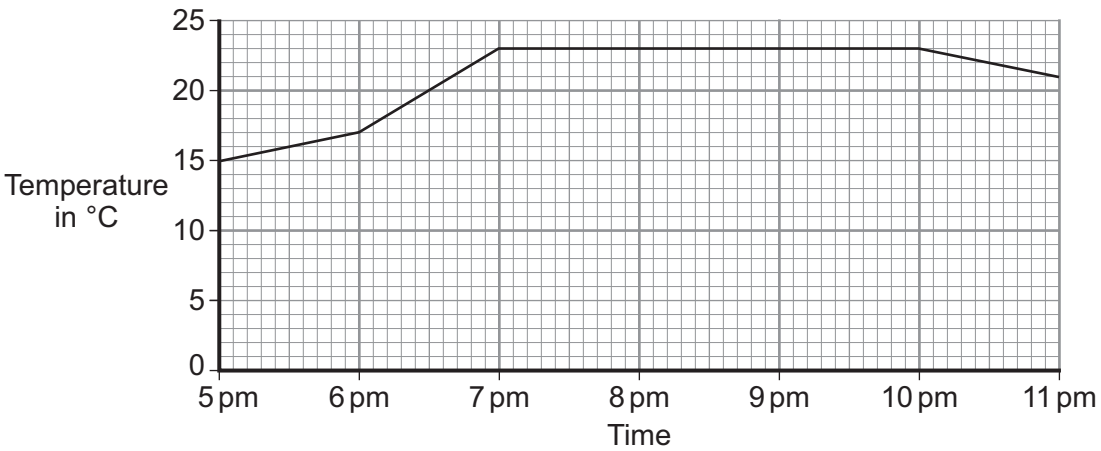
Question 3 continues on the next page

4.1.1.4 Power

Question 70 · continued

3 (b) The heater is used to warm a room.

The graph shows how the temperature of the room changes from the moment the heater is switched on.



The heater was first used on the medium setting.

3 (b) (i) At what time was the heater setting changed to the **high** setting?

.....

Give a reason for your answer.

.....

.....

.....

(2 marks)

3 (b) (ii) From 7 pm until 10 pm, the temperature of the room is **not** changing.

Which **one** of the following statements gives the reason why the temperature of the room is **not** changing?

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

The room is losing energy slower than the heater supplies energy. ☐

The room is losing energy as fast as the heater supplies energy. ☐

The room is losing energy faster than the heater supplies energy. ☐

(1 mark)

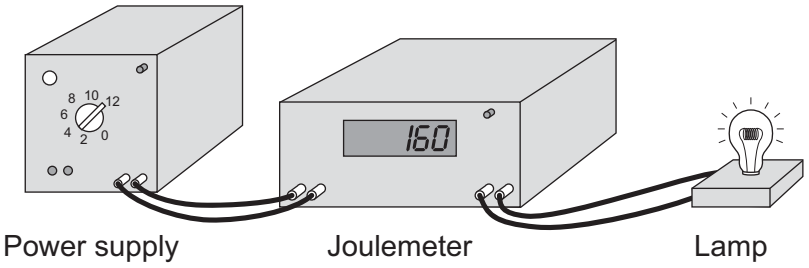
8

4.1.1.4 Power

Question 71

June 2010 | PHY2F | Original Q1 | Legacy

1 A student used a joulemeter to measure the energy transformed by a lamp.



The student set the joulemeter to zero, and then switched on the power supply.
After 120 seconds (2 minutes), the reading on the joulemeter had increased to 2880.

1 (a) In the space below, draw the circuit symbol used to represent a lamp.

(1 mark)

1 (b) (i) Use the equation in the box to calculate the power of the lamp.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

Show clearly how you work out your answer.

.....

.....

Power = ...

(2 marks)

4.1.1.4 Power

Question 71 · continued

1 (b) (ii) Which **one** of the following is the unit of power?

Draw a ring around your answer.

joule **newton** **watt**

(1 mark)

1 (c) Complete the following sentence using one of the phrases from the box.

larger than	the same as	smaller than

If the lamp was left switched on for 10 minutes, the amount of energy transformed would be ..... the amount of energy transformed in 2 minutes.

(1 mark)

5

Turn over for the next question

4.1.1.4 Power

Question 72

June 2010 | PHY3F | Original Q7 | Legacy

7 (a) Read this passage from a health leaflet.

> Most children can hear the full range of sounds which can be detected by the human ear. But as people get older, they cannot hear the higher frequencies.

7 (a) (i) Complete this statement.

Most children can detect sounds in the frequency range

..... Hz to ..... Hz.

(1 mark)

7 (a) (ii) What word is used to describe sound with a frequency so high that it cannot be heard by humans?

.....

(1 mark)

7 (b) Read this cutting from a newspaper.

> A shopkeeper has fitted a special loudspeaker outside his store.
> "We used to have gangs of young people out there," he said, "but now, when I switch on the special loudspeaker, they hate the sound and go away."
> Older people are not bothered by the sound because the frequency is too high for them to hear it.

Some people support the use of the special loudspeaker but other people do not.

Give **one** reason against its use.

.....

.....

(1 mark)

7 (c) Machines are often very noisy. They transfer energy, and some of the energy is transformed into sound.

What is the cause of the sound?

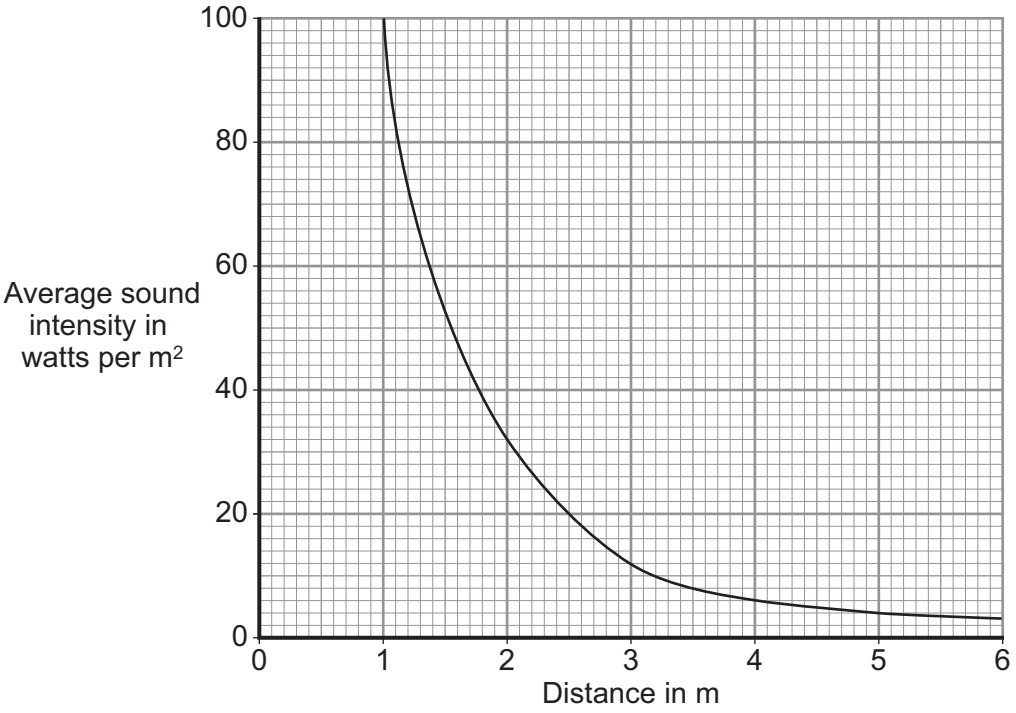
.....

(1 mark)

4.1.1.4 Power

Question 72 · continued

7 (d) Sound from a machine may damage the hearing of people who work close by. A safety officer measures the sound intensity at different distances from a noisy machine. The average results are shown on the graph.



7 (d) (i) Describe the pattern shown by the graph.

Use one or more examples from the graph to support your description.

.....

.....

.....

.....

(2 marks)

7 (d) (ii) Average results were plotted.

Explain why taking results several times and then calculating average values is more reliable than taking only a single result.

.....

.....

.....

.....

(2 marks)

8

4.1.1.4 Power

Question 73

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

4.1.1.4 Power

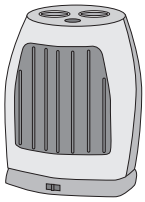
Question 74

November 2010 | PHY1AP | Original Q6 | Legacy

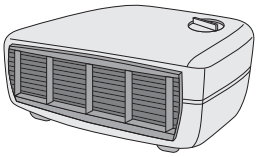
QUESTION SIX

The pictures show four different types of electric heater.

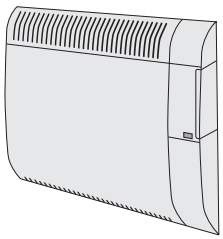
1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out



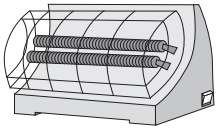
3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



400 W oil-filled panel heater
- 3 heat settings
- Efficient background heat
- Safety overheat cut-out



2 kW radiant heater
- 2 heat settings



6A Which heater is the most powerful?

1 the ceramic heater

2 the fan heater

3 the oil-filled panel heater

4 the radiant heater

6B The fan heater is run on full power for 4 hours.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

How much energy, in kWh, is transferred from the mains supply to the fan heater?

1 0.75

2 3.0

3 7.0

4 12.0

4.1.1.4 Power

Question 74 · continued

6C In one week, the oil-filled panel heater used 10 kWh of electrical energy.

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

Electricity costs 14p per kWh

How much did it cost to run the oil-filled panel heater for the week?

1 £0.14

2 £1.40

3 £14.00

4 £140.00

6D Which of the following is an advantage of the fan heater compared with the other heaters?

1 The fan heater can make a room feel cooler in summer.

2 The fan heater has a power indicator light.

3 The fan heater has a safety overheat cut-out.

4 The fan heater has more than one heat setting.

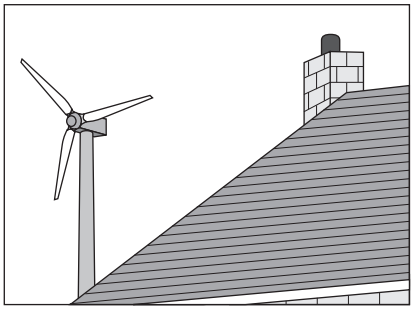
4.1.1.4 Power

Question 75

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?

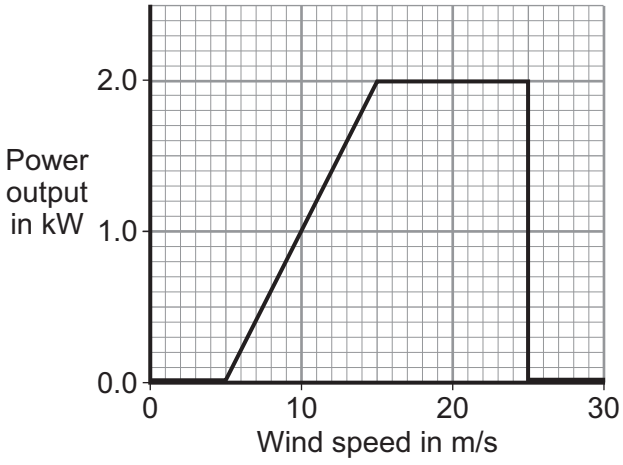
1 1000 days

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

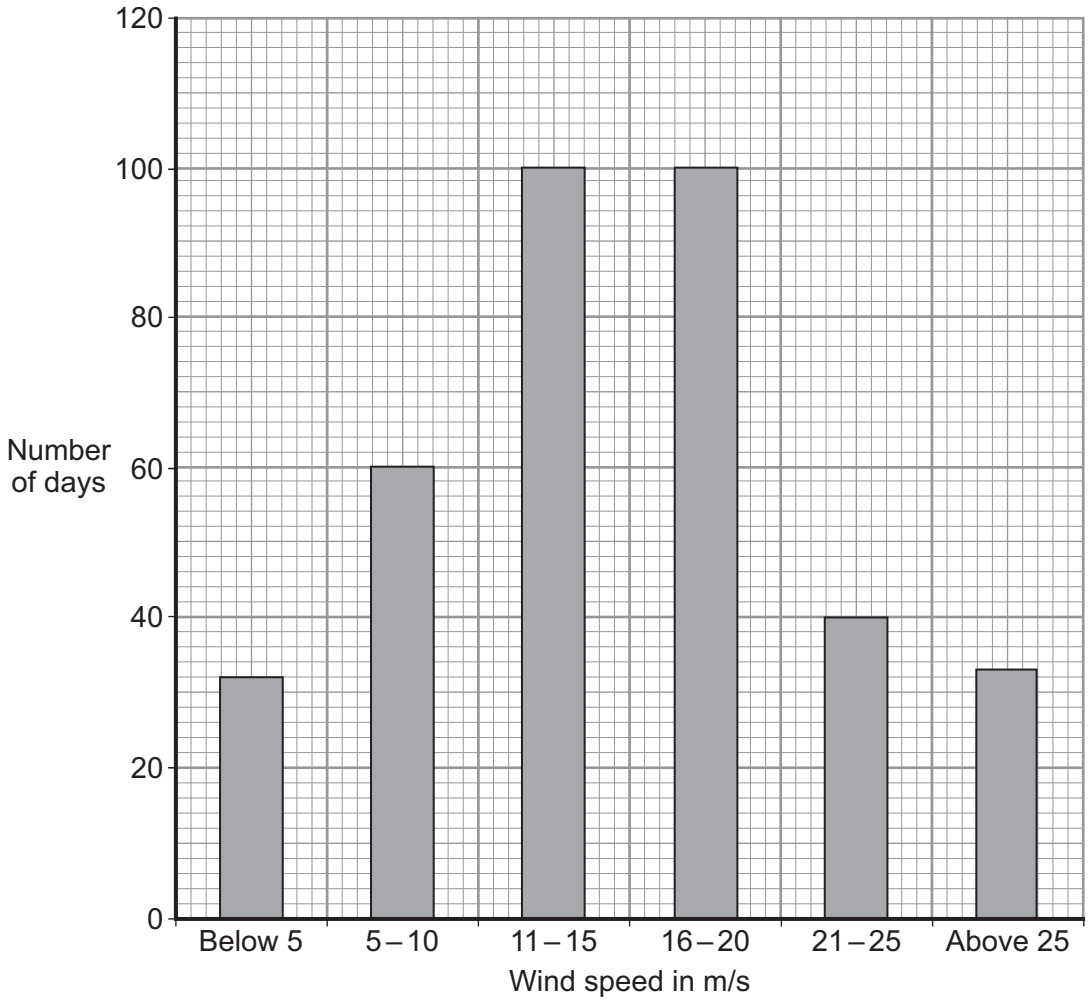
2 10 m/s

3 15 m/s

4 20 m/s

Question 75 · 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.

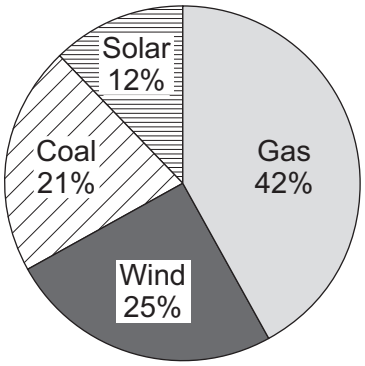
END OF TEST

4.1.1.4 Power

Question 76

January 2011 | PHY1F | Original Q1 | Legacy

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.

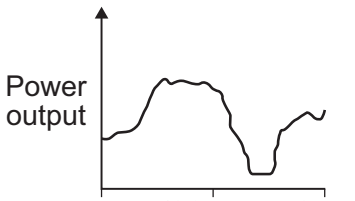
.....

Percentage = ...

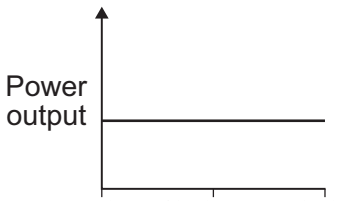
(1 mark)

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

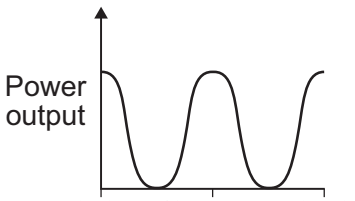
Write your answer, **A**, **B** or **C**, in the box.



Graph **A**



Graph **B**



Graph **C**

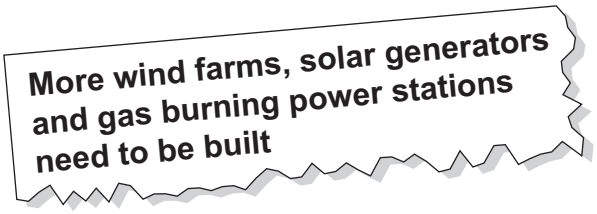
Graph ☐

(1 mark)

4.1.1.4 Power

Question 76 · 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

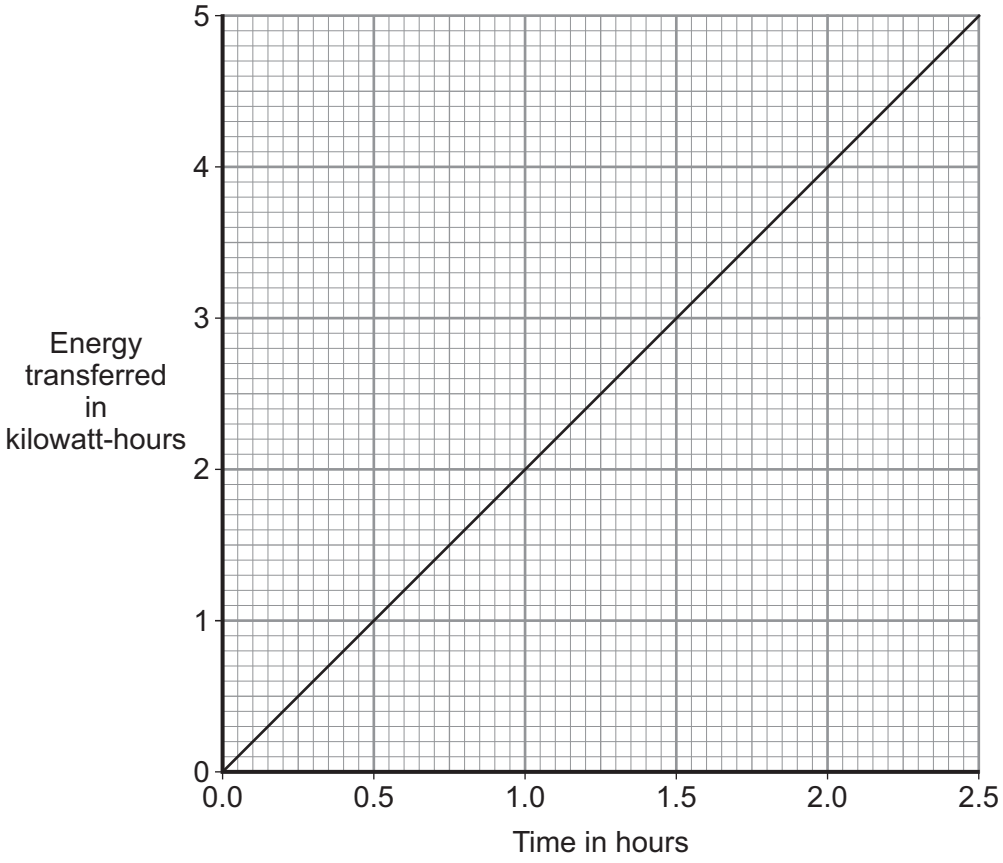
Turn over for the next question

4.1.1.4 Power

Question 77

January 2011 | PHY1F | Original Q2 | Legacy

2 The graph shows how the energy transferred by a 2 kW electric kettle varies with the time, in hours, that the kettle is switched on.



2 (a) In one week, the kettle is used for a total of 1.5 hours.
Electricity costs 15 p per kilowatt-hour.

Use the equation in the box to calculate the cost of using the kettle for the week.

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

Show clearly how you work out your answer.

.....

.....

Cost = ... p

(2 marks)

2 (b) Draw a new line on the graph to show how the energy transferred by a 1 kW kettle varies with time.

(1 mark)

3

4.1.1.4 Power

Question 78

January 2011 | PHY1F | Original Q4 | Legacy

4 (a) Use the words from the box to complete the following sentences.

conduction	convection	radiation

4 (a) (i) The transfer of thermal energy (heat) by the movement of hot liquids

is called ..... .

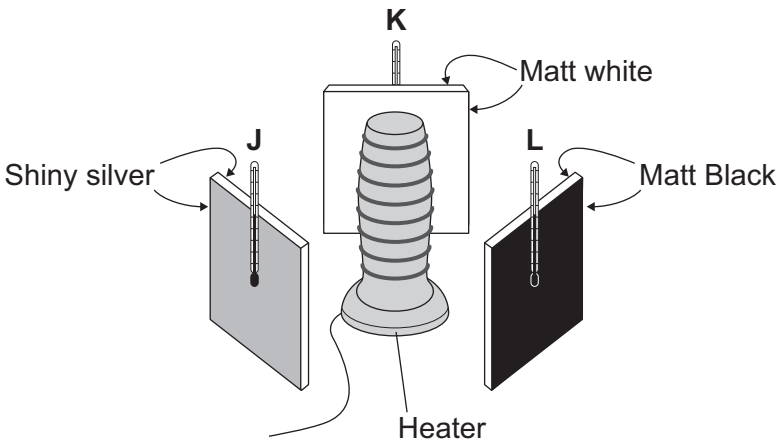
(1 mark)

4 (a) (ii) The transfer of thermal energy (heat) from one particle to another

is called ..... .

(1 mark)

4 (b) A student set up the following equipment. The 3 metal plates are the same distance from the heater. The surfaces of each of the 3 metal plates are different colours.



The student switched the heater on for 10 minutes. The thermometers were read before the heater was switched on. The thermometers were read again just after the heaters were switched off.
The readings are shown in the table.

	Temperature before switching on in °C	Temperature after switching on in °C
1	19	21
2	19	29
3	19	23

4.1.1.4 Power

Question 78 · continued

4 (b) (i) Which set of readings, **1**, **2** or **3**, is most likely to have been taken from the thermometer labelled **L**?

.....

Give a reason for your answer.

.....

.....

(2 marks)

4 (b) (ii) Which **one** of the following was **not** a control variable in this experiment?

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

the distance between the heater and the metal plates ☐

the power of the heater ☐

the temperature before the heater was switched on ☐

the colour of the metal plates ☐

(1 mark)

4 (b) (iii) Suggest **one** advantage of using a temperature sensor, data logger and computer, rather than a thermometer to carry out this experiment.

.....

.....

(1 mark)

Question 4 continues on the next page

4.1.1.4 Power

Question 78 · continued

4 (c) The picture shows a fire fighter putting out a forest fire. The fire fighter's clothing has thick thermal padding inside and a light coloured, fire proof, shiny layer outside.



4 (c) (i) What is the main way that heat is transferred through the air from the fire to the fire fighter?

.....

.....

(1 mark)

4 (c) (ii) Why is the outside layer of the clothing shiny?

.....

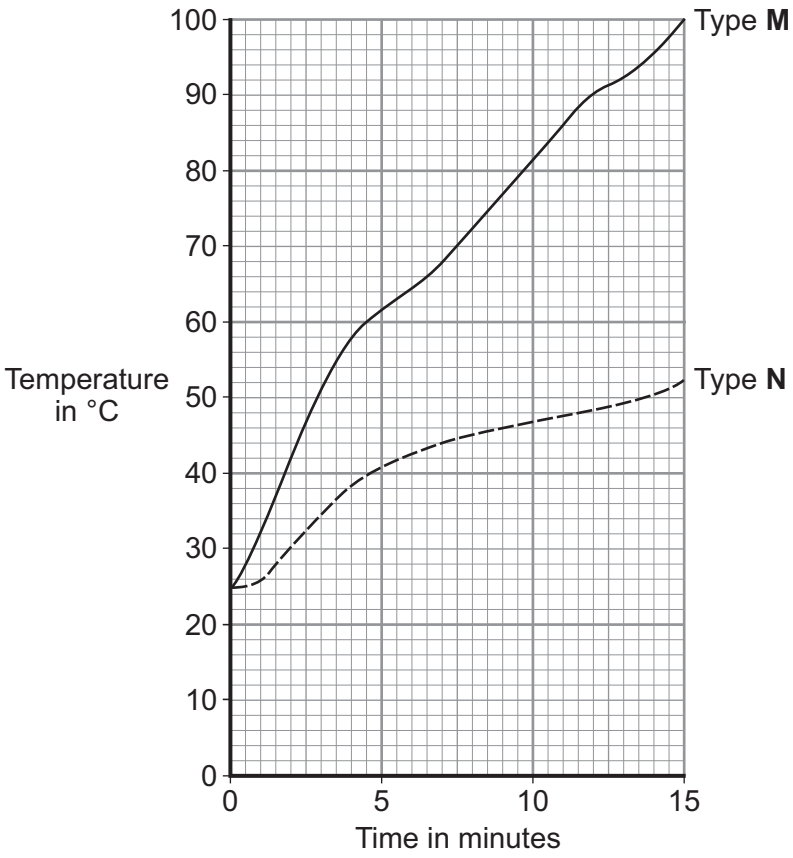
.....

(1 mark)

4.1.1.4 Power

Question 78 · continued

4 (d) The graph shows the result of a laboratory test on two types of thermal padding. Each type of padding was put onto a very hot metal surface and the temperature inside the padding was taken every minute.



Which type of padding, **M** or **N**, would it be best to use inside the fire fighter's clothing?

.....

Give a reason for your answer.

.....

.....

(1 mark)

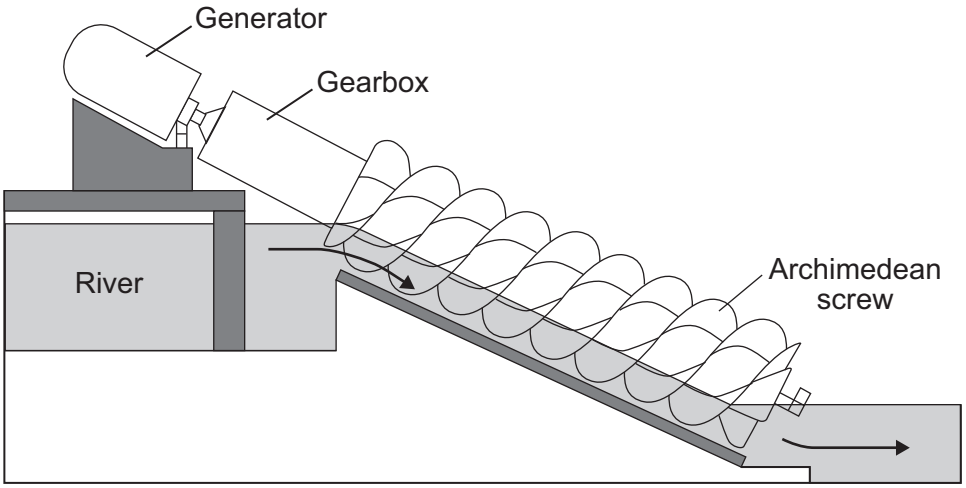
9

4.1.1.4 Power

Question 79

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)

4.1.1.4 Power

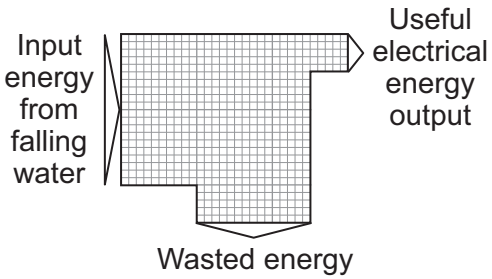
Question 79 · continued

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

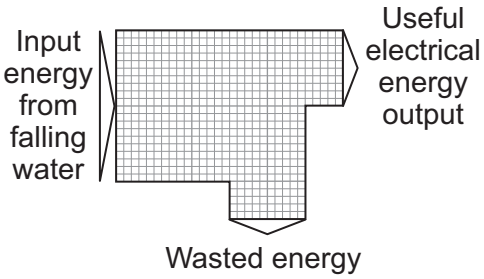
Which **one** of the following Sankey diagrams, **X**, **Y** or **Z**, shows the energy transformations produced by this generator?

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

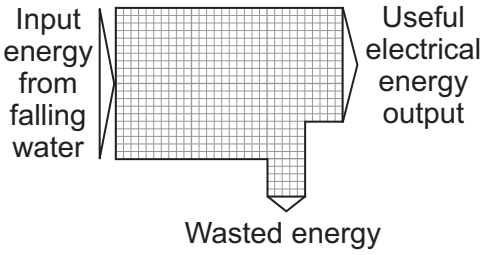
Sankey diagram **X**



Sankey diagram **Y**



Sankey diagram **Z**



Sankey diagram ☐

(1 mark)

Question 5 continues on the next page

4.1.1.4 Power

Question 79 · 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)

4.1.1.4 Power

Question 79 · 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

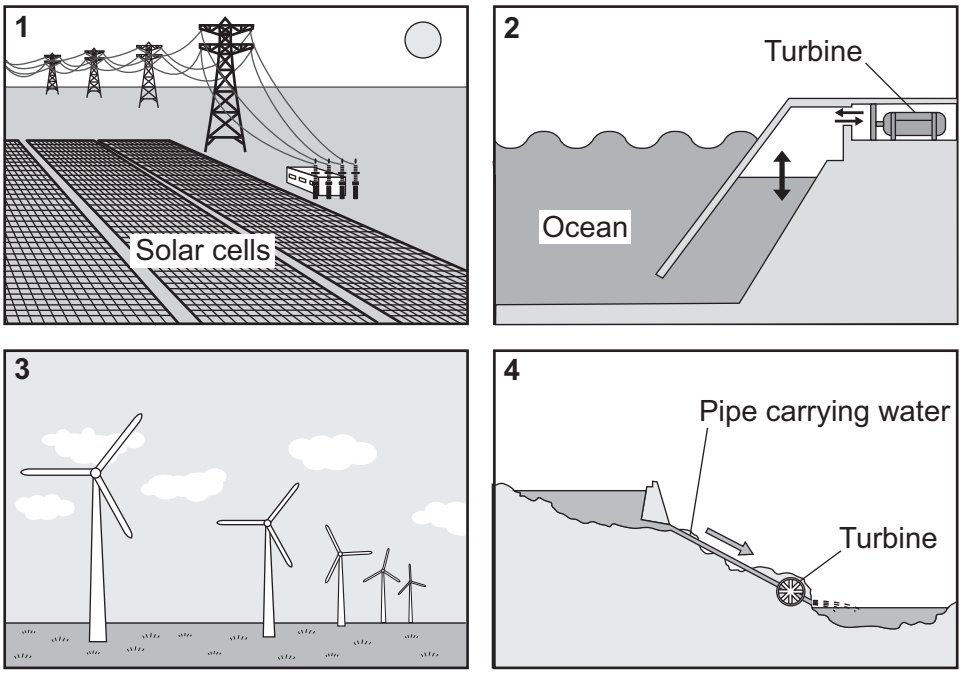
4.1.1.4 Power

Question 80

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

4.1.1.4 Power

Question 81

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

4.1.1.4 Power

Question 82

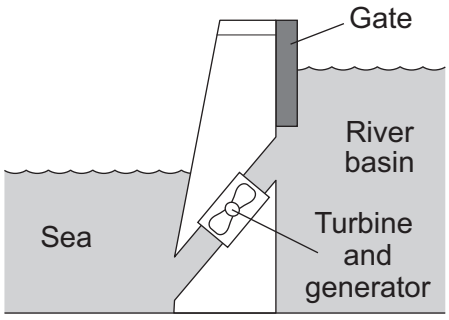
March 2011 | PHY1AP | Original Q8 | Legacy

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.

4.1.1.4 Power

Question 82 · continued

March 2011 | PHY1AP | Original Q8 | Legacy

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.

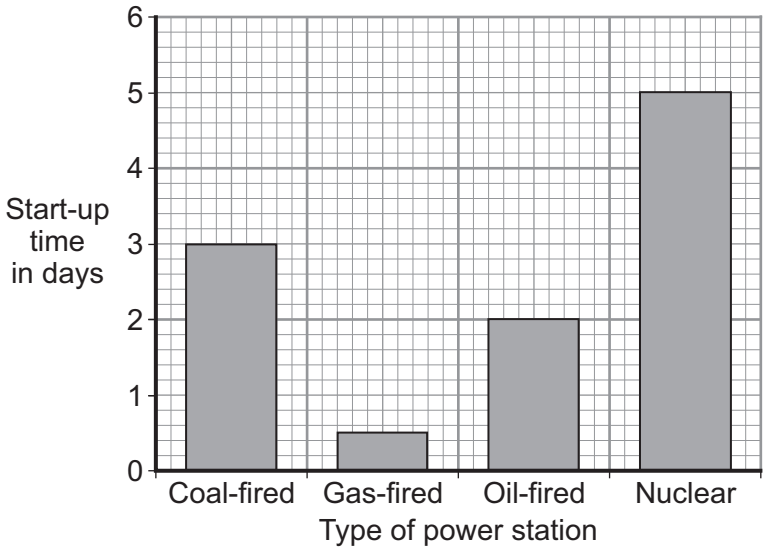
4.1.1.4 Power

Question 83

June 2011 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

The bar chart shows the start-up times for four types of power station.



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

A coal-fired

B gas-fired

C nuclear

D oil-fired

1	It has a start-up time of three days.
2	It could be used to meet an unexpected increase in demand.
3	It has the longest start-up time.
4	It uses a liquid fuel.

4.1.1.4 Power

Question 84

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.

4.1.1.4 Power

Question 84 · 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.

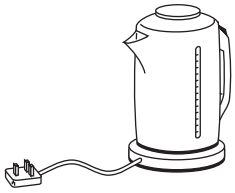
4.1.1.4 Power

Question 85

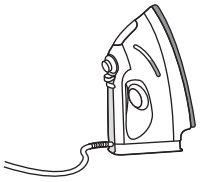
June 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

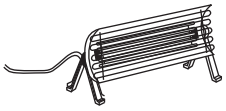
The diagrams show four electrical heating devices.



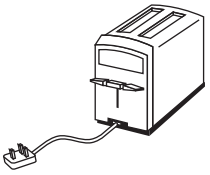
2 kW
Kettle



500 W
Iron



1 kW
Fire



0.5 kW
Toaster

7A Which two devices transform energy at the same rate?

1 the kettle and the iron

2 the iron and the toaster

3 the toaster and the fire

4 the fire and the kettle

7B The kettle is used for a total of 2 hours.

energy transferred (kilowatt-hour, kWh)	=	power (kilowatt, kW)	×	time (hour, h)

How much energy does the kettle transfer?

1 1 kWh

2 4 kWh

3 1000 kWh

4 4000 kWh

4.1.1.4 Power

Question 85 · continued

7C The fire is switched on for two hours and transfers 2 kWh of energy.

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

Electricity costs 14 p per kWh

What is the cost of using the electric fire for two hours?

1 7 p

2 14 p

3 28 p

4 56 p

7D The kettle casing is made of plastic.

A plastic kettle is more efficient than a metal kettle because . . .

1 plastic is an electrical insulator.

2 plastic is a thermal insulator.

3 plastic has a higher density than metal.

4 plastic is cheaper than metal.

4.1.1.4 Power

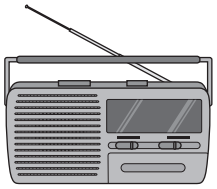
Question 86

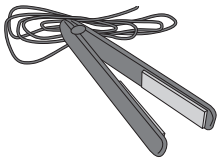
June 2011 | PHY1F | Original Q5 | Legacy

5 The diagram shows four electrical appliances. Each appliance is designed to transform electrical energy into one form of output energy.


Kettle


Toaster


Radio


Hair straighteners

5 (a) Which **one** of the appliances is designed to give a different form of output energy from the other three appliances?

.....

Give a reason for your answer.

.....

.....

(2 marks)

5 (b) The power of each appliance is given in the table.

Appliance	Power
Kettle	2.5 kW
Toaster	920 W
Radio	15 W
Hair straighteners	75 W

Each appliance is switched on for 5 minutes.

Which appliance transforms the most energy?

.....

(1 mark)

4.1.1.4 Power

Question 86 · continued

5 (c) The 75 watt hair straighteners are switched on for a few minutes each day.
In one year, the amount of energy transferred from the mains electricity supply to the hair straighteners is 4 kilowatt-hours.

Electricity costs 15 p per kilowatt-hour.

Use the equation in the box to calculate the yearly cost of using the hair straighteners.

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

Show clearly how you work out your answer.

.....

.....

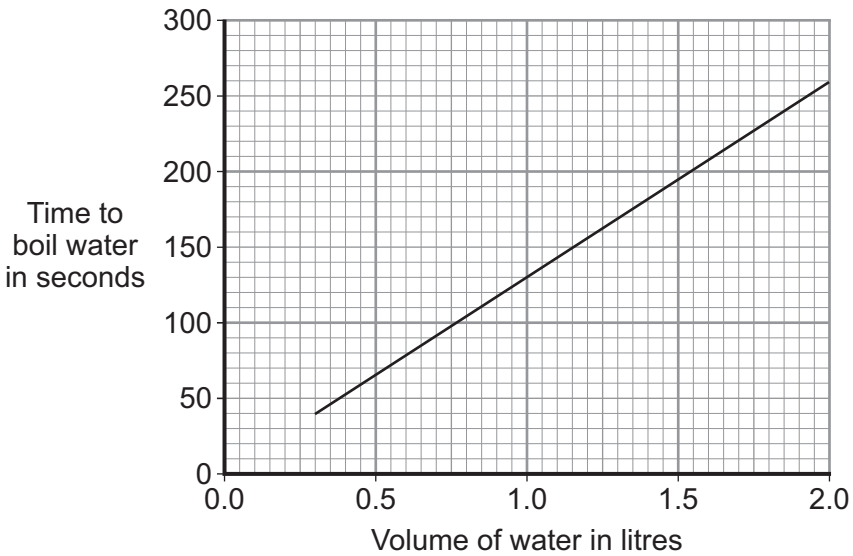
Total cost = ... pence
(2 marks)

Question 5 continues on the next page

4.1.1.4 Power

Question 86 · continued

5 (d) The graph shows how the time to boil water in an electric kettle depends on the volume of water in the kettle.



A householder always fills the electric kettle to the top, even when only enough boiling water for one small cup of coffee is required.

Explain how the householder is wasting money.

.....

.....

.....

.....

.....

.....

(3 marks)

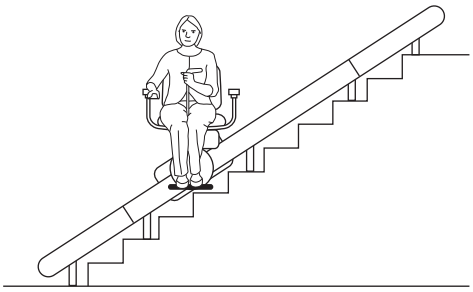
8

4.1.1.4 Power

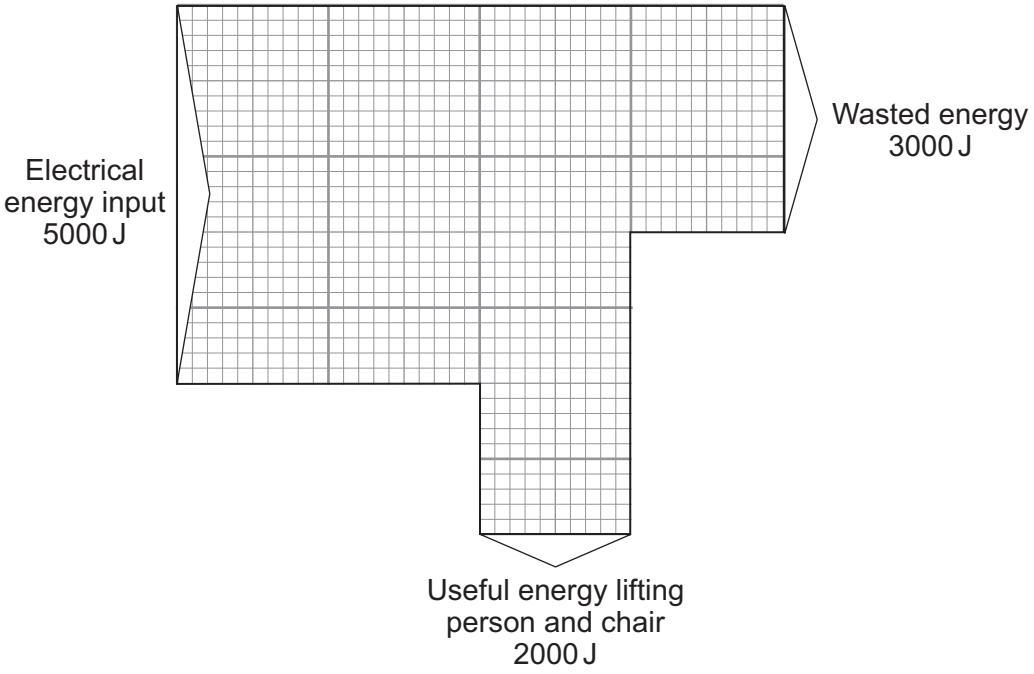
Question 87

June 2011 | PHY1F | Original Q6 | Legacy

6 A person uses a stairlift to go upstairs. The stairlift is powered by an electric motor.



The Sankey diagram shows the energy transfers for the electric motor.



6 (a) Complete the following sentence.

The electric motor wastes energy as ..... energy.

(1 mark)

4.1.1.4 Power

Question 87 · continued

6 (b) Use the equation in the box to calculate the efficiency of the electric motor.

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

3

Turn over for the next question

4.1.1.4 Power

Question 88

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.

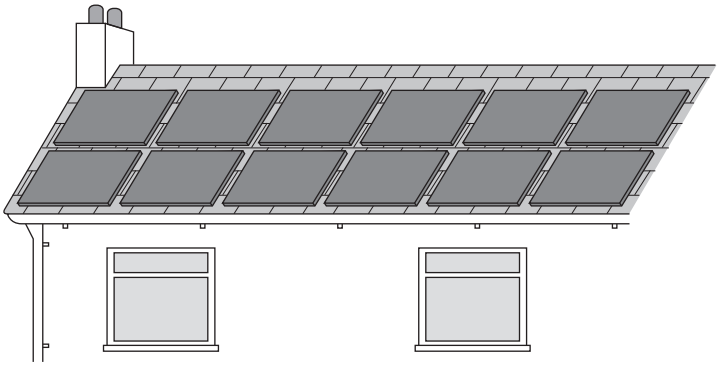
4.1.1.4 Power

Question 89

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

4.1.1.4 Power

Question 89 · 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.

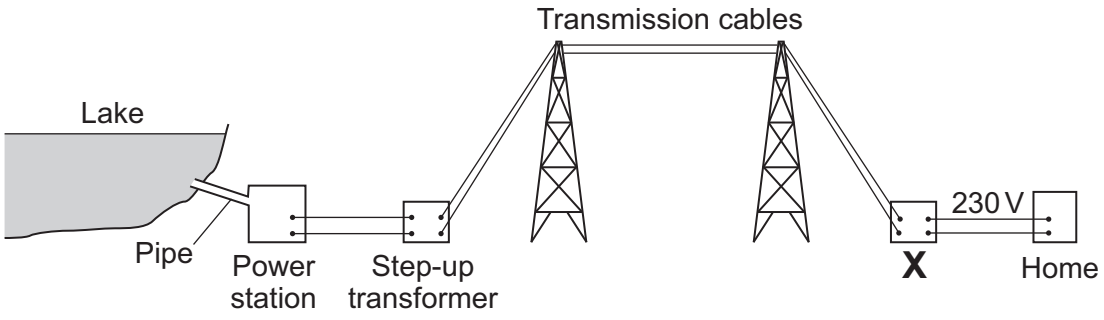
4.1.1.4 Power

Question 90

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.

4.1.1.4 Power

Question 90 · 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

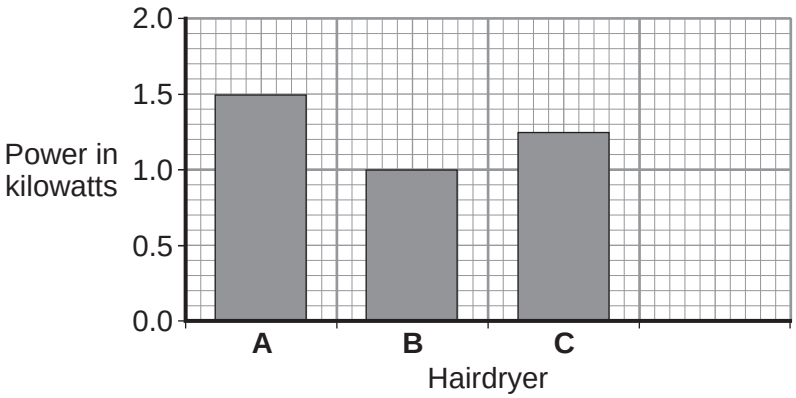
Turn over for the next question

4.1.1.4 Power

Question 91

June 2012 | PH1FP | Original Q4 | Legacy

4 (a) The bar chart shows the power of three different electric hairdryers.



4 (a) (i) Which **one** of the hairdryers, **A**, **B** or **C**, would transfer the most energy in 5 minutes?

Write the correct answer in the box. ☐

(1 mark)

4 (a) (ii) A small 'travel' hairdryer has a power of 500 watts.

Draw a fourth bar on the bar chart to show the power of the 'travel' hairdryer.

(1 mark)

4 (b) A family shares the same hairdryer.
The hairdryer has a power of 1.2 kW. The hairdryer is used for a total of 2 hours each week.

4 (b) (i) Calculate how many kilowatt-hours (kWh) of energy the hairdryer transfers in 2 hours.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

4.1.1.4 Power

Question 91 · continued

4 (b) (ii) Electricity costs 15 pence per kWh.

Calculate the cost of using the hairdryer for 2 hours.

Show clearly how you work out your answer.

.....

.....

Cost = ... pence
(2 marks)

6

Turn over for the next question

4.1.1.4 Power

Question 92

June 2012 | PH1FP | Original Q5 | Legacy

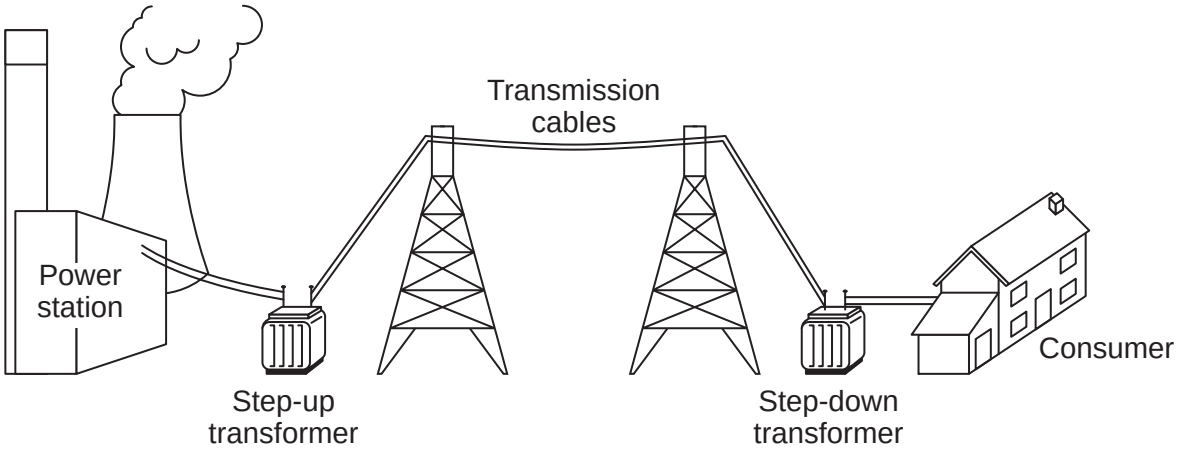
5 In the UK, most electricity is generated in power stations that burn fossil fuels.

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.

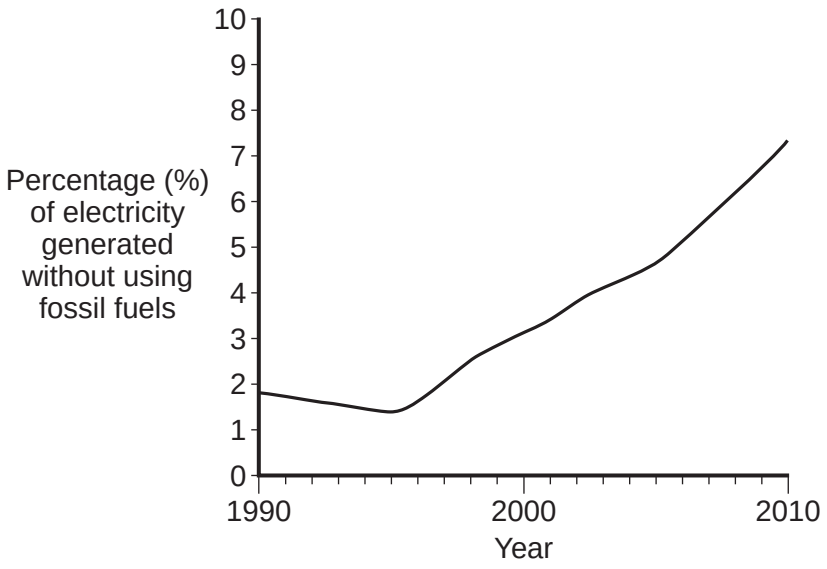
(2 marks)

4.1.1.4 Power

Question 92 · 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

4.1.1.4 Power

Question 93

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.

.....

.....

.....

.....

.....

.....

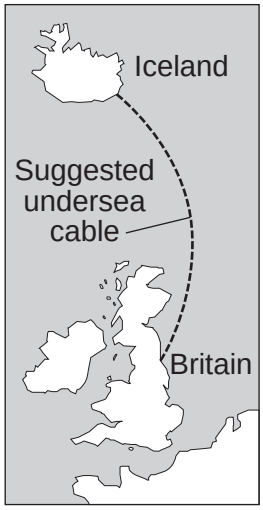
(2 marks)

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.

4.1.1.4 Power

Question 93 · 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)

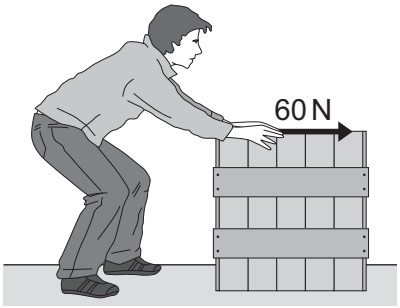
9

4.1.1.4 Power

Question 94

June 2012 | PH2FP | Original Q3 | Legacy

3 The diagram shows a worker using a constant force of 60 N to push a crate across the floor.



3 (a) The crate moves at a constant speed in a straight line.

3 (a) (i) Draw an arrow on the diagram to show the direction of the friction force acting on the moving crate.

(1 mark)

3 (a) (ii) State the size of the friction force acting on the moving crate.

..... N

Give the reason for your answer.

.....

.....

(2 marks)

3 (b) Calculate the work done by the worker to push the crate 28 metres.

Use the correct equation from the Physics Equations Sheet.

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

Choose the unit from the list below.

joule **newton** **watt**

.....

.....

Work done = ...

(3 marks)

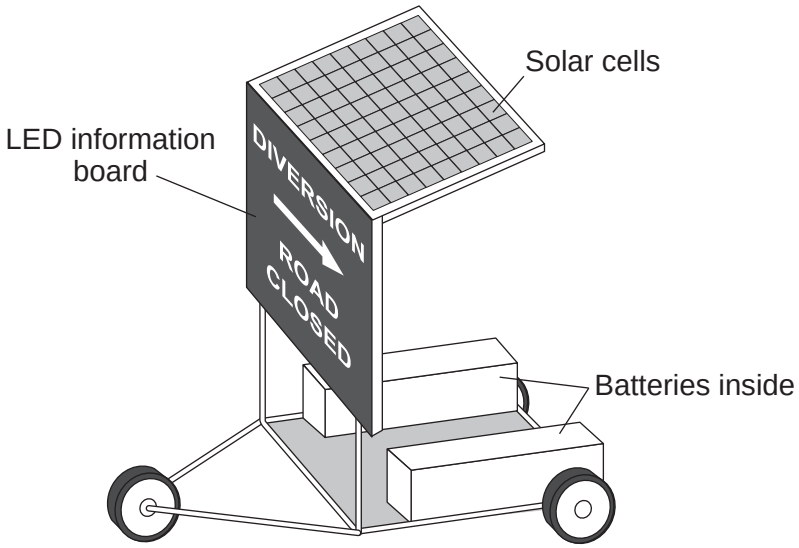
6

4.1.1.4 Power

Question 95

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)

4.1.1.4 Power

Question 95 · 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)

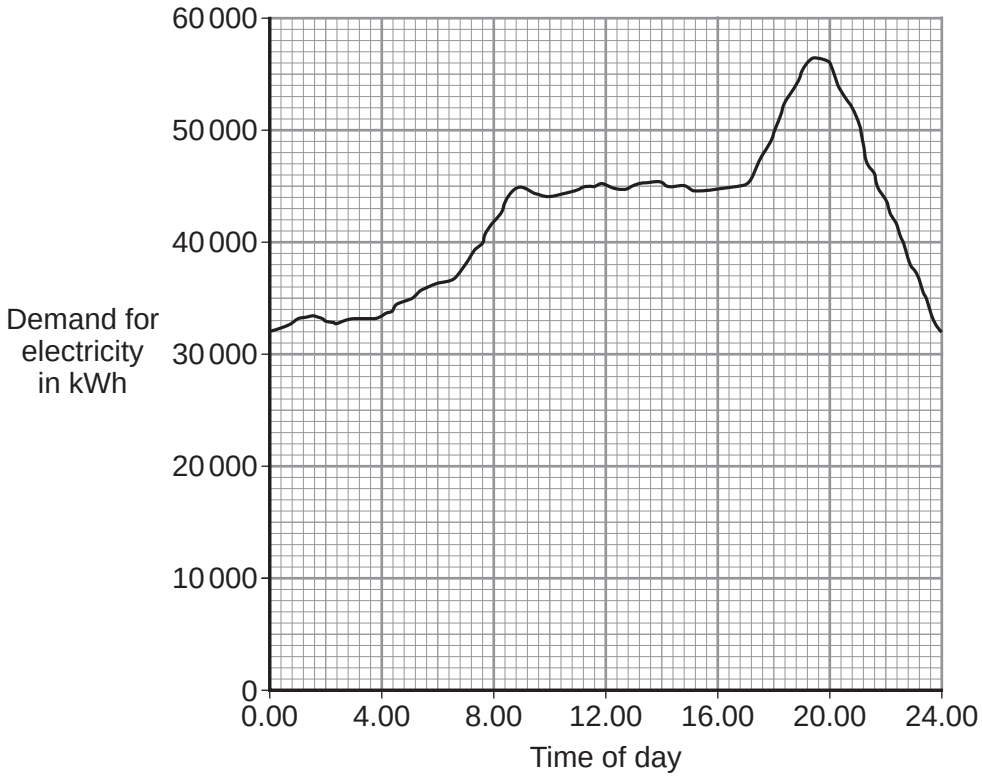
6

4.1.1.4 Power

Question 96

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)

4.1.1.4 Power

Question 96 · 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

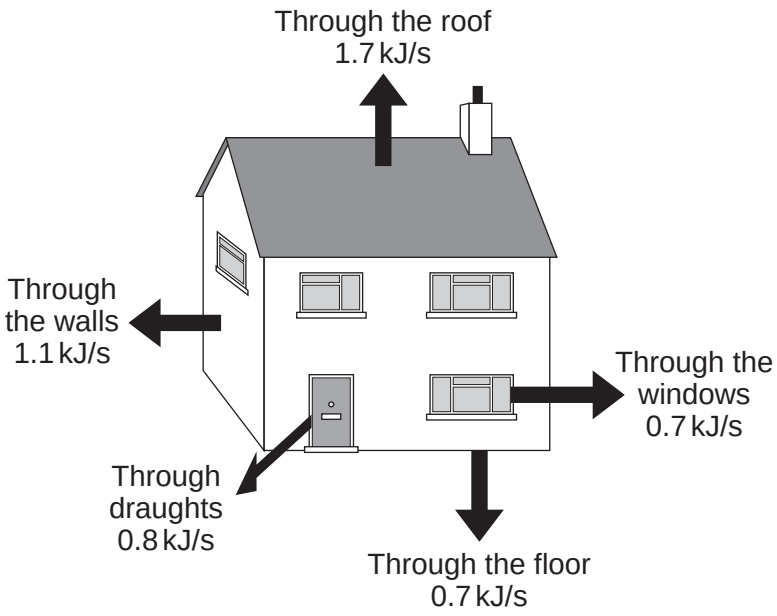
4.1.1.4 Power

Question 97

January 2013 | PH1FP | Original Q9 | Legacy

9 **Diagram 1** shows the energy transferred per second from a badly insulated house on a cold day in winter.

Diagram 1



9 (a) (i) When the inside of the house is at a constant temperature, the energy transferred from the heating system to the inside of the house equals the energy transferred from the house to the outside.

Calculate, in kilowatts, the power of the heating system used to keep the inside of the house in **Diagram 1** at a constant temperature.

1 kilowatt (kW) = 1 kilojoule per second (kJ/s)

.....

Power of the heating system = ... kW

(1 mark)

4.1.1.4 Power

Question 97 · continued

9 (a) (ii) In the winter, the heating system is switched on for a total of 7 hours each day.

Calculate, in kilowatt-hours, the energy transferred each day from the heating system to the inside of the house.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Energy transferred each day = ... kWh

(2 marks)

9 (a) (iii) Energy costs 15 p per kilowatt-hour.

Calculate the cost of heating the house for one day.

.....

Cost = ...

(1 mark)

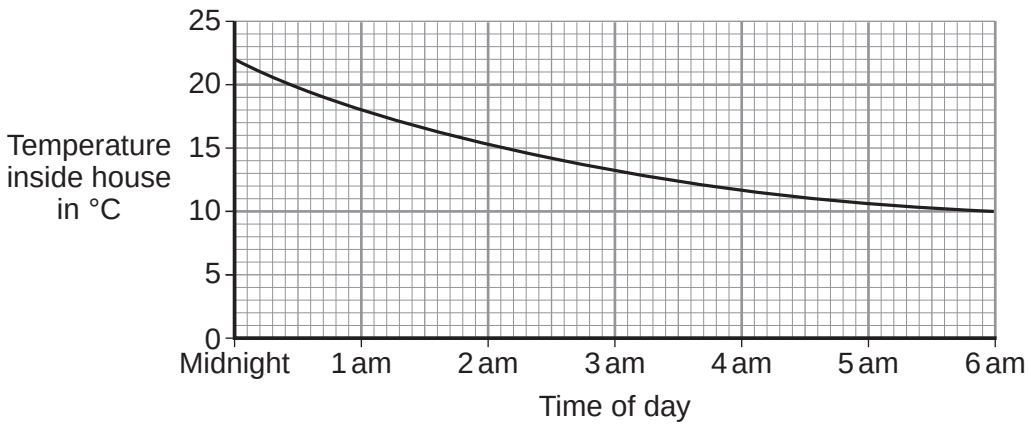
Question 9 continues on the next page

4.1.1.4 Power

Question 97 · continued

9 (a) (iv) The heating system is switched off at midnight.

The graph shows how the temperature inside the house changes after the heating system has been switched off.



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

Between midnight and 6 am the rate of energy transfer from

the house

decreases.
decreases then stays constant.
increases.

Give the reason for your answer.

.....

.....

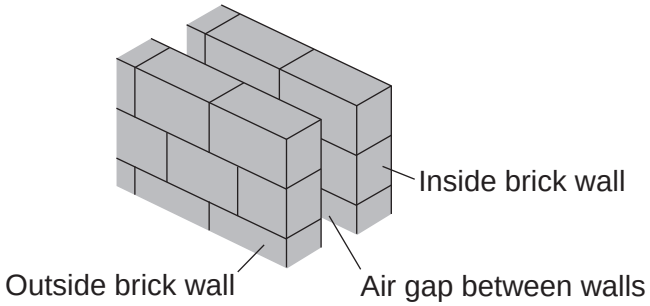
(2 marks)

4.1.1.4 Power

Question 97 · continued

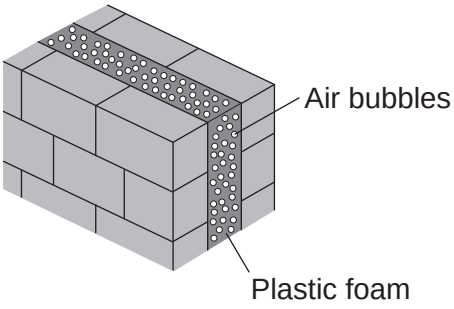
9 (b) **Diagram 2** shows how the walls of the house are constructed.
Diagram 3 shows how the insulation of the house could be improved by filling the air gap between the two brick walls with plastic foam.

Diagram 2



U-value of the wall = 0.7

Diagram 3



U-value of the wall = 0.3

9 (b) (i) The plastic foam reduces energy transfer by convection.

Explain why.

.....

.....

.....

.....

(2 marks)

9 (b) (ii) Filling the air gap with plastic foam reduces the U-value of the wall.

What is meant by the term *U-value*?

.....

.....

(1 mark)

Question 9 continues on the next page

4.1.1.4 Power

Question 97 · continued

9 (c) A homeowner has part of the outside wall of her house removed and replaced with double-glazed glass doors.

U-value of the wall = 0.3
U-value of glass doors = 1.8

Explain the effect of replacing part of the outside wall with glass doors on the rate of energy transfer from the house.

.....

.....

.....

.....

.....

(2 marks)

11

4.1.1.4 Power

Question 98

January 2013 | PH2FP | Original Q2 | Legacy

2 (a) Sources of background radiation are either natural or man-made.

Which **two** of the sources listed in the box are *natural* sources of background radiation?

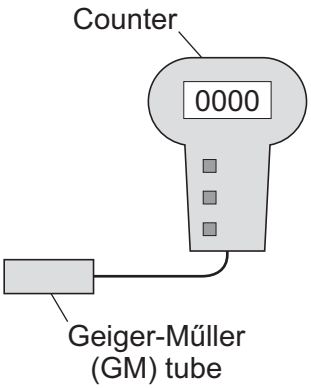
Draw a ring around each of your answers.

cosmic rays	**nuclear accidents**	**X-rays**	**radon gas**

(2 marks)

2 (b) A teacher used a Geiger-Műller (GM) tube and counter to measure the background radiation in her laboratory. The teacher reset the counter to zero, waited one minute and then took the count reading. The teacher repeated this two more times.

The three readings taken by the teacher are given in the table.



Count
17
21
19

2 (b) (i) The three readings are different.

What is the most likely reason for this?

Tick (✓) **one** box.

The teacher did not reset the counter to zero. ☐

Radioactive decay is a random process. ☐

The temperature in the laboratory changed. ☐

(1 mark)

2 (b) (ii) Calculate the mean (average) value of the three readings given in the table.

.....

Mean (average) value = ... counts

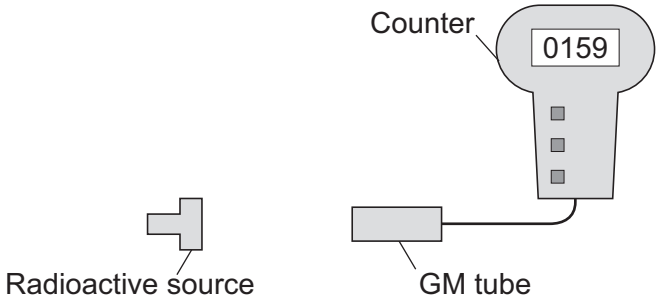
(1 mark)

4.1.1.4 Power

Question 98 · continued

2 (b) (iii) The diagram shows how the teacher used the GM tube and counter to measure the radiation emitted from a radioactive source.

The counter was reset to zero. The count after one minute was 159.



Calculate how many counts were due to the radiation from the radioactive source.

.....

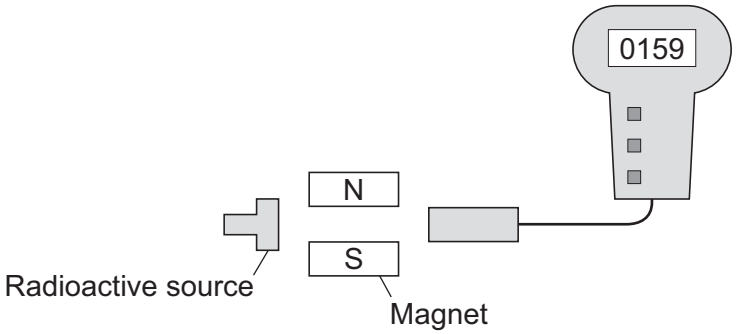
.....

Counts due to the radiation from the radioactive source = ...

(1 mark)

2 (b) (iv) The teacher then put a powerful magnet between the radioactive source and the GM tube.

The counter was reset to zero. The number on the counter shows the count after one minute.



What type of radiation was being emitted from the radioactive source?

Draw a ring around your answer.

alpha **beta** **gamma**

Explain the reason for your answer.

.....

.....

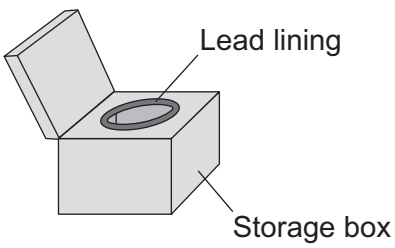
.....

.....

(3 marks)

Question 98 · continued

2 (c) At the end of the lesson the teacher put the radioactive source back inside its storage box.



Why is the inside of the box lined with lead?

.....

.....

(1 mark)

2 (d) Which **one** of the following questions **cannot** be answered by scientific study?

Tick (✓) **one** box.

Where does background radiation come from? ☐

What is meant by the half-life of a radioactive source? ☐

Should radioactive waste be dumped in the oceans? ☐

(1 mark)

10

4.1.1.4 Power

Question 99

January 2013 | PH2FP | Original Q4 | Legacy

4 (a) The diagram shows the information plate on an electric kettle. The kettle is plugged into the a.c. mains electricity supply.

230 V	**2760 W**
50 Hz	

Use the information from the plate to answer the following questions.

4 (a) (i) What is the frequency of the a.c. mains electricity supply?

.....

(1 mark)

4 (a) (ii) What is the power of the electric kettle?

.....

(1 mark)

4 (b) To boil the water in the kettle, 2400 coulombs of charge pass through the heating element in 200 seconds.

Calculate the current flowing through the heating element and give the unit.

Use the correct equation from the Physics Equations Sheet.

Choose the unit from the list below.

amps **volts** **watts**

.....

.....

.....

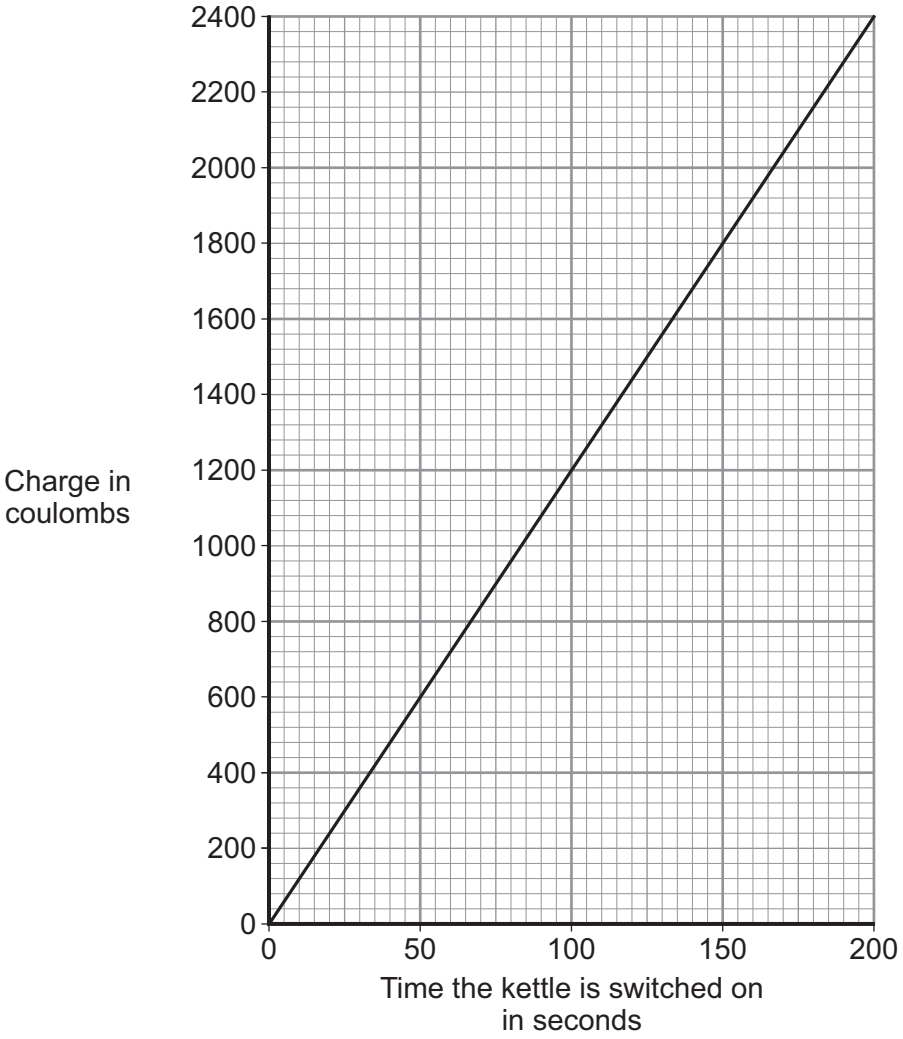
Current = ...

(3 marks)

4.1.1.4 Power

Question 99 · continued

4 (c) The amount of charge passing through the heating element of an electric kettle depends on the time the kettle is switched on.



What pattern links the amount of charge passing through the heating element and the time the kettle is switched on?

.....

.....

(2 marks)

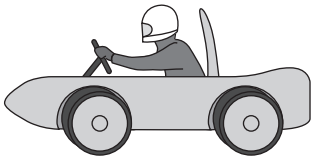
7

4.1.1.4 Power

Question 100

January 2013 | PH2FP | Original Q6 | Legacy

6 Some students designed and built an electric-powered go-kart.
The go-kart is shown below.



6 (a) Suggest **two** changes that could be made to the design of the go-kart to increase its top speed.

1 .....

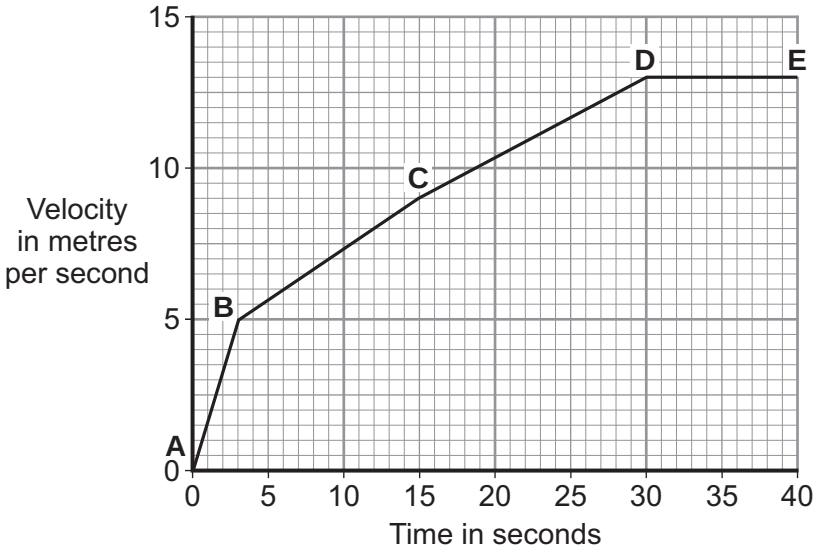
.....

2 .....

.....

(2 marks)

6 (b) A go-kart with a new design is entered into a race.
The velocity-time graph for the go-kart, during the first 40 seconds of the race, is shown below.



4.1.1.4 Power

Question 100 · continued

6 (b) (i) Between which **two** points did the go-kart have the greatest acceleration?

Tick (✓) **one** box.

A–B ☐

B–C ☐

C–D ☐

Give a reason for your answer.

.....

.....

(2 marks)

6 (b) (ii) The go-kart travels at a speed of 13 m/s between points **D** and **E**.
The total mass of the go-kart and driver is 140 kg.

Calculate the momentum of the go-kart and driver between points **D** and **E**.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Momentum = ... kg m/s
(2 marks)

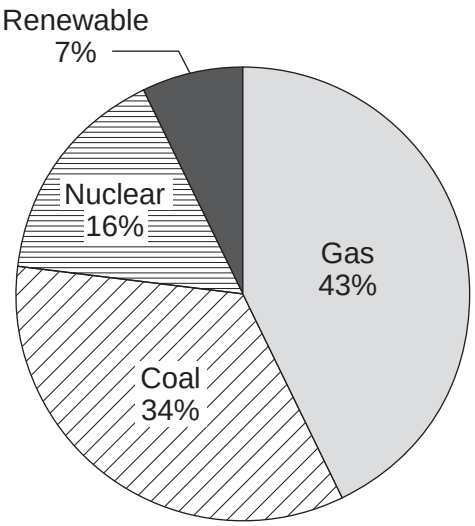
6

4.1.1.4 Power

Question 101

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)

4.1.1.4 Power

Question 101 · 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

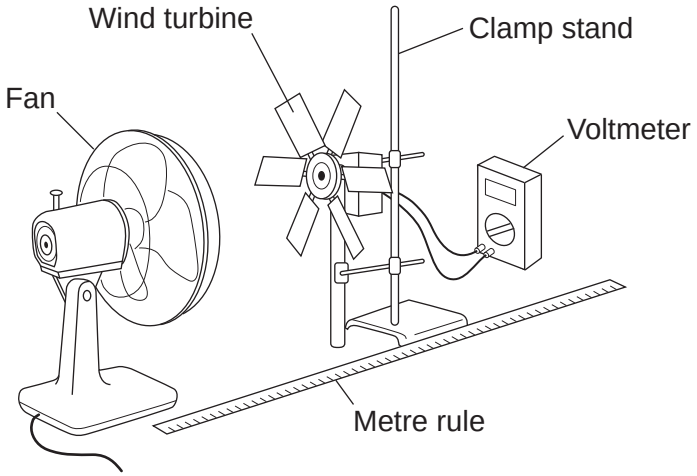
4.1.1.4 Power

Question 102

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.

.....

.....

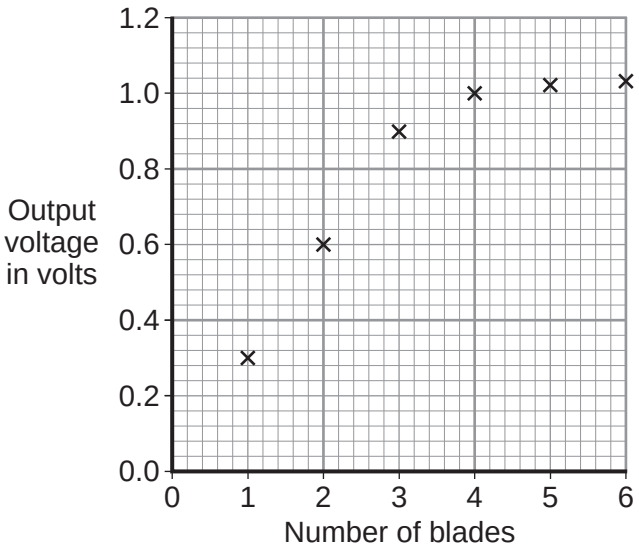
(1 mark)

4.1.1.4 Power

Question 102 · 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

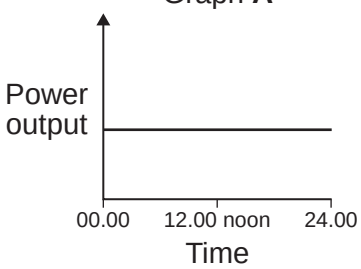
4.1.1.4 Power

Question 102 · continued

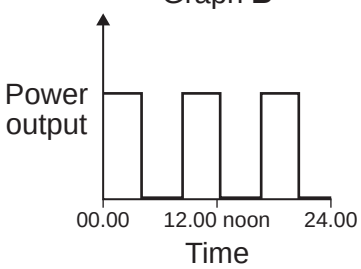
4 (b) The amount of electricity generated using wind turbines is increasing.

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

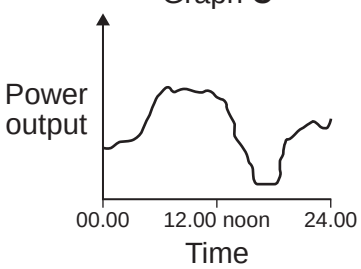
Graph **A**



Graph **B**



Graph **C**



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

Give a reason for your answer.

.....

.....

.....

(2 marks)

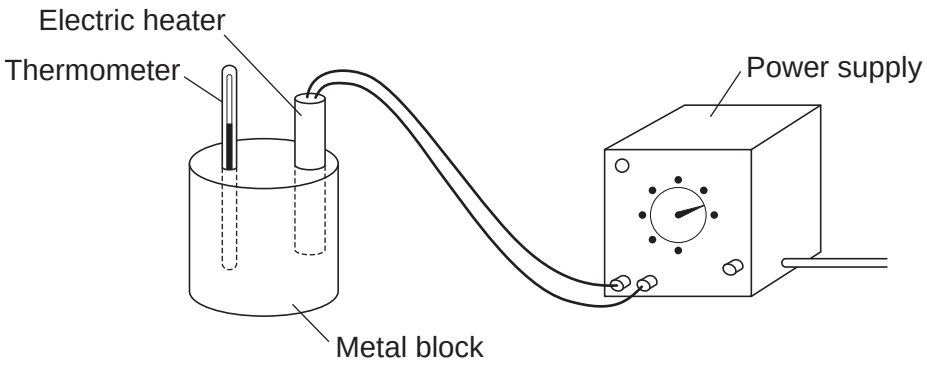
6

4.1.1.4 Power

Question 103

June 2013 | PH1FP | Original Q6 | Legacy

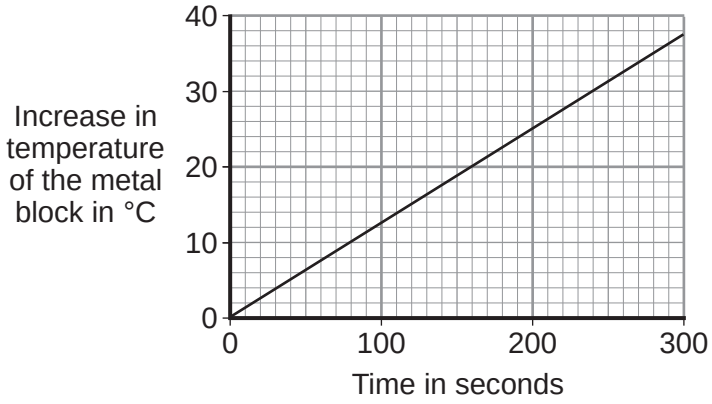
6 (a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.



6 (a) (i) Before starting the experiment, the student drew **Graph A**.

Graph A shows how the student expected the temperature of the metal block to change after the heater was switched on.

Graph A



Describe the pattern shown in **Graph A**.

.....

.....

.....

.....

(2 marks)

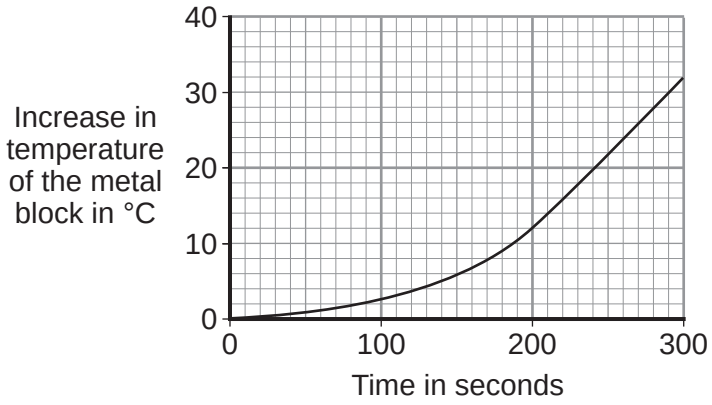
4.1.1.4 Power

Question 103 · continued

6 (a) (ii) The student measured the room temperature. He then switched the heater on and measured the temperature of the metal block every 50 seconds.

The student calculated the increase in temperature of the metal block and plotted **Graph B**.

Graph B



After 300 seconds, **Graph B** shows the increase in temperature of the metal block is lower than the increase in temperature expected from **Graph A**.

Suggest **one** reason why.

.....

.....

(1 mark)

6 (a) (iii) The power of the electric heater is 50 watts.

Calculate the energy transferred to the heater from the electricity supply in 300 seconds.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Energy transferred = ... J

(2 marks)

Question 6 continues on the next page

4.1.1.4 Power

Question 103 · continued

6 (b) The student uses the same heater to heat blocks of different metals. Each time the heater is switched on for 300 seconds.

Each block of metal has the same mass but a different specific heat capacity.

Metal	Specific heat capacity in J/kg°C
Aluminium	900
Iron	450
Lead	130

Which **one** of the metals will heat up the most?

Draw a ring around the correct answer.

aluminium **iron** **lead**

Give, in terms of the amount of energy needed to heat the metal blocks, a reason for your answer.

.....

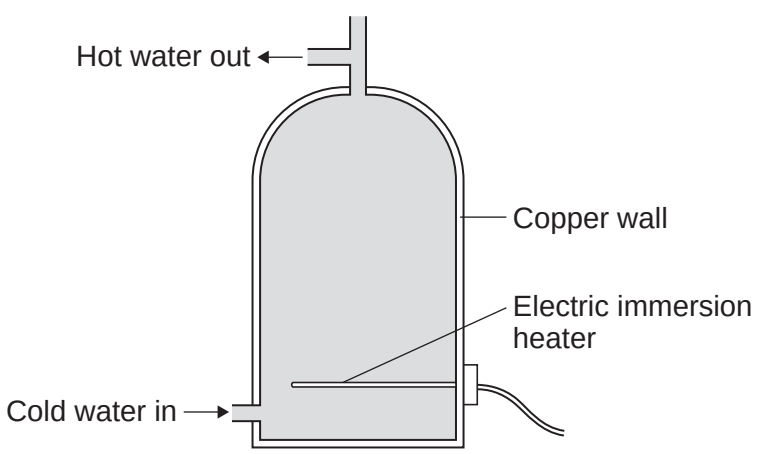
.....

.....

.....

(2 marks)

6 (c) A homeowner uses an electric immersion heater to heat the water in his hot water tank. The hot water tank has no insulation.



4.1.1.4 Power

Question 103 · continued

6 (c) (i) Draw a ring around the correct answer to complete each sentence.

Energy is transferred through the water by

conduction.
convection.
evaporation.

Energy is transferred through the copper wall of the hot water tank by

conduction.
convection.
evaporation.

(2 marks)

6 (c) (ii) To keep the water in the tank hot for longer, the homeowner fits an insulating jacket around the tank. The insulating jacket costs £12 to buy.

The homeowner expects to save £16 each year from reduced energy bills.

Calculate the pay-back time for the insulating jacket.

.....

.....

Pay-back time = ... years

(2 marks)

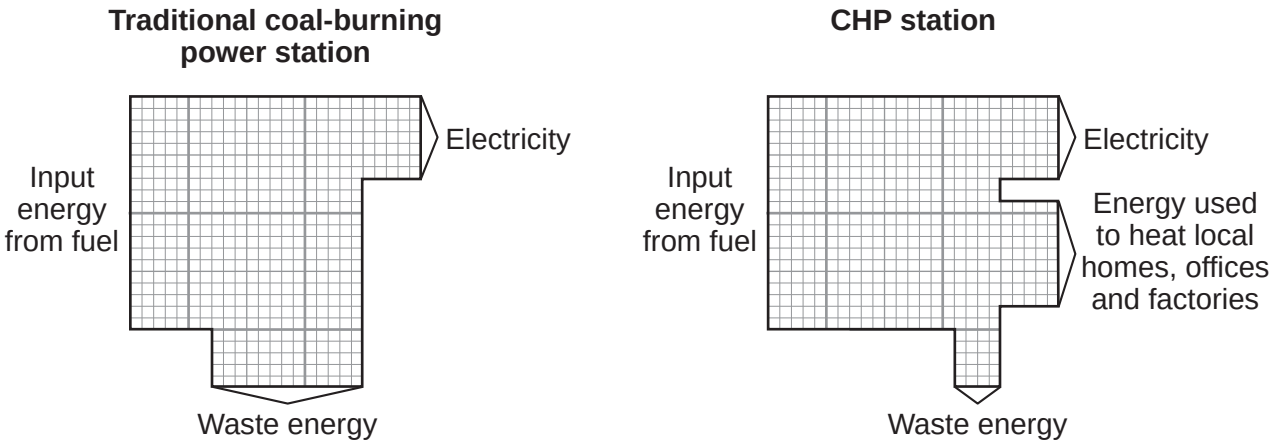
11

4.1.1.4 Power

Question 104

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)

4.1.1.4 Power

Question 104 · 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)

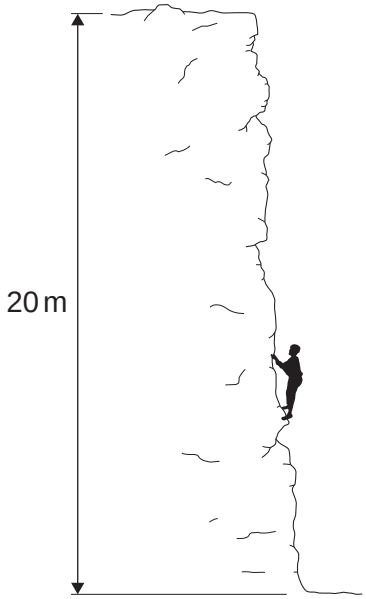
7

4.1.1.4 Power

Question 105

June 2013 | PH2FP | Original Q4 | Legacy

4 The diagram shows a climber part way up a cliff.



4 (a) Complete the sentence.

When the climber moves up the cliff, the climber

gains gravitational ..... energy.

(1 mark)

4 (b) The climber weighs 660 N.

4 (b) (i) Calculate the work the climber must do against gravity, to climb to the top of the cliff.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Work done = ... J

(2 marks)

4 (b) (ii) It takes the climber 800 seconds to climb to the top of the cliff. During this time the energy transferred to the climber equals the work done by the climber.

Calculate the power of the climber during the climb.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Power = ... W

(2 marks)

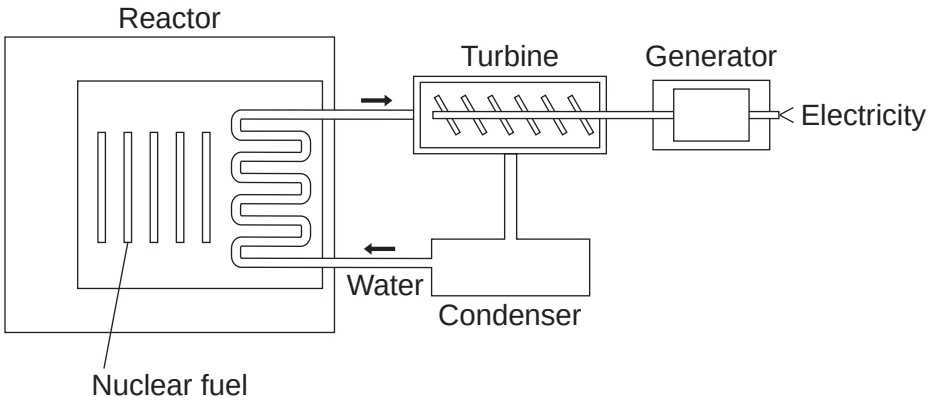
5

4.1.1.4 Power

Question 106

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)

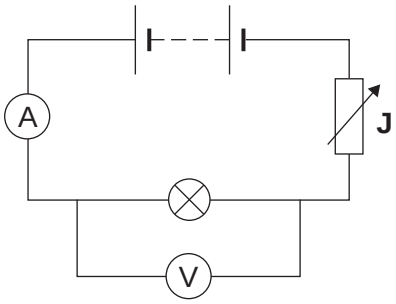
6

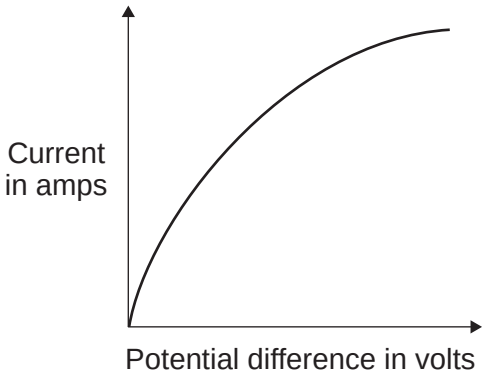
4.1.1.4 Power

Question 107

June 2013 | PH2FP | Original Q8 | Legacy

8 (a) The diagram shows the circuit used to obtain the data needed to plot the current–potential difference graph for a filament bulb.





8 (a) (i) Why is the component labelled '**J**' included in the circuit?

.....

.....

(1 mark)

8 (a) (ii) The resistance of the bulb increases as the potential difference across the bulb increases. Why?

.....

.....

(1 mark)

8 (a) (iii) The bulb is at full brightness when the potential difference across the bulb is 12 V. The current through the bulb is then 3 A.

Calculate the power of the bulb when it is at full brightness and give the unit.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Power = ...

(3 marks)

4.1.1.4 Power

Question 107 · continued

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

The table gives data about two types of light bulb people may use in their homes.

Type of light bulb	Energy efficiency	Cost of one light bulb	Average lifetime in hours
Halogen	10%	£1.95	2 000
Light Emitting Diode (LED)	32%	£11.70	36 000

Both types of light bulb produce the same amount of light.

Evaluate, in terms of cost and energy efficiency, the use of the two types of light bulb.

To gain full marks you must compare both types of light bulb and conclude which light bulb would be the best to use.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6 marks)

11

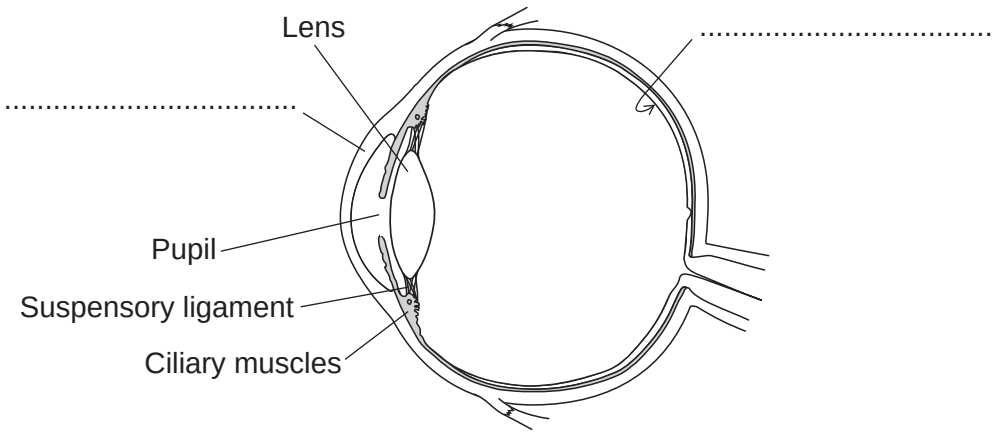
4.1.1.4 Power

Question 108

June 2013 | PH3FP | Original Q7 | Legacy

7 (a) The diagram shows parts of the human eye.

Complete the missing labels.



(2 marks)

7 (b) Each part of the human eye has a function.

Complete the table below.

Part of the human eye	Function of the part
.....	Changes size to make sure the correct amount of light enters the eye.
Ciliary muscles	....
Lens	....

(3 marks)

4.1.1.4 Power

Question 108 · continued

7 (c) The human eye can focus on near objects. The closest distance the eye can bring into sharp focus is called the near point.

A student measured the near point of four people of different ages. The table shows her data.

Age of human in years	Near point in millimetres
10	200
25	250
40	400
55	700

What can you conclude from the data in the table above?

.....

.....

.....

.....

(2 marks)

7 (d) Suggest how the data obtained by the student could be improved.

.....

.....

(1 mark)

7 (e) Spectacles are worn to correct vision. One of the lenses in a pair of spectacles has a focal length of 40 centimetres.

Calculate the power of the lens.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Power of lens = ... dioptres

(2 marks)

10

4.1.1.4 Power

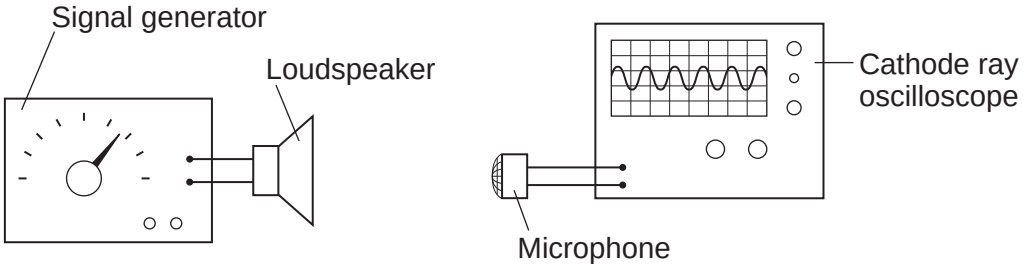
Question 109

June 2014 | PH1FP | Original Q2 | Legacy

2 (a) **Figure 2** shows a signal generator connected to a loudspeaker.

The signal generator is adjusted to change the sound wave produced by the loudspeaker.

Figure 2

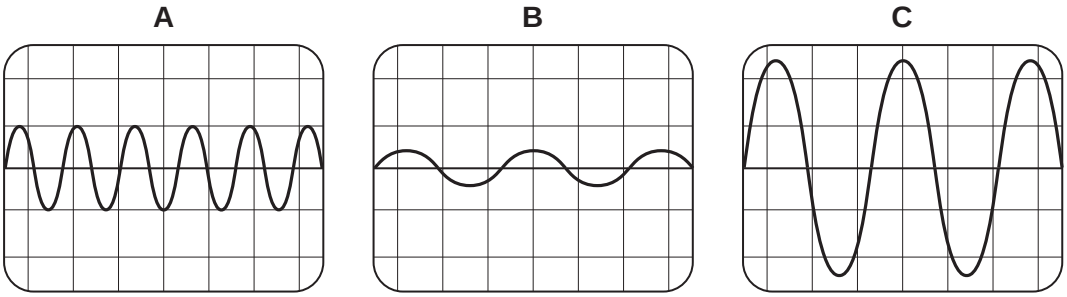


A microphone connected to a cathode ray oscilloscope (CRO) is used to detect the sound waves from the loudspeaker.

Figure 3 shows the CRO traces, **A**, **B** and **C**, produced by three different sound waves.

The settings on the CRO were the same for each trace.

Figure 3



Use the correct letter, **A**, **B** or **C**, to complete each sentence.

2 (a) (i) The sound wave with the highest frequency is shown by trace ☐.

[1 mark]

2 (a) (ii) The sound wave with the smallest amplitude is shown by trace ☐.

[1 mark]

4.1.1.4 Power

Question 109 · continued

2 (b) The loudspeaker produces a sound wave with a frequency of 850 hertz and a wavelength of 0.4 metres.

Calculate the speed of this sound wave. Give the unit.

Use the correct equation from the Physics Equations Sheet.

Choose the unit from the list below.

joules **metres / second** **watts**

[3 marks]

.....

.....

.....

Speed = ...

2 (c) A motorbike is driven towards a microphone and CRO which are placed by the side of the road.

The motorbike emits a sound wave of constant frequency.

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

[2 marks]

As the motorbike moves towards the microphone, the frequency of the sound wave detected by the microphone will be

higher than
the same as
lower than

the frequency of the sound wave produced by the motorbike.

The wavelength of the sound wave detected by the microphone will be

longer than
the same as
shorter than

the wavelength of the sound wave from the motorbike.

7

4.1.1.4 Power

Question 110

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

4.1.1.4 Power

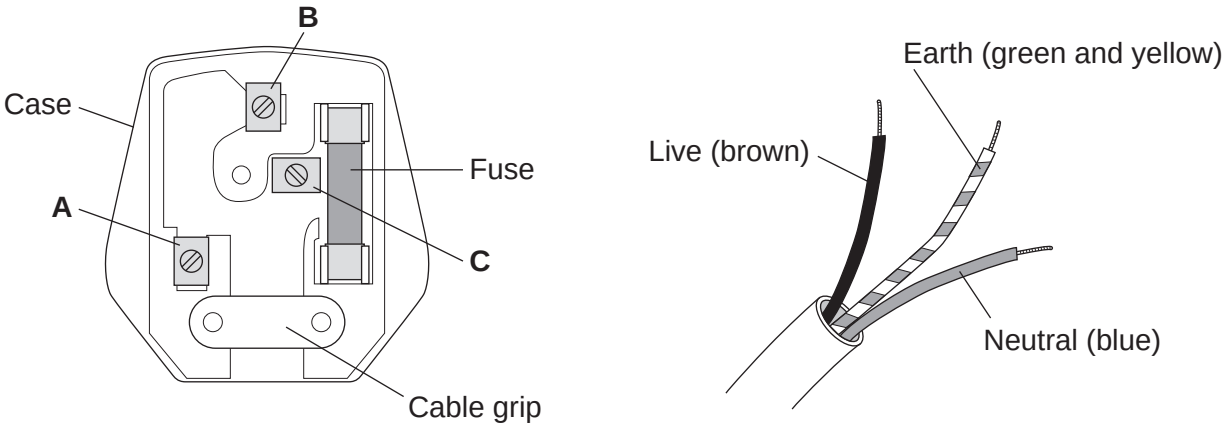
Question 111

June 2014 | PH2FP | Original Q6 | Legacy

6 (a) **Figure 10** shows the inside of a three-pin plug and a length of three-core cable.

The cable is to be connected to the plug.

Figure 10



6 (a) (i) Complete **Table 1** to show which plug terminal, **A**, **B** or **C**, connects to each of the wires inside the cable.

[2 marks]

Table 1

Wire	Plug terminal
Live	
Neutral	
Earth	

6 (a) (ii) Name a material that could be used to make the case of the plug.

[1 mark]

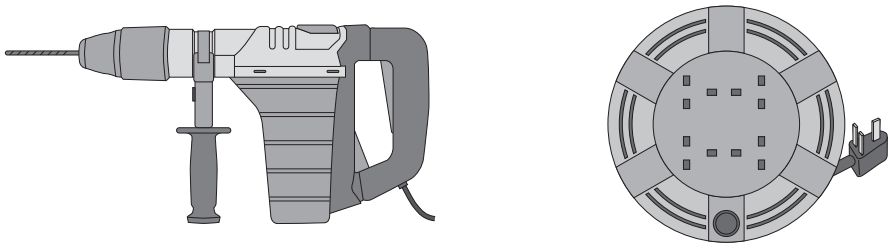
.....

4.1.1.4 Power

Question 111 · continued

6 (b) **Figure 11** shows an electric drill and an extension lead. The drill is used with the extension lead.

Figure 11



Electric drill

Extension lead

6 (b) (i) The drill is used for 50 seconds.

In this time, 30 000 joules of energy are transferred from the mains electricity supply to the drill.

Calculate the power of the drill.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Power = ... W

Question 6 continues on the next page

4.1.1.4 Power

Question 111 · continued

6 (b) (ii) A second drill is used with the extension lead. The power of this drill is 1200 W.

The instructions for using the extension lead include the following information.

> **When in use the lead may get hot:**
>
> **DO NOT go over the maximum power**
>
> - lead wound inside the case: 820 watts
> - lead fully unwound outside the case: 3100 watts

It would **not** be safe to use this drill with the extension lead if the lead was left wound inside the plastic case.

Explain why.

[3 marks]

.....

.....

.....

.....

.....

.....

4.1.1.4 Power

Question 111 · continued

6 (c) **Table 2** gives information about three different electric drills.

Table 2

Drill	Power input in watts	Power output in watts
X	640	500
Y	710	500
Z	800	500

A person is going to buy **one** of the drills, **X**, **Y** or **Z**. The drills cost the same to buy.

Use only the information in the table to decide which **one** of the drills, **X**, **Y** or **Z**, the person should buy.

Write your answer in the box. ☐

Give a reason for your answer.

[1 mark]

.....

.....

.....

9

4.1.1.4 Power

Question 112

June 2015 | PH1FP | Original Q2 | Legacy

2 **Figure 3** shows a man using a leaf blower to move some leaves.

Figure 3



The leaf blower is powered by an electric motor connected to a battery.

2 (a) Energy transfers take place when the leaf blower is being used.

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

[3 marks]

chemical	**electrical**	**kinetic**	**nuclear**	**sound**

The battery stores ..... energy which is transferred into electrical energy.

The electric motor transfers electrical energy usefully into ..... energy.

The motor wastes energy as ..... energy and as energy that heats the surroundings.

Question 2 continues on the next page

4.1.1.4 Power

Question 112 · continued

2 (b) The total power input to the leaf blower is 750 W.
The useful power output of the leaf blower is 360 W.

Calculate the efficiency of the leaf blower.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

.....

Efficiency = ...

5

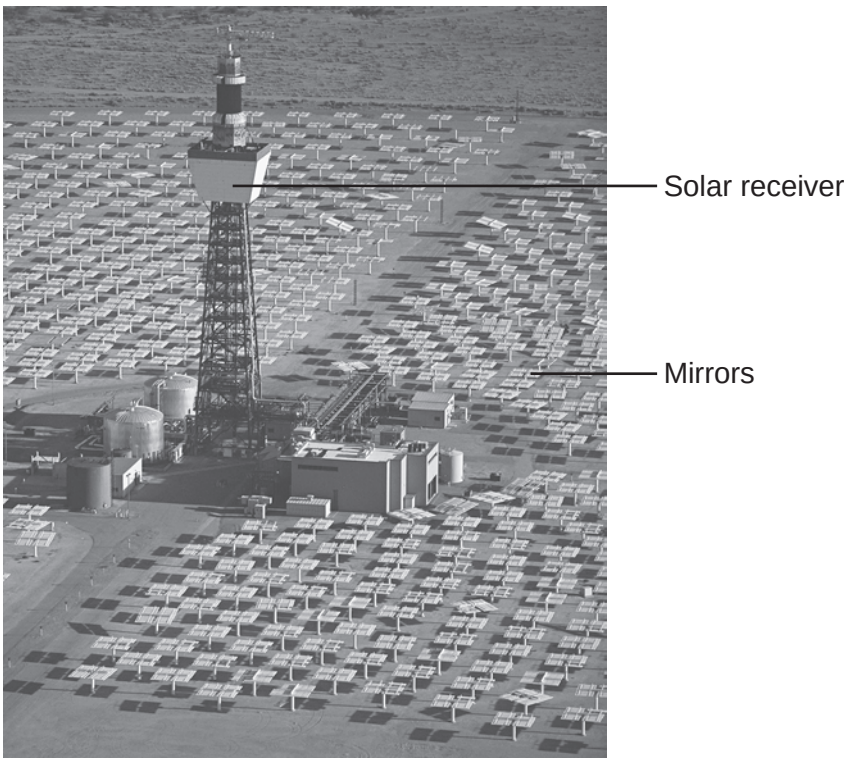
4.1.1.4 Power

Question 113

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

4.1.1.4 Power

Question 113 · 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

4.1.1.4 Power

Question 113 · 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

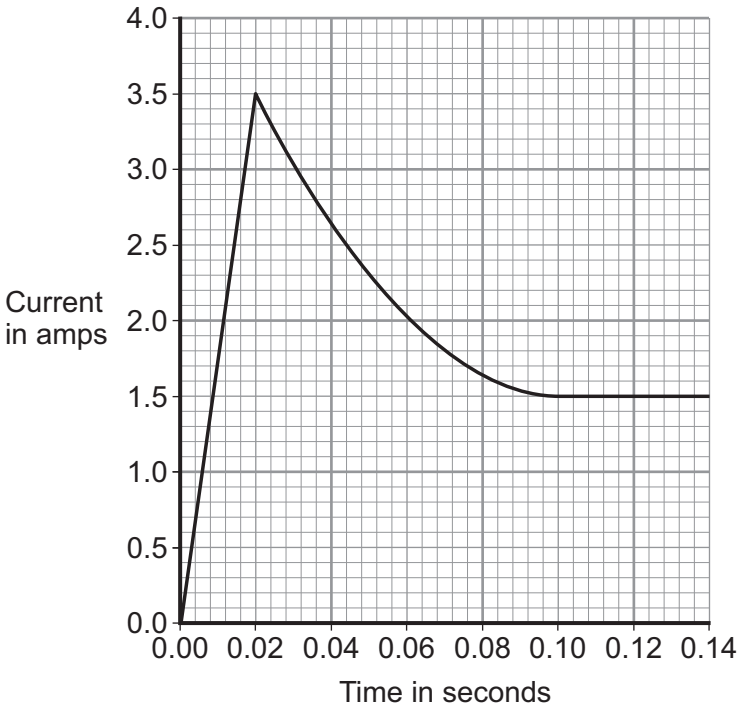
4.1.1.4 Power

Question 114

June 2015 | PH2FP | Original Q1 | Legacy

1 **Figure 1** shows how the current through a filament bulb changes after the bulb is switched on.

Figure 1



1 (a) What happens to the current through the bulb in the first 0.02 seconds after the bulb is switched on?

[1 mark]

.....

1 (b) Between 0.02 seconds and 0.08 seconds the current through the bulb decreases.

1 (b) (i) What, if anything, happens to the **resistance** of the bulb between 0.02 seconds and 0.08 seconds?

[1 mark]

Draw a ring around the correct answer.

decreases **does not change** **increases**

4.1.1.4 Power

Question 114 · continued

1 (b) (ii) What, if anything, happens to the **temperature** of the bulb between 0.02 seconds and 0.08 seconds?

[1 mark]

Draw a ring around the correct answer.

decreases **does not change** **increases**

1 (c) The bulb is connected to a 12 V power supply.

Calculate the power of the bulb when the current through the bulb is 1.5 A.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Choose the unit from the list below.

coulomb **joule** **watt**

.....

.....

Power = ... unit .....

6

4.1.1.4 Power

Question 115

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

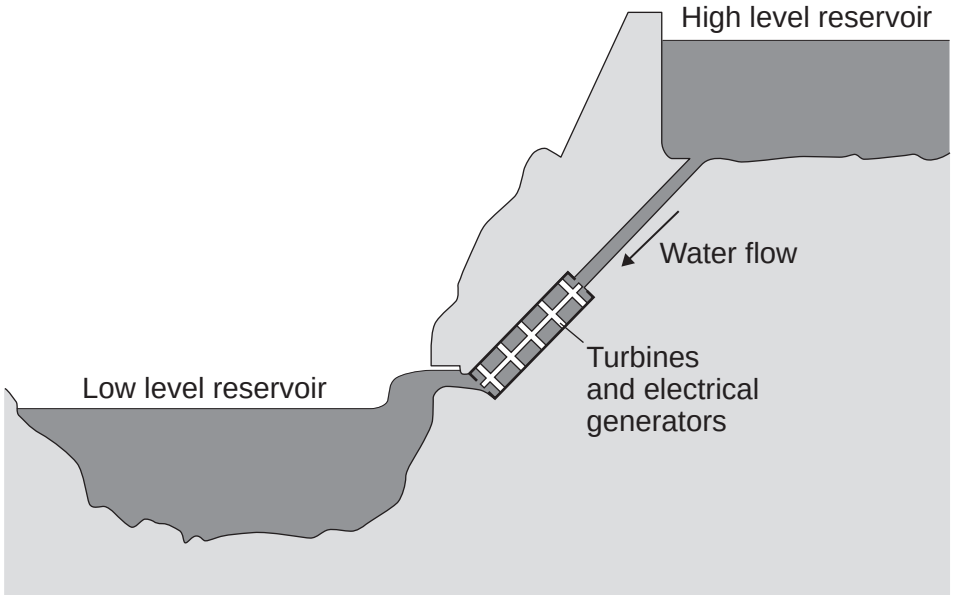
Table 1

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



4.1.1.4 Power

Question 115 · 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

4.1.1.4 Power

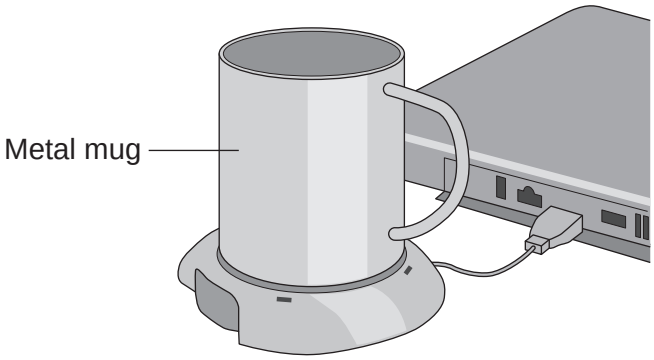
Question 116

June 2016 | PH1FP | Original Q5 | Legacy

5 A heater uses energy from a laptop computer to keep a drink hot.

Figure 9 shows a metal mug on the heater.

Figure 9



5 (a) The laptop computer is operating on battery power.
How would connecting the heater affect the amount of time the laptop computer would operate for, before needing to be recharged?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
it would decrease the time	
it would not affect the time	
it would increase the time	

5 (b) The power output from the heater is 12 W.

Calculate the energy transferred to the metal mug in 60 seconds.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ joules

4.1.1.4 Power

Question 116 · continued

June 2016 | PH1FP | Original Q5 | Legacy

5 (c) The heater causes a convection current in the liquid inside the mug.

Complete the sentences to explain how.

[3 marks]

The liquid at the bottom of the mug heats up and becomes less _____ .

The hot liquid _____ and the cooler liquid at the top of the mug _____ .

5 (d) **Table 2** lists changes that may affect the energy transfer per second from the heater to the liquid.

Tick (✓) **one** box to show the effect of **each** change.

[3 marks]

Table 2

Change	Energy transfer per second to the liquid		
	increases	**decreases**	**does not change**
use a mug with a smaller base			
use a lower power heater			
use a plastic mug instead of a metal mug			

9

4.1.1.4 Power

Question 117

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.

4.1.1.4 Power

Question 117 · 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

4.1.1.4 Power

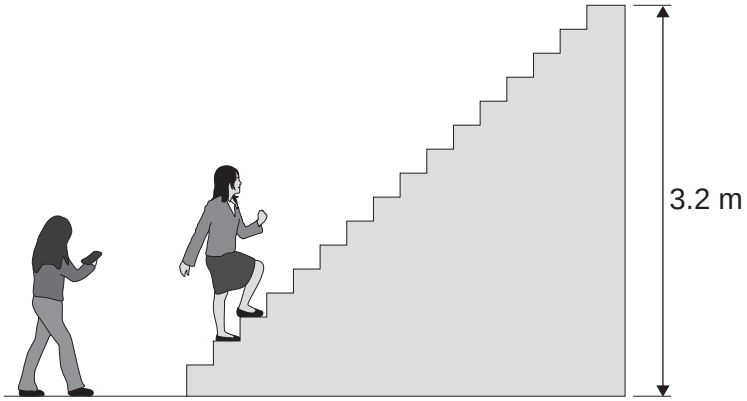
Question 118

June 2016 | PH2FP | Original Q6 | Legacy

6 A student did an experiment to calculate her power.
Figure 9 shows how she obtained the measurements needed.

The student first weighed herself and then ran up a flight of stairs. A second student timed how long it took her to go from the bottom to the top of the stairs. The height of the stairs was also measured.

Figure 9



6 (a) Complete the following sentence.

[1 mark]

To run up the stairs the student must do work against

the force of _____ .

6 (b) The student did 2240 J of work going from the bottom of the stairs to the top of the stairs.
The student took 2.8 seconds to run up the stairs.

6 (b) (i) Calculate the power the student developed when running up the stairs.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Power = _____ W

4.1.1.4 Power

Question 118 · continued

6 (b) (ii) How much gravitational potential energy did the student gain in going from the bottom to the top of the stairs?

[1 mark]

Tick (✓) **one** box.

much more than 2240 J ☐

2240 J ☐

much less than 2240 J ☐

6 (c) Another four students did the same experiment.
The measurements taken and the calculated values for power are given in **Table 1**.

Table 1

Student	Weight in newtons	Time taken in seconds	Power in watts
A	285	3.8	240
B	360	2.4	480
C	600	3.4	560
D	725	4.0	580

6 (c) (i) To make a fair comparison of their powers the students kept **one** variable in the experiment constant.

What variable did the students keep constant?

[1 mark]

6 (c) (ii) From the data in **Table 1** a student wrote the following conclusion.

'The greater the weight of the student the greater the power developed.'

Suggest why this conclusion may **not** be true for a larger group of students.

[1 mark]

6

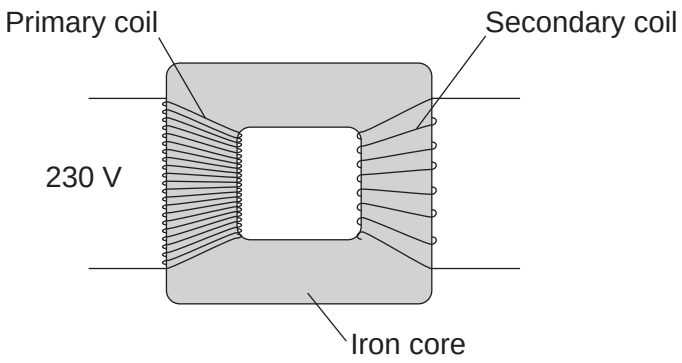
4.1.1.4 Power

Question 119

June 2016 | PH3FP | Original Q9 | Legacy

9 **Figure 12** shows the structure of a traditional transformer.

Figure 12



9 (a) There is an alternating current in the primary coil of the transformer.

State what is produced in the iron core.

[2 marks]

_____

_____

9 (b) A transformer has only **one** turn of wire on the secondary coil.
The potential difference across the secondary coil is 11.5 V
The potential difference across the primary coil is 230 V

Calculate the number of turns on the primary coil.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

_____

Number of turns on the primary coil = _____

Question 9 continues on the next page

4.1.1.4 Power

Question 119 · continued

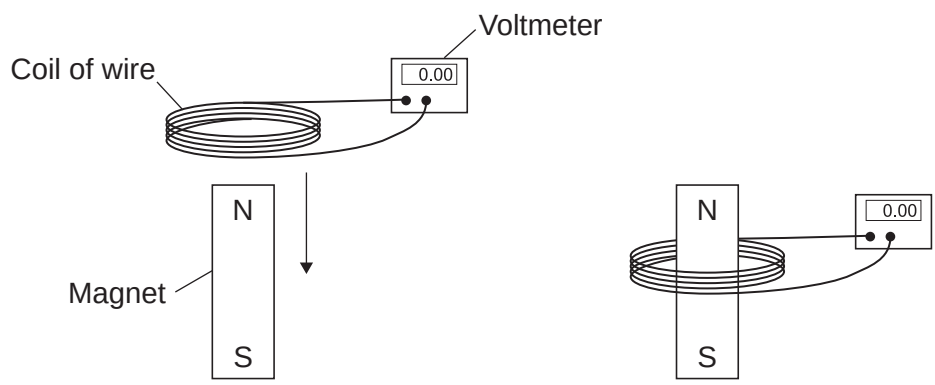
9 (c) In most transformers, the power output is less than the power input.

State why.

[1 mark]

9 (d) Two students investigated how magnets can be used to produce a potential difference. The students held a coil of wire above a magnet. The students quickly lowered the coil so that the magnet was inside the coil, as shown in **Figure 13**.

Figure 13



The students recorded the maximum potential difference for coils with different numbers of turns of wire. The results are shown in **Table 2**.

Table 2

Number of turns of wire in the coil	Maximum potential difference in volts	
	Results from student 1	Results from student 2
5	0.09	0.08
10	0.20	0.15
15	0.31	0.25
20	0.39	0.33
25	0.51	0.39

4.1.1.4 Power

Question 119 · continued

June 2016 | PH3FP | Original Q9 | Legacy

9 (d) (i) State the resolution of the voltmeter.

Give **one** reason why the resolution of the voltmeter is suitable for this investigation.

[2 marks]

Resolution _____

Reason _____

_____

9 (d) (ii) The two students used exactly the same equipment to carry out their investigations. Both students recorded their results correctly.

Give the reason why student 2 got different results from student 1.

[1 mark]

_____

_____

9 (d) (iii) The students decided that even though the results were different, there was no need to repeat the investigation.

How do the results show that the investigation is reproducible?

[1 mark]

_____

_____

9 (d) (iv) State the name of the process which causes the potential difference to be produced in this investigation.

[1 mark]

_____

9 (e) A transformer has been developed that can be used with many different devices.

Suggest **one** advantage of having a transformer that can be used with many different devices.

[1 mark]

_____

_____

11

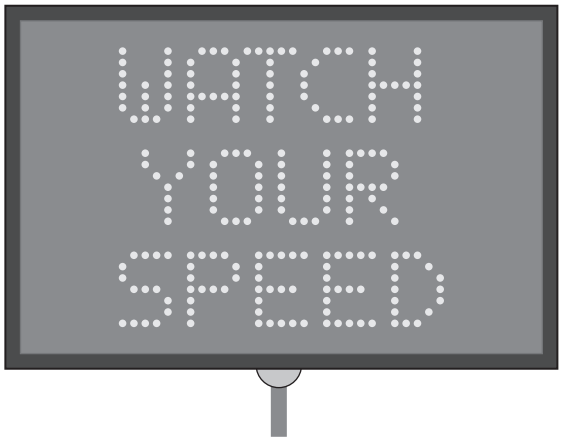
4.1.1.4 Power

Question 120

June 2017 | PH1FP | Original Q2 | Legacy

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

Figure 2

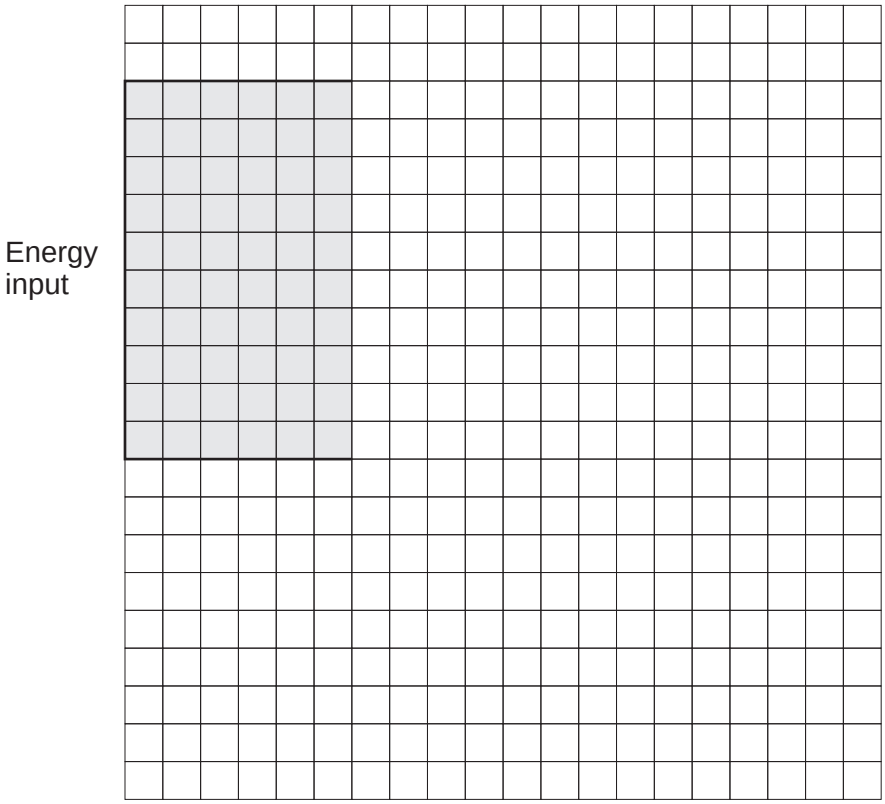


2 (a) The road sign is powered by an electrical generator which has an efficiency of 40%.

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

[2 marks]

Figure 3



4.1.1.4 Power

Question 120 · 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

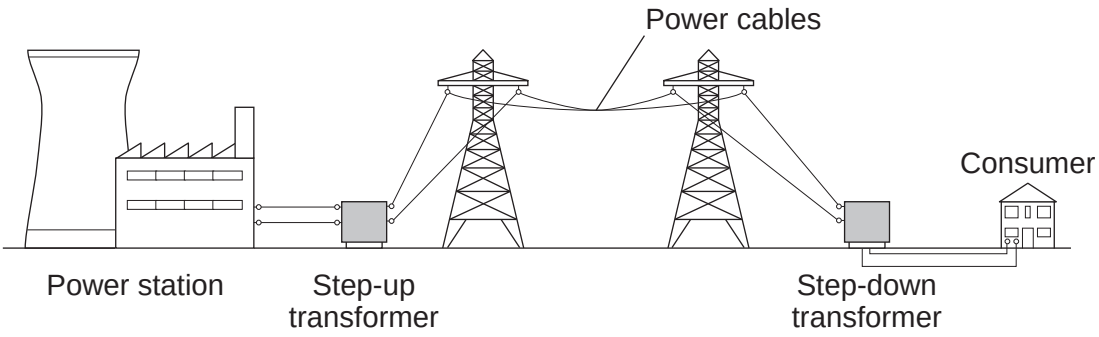
4.1.1.4 Power

Question 121

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]

_____

_____

4.1.1.4 Power

Question 121 · 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

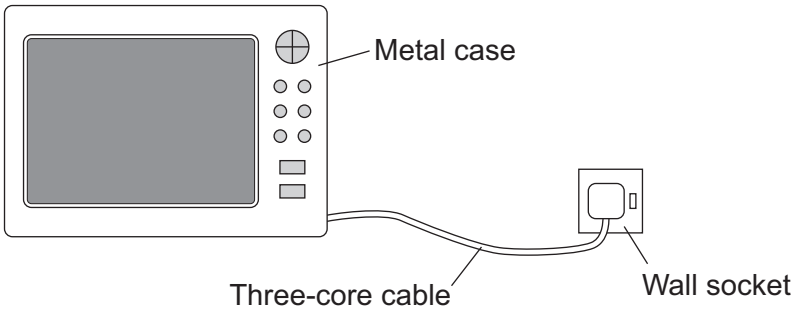
4.1.1.4 Power

Question 122

June 2017 | PH2FP | Original Q5 | Legacy

5 **Figure 10** shows a microwave oven.

Figure 10



5 (a) The microwave oven is connected to the mains electricity supply using a three-core cable and plug.

Explain why a three-core cable must be used and not a two-core cable.

[2 marks]

5 (b) (i) The microwave oven draws a current of 3.3 amps from the mains electricity supply.

Which one of the following fuses should be used inside the plug?

[2 marks]

Tick (✓) **one** box.

1 A ☐ **3 A** ☐ **13 A** ☐

Give the reason for your answer.

Question 5 continues on the next page

4.1.1.4 Power

Question 122 · continued

5 (b) (ii) The microwave oven is used to cook a meal.
The microwave oven is switched on for 300 seconds.

During this time 225 000 joules of energy are transferred from the mains electricity supply to the oven.

Calculate the power of the microwave oven.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Power = _____ W

6

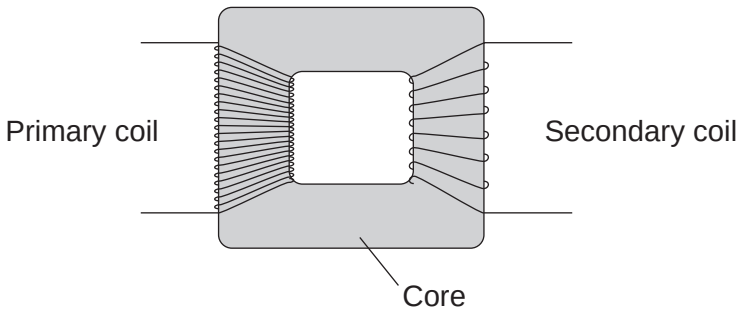
4.1.1.4 Power

Question 123

June 2017 | PH3FP | Original Q2 | Legacy

2 **Figure 3** shows a traditional transformer.

Figure 3



2 (a) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

greater than	**equal to**	**less than**

The potential difference across the secondary coil is _____

the potential difference across the primary coil.

2 (a) (ii) Give a reason for your answer to part **2 (a) (i)**.

[1 mark]

_____

_____

2 (b) What is the core of the transformer made from?

[1 mark]

_____

4.1.1.4 Power

Question 123 · continued

2 (c) What happens as the magnetic field in the core of the transformer changes?

[1 mark]

Tick (✓) **one** box.

The mass of the core increases. ☐

A potential difference is induced across the secondary coil. ☐

The temperature of the core decreases. ☐

2 (d) The power supply to the transformer is connected to the mains electricity supply.

What is the frequency of the mains electricity supply?

[1 mark]

Tick (✓) **one** box.

25 hertz ☐

50 hertz ☐

100 hertz ☐

2 (e) The power input of the transformer is 2 W. The transformer is 100% efficient.

State the power output of the transformer.

[1 mark]

_____

6

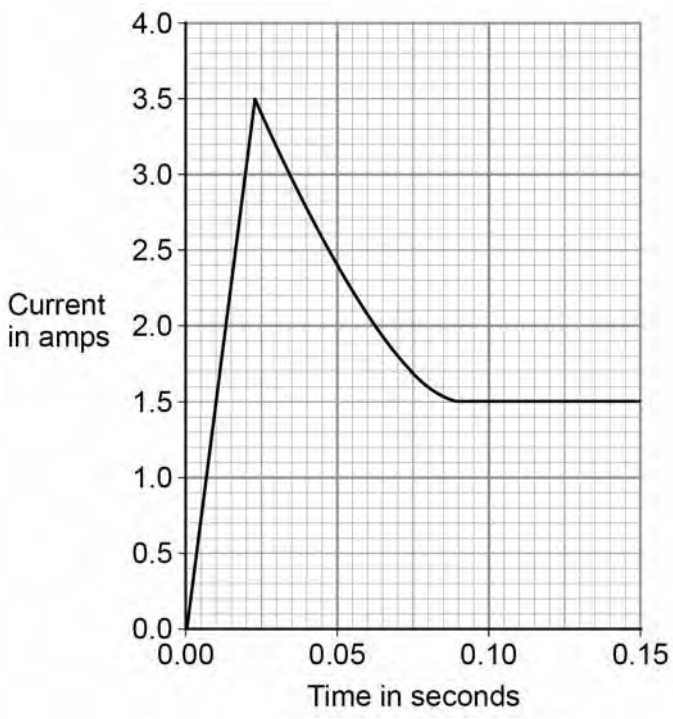
4.1.1.4 Power

Question 124

June 2018 | 8463/1F | Original Q2

0 2 **Figure 2** shows how the current through a filament lamp changes after the lamp is switched on.

Figure 2



0 2 . 1 The normal current through the filament lamp is 1.5 A.

For how many seconds is the current through the filament lamp greater than 1.5 A?

Tick **one** box.

[1 mark]

- 0.01 s ☐
- 0.08 s ☐
- 0.09 s ☐
- 0.14 s ☐

4.1.1.4 Power

Question 124 · continued

0 2 . 2 Why might the filament inside a lamp melt when the lamp is first switched on?

[1 mark]

0 2 . 3 The lamp is connected to a 24 V power supply. The current through the lamp is 1.5 A.

Calculate the power of the lamp.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 2 . 4 LED lamps are much more efficient than filament lamps.

What does this statement mean?

Tick **one** box.

[1 mark]

- LED lamps have a similar power output to filament lamps. ☐
- LED lamps waste a smaller proportion of the input energy than filament lamps. ☐
- LED lamps have a higher power input than filament lamps. ☐
- LED lamps waste a larger proportion of the input energy than filament lamps. ☐

5

4.1.1.4 Power

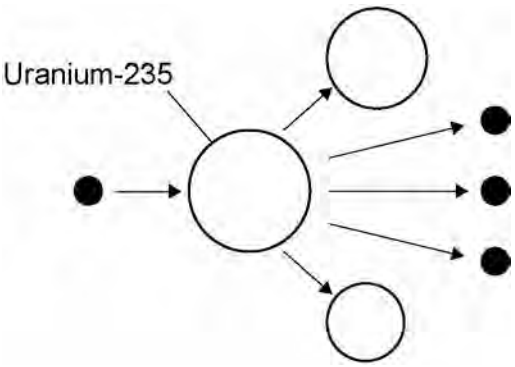
Question 125

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 = _____

Question 125 · continued

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

[2 marks]

1 _____

_____

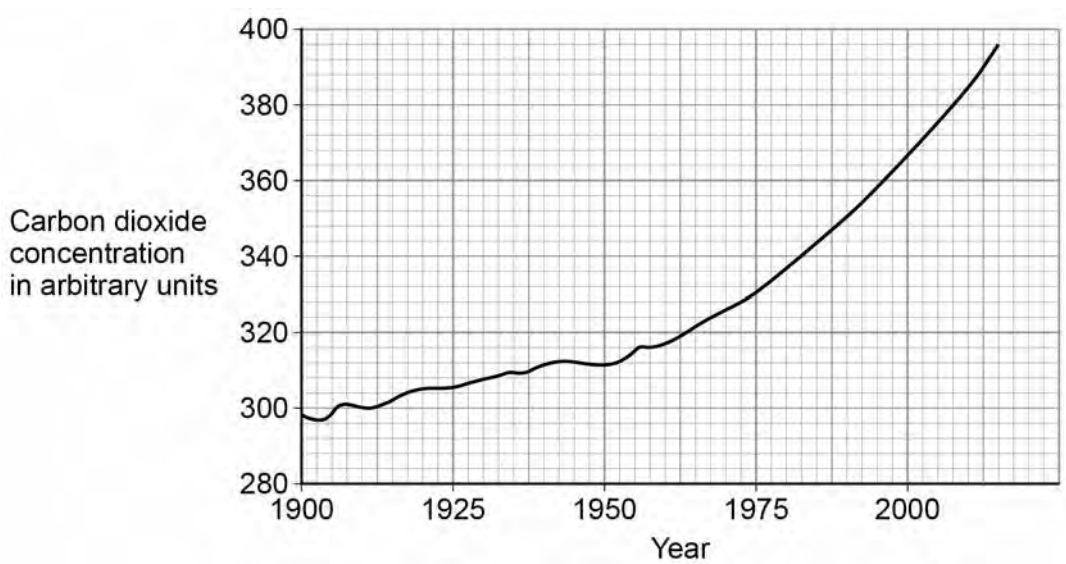
2 _____

_____

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

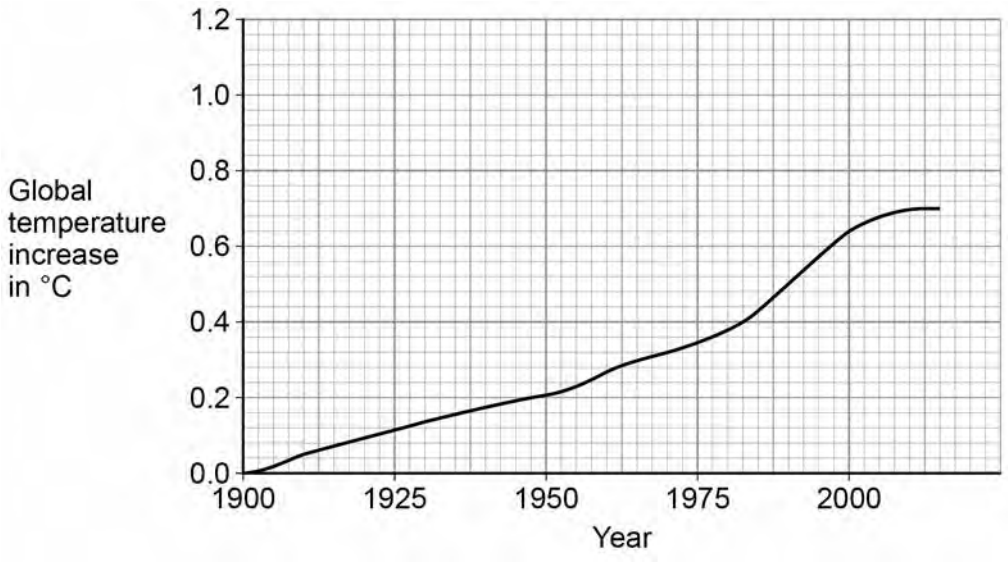


4.1.1.4 Power

Question 125 · 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

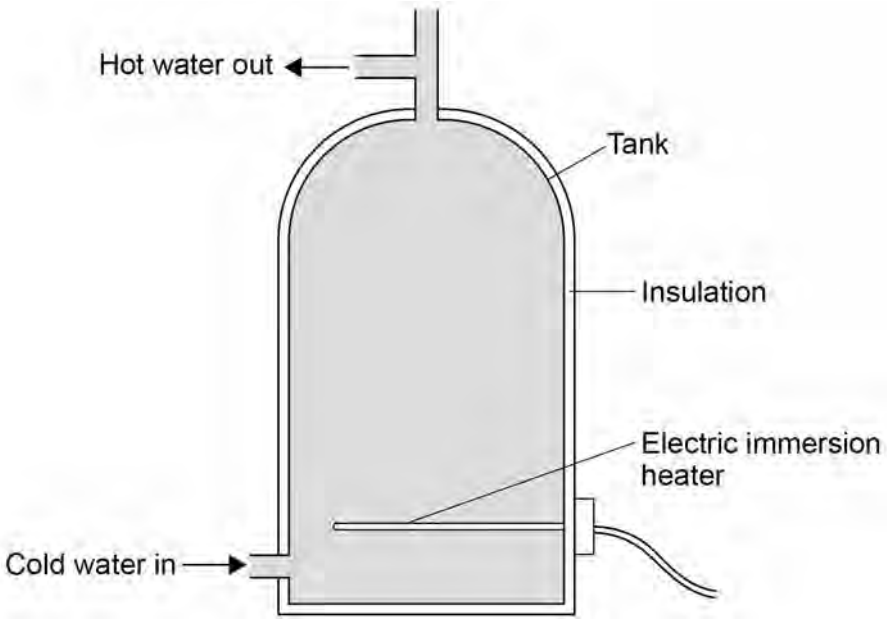
4.1.1.4 Power

Question 126

June 2018 | 8463/1F | Original Q8

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 ☐

4.1.1.4 Power

Question 126 · 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

4.1.1.4 Power

Question 126 · 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

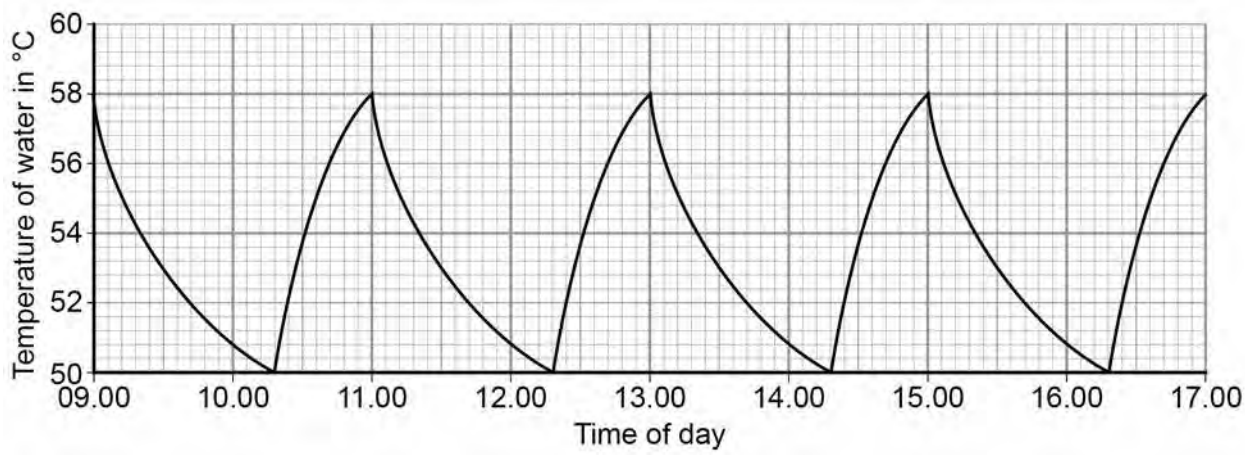
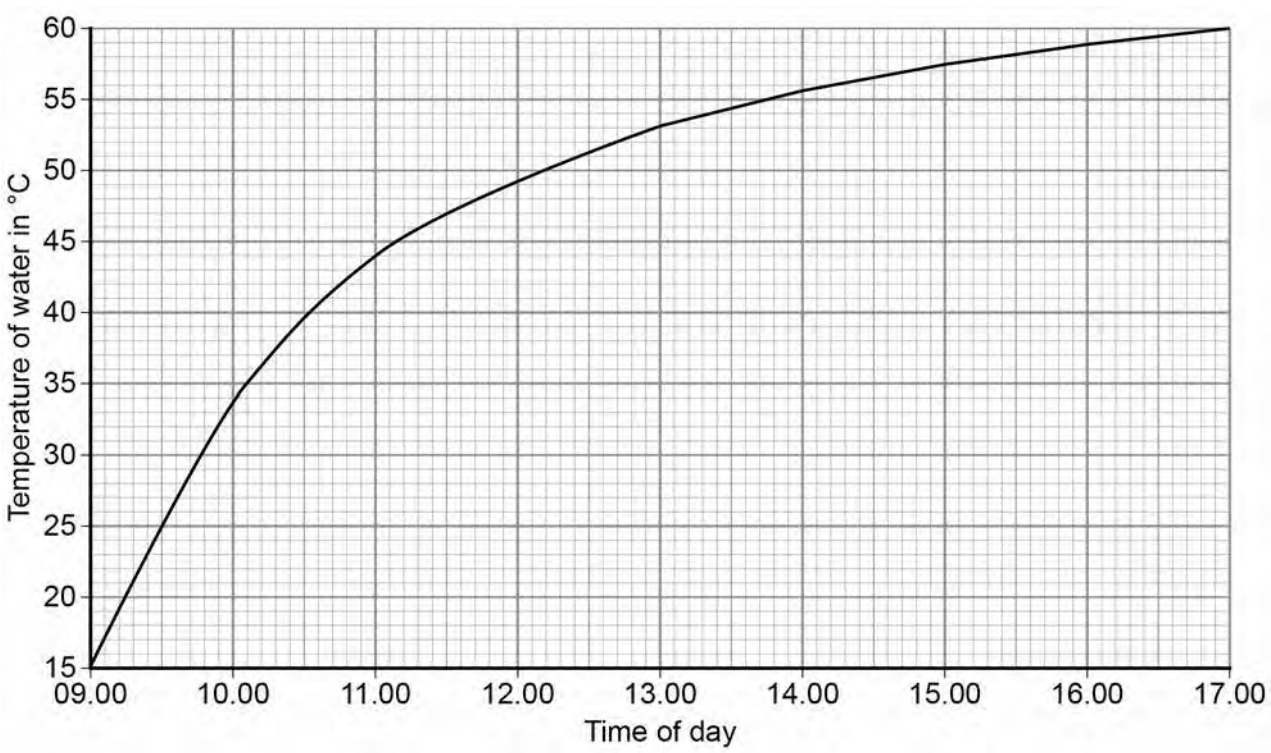


Figure 12



4.1.1.4 Power

Question 126 · 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

4.1.1.4 Power

Question 126 · 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 _____

4.1.1.4 Power

Question 127

June 2018 | 8463/1F | Original Q9

0 9 **Figure 13** shows a lift inside a building.

Figure 13



0 9 . 1 The motor in the lift does 120 000 J of work in 8.0 seconds.

Calculate the power output of the motor in the lift.

Use the equation:

$$\text{Power output} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

Power output = _____ W

4.1.1.4 Power

Question 127 · continued

0 9 . 2 The power input to the motor is greater than the power output.

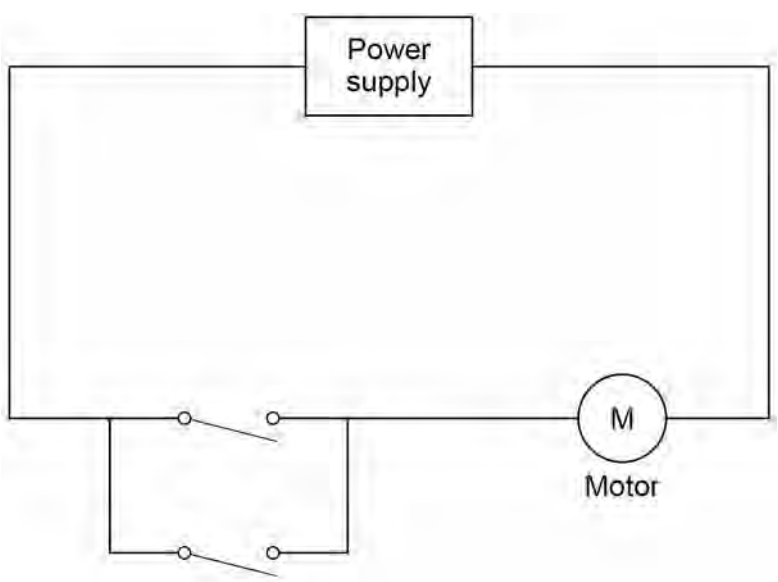
Tick **two** reasons why.

[2 marks]

- Energy is transferred in heating the surroundings. ☐
- Friction causes energy to be transferred in non-useful ways. ☐
- The motor is connected to the mains electricity supply. ☐
- The motor is more than 100% efficient. ☐
- There are only four people in the lift. ☐

0 9 . 3 **Figure 14** shows part of the circuit that operates the lift motor.

Figure 14



The lift can be operated using either of the two switches.

Explain why.

[2 marks]

4.1.1.4 Power

Question 127 · continued

June 2018 | 8463/1F | Original Q9

0 9 . 4 Write down the equation that links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

0 9 . 5 The lift goes up 14 m. The total mass of the people in the lift is 280 kg.

gravitational field strength = 9.8 N/kg

Calculate the increase in gravitational potential energy of the people in the lift.

Give your answer to 2 significant figures.

[3 marks]

Increase in gravitational potential energy = _____ J

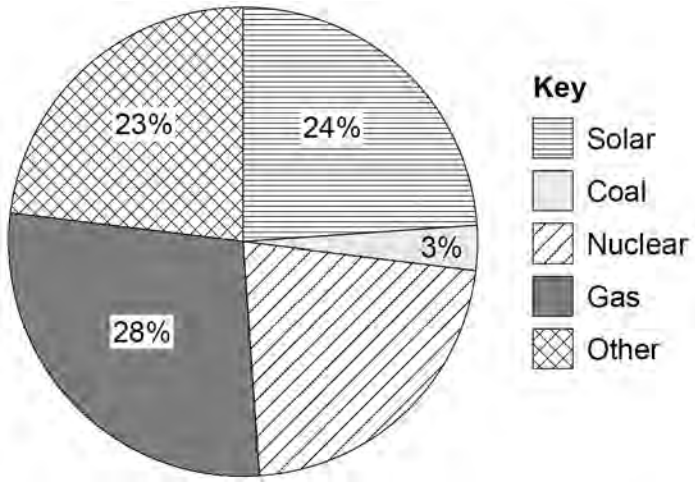
10

4.1.1.4 Power

Question 128

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

4.1.1.4 Power

Question 128 · 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 = _____ %

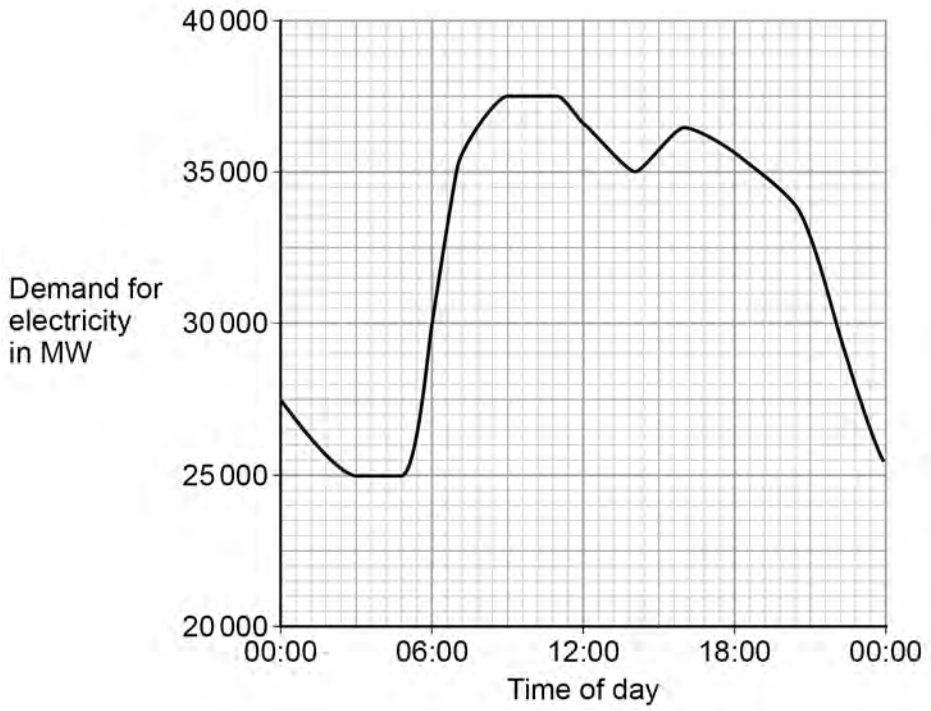
Question 5 continues on the next page

4.1.1.4 Power

Question 128 · 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

4.1.1.4 Power

Question 128 · 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]

10

Turn over for the next question

4.1.1.4 Power

Question 129

June 2019 | 8463/1F | Original Q6

0 6 An electric car has a motor that is powered by a battery.

A diesel car has an engine that is powered by diesel fuel.

0 6 . 1 **Table 2** compares an electric car and a diesel car.

Table 2

Power source	Maximum acceleration in m/s^2	Mass of power source in kg	Range in km	Maximum power output in kW
Battery	4.8	420	220	200
Diesel fuel	3.2	51	1120	120

Give **two** advantages of the diesel car compared with the electric car in **Table 2**.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 2 The mass of the battery in the electric car is 420 kg

The total mass of the electric car is 1610 kg

Calculate the mass of the battery as a percentage of the total mass of the electric car.

[2 marks]

_____

_____

_____

_____

Percentage of total mass = _____ %

4.1.1.4 Power

Question 129 · continued

0 6 . 3 Designers of electric car batteries want to increase the amount of energy that can be stored in a battery.

Suggest **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

Figure 8 shows an electric car being recharged.

Figure 8



0 6 . 4 Write down the equation which links energy transferred, power and time.

[1 mark]

_____

_____

0 6 . 5 The charger has a power output of 7000 W

Calculate the time taken to transfer 420 000 J of energy to the car battery.

[3 marks]

_____

_____

_____

_____

Time = _____ s

10

4.1.1.4 Power

Question 130

June 2019 | 8463/1F | Original Q9

0 9 Light bulbs are labelled with a power input.

0 9 . 1 What does power input mean?

[1 mark]

Tick (✓) **one** box.

- The charge transferred each second by the bulb. ☐
- The current through the bulb. ☐
- The energy transferred each second to the bulb. ☐
- The potential difference across the bulb. ☐

0 9 . 2 Write down the equation which links current, potential difference and power.

[1 mark]

_____

0 9 . 3 A light bulb has a power input of 40 W

The mains potential difference is 230 V

Calculate the current in the light bulb.

[3 marks]

_____

_____

_____

Current = _____ A

4.1.1.4 Power

Question 130 · continued

Table 3 shows information about three different light bulbs.

Table 3

Light bulb	Total power input in watts	Useful power output in watts	Efficiency
P	6.0	5.4	0.90
Q	40	2.0	0.05
R	9.0	**X**	0.30

0 9 . 4 Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

0 9 . 5 Calculate the value of **X** in **Table 3**.

[3 marks]

X = _____ W

0 9 . 6 In addition to power input, light bulbs should also be labelled with the rate at which they emit visible light.

Suggest why.

[2 marks]

1

4.1.1.4 Power

Question 131

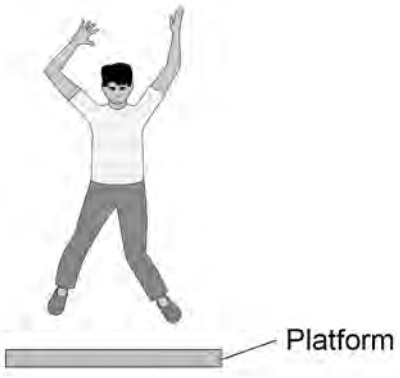
June 2019 | 8463/1F | Original Q11

1 1 A scientist investigated how the maximum muscle power of humans varies with age and gender.

The scientist asked volunteers to stand on a platform and to jump as high as they could.

Figure 18 shows a volunteer taking part in the experiment.

Figure 18



An electronic timer measured the time that the volunteer was in the air.

1 1 . 1 The muscle power in watts per kg is calculated using the following equation:

$$\text{muscle power} = \frac{9.8 \times \text{jump height}}{\text{time}}$$

One volunteer has a muscle power of 41 W/kg

He was in the air for 0.12 s

Calculate his jump height.

[3 marks]

Jump height = _____ m

4.1.1.4 Power

Question 131 · continued

1 1 . 2 Write down the equation which links kinetic energy, mass and speed.

[1 mark]

1 1 . 3 One volunteer had a kinetic energy of 270 J and a speed of 3.0 m/s at the moment he left the ground.

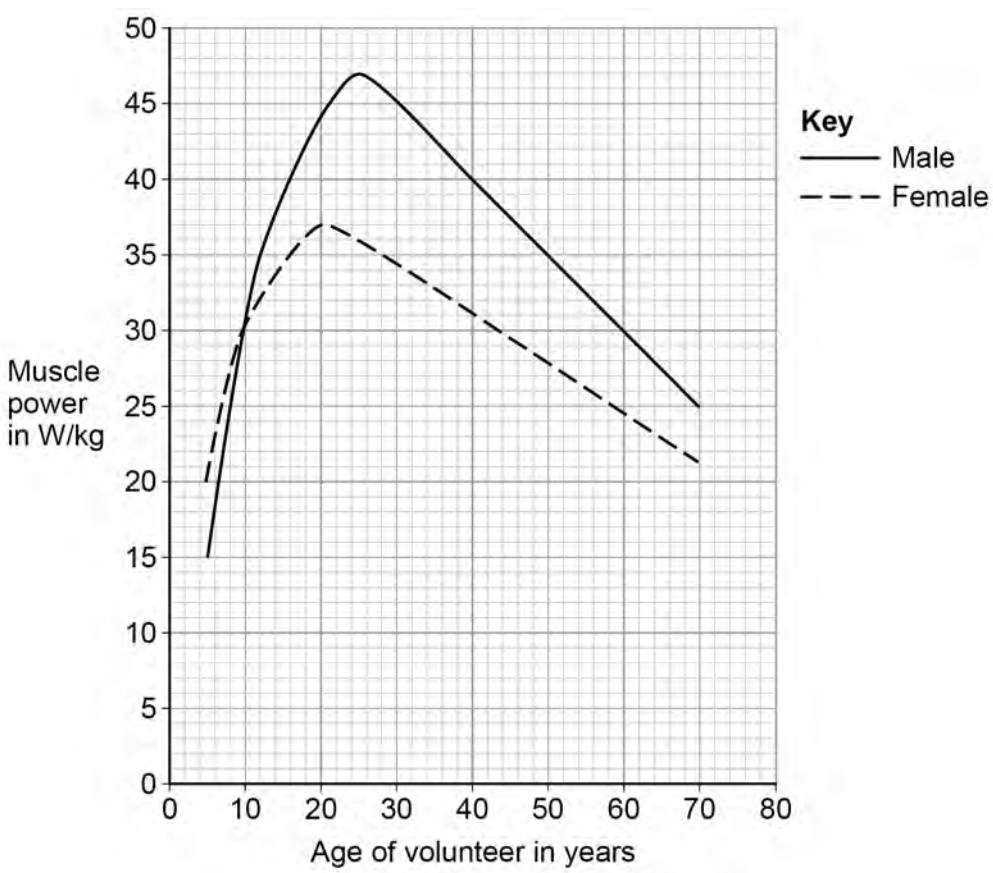
Calculate his mass.

[3 marks]

Mass = _____ kg

Figure 19 shows the scientist's results.

Figure 19



4.1.1.4 Power

Question 131 · continued

June 2019 | 8463/1F | Original Q11

1 1 . 4 Compare the muscle power of males with the muscle power of females.

Use data from **Figure 19** in your answer.

[4 marks]

1 1 . 5 The muscle power of each volunteer was measured five times.

The highest muscle power reading was recorded instead of calculating an average.

Suggest **one** reason why.

[1 mark]

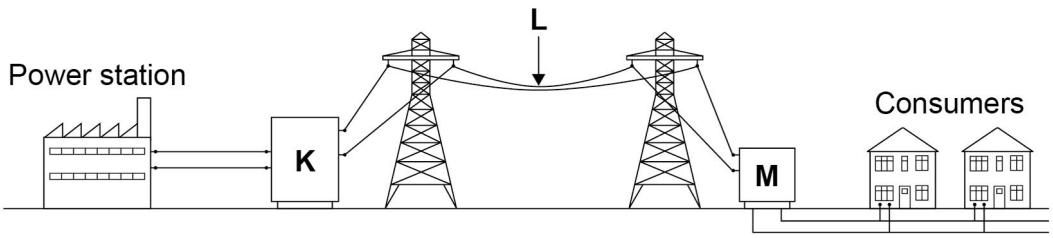
4.1.1.4 Power

Question 132

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]

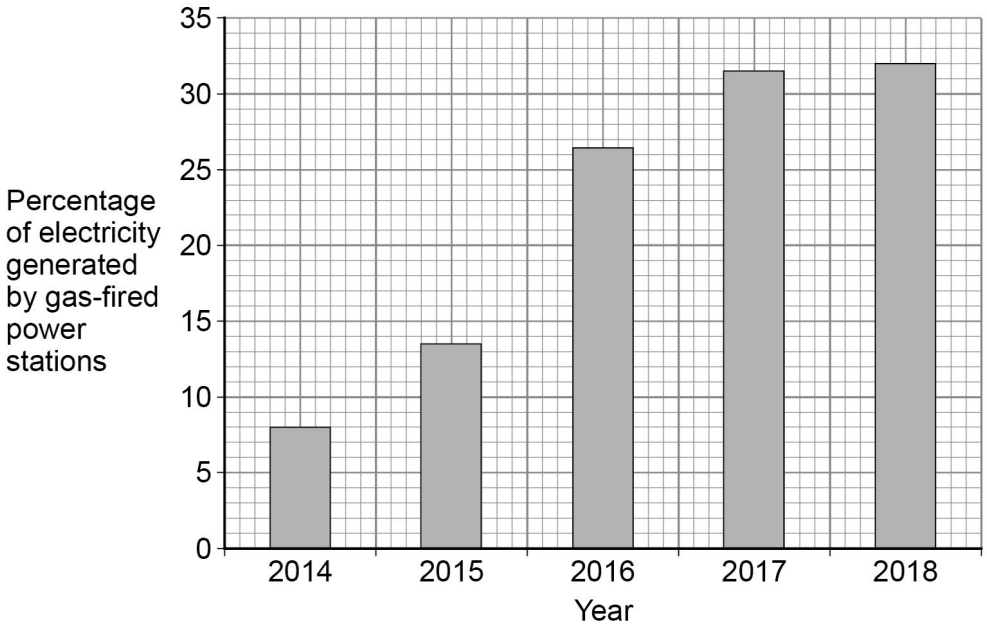
K = _____

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



4.1.1.4 Power

Question 132 · 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

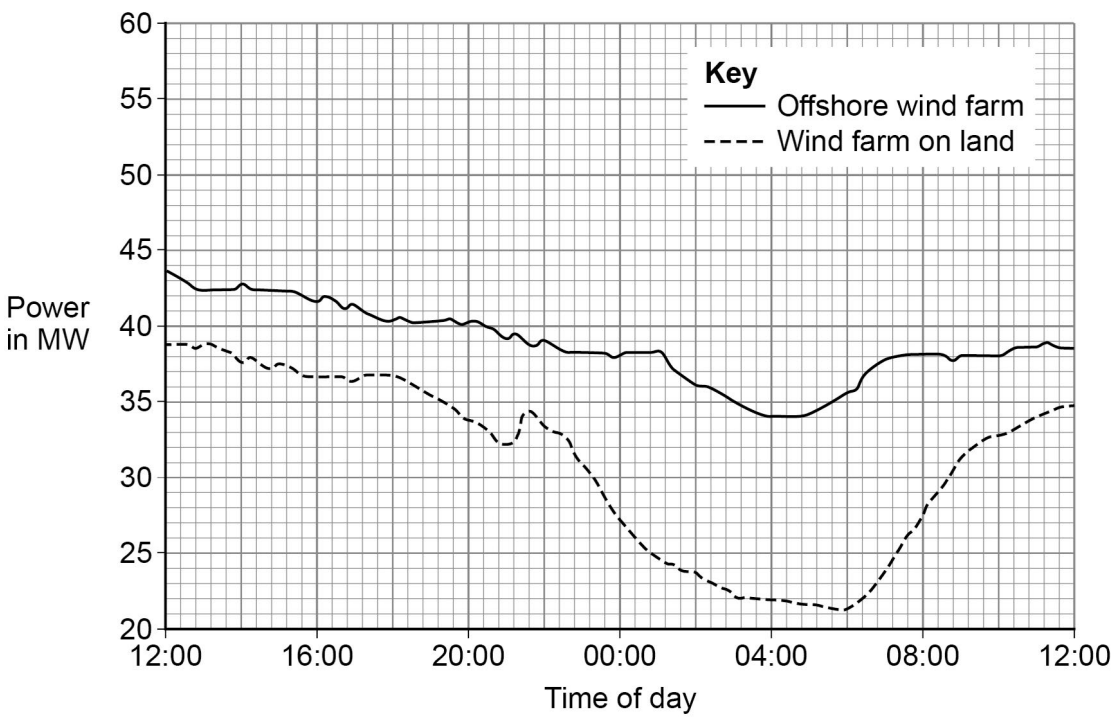
4.1.1.4 Power

Question 132 · 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

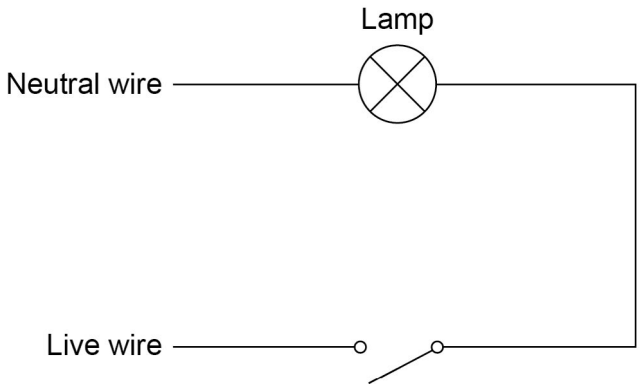
4.1.1.4 Power

Question 133

November 2020 | 8463/1F | Original Q3

0 3 **Figure 5** shows part of a lighting circuit in a house.

Figure 5



0 3 . 1 What is the frequency of the ac mains electricity supply in the UK?

[1 mark]

Tick (✓) **one** box.

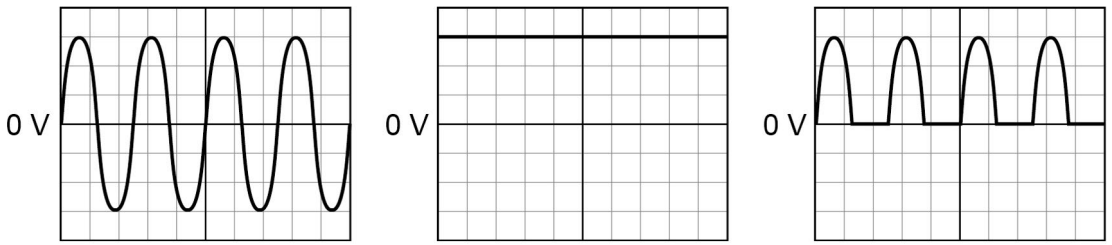
20 Hz ☐ 50 Hz ☐ 60 Hz ☐ 100 Hz ☐

0 3 . 2 The mains electricity supply has an alternating potential difference.

Which diagram shows an alternating potential difference?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐

4.1.1.4 Power

Question 133 · continued

0 3 . 3 The potential difference across the lamp is 230 V.

The current in the lamp is 0.020 A.

Calculate the power output of the lamp.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 3 . 4 The potential difference across the lamp is 230 V.

Calculate the energy transferred by the lamp when 180 C of charge flows through the lamp.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

0 3 . 5 An electrician needs to replace the light switch in **Figure 5**.

Describe the possible hazard and the risk to the electrician of changing the light switch.

[2 marks]

Hazard _____

Risk _____

8

4.1.1.4 Power

Question 134

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 _____ .

4.1.1.4 Power

Question 134 · 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. ☐

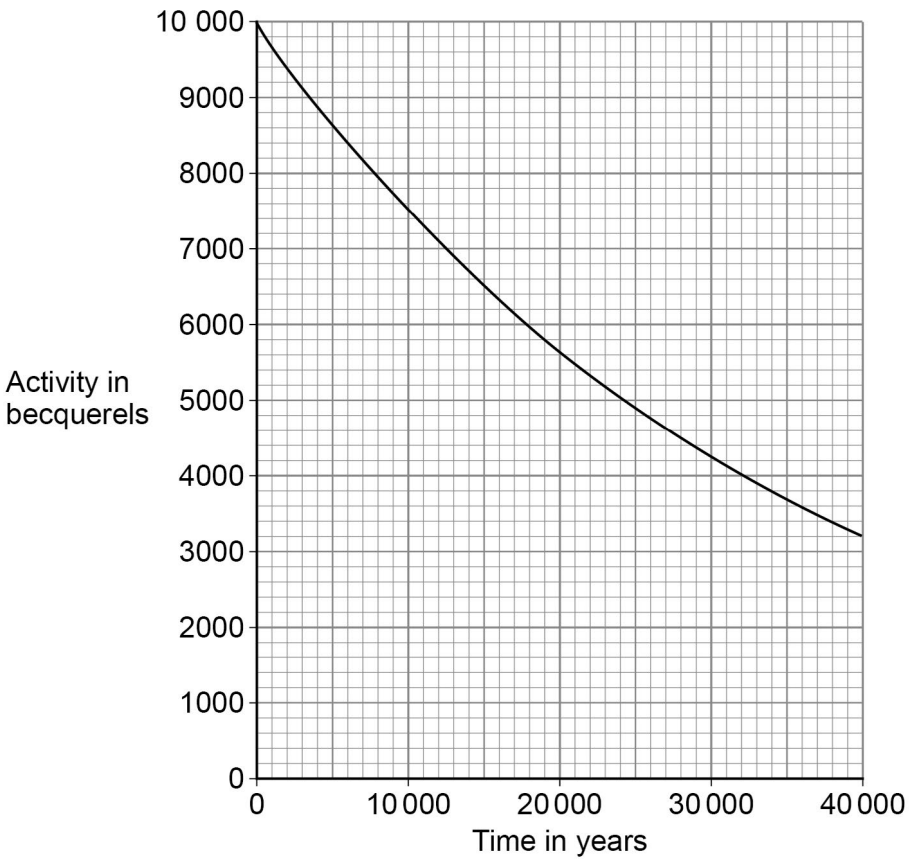
Question 5 continues on the next page

4.1.1.4 Power

Question 134 · 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

4.1.1.4 Power

Question 134 · 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

4.1.1.4 Power

Question 135

November 2020 | 8463/1F | Original Q7

0 7 A student heated water in an electric kettle.

0 7 . 1 Water has a high specific heat capacity.

Complete the sentence.

Choose answers from the box.

[2 marks]

°C	**J**	**kg**	**s**	**W**

The specific heat capacity of a substance is the energy needed to raise the

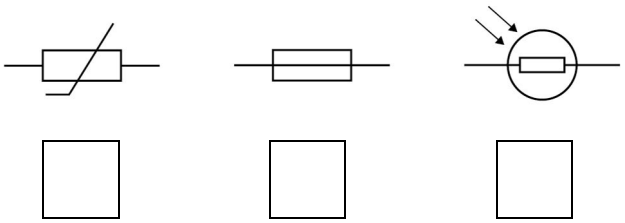
temperature of 1 _____ of the substance by 1 _____.

0 7 . 2 The kettle circuit contains a thermistor which is used to switch the kettle off when the water reaches 100 °C.

What is the correct symbol for a thermistor?

[1 mark]

Tick (✓) **one** box.



4.1.1.4 Power

Question 135 · continued

0 7 . 3 The resistance of the heating element in the kettle is 15 Ω.

The current in the heating element is 12 A.

Calculate the power of the heating element.

Use the equation:

$$\text{power} = (\text{current})^2 \times \text{resistance}$$

[2 marks]

Power = _____ W

Question 7 continues on the next page

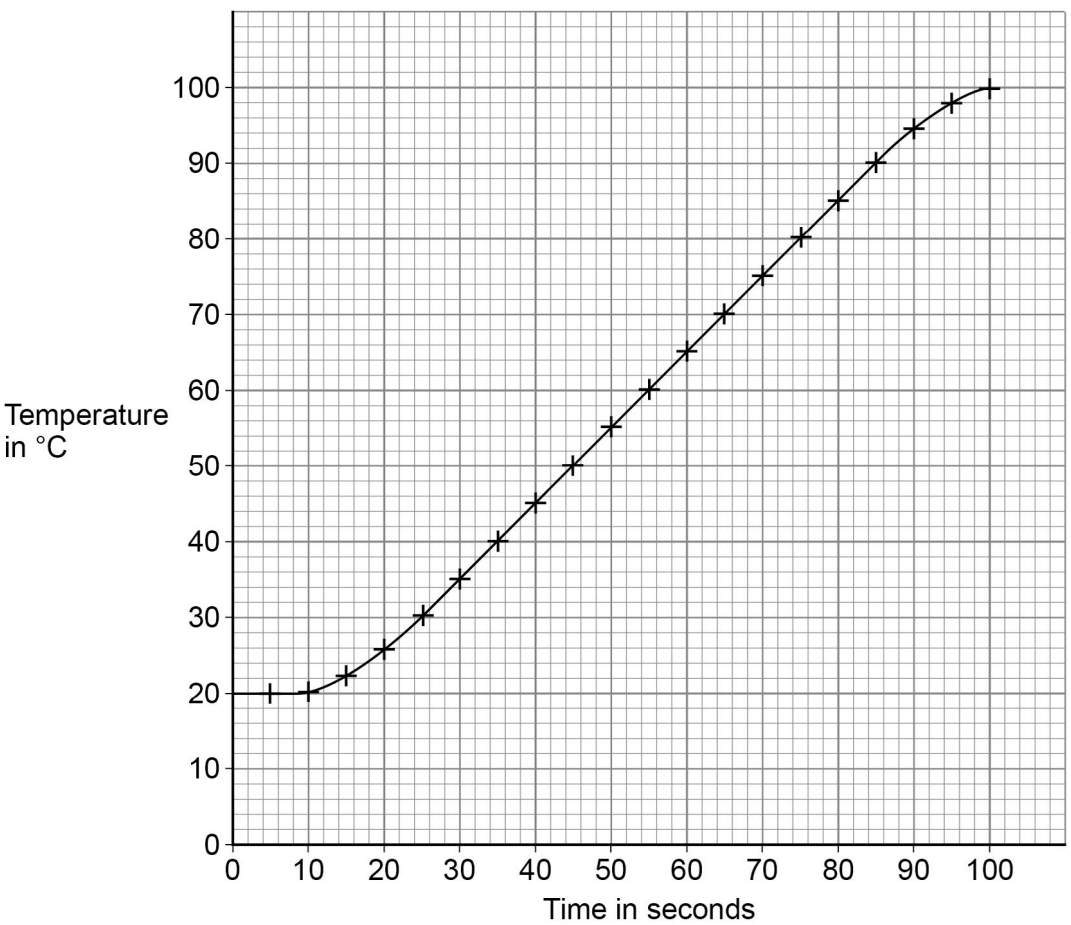
4.1.1.4 Power

Question 135 · continued

The student investigated how quickly the kettle could increase the temperature of 0.50 kg of water.

Figure 10 shows the results of the investigation.

Figure 10



4.1.1.4 Power

Question 135 · continued

0 7 . 4 The temperature of the water did **not** start to increase until 10 seconds after the kettle was switched on.

What is the reason for this?

[1 mark]

Tick (✓) **one** box.

- Energy is transferred from the surroundings to the kettle. ☐
- The charge flows slowly through the kettle circuit. ☐
- The heating element in the kettle takes time to heat up. ☐
- The power output of the kettle increases slowly. ☐

0 7 . 5 Describe a method the student could have used to obtain the results shown in **Figure 10**.

[6 marks]

Question 7 continues on the next page

4.1.1.4 Power

Question 135 · continued

0 7 . 6 The mass of water in the kettle was 0.50 kg.

The temperature of the water increased from 20 °C to 100 °C.

specific heat capacity of water = 4200 J/kg °C

Calculate the energy transferred to the water.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

0 7 . 7 The water in the kettle boiled for a short time before the kettle switched off.

During this time 5.0 g of water changed to steam.

specific latent heat of vaporisation of water = 2 260 000 J/kg

Calculate the energy transferred to change the water to steam.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

18

4.1.1.4 Power

Question 136

November 2020 | 8463/1F | Original Q9

0 9 **Figure 13** shows an LED torch.

Figure 13

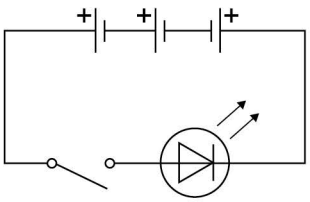


0 9 . 1 The torch contains one LED, one switch and three cells.

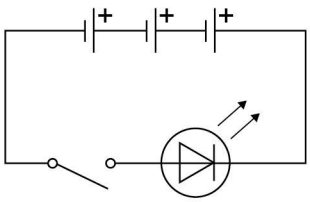
Which diagram shows the correct circuit for the torch?

[1 mark]

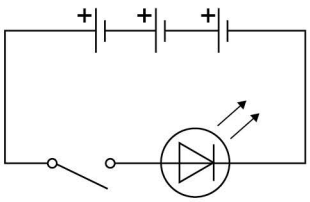
Tick (✓) **one** box.



☐



☐



☐

4.1.1.4 Power

Question 136 · continued

0 9 . 2 Write down the equation which links charge flow (Q), current (I) and time (t).

[1 mark]

0 9 . 3 The torch worked for 14 400 seconds before the cells needed replacing.

The current in the LED was 50 mA.

Calculate the total charge flow through the cells.

[3 marks]

Total charge flow = _____ C

0 9 . 4 When replaced, the cells were put into the torch the wrong way around.

Explain why the torch did not work.

[2 marks]

Question 9 continues on the next page

4.1.1.4 Power

Question 136 · continued

0 9 . 5 Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

0 9 . 6 The total power input to the LED was 0.24 W.

The efficiency of the LED was 0.75

Calculate the useful power output of the LED.

[3 marks]

Useful power output = _____ W

11

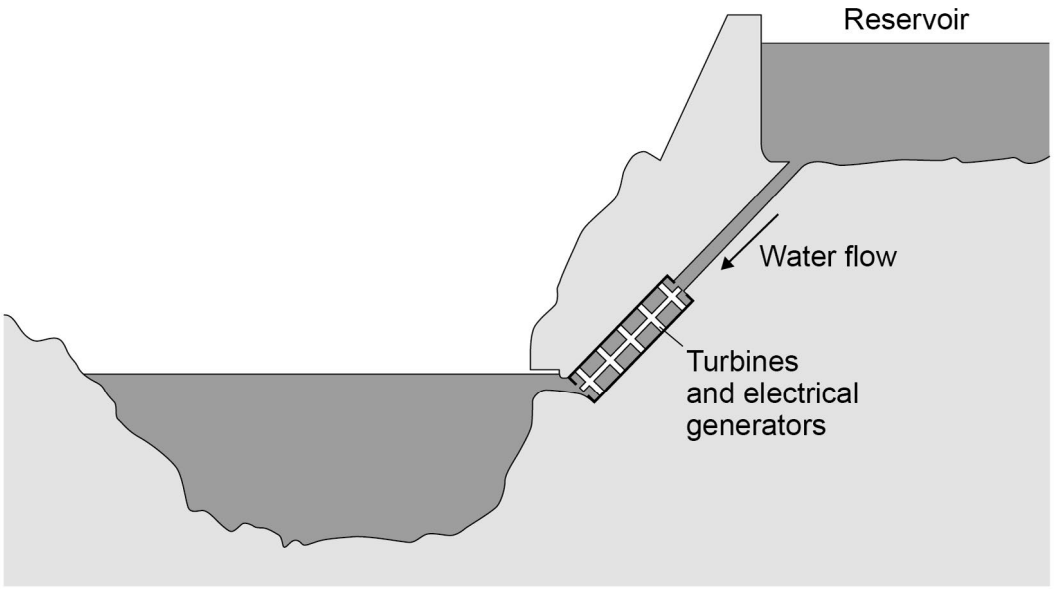
4.1.1.4 Power

Question 137

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

4.1.1.4 Power

Question 137 · continued

1 0 . 3 Write down the equation which links energy transferred (E), power (P) and time (t).

[1 mark]

1 0 . 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

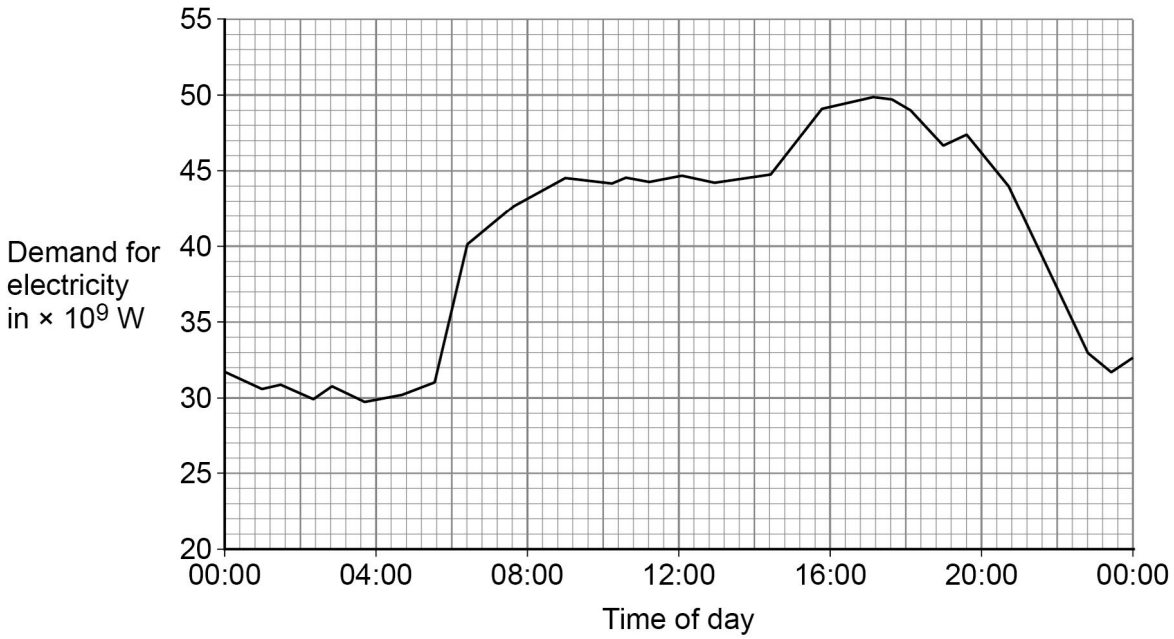
Question 10 continues on the next page

4.1.1.4 Power

Question 137 · 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

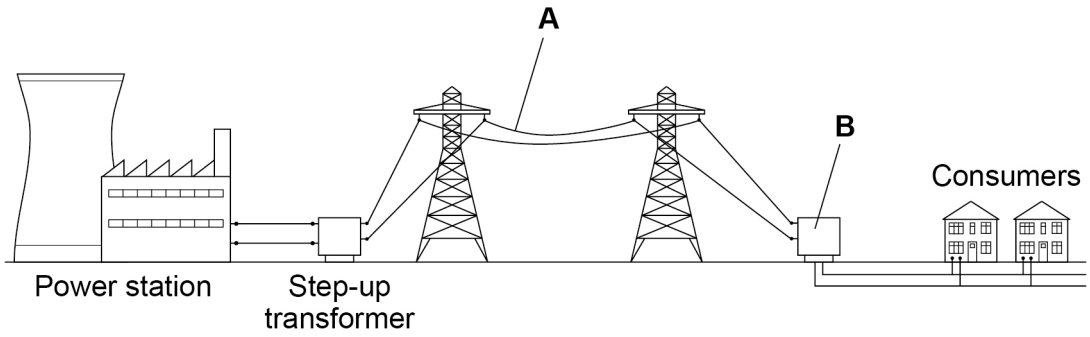
4.1.1.4 Power

Question 138

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. ☐

4.1.1.4 Power

Question 138 · 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

4.1.1.4 Power

Question 138 · 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

4.1.1.4 Power

Question 138 · 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

4.1.1.4 Power

Question 139

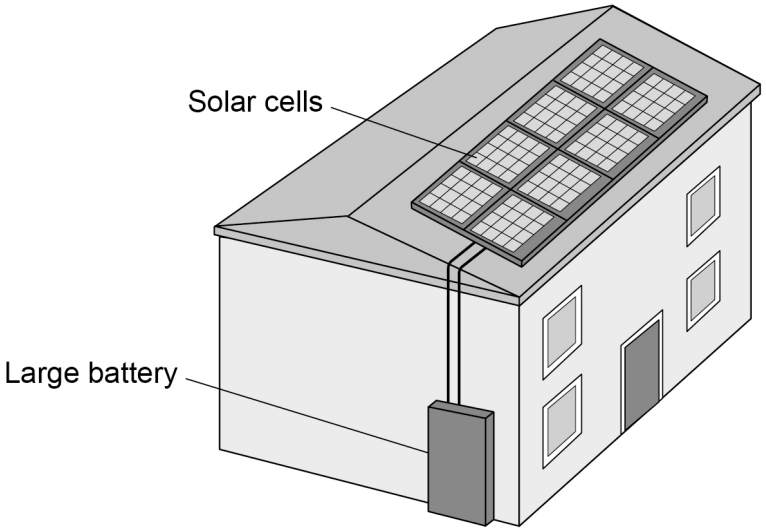
November 2021 | 8463/1F | Original Q6

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]

4.1.1.4 Power

Question 139 · 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

4.1.1.4 Power

Question 139 · 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

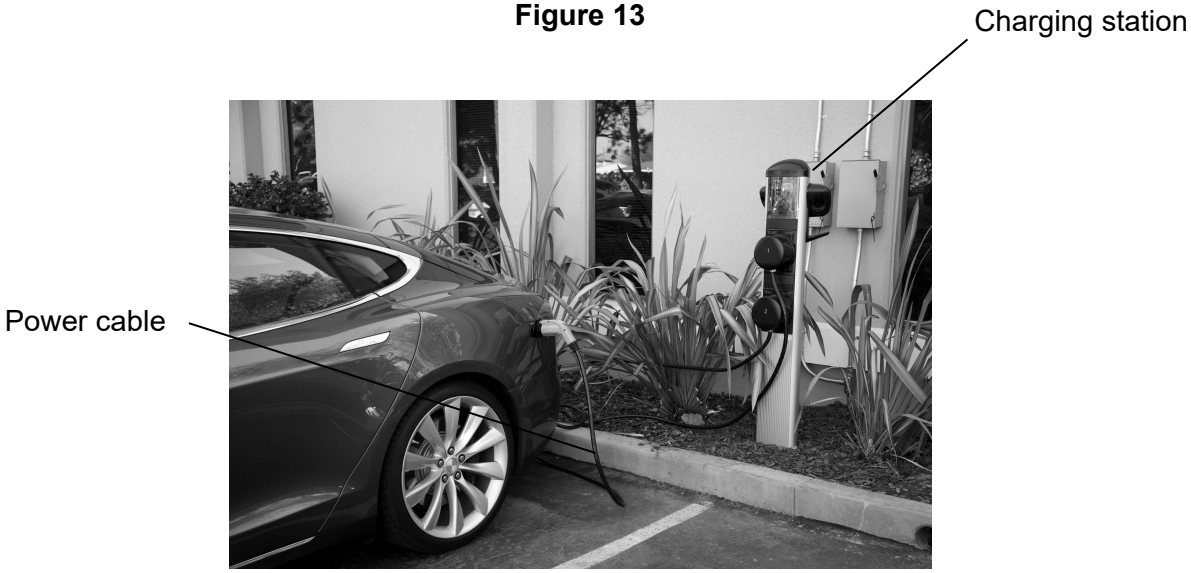
4.1.1.4 Power

Question 140

November 2021 | 8463/1F | Original Q9

0 9 **Figure 13** shows an electric car being recharged.

Figure 13



0 9 . 1 The charging station applies a direct potential difference across the battery of the car.

What does 'direct potential difference' mean?

[1 mark]

Question 9 continues on the next page

4.1.1.4 Power

Question 140 · continued

0 9 . 2 Which equation links energy transferred (E), power (P) and time (t)?

[1 mark]

Tick (✓) **one** box.

energy transferred = $\frac{\text{power}}{\text{time}}$ ☐

energy transferred = $\frac{\text{time}}{\text{power}}$ ☐

energy transferred = power × time ☐

energy transferred = power^2 × time ☐

0 9 . 3 The battery in the electric car can store 162 000 000 J of energy.

The charging station has a power output of 7200 W.

Calculate the time taken to fully recharge the battery from zero.

[3 marks]

Time taken = _____ s

4.1.1.4 Power

Question 140 · continued

0 9 . 4 Which equation links current (I), potential difference (V) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$I = V \times R$ ☐

$I = V^2 \times R$ ☐

$R = I \times V$ ☐

$V = I \times R$ ☐

0 9 . 5 The potential difference across the battery is 480 V.

There is a current of 15 A in the circuit connecting the battery to the motor of the electric car.

Calculate the resistance of the motor.

[3 marks]

Resistance = _____ Ω

Question 9 continues on the next page

4.1.1.4 Power

Question 140 · continued

0 9 . 6 Different charging systems use different electrical currents.

- Charging system **A** has a current of 13 A.
- Charging system **B** has a current of 26 A.
- The potential difference of both charging systems is 230 V.

How does the time taken to recharge a battery using charging system **A** compare with the time taken using charging system **B**?

[1 mark]

Tick (✓) **one** box.

Time taken using system **A** is half the time of system **B** ☐

Time taken using system **A** is the same as system **B** ☐

Time taken using system **A** is double the time of system **B** ☐

10

4.1.1.4 Power

Question 141

November 2021 | 8463/1F | Original Q10

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

4.1.1.4 Power

Question 141 · 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

4.1.1.4 Power

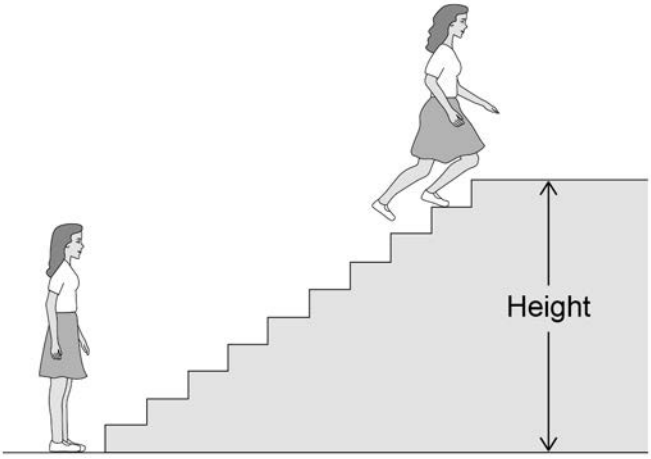
Question 142

June 2022 | 8463/1F | Original Q2

0 2 A girl ran to the top of some stairs.

Figure 2 shows the stairs.

Figure 2



0 2 . 1 The girl measured the height of the stairs.

What measuring instrument should she have used?

[1 mark]

0 2 . 2 The height of the stairs was 1.7 m.

The mass of the girl was 50 kg.

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the girl.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

4.1.1.4 Power

Question 142 · continued

0 2 . 3 A boy ran up the same stairs and did 1800 J of work.

The time it took the boy to run up the stairs was 1.44 s.

Calculate the power of the boy.

Use the equation:

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

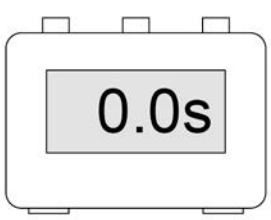
Power = _____ W

0 2 . 4 Which stop-clock was used to measure the time the boy took to run up the stairs?

[1 mark]

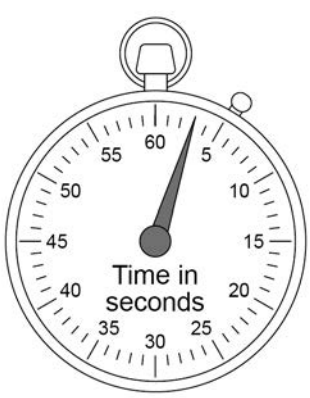
Tick (✓) **one** box.

Stop-clock A



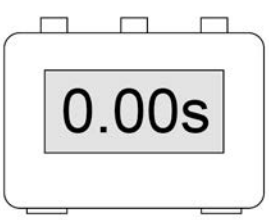
☐

Stop-clock B



☐

Stop-clock C



☐

4.1.1.4 Power

Question 142 · continued

0 2 . 5 The boy had a speed of 2.0 m/s at the top of the stairs.

The mass of the boy was 70 kg.

Calculate the kinetic energy of the boy at the top of the stairs.

Use the equation:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

[2 marks]

Kinetic energy = _____ J

8

4.1.1.4 Power

Question 143

June 2022 | 8463/1F | Original Q4

0 4 Radioactive isotopes emit different types of nuclear radiation.

0 4 . 1 What does an alpha particle consist of?

[1 mark]

Tick (✓) **one** box.

- 2 protons and 2 electrons ☐
- 2 protons and 2 neutrons ☐
- 4 protons ☐
- 4 neutrons ☐

0 4 . 2 What is a beta particle?

[1 mark]

Tick (✓) **one** box.

- An electron ☐
- A neutron ☐
- Electromagnetic radiation ☐

0 4 . 3 A krypton (Kr) nucleus decays into a rubidium (Rb) nucleus by emitting a beta particle.

What is the correct equation for this decay?

[1 mark]

Tick (✓) **one** box.

- $^{85}_{36}Kr + {}^{0}_{-1}e \longrightarrow {}^{85}_{37}Rb$ ☐
- $^{85}_{36}Kr \longrightarrow {}^{85}_{37}Rb + {}^{0}_{-1}e$ ☐
- $^{85}_{37}Rb \longrightarrow {}^{85}_{36}Kr + {}^{0}_{-1}e$ ☐

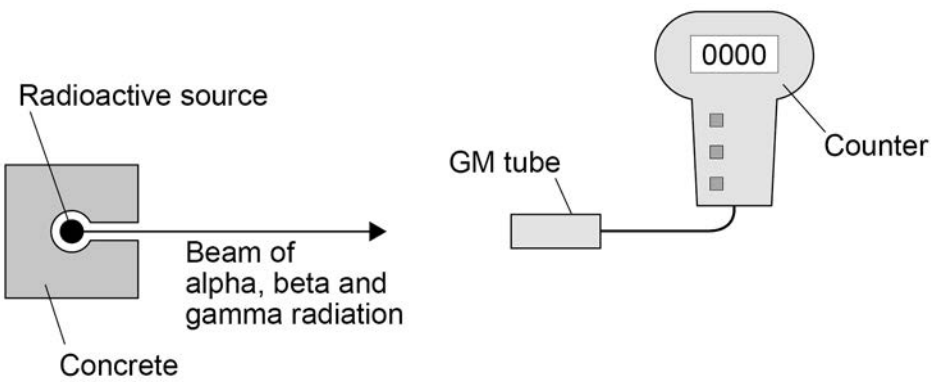
4.1.1.4 Power

Question 143 · continued

0 4 . 4 **Figure 5** shows an experiment to demonstrate how alpha, beta and gamma radiation penetrate different materials.

The experiment takes place in a vacuum.

Figure 5



Three different materials are used:

- a sheet of paper
- a 0.5 cm thick sheet of aluminium
- a 10 cm block of lead.

Each material is placed one at a time between the radioactive source and the GM tube.

The GM tube and counter show whether the material has stopped the radiation.

Complete **Table 1** to show how alpha, beta and gamma radiation penetrate the materials in **Figure 5**.

Use the words **Yes** and **No**.

Part of **Table 1** has been completed for you.

[3 marks]

Table 1

Type of radiation	Most radiation is stopped by:		
	the sheet of paper	the sheet of aluminium	the block of lead
Alpha			Yes
Beta	No		
Gamma		No	

4.1.1.4 Power

Question 143 · continued

0 4 . 5 Alpha, beta and gamma radiation have different ionising powers.

Draw **one** line from each radiation type to the correct ionising power.

[3 marks]

Radiation type	Ionising power
Alpha	Zero
Beta	Low
Gamma	Medium
	High

0 4 . 6 Some sources of background radiation are natural and other sources are man-made.

Which of the following is a man-made source of background radiation?

[1 mark]

Tick (✓) **one** box.

Cosmic rays ☐

Nuclear accidents ☐

Rocks ☐

0 4 . 7 The average background radiation dose per year in the UK is 2.0 millisieverts.

A dental X-ray gives a patient a radiation dose of 0.005 millisieverts.

Calculate how many dental X-rays would be the same as the average background radiation dose per year.

[2 marks]

Number of dental X-rays = _____

12

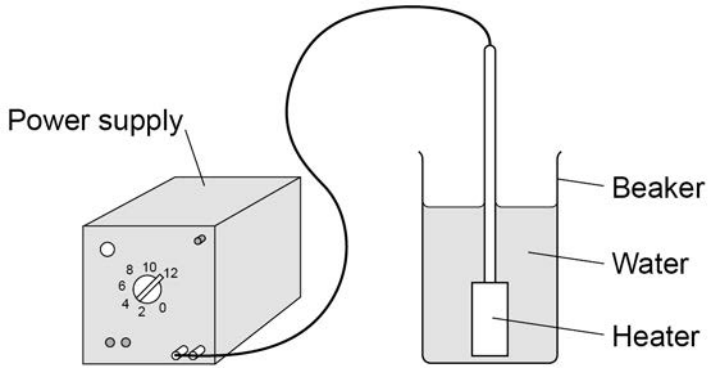
4.1.1.4 Power

Question 144

0 5 A student determined the specific latent heat of vaporisation of water.

Figure 6 shows some of the equipment used.

Figure 6



0 5 . 1 The student measured a mass of water and put it into the beaker.

What measuring instrument should the student have used to measure the mass of the water?

[1 mark]

Tick (✓) **one** box.

- balance ☐
- joulemeter ☐
- newtonmeter ☐
- thermometer ☐

4.1.1.4 Power

Question 144 · continued

0 5 . 2 The power output of the heater stayed the same throughout the experiment.

What type of variable was the power output of the heater?

[1 mark]

Tick (✓) **one** box.

- Categoric variable ☐
- Control variable ☐
- Dependent variable ☐
- Independent variable ☐

0 5 . 3 The student turned on the heater and heated the water until it reached boiling point.

The student continued to heat the water so that it boiled for several minutes.

The mass of the water remaining in the beaker was measured again.

Give **one** way the beaker of boiling water could be moved safely to measure its new mass.

[1 mark]

Question 5 continues on the next page

Question 144 · continued

0 5 . 4 The mass of water that turned into steam was 0.0090 kg.

The heater transferred 25 200 J of energy to the water to turn it into steam.

Calculate the specific latent heat of vaporisation of water given by the student's data.

Use the Physics Equations Sheet.

Choose the unit from the box.

[4 marks]

J	kg	J/kg

Specific latent heat of vaporisation = _____ Unit _____

0 5 . 5 What was a source of error in the student's experiment?

[1 mark]

Tick (✓) **one** box.

The transfer of thermal energy from the heater to the water ☐

The transfer of thermal energy from the surroundings to the water ☐

The transfer of thermal energy from the water to the heater ☐

The transfer of thermal energy from the water to the surroundings ☐

8

4.1.1.4 Power

Question 145

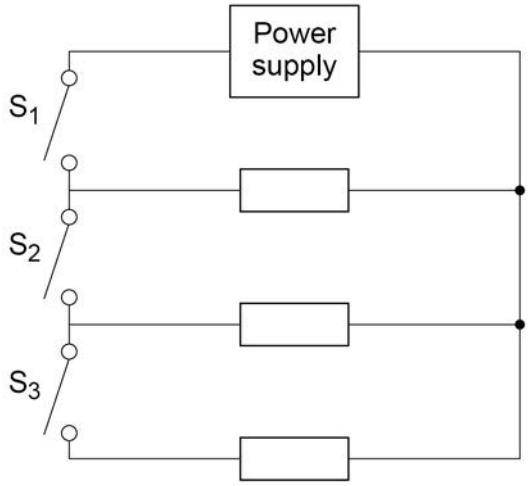
June 2022 | 8463/1F | Original Q6

0 6 A hair dryer contains three heating elements.

Figure 7 shows the circuit diagram for the heating elements in the hair dryer.

In **Figure 7** the heating elements are represented by resistor symbols.

Figure 7



0 6 . 1 Complete the sentence.

[1 mark]

The three resistors in **Figure 7** are connected in _____ with the power supply.

0 6 . 2 Which switch must always be closed for the hair dryer to work?

[1 mark]

Tick (✓) **one** box.

S_1 ☐

S_2 ☐

S_3 ☐

4.1.1.4 Power

Question 145 · continued

0 6 . 3 Which switches must be closed for the hair dryer to work at maximum power output?

[1 mark]

Tick (✓) **one** box.

S_1 and S_2 ☐

S_1 and S_3 ☐

S_1, S_2 and S_3 ☐

Use the Physics Equations Sheet to answer questions **06.4** and **06.5**.

0 6 . 4 Write down the equation which links energy transferred (*E*), power (*P*) and time (*t*).

[1 mark]

_____

0 6 . 5 The heating elements have a maximum power output of 1200 W.

The energy transferred to the heating elements to reach normal operating temperature is 3600 J.

Calculate the time taken for the heating elements to reach normal operating temperature at maximum power output.

[3 marks]

_____

_____

_____

_____

_____

_____

Time = _____ s

4.1.1.4 Power

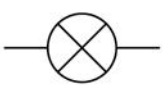
Question 145 · continued

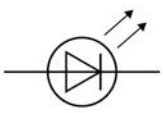
0 6 . 6 The hair dryer has LEDs to indicate the power setting.

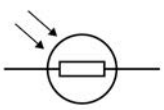
What is the circuit symbol for an LED?

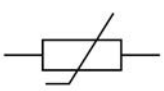
[1 mark]

Tick (✓) **one** box.









8

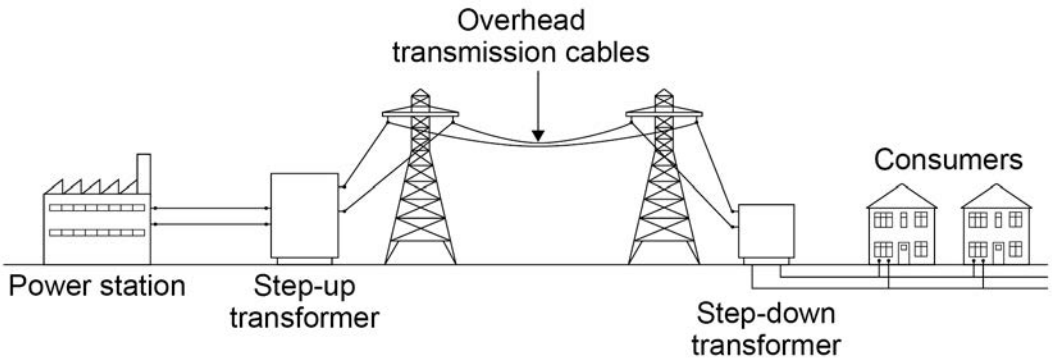
4.1.1.4 Power

Question 146

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

4.1.1.4 Power

Question 146 · 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 _____ .

4.1.1.4 Power

Question 146 · 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

4.1.1.4 Power

Question 147

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

4.1.1.4 Power

Question 147 · 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

4.1.1.4 Power

Question 148

June 2022 | 8463/1F | Original Q11

1 1 An engineering company has invented pavement tiles that generate electricity as people walk on them.

Figure 15 shows someone walking on the pavement tiles.

Figure 15



Use the Physics Equations Sheet to answer questions **11.1** and **11.2**.

1 1 . 1 What equation links current (I), potential difference (V) and power (P)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{V}{I}$ ☐

$P = V \times I$ ☐

$I = P \times V$ ☐

$V = I^2 \times P$ ☐

4.1.1.4 Power

Question 148 · continued

11.2 When a person walks on a tile, a potential difference of 40 V is induced across the tile.

The power output of the tile is 4.4 W.

Calculate the current in the tile.

[3 marks]

Current = _____ A

Question 11 continues on the next page

4.1.1.4 Power

Question 148 · continued

June 2022 | 8463/1F | Original Q11

Use the Physics Equations Sheet to answer questions **11.3** and **11.4**.

11.3 What equation links efficiency, total power input and useful power output?

[1 mark]

Tick (✓) **one** box.

Efficiency = $\frac{\text{useful power output}}{\text{total power input}}$ ☐

Efficiency = $\frac{\text{total power input}}{\text{useful power output}}$ ☐

Efficiency = useful power output × total power input ☐

11.4 The tiles are used to power LED lights in the pavement.

An LED light has a total power input of 4.0 W.

The efficiency of the LED light is 0.85

Calculate the useful power output of the LED light.

[3 marks]

Useful power output = _____ W

8

4.1.1.4 Power

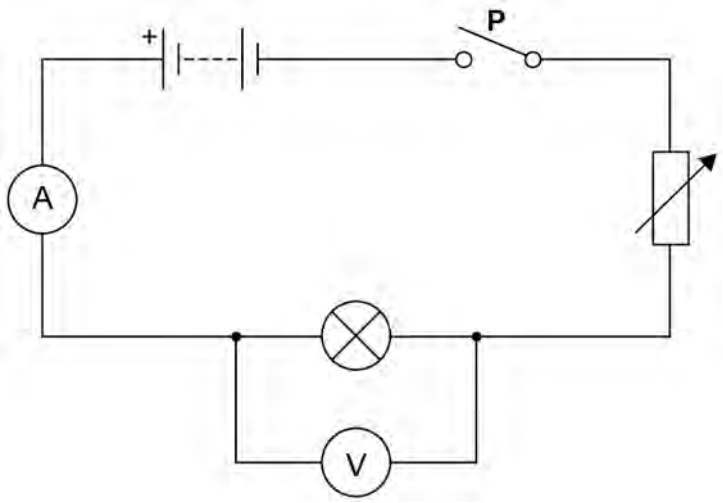
Question 149

June 2023 | 8463/1F | Original Q1

0 1 A student investigated how the current in a filament lamp varies with the potential difference across the lamp.

Figure 1 shows the circuit used.

Figure 1



0 1 . 1 What is component **P**?

[1 mark]

_____

0 1 . 2 Complete the sentences.

Choose answers from the box.

[2 marks]

charge	**current**	**energy**	**potential difference**	**power**

The ammeter in the circuit measures _____ .

The voltmeter in the circuit measures _____ .

Question 149 · continued

0 1 . 3 How will **increasing** the resistance of the variable resistor in **Figure 1** affect each of the following quantities?

[3 marks]

Tick (✓) **one** box in **each** row.

Quantity	Decreases	Stays the same	Increases
Current in the circuit			
Potential difference across the lamp			
Total resistance of the circuit			

0 1 . 4 A charge flow of 15 coulombs passed through the filament lamp in a time of 60 seconds.

Calculate the current in the lamp.

Use the equation:

$$\text{current} = \frac{\text{charge flow}}{\text{time}}$$

[2 marks]

Current = _____ A

Question 1 continues on the next page

4.1.1.4 Power

Question 149 · continued

0 1 . 5 When the current in the filament lamp is 0.12 A, the potential difference across the lamp is 6.0 V.

Calculate the resistance of the filament lamp.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

[2 marks]

Resistance = _____ Ω

4.1.1.4 Power

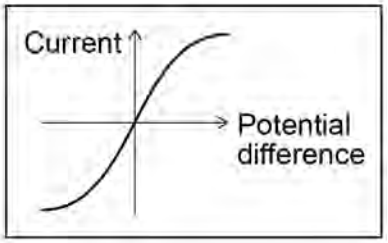
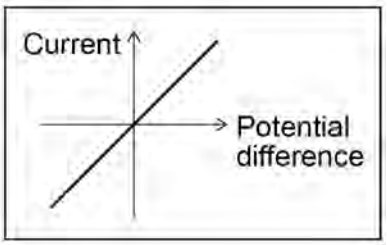
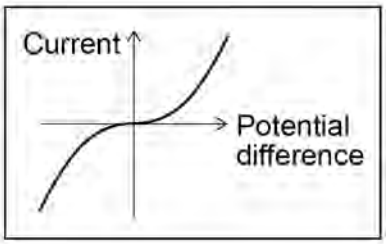
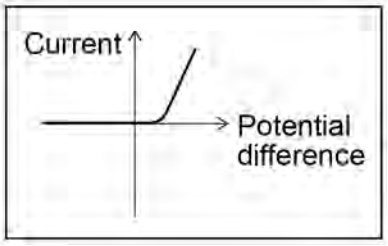
Question 149 · continued

0 1 . 6 The student repeated the investigation after replacing the lamp with a resistor at constant temperature and then a diode.

The student plotted a graph for each component.

Draw **one** line from each component to its graph.

[2 marks]

Component	Graph
Diode	
Filament lamp	
Resistor	
	

4.1.1.4 Power

Question 149 · continued

0 1 . 7 **Figure 2** shows an ammeter.

The ammeter is **not** connected to a circuit.

Figure 2



What type of error does the ammeter display?

[1 mark]

Tick (✓) **one** box.

A positive error ☐

A random error ☐

A zero error ☐

13

4.1.1.4 Power

Question 150

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

Question 150 · 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 ☐

Question 150 · 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

Question 150 · 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 = _____

4.1.1.4 Power

Question 150 · 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

4.1.1.4 Power

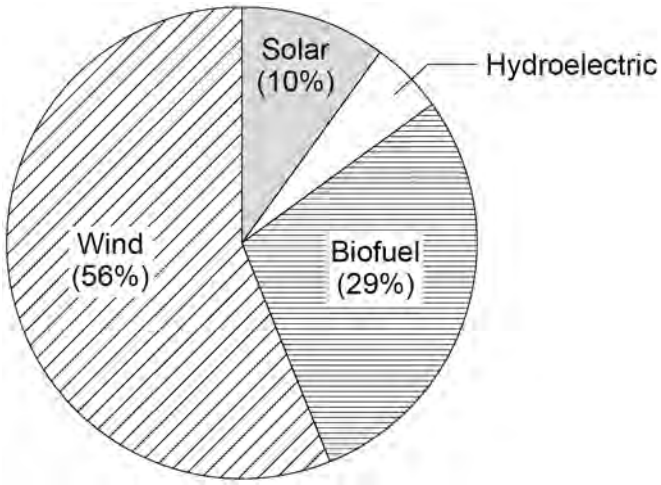
Question 151

June 2023 | 8463/1F | Original Q4

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 = _____ %

4.1.1.4 Power

Question 151 · 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

4.1.1.4 Power

Question 151 · 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

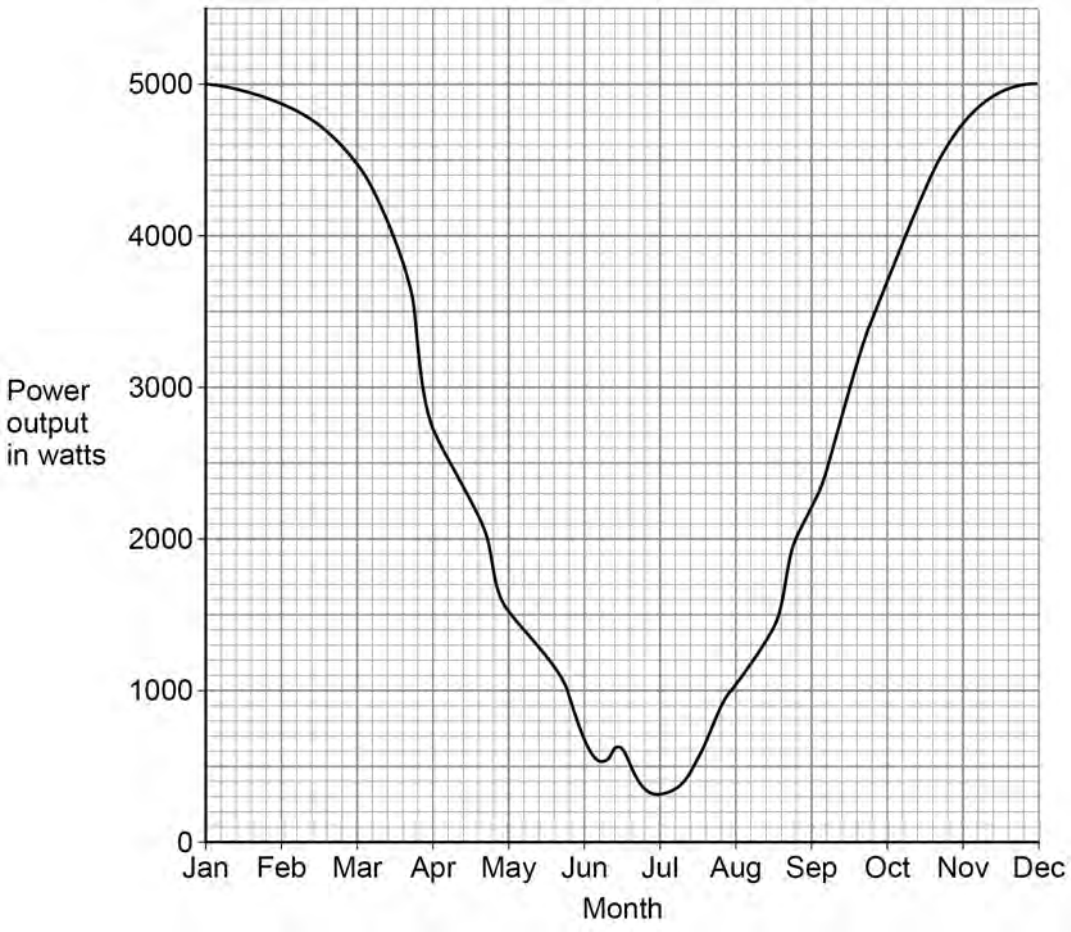
4.1.1.4 Power

Question 151 · continued

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]

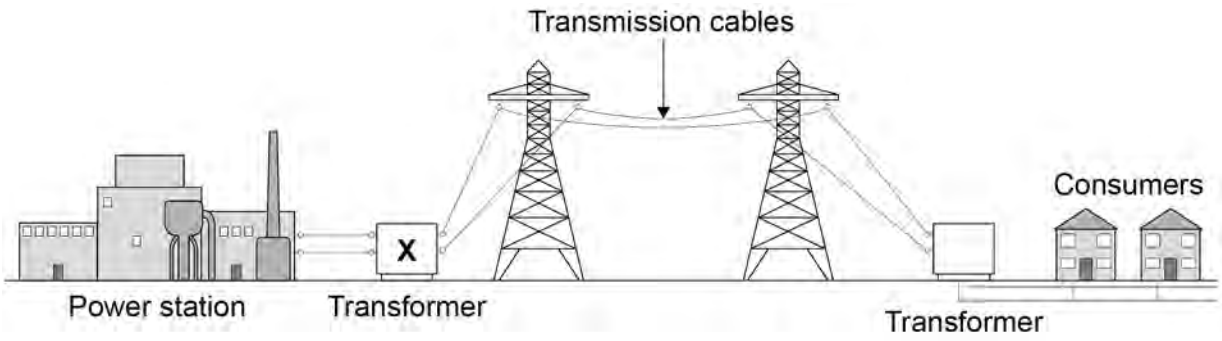
10

4.1.1.4 Power

Question 152

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.

$P = \frac{I}{R}$ ☐

$P = \frac{I}{R^2}$ ☐

$P = I^2 R$ ☐

$P = IR$ ☐

4.1.1.4 Power

Question 152 · 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

4.1.1.4 Power

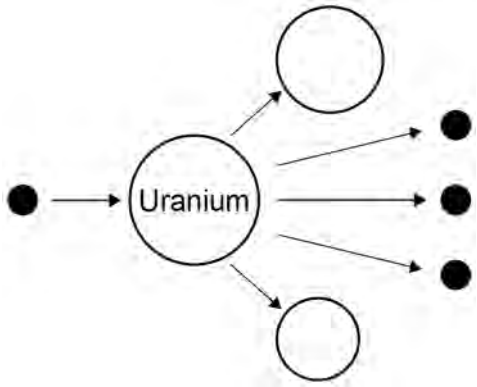
Question 153

June 2024 | 8463/1F | Original Q10

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 _____.

4.1.1.4 Power

Question 153 · 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]

4.1.1.4 Power

Question 153 · 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

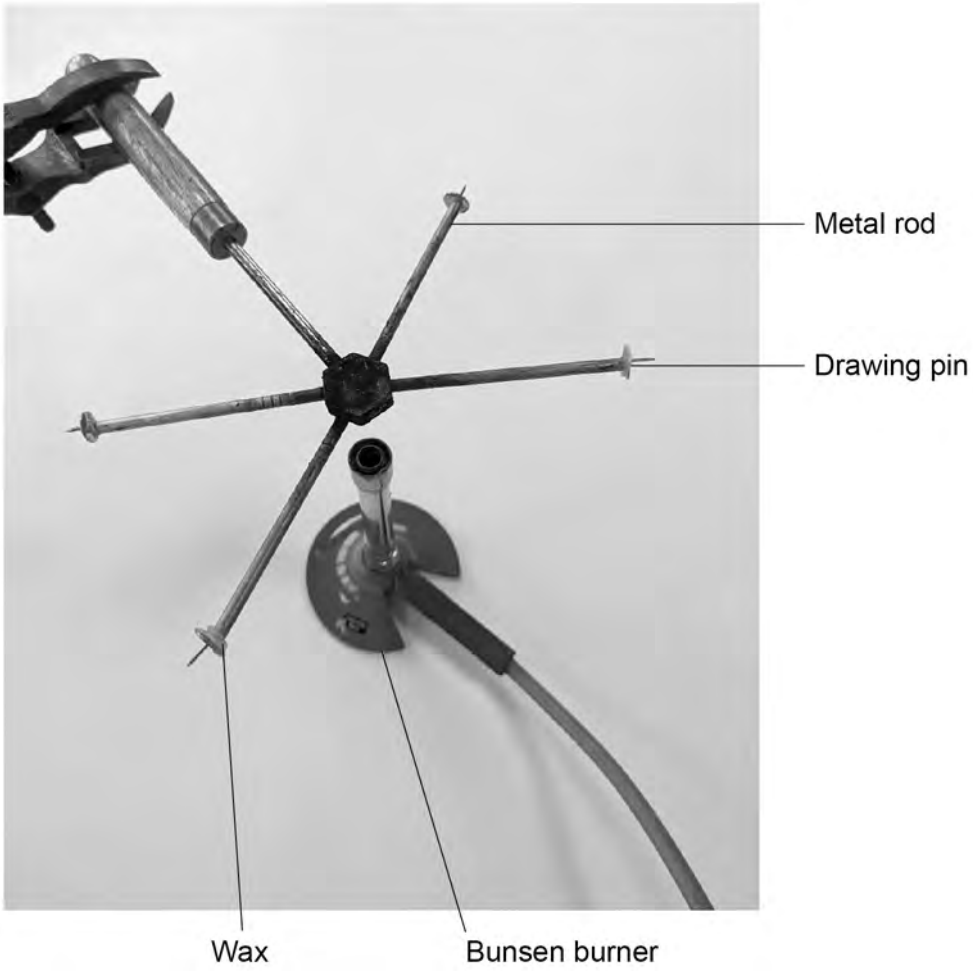
4.1.1.4 Power

Question 154

0 2 A student investigated the thermal conductivity of different metals.

Figure 2 shows some of the apparatus used.

Figure 2



Each rod was made from a different metal.

The metal rods are joined at the centre.

The size of each metal rod was the same.

This is the method used.

1. Attach a drawing pin to the end of each metal rod using wax.
2. Light the Bunsen burner.
3. Start a stopclock.
4. Record the time taken for the wax to melt and for the drawing pin to fall off each metal rod.

Question 154 · continued

Table 1 shows the results.

Table 1

Type of metal	Time taken for drawing pin to fall off in seconds
Copper	10
Iron	22
Nickel	18
Steel	24

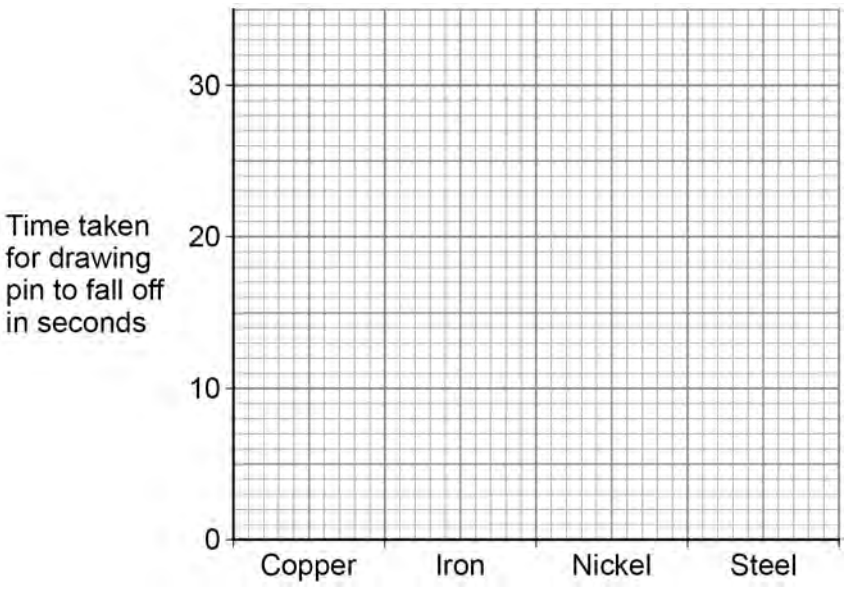
0 2 . 1 Complete **Figure 3**.

You should:

- label the *x*-axis
- plot the data from **Table 1** as a bar chart.

[3 marks]

Figure 3



Question 154 · continued

0 2 . 2 Which type of metal in **Table 1** had the greatest thermal conductivity?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Copper ☐ Iron ☐ Nickel ☐ Steel ☐

Reason _____

_____

_____

0 2 . 3 The thermal energy transferred to the nickel rod was 132 J.

The temperature change of the rod was 20 °C.

mass of the nickel rod = 0.015 kg

Calculate the specific heat capacity of nickel.

Use the equation:

$$\text{specific heat capacity} = \frac{\text{thermal energy}}{(\text{mass} \times \text{temperature change})}$$

[2 marks]

_____

_____

_____

_____

Specific heat capacity = _____ J/kg °C

4.1.1.4 Power

Question 154 · continued

Use the Physics Equations Sheet to answer questions **02.4** and **02.5**.

0 2 . 4 Write down the equation which links energy transferred (*E*), power (*P*) and time (*t*).

[1 mark]

0 2 . 5 At the end of the investigation, the Bunsen burner was turned off.

As the nickel rod cooled to room temperature, the rod transferred 132 J of energy to the room.

The mean power transfer was 0.33 W.

Calculate the time taken for the energy transfer.

[3 marks]

Time taken = _____ s

11

4.1.1.4 Power

Question 155

June 2025 | 8463/1F | Original Q5

0 5 **Figure 8** shows an electric kettle used to boil water.

Figure 8

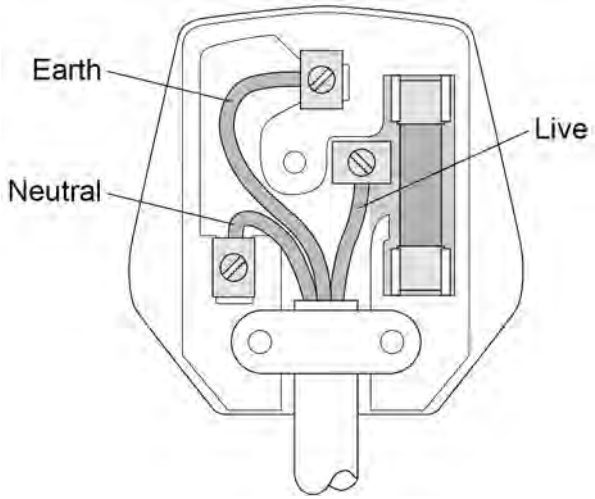


Question 155 · continued

0 5 . 1 The kettle is connected to the mains electricity supply by a three-core cable and plug.

Figure 9 shows the inside of the plug.

Figure 9



What are the colours of the insulation around the earth, live and neutral wires inside a plug?

[3 marks]

Choose answers from the box.

blue	**brown**	**green and yellow**	**red**	**yellow and brown**

Earth wire _____

Live wire _____

Neutral wire _____

Question 5 continues on the next page

4.1.1.4 Power

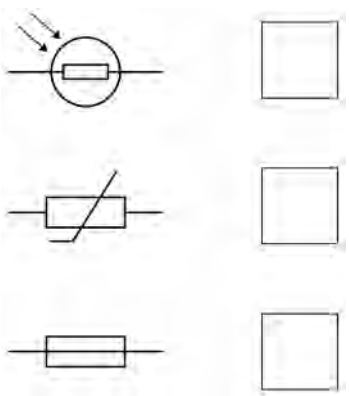
Question 155 · continued

0 5 . 2 The plug in **Figure 9** contains a fuse.

What is the circuit symbol for a fuse?

[1 mark]

Tick (✓) **one** box.



0 5 . 3 The electric kettle contains a heating element.

The power of the heating element is 2420 W.

The current in the heating element is 11.0 A.

Calculate the potential difference across the heating element.

Use the equation:

$$\text{potential difference} = \frac{\text{power}}{\text{current}}$$

[2 marks]

Potential difference = _____ V

Question 155 · continued

0 5 . 4 The power of the heating element is 2420 W.

The current in the heating element is 11.0 A.

Calculate the resistance of the heating element.

Use the equation:

$$\text{resistance} = \frac{\text{power}}{(\text{current})^2}$$

[2 marks]

Resistance = _____ Ω

0 5 . 5 Kettle **A** and kettle **B** have the same total power input.

Kettle **A** has a greater efficiency than kettle **B**.

Which **two** of the following describe heating water in kettle **A** compared with kettle **B**?

[2 marks]

Tick (✓) **two** boxes.

- A greater percentage of energy is usefully transferred by kettle **A**. ☐
- Kettle **A** has a lower useful power output. ☐
- Kettle **A** takes less time to boil the same volume of water. ☐
- More energy is wasted by kettle **A** each second. ☐
- The temperature of the same volume of water increases more slowly in kettle **A**. ☐

10

4.1.1.4 Power

Question 156

June 2025 | 8463/1F | Original Q8

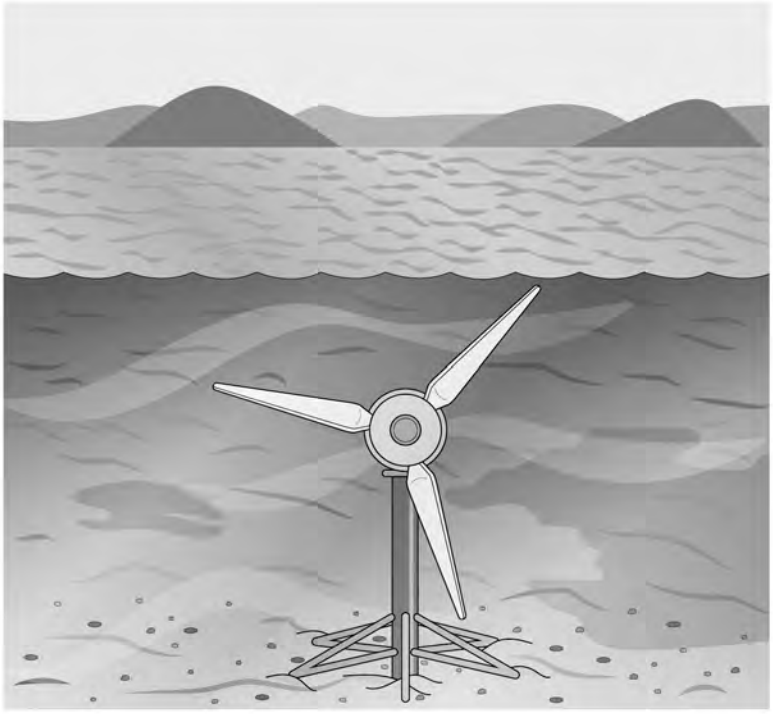
0 8 Tides and wind are two renewable energy resources.

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



4.1.1.4 Power

Question 156 · continued

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

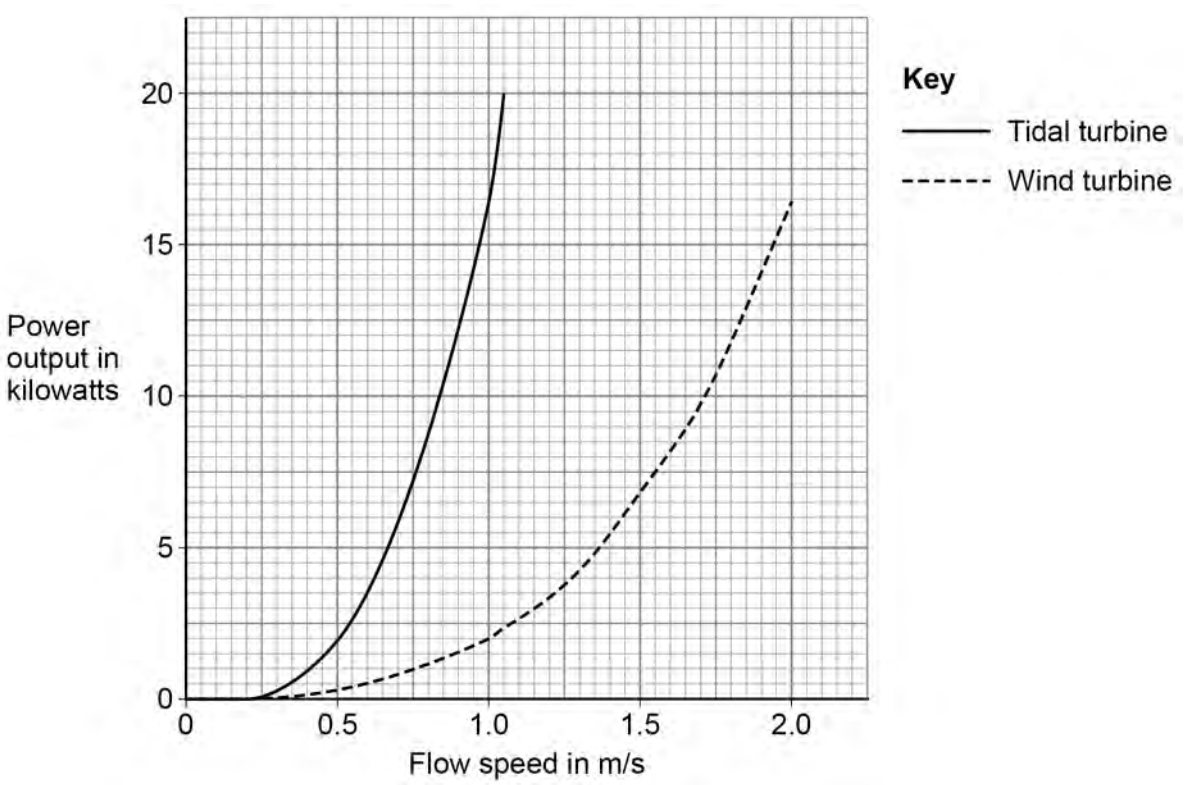
4.1.1.4 Power

Question 156 · 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 _____

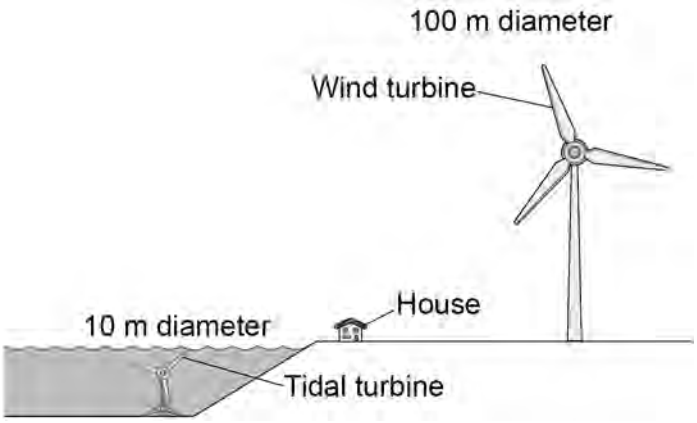
_____

4.1.1.4 Power

Question 156 · 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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