AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.4.1

Power

Past-paper questions

Tier	**Foundation**
Question groups	**44**
Available paper years	**2004–2025**

Using this booklet

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

Name: _____ **Date:** _____

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

4.2.4.1 Power

Question 01

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;

.....

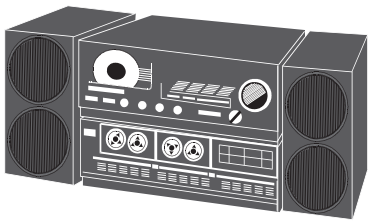
(1 mark)

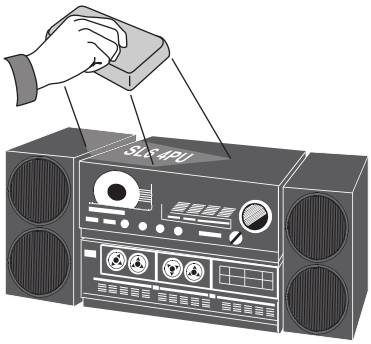
(ii) to send a signal to a TV from a remote control.

.....

(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)

4.2.4.1 Power

Question 01 · 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

4.2.4.1 Power

Question 02

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;

.....

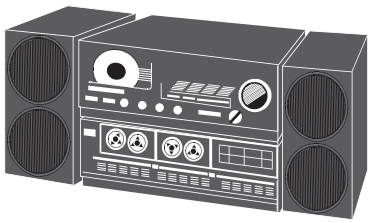
(1 mark)

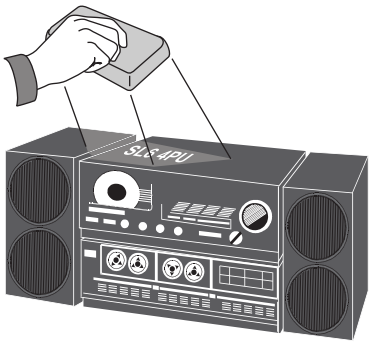
(ii) to send a signal to a TV from a remote control.

.....

(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)

4.2.4.1 Power

Question 02 · 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)

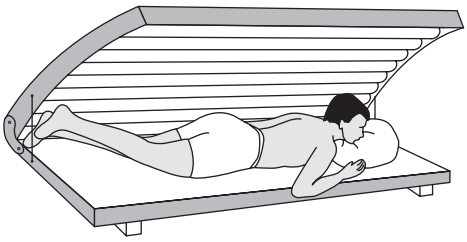
9

4.2.4.1 Power

Question 03

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 03 · continued

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(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)

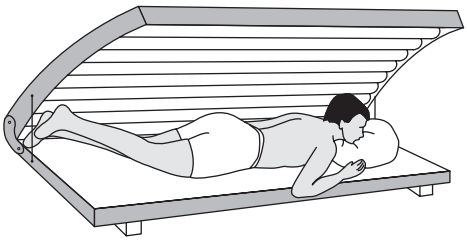
5

4.2.4.1 Power

Question 04

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 04 · continued

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(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)

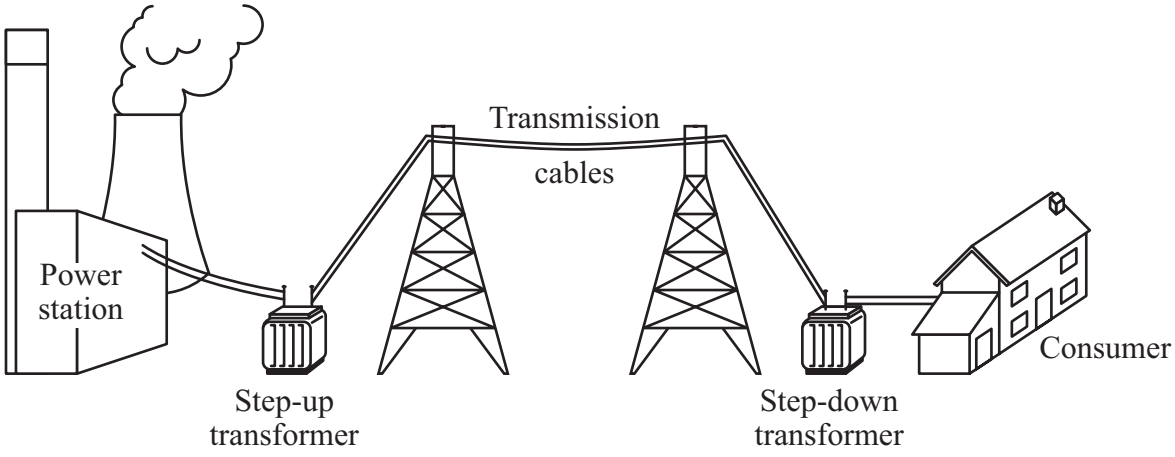
5

4.2.4.1 Power

Question 05

June 2007 | PHY1F | Original Q1 | Legacy

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



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

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

(1 mark)

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

(1 mark)

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

(1 mark)

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

(1 mark)

4.2.4.1 Power

BLANK

(b) Transformers always waste some energy.

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

.....

(1 mark)

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

Draw a ring around your answer.

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

(1 mark)

6

Turn over for the next question

4.2.4.1 Power

Question 06

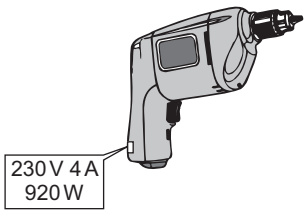
January 2008 | PHY2F | Original Q4 | Legacy

4 (a) Look at this electrical safety information poster.

Get it right!
Choose the right fuse.

Most fuses are 3 A or 13 A.

To choose the right fuse you must know the power of the appliance.



Power is marked on the information plate.

Power over 700 W use a 13 A fuse.	Power under 700 W use a 3 A fuse.
• Fan heaters • Kettles • Dishwashers • Washing machines	• Radios • Table lamps • Portable TVs • Electric blankets

(i) Complete the table to show which size fuse, 3 A or 13 A, should be fitted to each of the appliances.

Appliance	Power rating	Fuse
Hairdryer	1600 W	
Electric saw	350 W	
Food mixer	1200 W	

(2 marks)

(ii) The plug of an electric kettle has been wrongly fitted with a 3 A fuse.

What will happen to the fuse when the kettle is switched on?

.....

.....

(1 mark)

4.2.4.1 Power

Question 06 · continued

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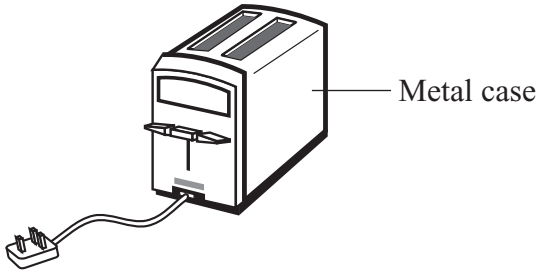
(b) The drawing shows a toaster, which takes a current of 4 A from the 230 V mains electricity supply.



(i) Use the equation in the box to calculate the power of the toaster.

Power (watt, W)	=	current (ampere, A)	×	potential difference (volt, V)

Show clearly how you work out your answer.

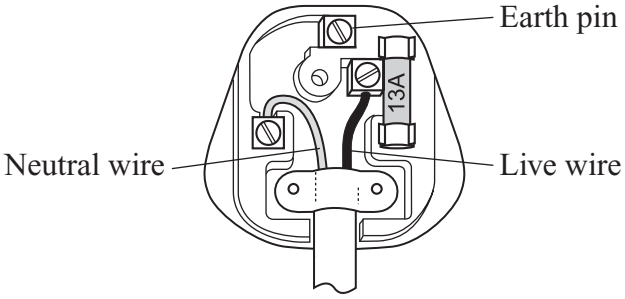
.....

.....

Power = ... W

(2 marks)

(ii) A householder rewires the toaster with a new cable and plug. The diagram shows how the new cable has been connected to the plug.



Explain why the toaster may **not** be safe to use.

.....

.....

.....

.....

(2 marks)

Question 4 continues on the next page

4.2.4.1 Power

Question 06 · continued

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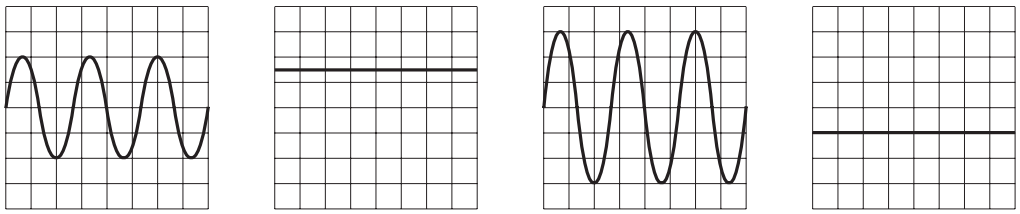
(c) The diagram shows the oscilloscope traces produced by four different electricity supplies. The settings on the oscilloscope are the same for each electricity supply.



K **L** **M** **N**

(i) Which **two** supplies give a direct current (d.c)?

..... and .....

(1 mark)

(ii) Supply **K** provides a peak potential difference of 6 V.

What is the peak potential difference provided by supply **M**?

.....

(1 mark)

9

4.2.4.1 Power

Question 07

June 2008 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

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

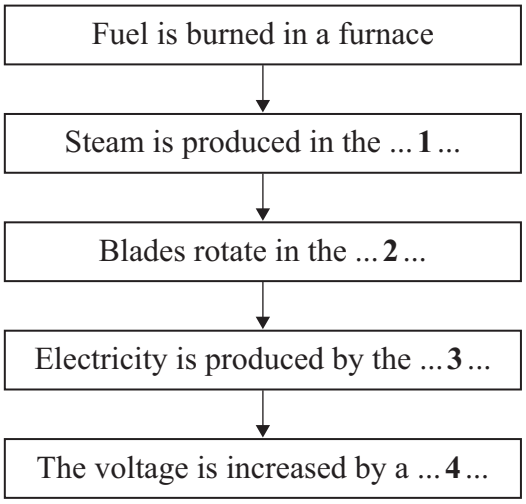
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** on the flow chart.

A boiler

B generator

C transformer

D turbine



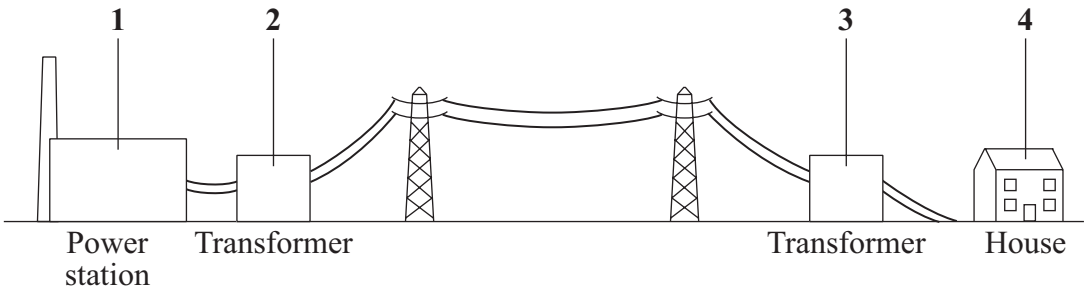
4.2.4.1 Power

Question 08

November 2008 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows part of the National Grid.



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

A This is where the electricity is being used.

B This is where the electricity is being generated.

C This is where the voltage is increased.

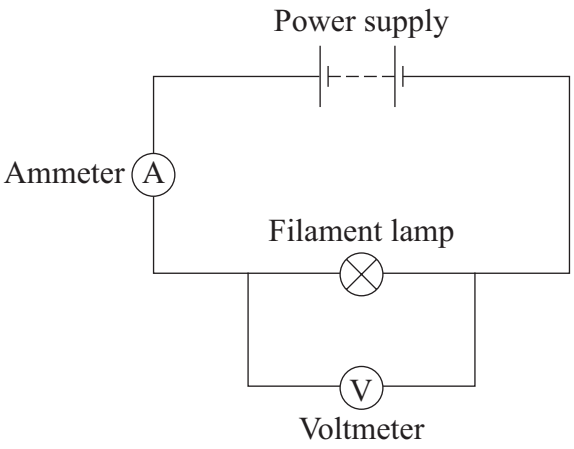
D This is where the voltage is decreased.

4.2.4.1 Power

Question 09

January 2009 | PHY2F | Original Q4 | Legacy

4 (a) The diagram shows the circuit used by a student to measure the power of a filament lamp.



Name a component connected in parallel with the filament lamp.

.....

(1 mark)

4 (b) By adding another component to the circuit, the student is able to obtain a range of ammeter and voltmeter readings.

Ammeter reading in amps	Voltmeter reading in volts
0.10	1.0
0.15	2.0
0.20	4.0
0.25	7.0
0.30	11.0

4.2.4.1 Power

Question 09 · continued

for mark

4 (b) (i) Which **one** of the following components did the student add to the circuit?

Draw a ring around your answer.

fuse **switch** **variable resistor**

(1 mark)

4 (b) (ii) What is the range of ammeter readings taken by the student?

from ..... amps to ..... amps

(1 mark)

4 (b) (iii) Use the data in the table and the equation in the box to calculate the **maximum** power of the filament lamp.

power (watt, W)	=	current (ampere, A)	×	potential difference (volt, V)

Show clearly how you work out your answer.

.....

.....

Power = ... W

(3 marks)

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

As the temperature of a filament lamp increases, its resistance

increases
remains constant
decreases

.

(1 mark)

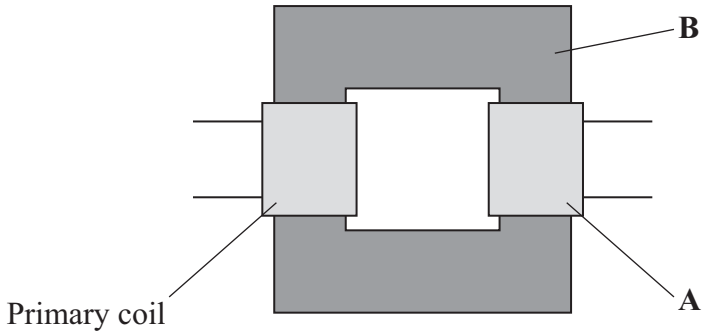
7

4.2.4.1 Power

Question 10

June 2009 | PHY3F | Original Q7 | Legacy

7 (a) The diagram shows a transformer.



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

.....

(1 mark)

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

.....

.....

(2 marks)

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

.....

.....

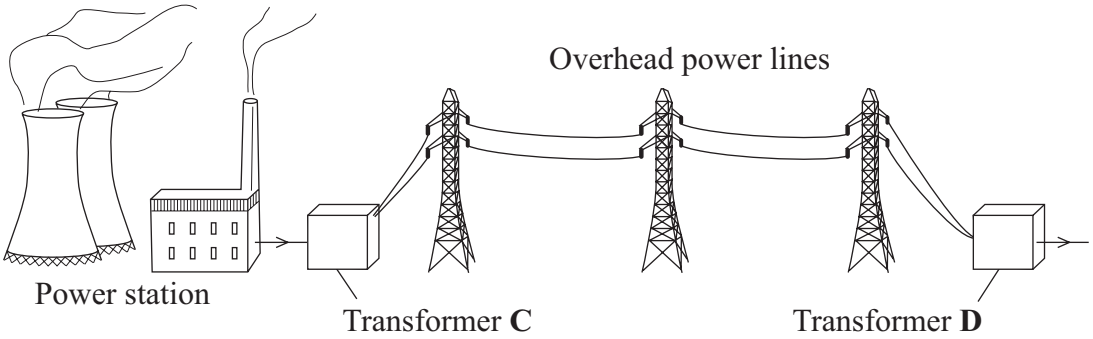
(2 marks)

4.2.4.1 Power

Question 10 · continued

for mark

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



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

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

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

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

Health at risk from power lines?

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

Some scientists think that scientific evidence shows that they are.

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

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

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

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

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

Build new power lines away from where people live. ☐

Use more transformers in the National Grid. ☐

(2 marks)

8

4.2.4.1 Power

Question 11

November 2009 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

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

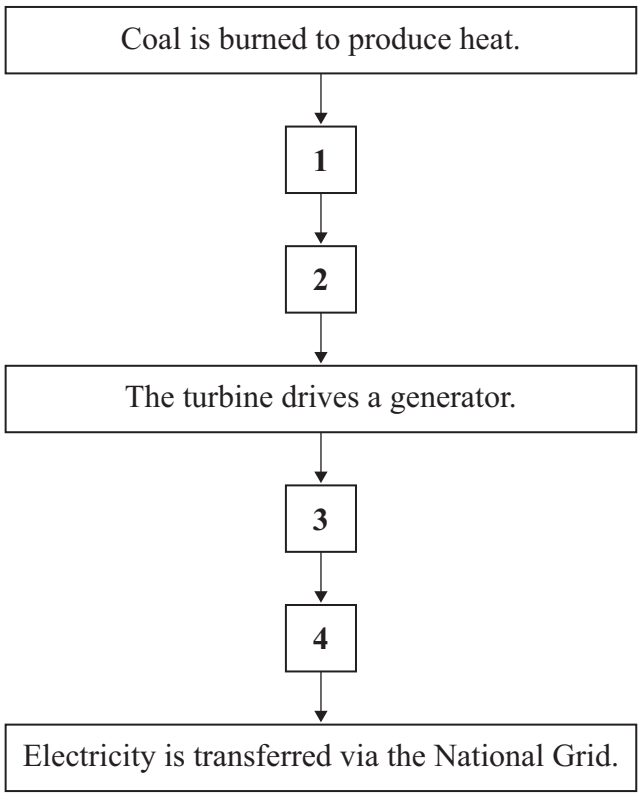
Match stages, **A**, **B**, **C** and **D**, with the boxes **1–4** in the flow chart.

A A step-up transformer increases the voltage.

B Steam drives a turbine.

C The generator produces electricity.

D Water is heated to produce steam.



4.2.4.1 Power

Question 12

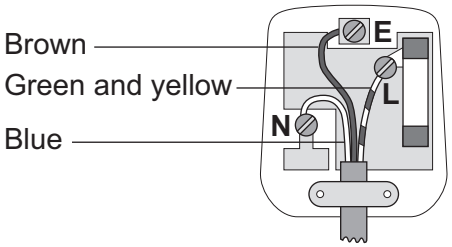
January 2011 | PHY2F | Original Q4 | Legacy

4 The diagrams show the inside of a 13 amp plug.

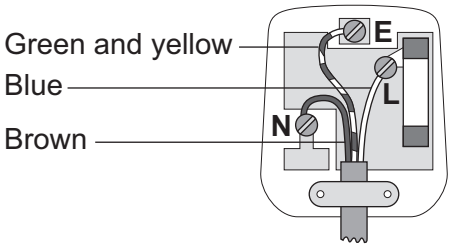
4 (a) (i) Which **one** of the plugs, **A**, **B**, **C** or **D**, is correctly wired?

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

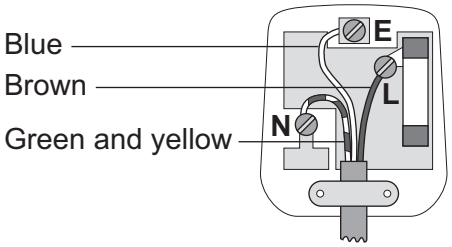
A



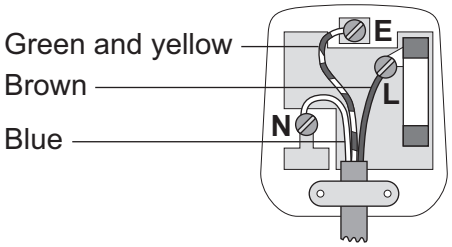
B



C



D



The plug that is correctly wired is ☐ .

(1 mark)

4 (a) (ii) What material is the outside casing of a plug made from?

.....

(1 mark)

4 (b) An electric drill draws a current of 2 amps from the 230 volt mains electricity supply.

Use the equation in the box to calculate the power of the drill.

power = current × potential difference

Show clearly how you work out your answer.

.....

.....

Power ..... watts

(2 marks)

4.2.4.1 Power

Question 12 · continued

4 (c) A householder needs to replace a damaged plug. Most replacement plugs are sold with a 13 amp fuse fitted inside. The householder thinks it would be better for shops to sell the plugs without a fuse. He could then buy either a 3 A, 5 A or 13 A fuse to fit inside the plug.

Explain an advantage of selling plugs without a fuse, rather than with a 13 amp fuse fitted.

.....

.....

.....

.....

(2 marks)

6

Turn over for the next question

4.2.4.1 Power

Question 13

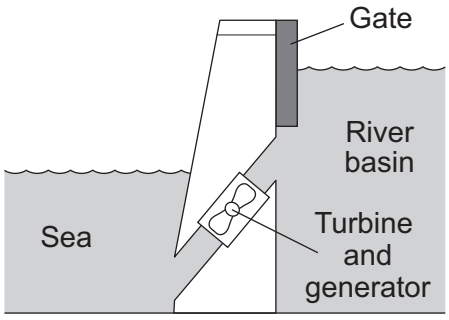
March 2011 | PHY1AP | Original Q8 | Legacy

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.

4.2.4.1 Power

Question 13 · 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.

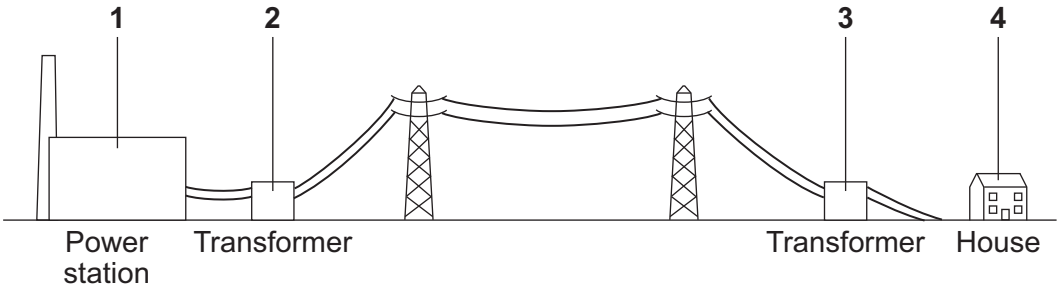
4.2.4.1 Power

Question 14

June 2011 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows part of the National Grid.



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

A This is where the electricity is being generated.

B This is where the electricity is being used.

C This is where the voltage is decreased.

D This is where the voltage is increased.

4.2.4.1 Power

Question 15

June 2011 | PHY2F | Original Q6 | Legacy

6 **Diagram 1** shows a hairdryer.
Diagram 2 shows how the heaters and fan of the hairdryer are connected to a 3-pin plug.
The hairdryer does not have an earth wire.

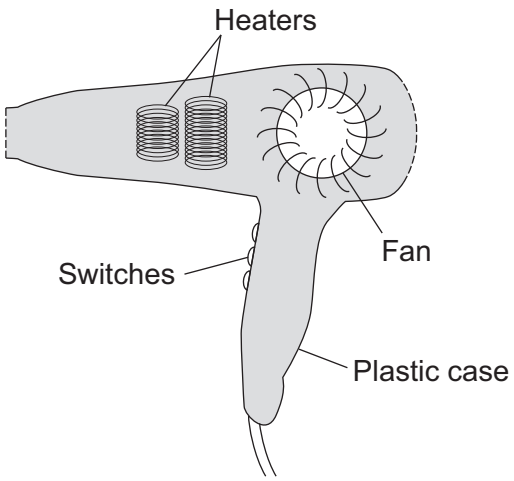


Diagram 1

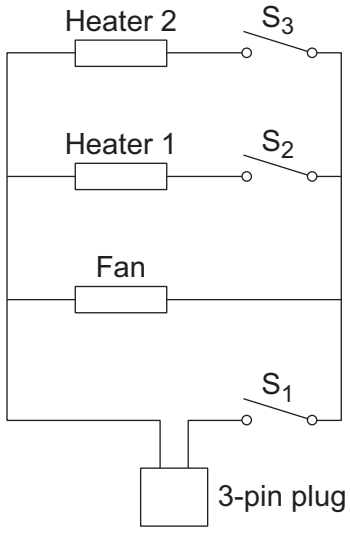


Diagram 2

6 (a) What colour is the insulation around the wire connected to the live pin inside the plug?

.....

(1 mark)

6 (b) Why does the hairdryer **not** need an earth wire?

.....

.....

(1 mark)

6 (c) All the switches are shown in the OFF position.

6 (c) (i) Which switch or switches have to be ON to make:

(1) only the fan work; .....

(2) heater 2 work? .....

(2 marks)

4.2.4.1 Power

Question 15 · continued

6 (c) (ii) The heaters can only be switched on when the fan is also switched on.

Explain why.

.....

.....

.....

.....

.....

(2 marks)

6 (d) The table shows the current drawn from the 230 volt mains electricity supply when different parts of the hairdryer are switched on.

	Current in amps
Fan only	1.0
Fan and heater 1	4.4
Fan and both heaters	6.5

Use the equation in the box to calculate the maximum power of the hairdryer.

power = current × potential difference

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

.....

.....

Maximum power = ...

(3 marks)

9

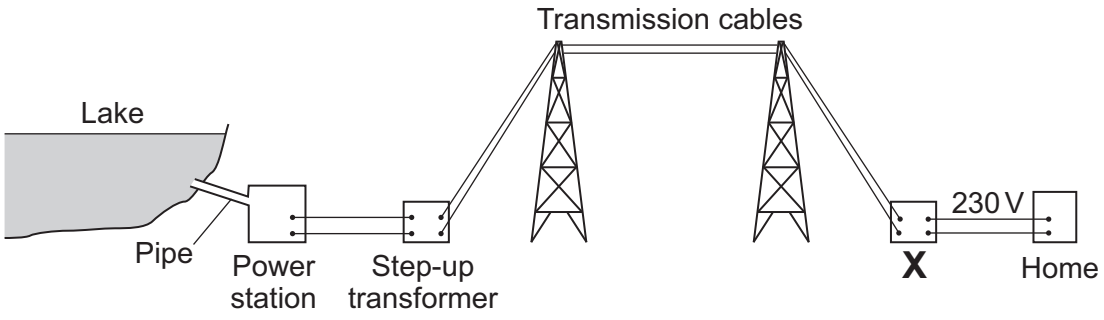
4.2.4.1 Power

Question 16

November 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

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



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

1 current.

2 energy.

3 power.

4 voltage.

7B Using a step-up transformer . . .

1 makes the transmission cables warmer.

2 makes the electricity move faster.

3 reduces the energy loss in the transmission cables.

4 reduces the risk of electrocution.

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

Device **X** is a . . .

1 boiler.

2 generator.

3 step-down transformer.

4 thermal circuit breaker.

4.2.4.1 Power

Question 16 · continued

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

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

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

The efficiency of the power station is . . .

1 0.2

2 0.4

3 0.6

4 1.7

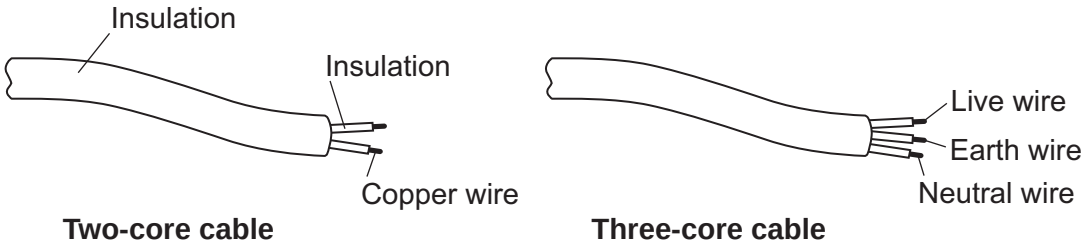
Turn over for the next question

4.2.4.1 Power

Question 17

June 2012 | PH2FP | Original Q5 | Legacy

5 (a) The diagram shows a piece of two-core cable and a piece of three-core cable.



Two-core cable **Three-core cable**

5 (a) (i) Which **one** of the wires inside a three-core cable is missing from a two-core cable?

Draw a ring around your answer.

earth wire **live wire** **neutral wire**

(1 mark)

5 (a) (ii) Use a word from the box to complete the following sentence.

double	**extra**	**totally**

A pottery table lamp fitted with a two-core cable is safe to use because it is

..... insulated.

(1 mark)

5 (b) The cables connecting the power sockets in a building contain wires 1.8 mm thick.
The maximum current that can safely pass through these wires is 20 amps.
A fuse is included in the circuit to protect the wiring.

Explain how a fuse protects the wiring of a circuit.

.....

.....

.....

.....

.....

.....

.....

(3 marks)

5

4.2.4.1 Power

Question 18

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**

.....

.....

.....

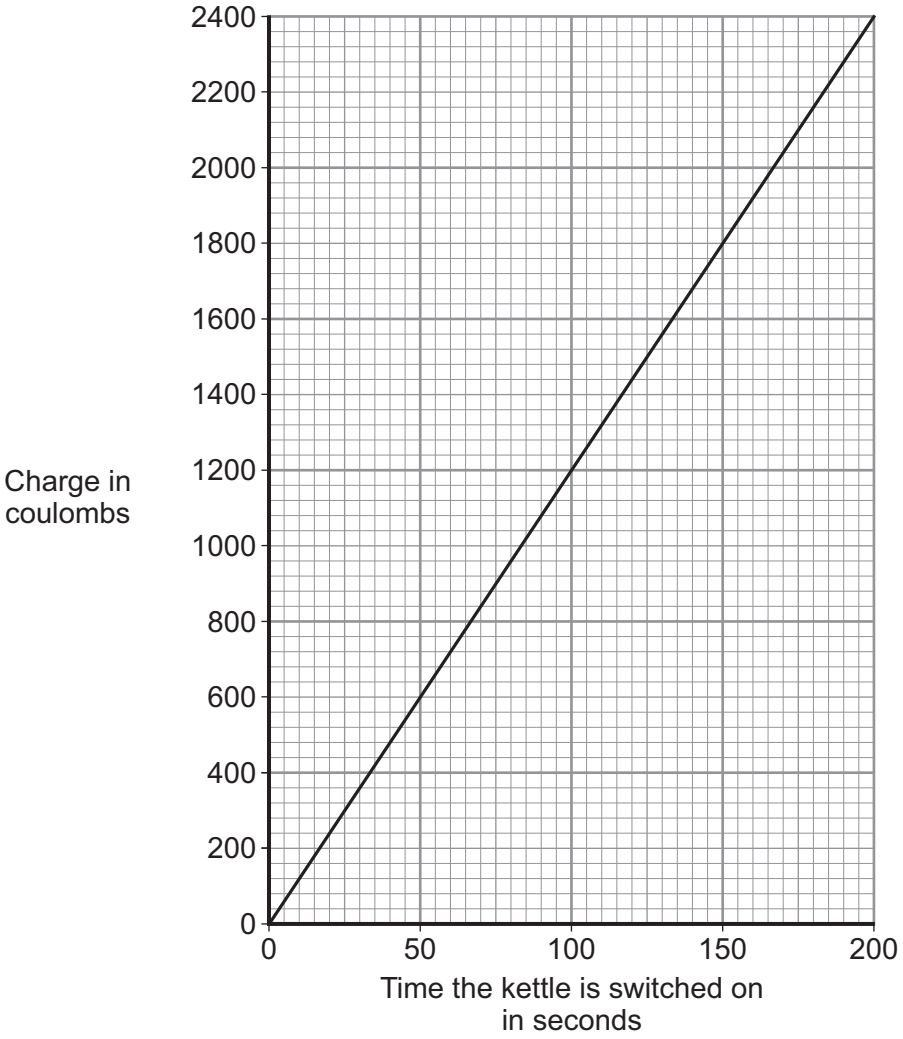
Current = ...

(3 marks)

4.2.4.1 Power

Question 18 · 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

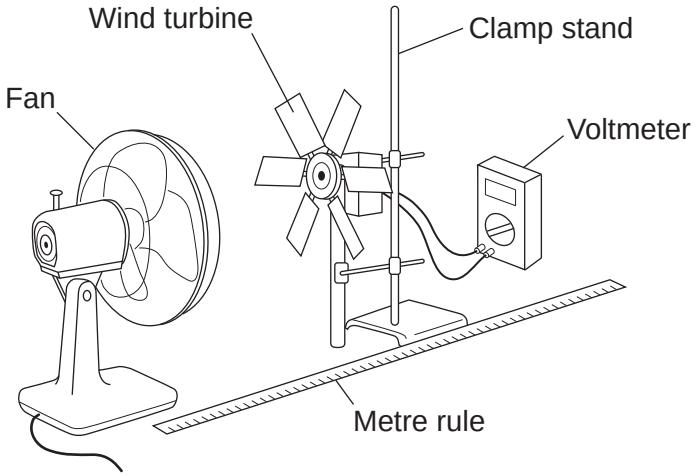
4.2.4.1 Power

Question 19

June 2013 | PH1FP | Original Q4 | Legacy

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

The student used the apparatus shown in the diagram.



The fan was used to turn the wind turbine.

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

Why?

.....

.....

(1 mark)

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

Suggest why.

.....

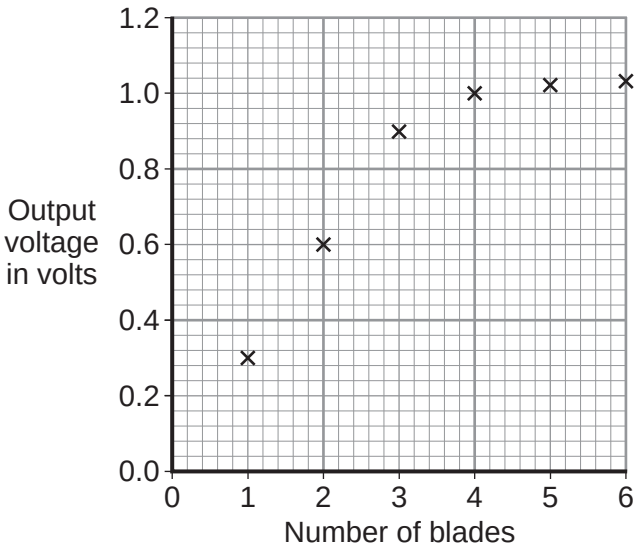
.....

(1 mark)

Question 19 · 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

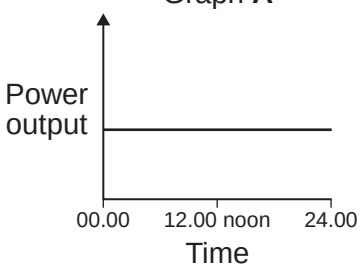
4.2.4.1 Power

Question 19 · continued

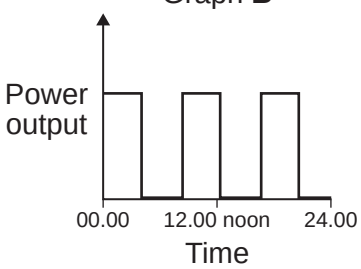
4 (b) The amount of electricity generated using wind turbines is increasing.

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

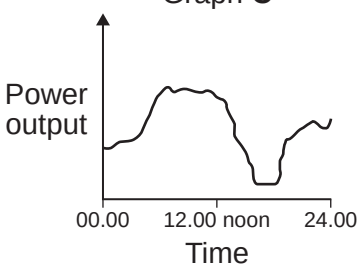
Graph **A**



Graph **B**



Graph **C**



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

Give a reason for your answer.

.....

.....

.....

(2 marks)

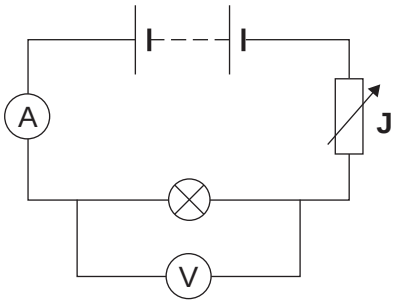
6

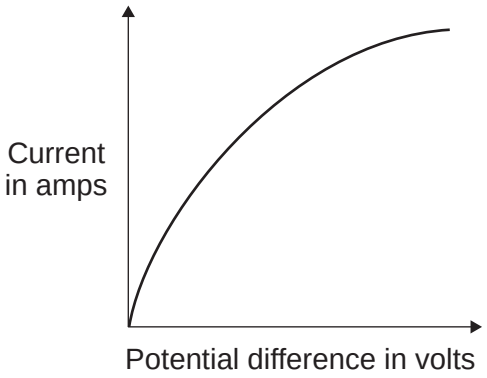
4.2.4.1 Power

Question 20

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)

4.2.4.1 Power

Question 20 · 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

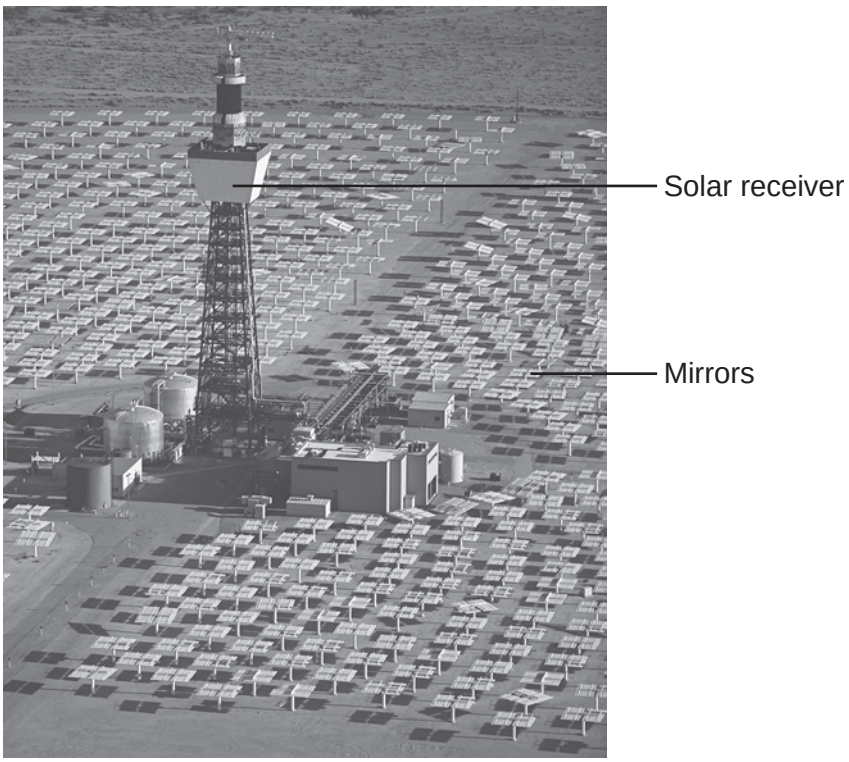
4.2.4.1 Power

Question 21

June 2015 | PH1FP | Original Q5 | Legacy

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

Figure 8



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

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

[1 mark]

.....

.....

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

[1 mark]

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

Question 5 continues on the next page

4.2.4.1 Power

Question 21 · continued

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

[3 marks]

boiler	motor	transformer	turbine

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

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

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

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

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy = ... kWh

4.2.4.1 Power

Question 21 · continued

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

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

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

[2 marks]

1 .....

.....

2 .....

.....

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

[1 mark]

.....

.....

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

[1 mark]

.....

.....

11

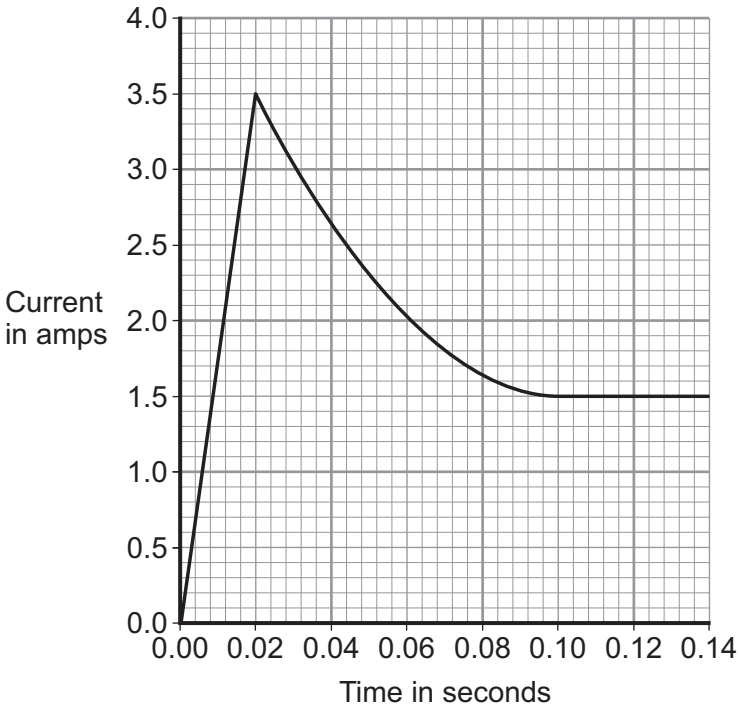
4.2.4.1 Power

Question 22

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**

4.2.4.1 Power

Question 22 · 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

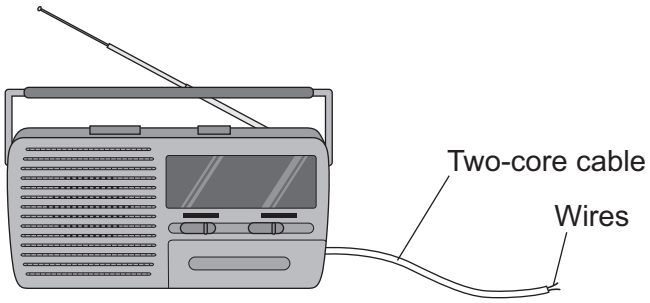
4.2.4.1 Power

Question 23

June 2015 | PH2FP | Original Q4 | Legacy

4 **Figure 5** shows a radio. The radio can be powered by connecting the two-core cable to the mains electricity supply.

Figure 5



4 (a) (i) What must be fitted to the cable before it can be connected to the mains electricity supply?

[1 mark]

.....

4 (a) (ii) There are only two wires inside the cable.
What are the names of the two wires inside the cable?

[1 mark]

Tick (✓) **one** box.

Earth and live ☐

Earth and neutral ☐

Live and neutral ☐

4 (a) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

double	**extra**	**fully**

It is safe to connect the radio to the mains electricity supply using a two-core cable because the radio is ..... insulated.

4.2.4.1 Power

Question 23 · continued

4 (b) The radio can also be powered by a battery.

What type of current does a battery supply?

[1 mark]

Tick (✓) **one** box.

Alternating current (a.c.) only ☐

Direct current (d.c.) only ☐

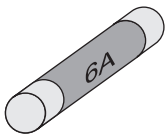
Both a.c. and d.c. ☐

4 (c) **Figure 6** shows a fuse and a circuit breaker.

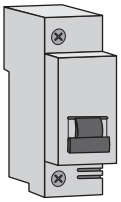
Fuses and circuit breakers are able to disconnect and switch off circuits.

Figure 6

Fuse



Circuit breaker



4 (c) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

earth	live	neutral

A fuse or a circuit breaker is connected to the ..... wire in a circuit.

4 (c) (ii) What happens to cause a fuse or circuit breaker to disconnect a circuit?

[1 mark]

.....

.....

Question 4 continues on the next page

4.2.4.1 Power

Question 23 · continued

4 (c) (iii) Suggest **two** advantages of using a circuit breaker to disconnect a circuit compared with using a fuse.

[2 marks]

1 .....

.....

2 .....

.....

8

4.2.4.1 Power

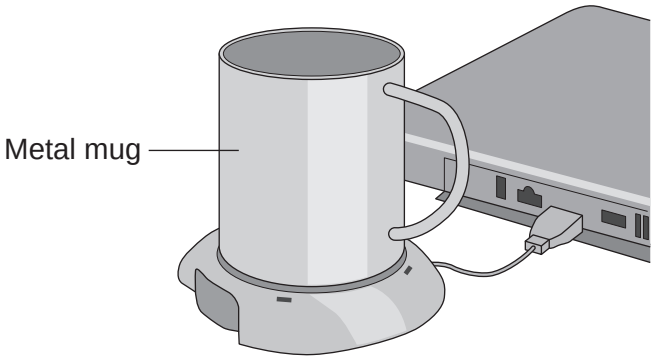
Question 24

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

4.2.4.1 Power

Question 24 · continued

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

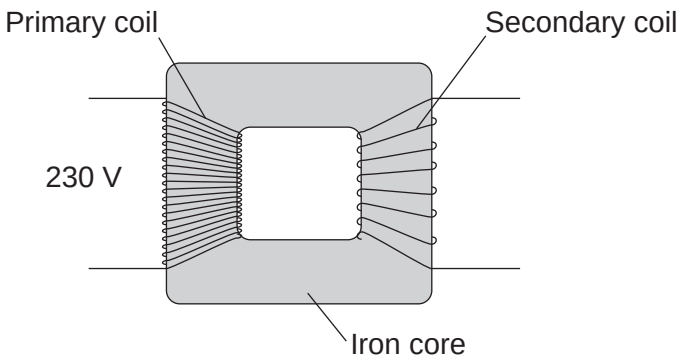
4.2.4.1 Power

Question 25

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

Question 25 · continued

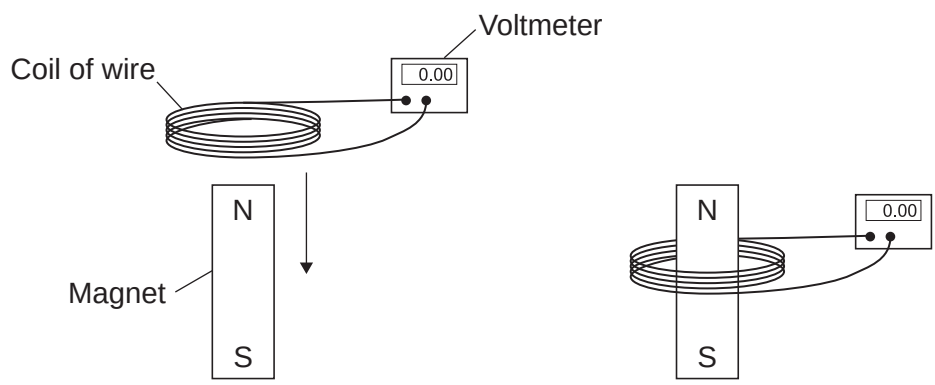
9 (c) In most transformers, the power output is less than the power input.

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

4.2.4.1 Power

Question 25 · continued

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

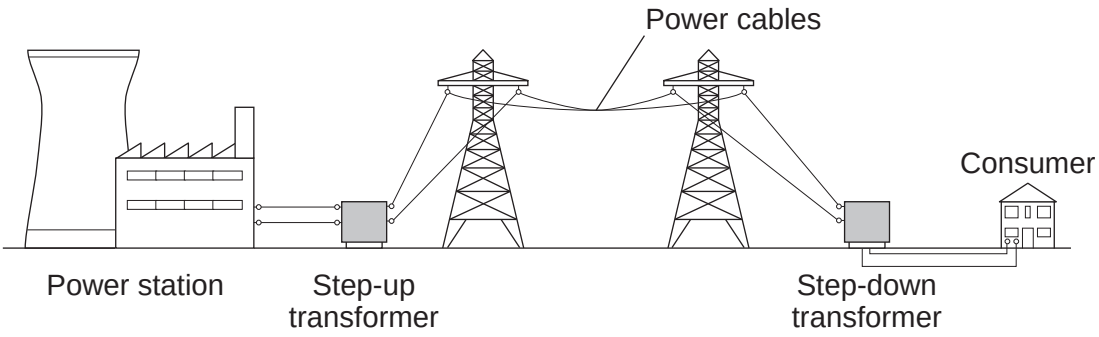
4.2.4.1 Power

Question 26

June 2017 | PH1FP | Original Q4 | Legacy

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

Figure 7



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

[1 mark]

Tick (✓) **one** box.

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

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

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

[1 mark]

4.2.4.1 Power

Question 26 · continued

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

Each word can be used once or not at all.

[3 marks]

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

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

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

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

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

The cost of 1 kWh is 15 pence.

Calculate the cost of the electricity used that month.

[2 marks]

_____

_____

_____

Cost = _____ pence

7

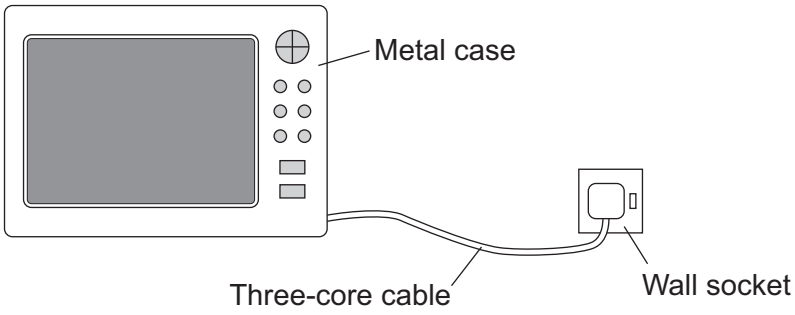
4.2.4.1 Power

Question 27

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

4.2.4.1 Power

Question 27 · 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

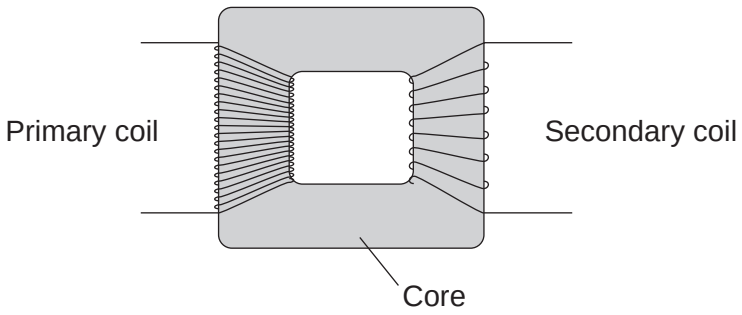
4.2.4.1 Power

Question 28

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]

_____

4.2.4.1 Power

Question 28 · 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]

_____

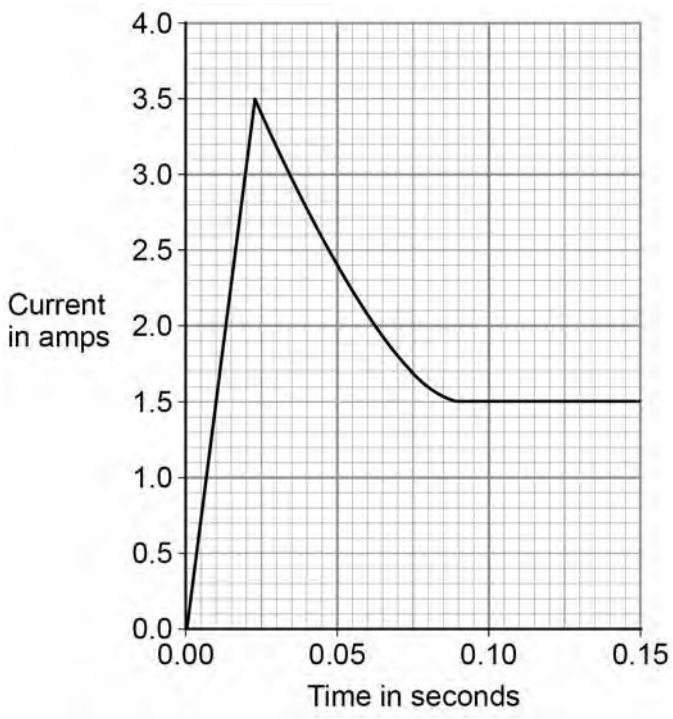
6

4.2.4.1 Power

Question 29

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 ☐

4.2.4.1 Power

Question 29 · 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

4.2.4.1 Power

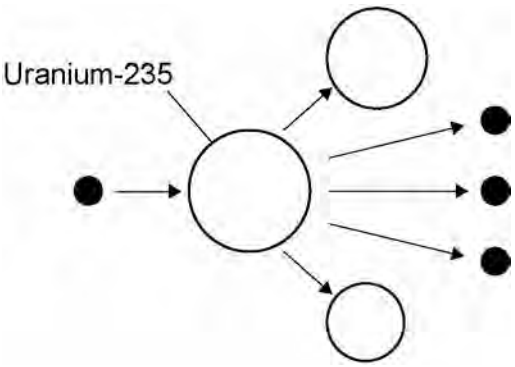
Question 30

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 30 · continued

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

[2 marks]

1 _____

_____

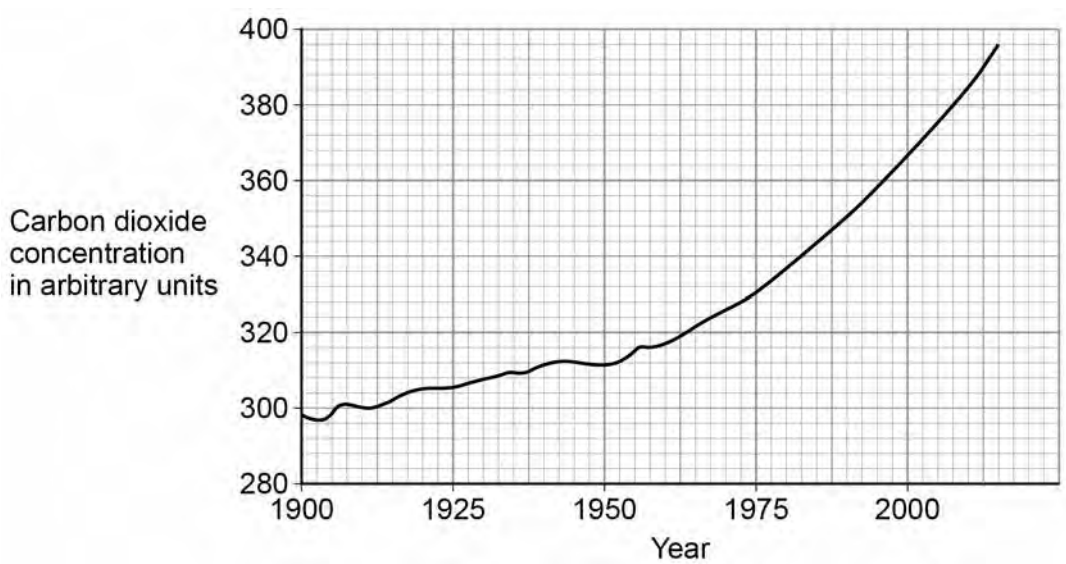
2 _____

_____

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

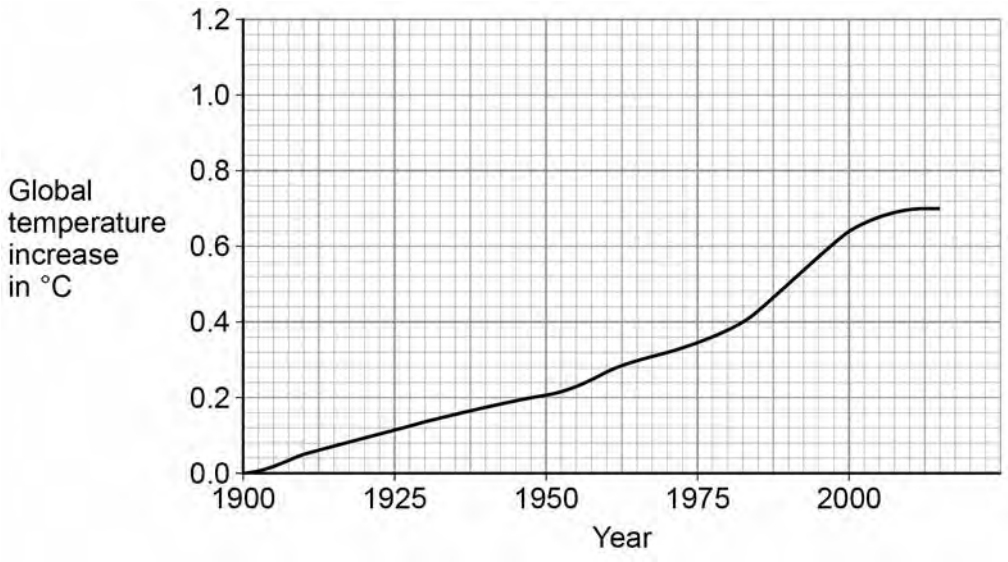


4.2.4.1 Power

Question 30 · 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

4.2.4.1 Power

Question 31

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

4.2.4.1 Power

Question 31 · 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

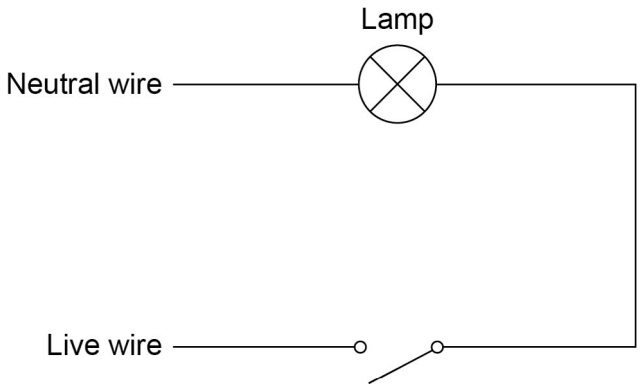
4.2.4.1 Power

Question 32

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.

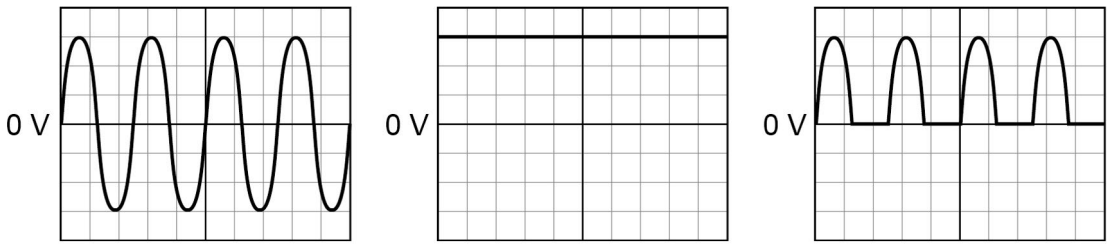
20 Hz ☐ 50 Hz ☐ 60 Hz ☐ 100 Hz ☐

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

Which diagram shows an alternating potential difference?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐

4.2.4.1 Power

Question 32 · 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

4.2.4.1 Power

Question 33

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

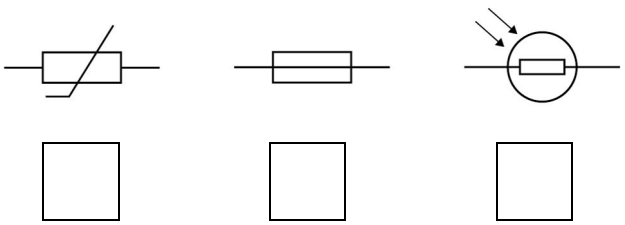
temperature of 1 _____ of the substance by 1 _____.

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.



4.2.4.1 Power

Question 33 · 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

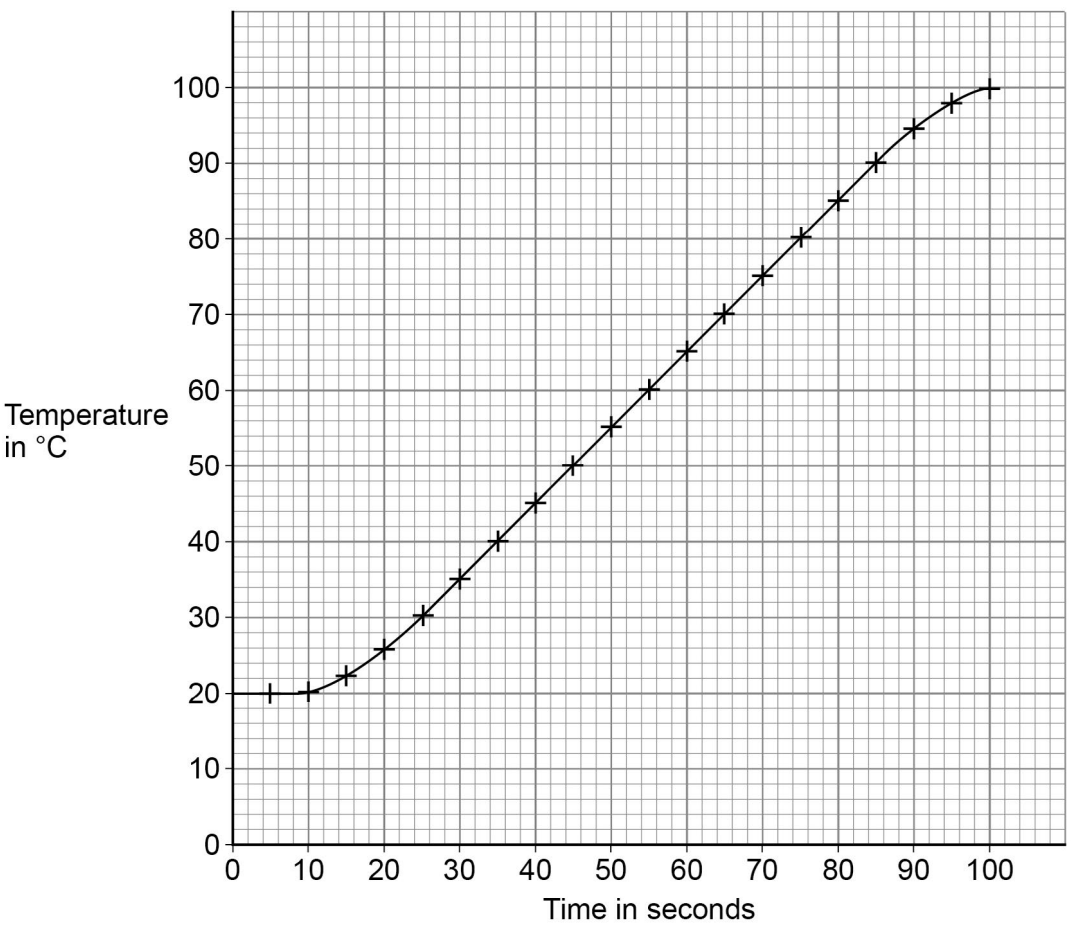
Question 7 continues on the next page

Question 33 · 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



4.2.4.1 Power

Question 33 · 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

Question 33 · 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

4.2.4.1 Power

Question 34

November 2020 | 8463/1F | Original Q9

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

Figure 13

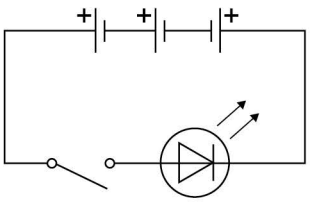


0 9 . 1 The torch contains one LED, one switch and three cells.

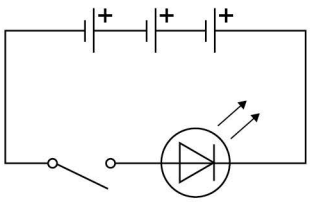
Which diagram shows the correct circuit for the torch?

[1 mark]

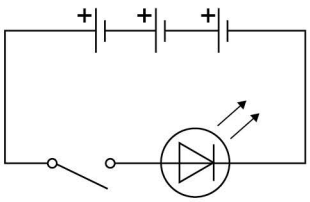
Tick (✓) **one** box.



☐



☐



☐

4.2.4.1 Power

Question 34 · 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

4.2.4.1 Power

Question 34 · 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

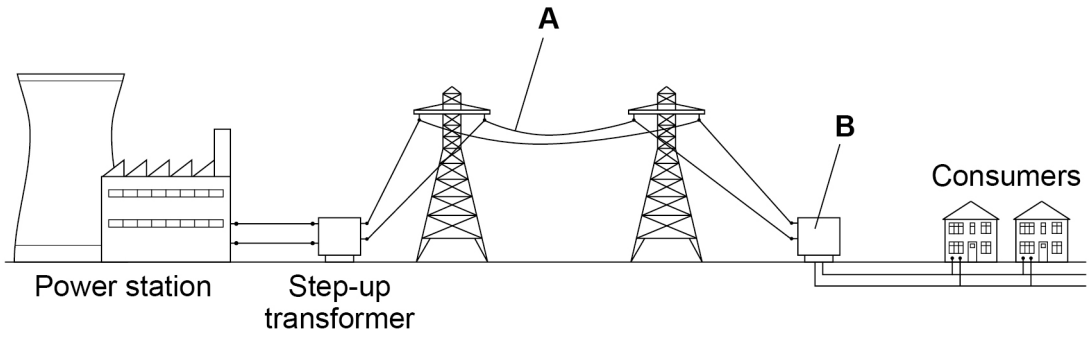
4.2.4.1 Power

Question 35

November 2021 | 8463/1F | Original Q2

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

Figure 2



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

[2 marks]

A _____

B _____

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

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

[1 mark]

Tick (✓) **one** box.

A high potential difference is safer for consumers. ☐

Less thermal energy is transferred to the surroundings. ☐

Power transmission is faster. ☐

4.2.4.1 Power

Question 35 · 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

Question 35 · continued

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

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

Table 1

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

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

Use the equation:

power = potential difference × current

[3 marks]

Total power = _____ W

4.2.4.1 Power

Question 35 · continued

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

Which appliance will transfer the most energy?

Give a reason for your answer.

[2 marks]

Appliance _____

Reason _____

_____

_____

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

There are 32 000 000 seconds in one year.

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

[2 marks]

_____

_____

_____

Average energy transferred = _____ J

12

4.2.4.1 Power

Question 36

0 4 A student investigated how the current in a circuit varied with the number of lamps connected in parallel in the circuit.

Figure 4 shows the circuit with three identical lamps connected in parallel.

Figure 4

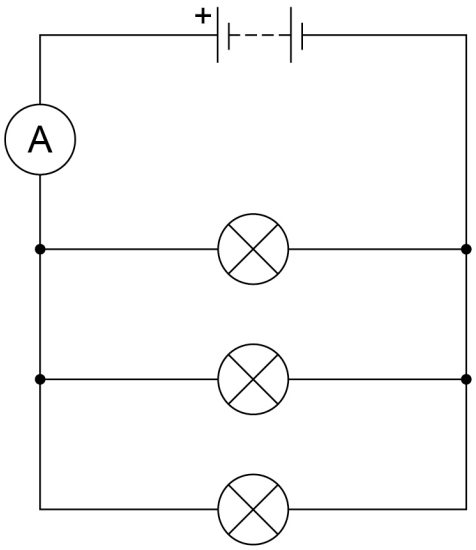
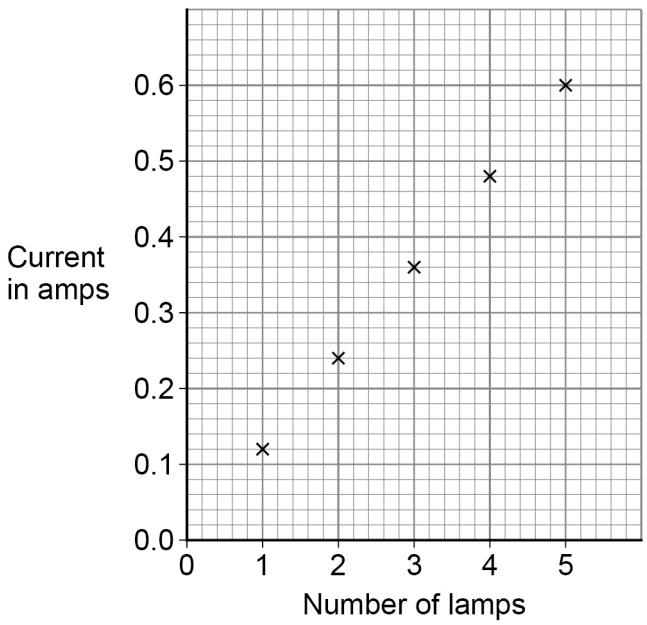


Figure 5 shows the results.

Figure 5



Question 36 · continued

0 4 . 1 Complete the sentences.

Choose answers from the box.

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

decreased	**stayed the same**	**increased**

[3 marks]

As the number of lamps increased, the current _____.

As the number of lamps increased, the total resistance of the circuit _____.

As the number of lamps increased, the potential difference across the battery _____.

0 4 . 2 When there were three lamps in the circuit the ammeter reading kept changing between 0.35 A and 0.36 A.

What type of error would this lead to?

[1 mark]

Tick (✓) **one** box.

Random error ☐

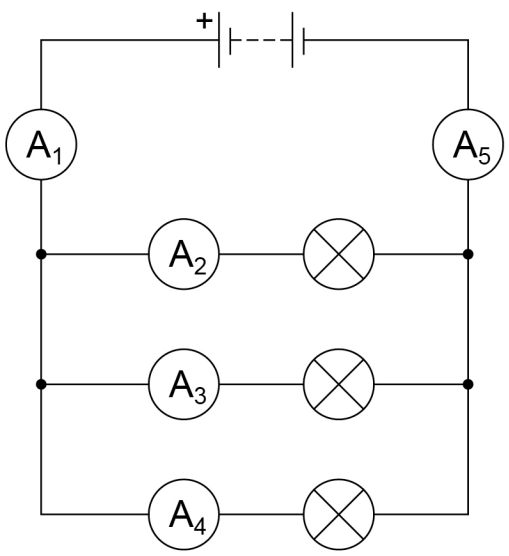
Systematic error ☐

Zero error ☐

Question 4 continues on the next page

Figure 6 shows a circuit with five ammeters and three identical lamps.

Figure 6



0 4 . 3 Complete **Table 2** to show the readings on ammeters A_2 and A_5.

[2 marks]

Table 2

Ammeter	**A_1**	**A_2**	**A_3**	**A_4**	**A_5**
Current in amps	0.36		0.12	0.12	

4.2.4.1 Power

Question 36 · continued

0 4 . 4 The resistance of one lamp is 15 Ω.

The current in the lamp is 0.12 A.

Calculate the power output of the lamp.

Use the equation:

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

[2 marks]

Power = _____ W

8

Turn over for the next question

4.2.4.1 Power

Question 37

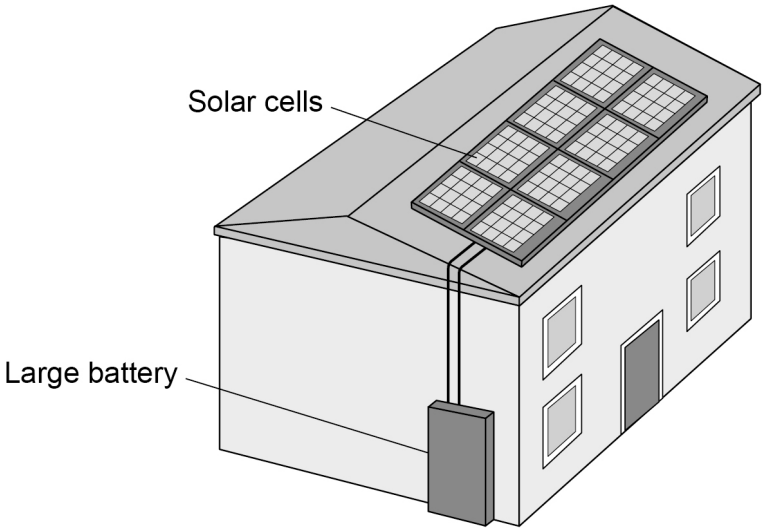
November 2021 | 8463/1F | Original Q6

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]

4.2.4.1 Power

Question 37 · 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

4.2.4.1 Power

Question 37 · 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. ☐

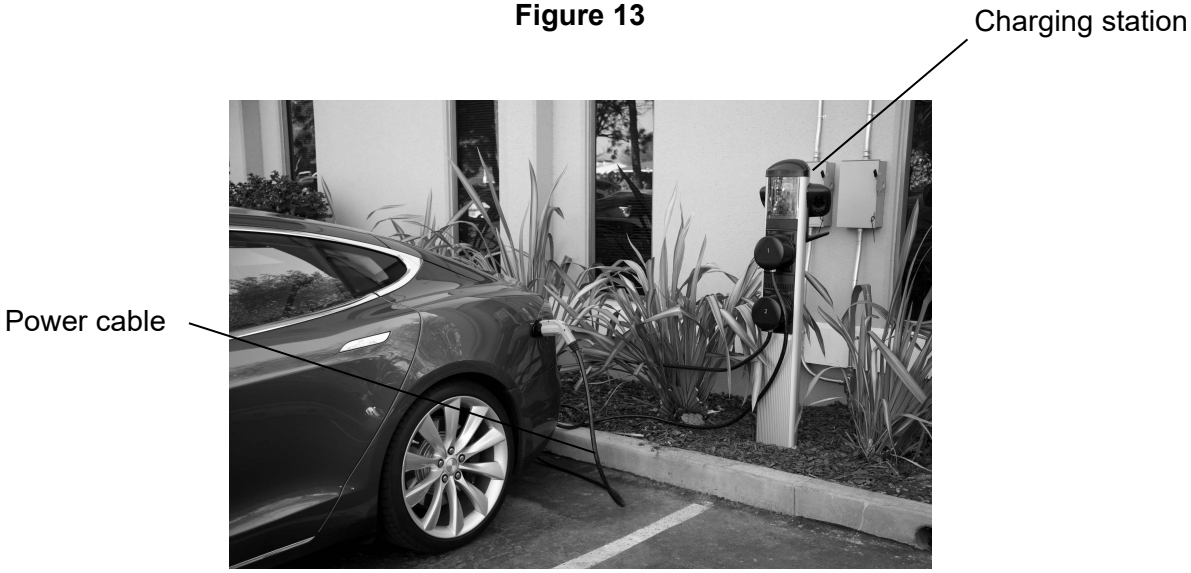
10

4.2.4.1 Power

Question 38

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

4.2.4.1 Power

Question 38 · 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

4.2.4.1 Power

Question 38 · 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

4.2.4.1 Power

Question 38 · 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

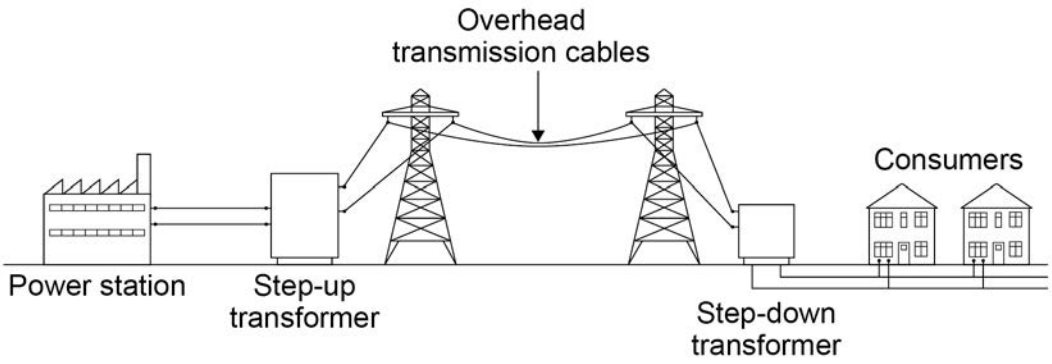
4.2.4.1 Power

Question 39

June 2022 | 8463/1F | Original Q7

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

Figure 8



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

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

[2 marks]

Tick (✓) **one** box in **each** row.

Table 2

Energy resource	Renewable	Non-renewable
biofuel		
coal		
nuclear		
tides		

Question 7 continues on the next page

4.2.4.1 Power

Question 39 · continued

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

Complete the sentences.

Choose answers from the box.

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

[4 marks]

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

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

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

The step-down transformer decreases the _____ .

4.2.4.1 Power

Question 39 · continued

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

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

[1 mark]

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

The battery supplies a current of 130 000 A.

Calculate the charge flow from the battery in 5 minutes.

Choose the unit from the box.

[4 marks]

coulombs	newtons	watts

Charge flow = _____ Unit _____

11

4.2.4.1 Power

Question 40

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.

$P = \frac{V}{I}$ ☐

$P = V \times I$ ☐

$I = P \times V$ ☐

$V = I^2 \times P$ ☐

4.2.4.1 Power

Question 40 · 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

Question 40 · continued

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

4.2.4.1 Power

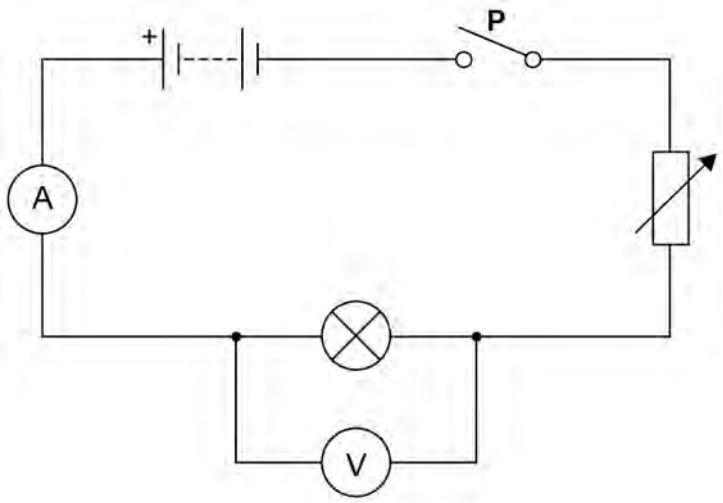
Question 41

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 _____ .

4.2.4.1 Power

Question 41 · 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

4.2.4.1 Power

Question 41 · 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

4.2.4.1 Power

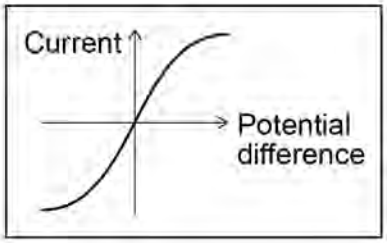
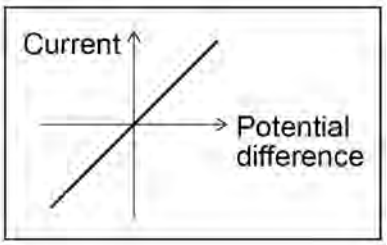
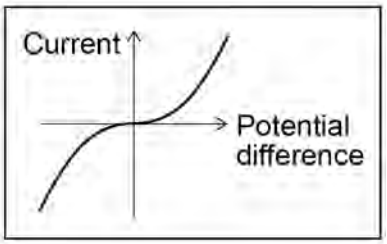
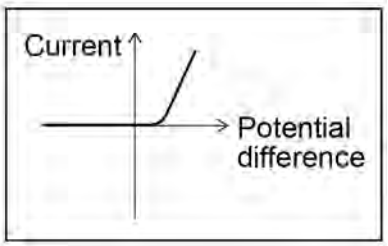
Question 41 · continued

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	
	

4.2.4.1 Power

Question 41 · 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 ☐

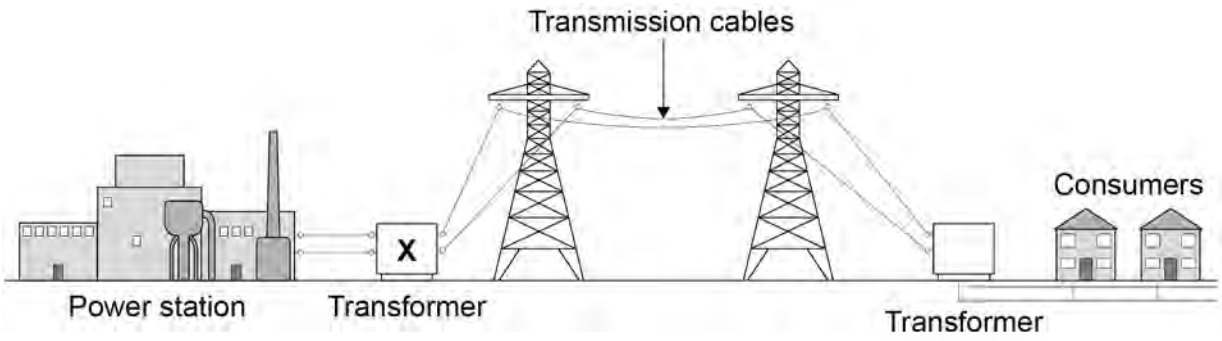
13

4.2.4.1 Power

Question 42

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.

$P = \frac{I}{R}$ ☐

$P = \frac{I}{R^2}$ ☐

$P = I^2 R$ ☐

$P = IR$ ☐

Question 42 · 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

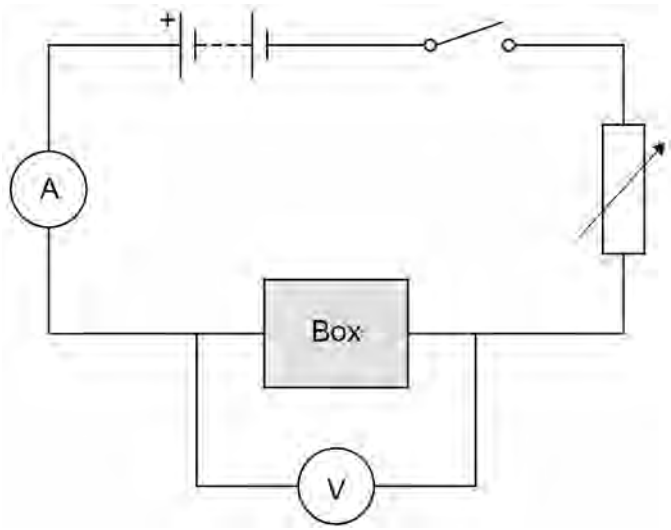
4.2.4.1 Power

Question 43

0 8 A student had an unknown electrical component inside a sealed box.

Figure 14 shows the circuit the student used to identify the component.

Figure 14



The student varied the potential difference across the component and measured the current in the component.

Table 3 shows the results when the potential difference across the component was 6.0 V.

Table 3

Potential difference in volts	Current in amps			
	1st reading	2nd reading	3rd reading	**Mean**
6.0	0.26	0.21	0.25	**X**

0 8 . 1 Calculate value **X** in **Table 3**.

[2 marks]

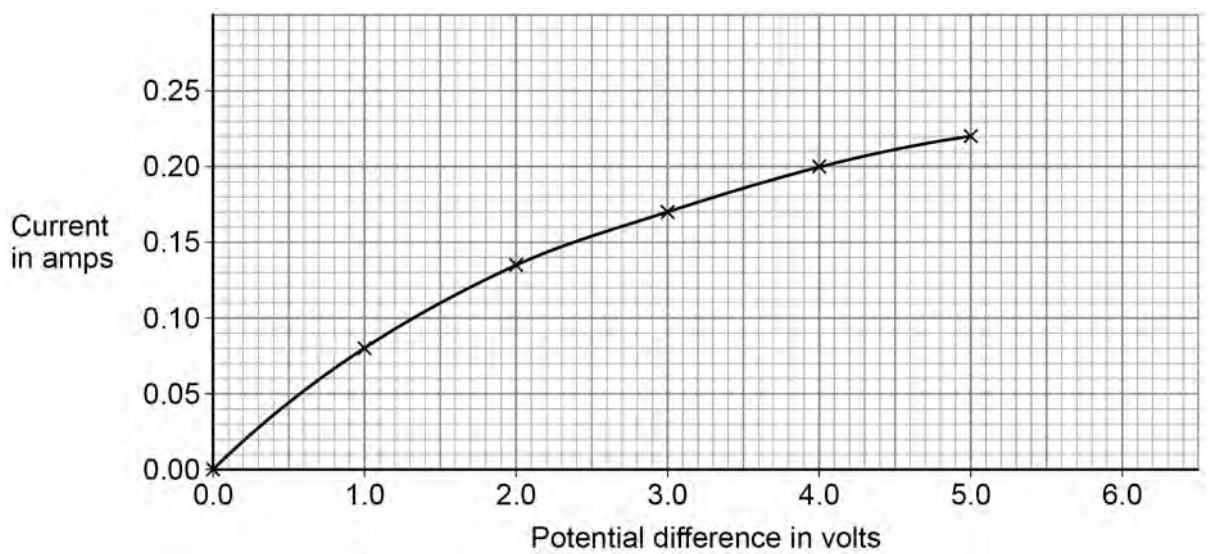
X = _____ A

4.2.4.1 Power

Question 43 · continued

Figure 15 shows the results.

Figure 15



0 8 . 2 Calculate the power of the component when the potential difference across the component is 3.0 V.

Use **Figure 15** and the equation:

power = potential difference × current

[3 marks]

Power = _____ W

4.2.4.1 Power

Question 43 · continued

0 8 . 3 Complete the sentence.

Choose the answer from the box.

[1 mark]

decreases	**stays the same**	**increases**

As the potential difference across the component increases, the gradient of the graph _____.

0 8 . 4 What is the component in the sealed box?

[1 mark]

Tick (✓) **one** box.

Diode ☐

Filament lamp ☐

Resistor at constant temperature ☐

7

4.2.4.1 Power

Question 44

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

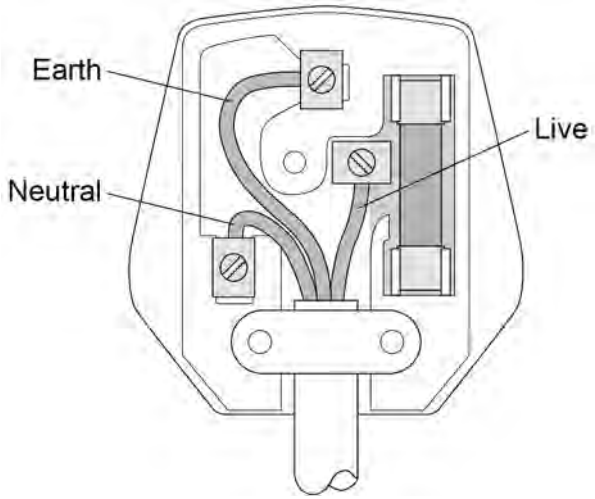
Figure 8



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

4.2.4.1 Power

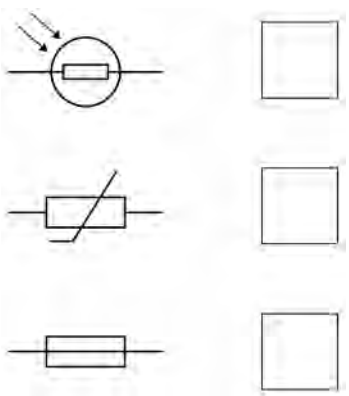
Question 44 · continued

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 44 · 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