AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.4.1

Power

Past-paper questions

Tier	**Higher**
Question groups	**52**
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.

4.2.4.1 Power

Question 01

June 2003 | 3451H | Original Q15 | Legacy

15 (a) An electronic circuit in a freezer contains an alarm. This alarm will sound if the temperature inside the freezer rises above –15 °C. The alarm will also sound if the freezer door is left open for more than 45 seconds.

In the electronic circuit, name:

(i) the logic gate;

.....

(1 mark)

(ii) an input sensor which could detect the temperature rise;

.....

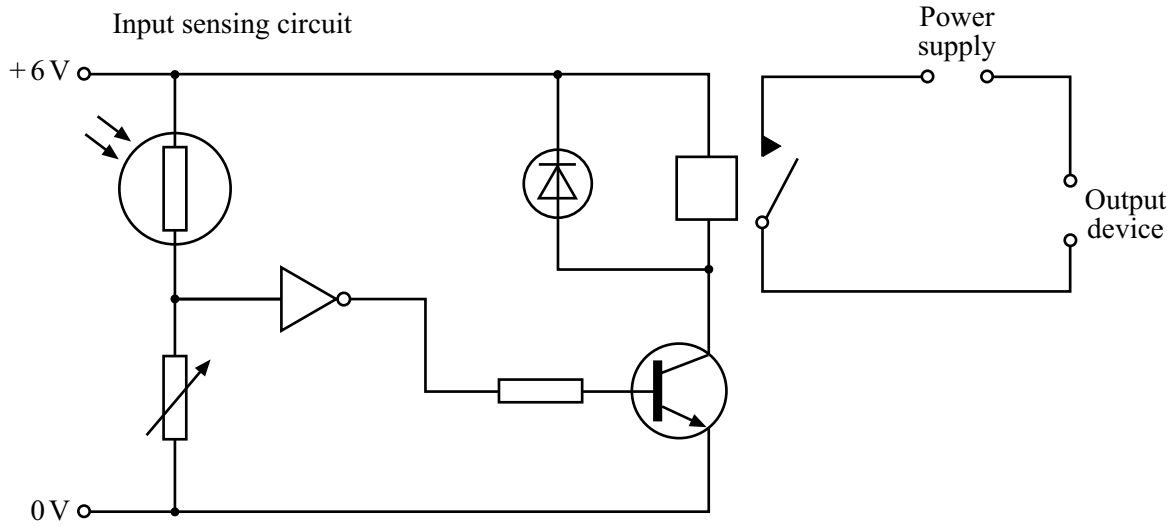
(1 mark)

(iii) a component which could act as a timer.

.....

(1 mark)

(b) The diagram shows a different system which could be used to switch on a security light, outside a house, at night. The diagram shows the input sensing circuit and the circuit for an output device.



4.2.4.1 Power

Question 01 · continued

MARGIN
BLANK

(i) Complete the **five** spaces in these sentences to give the correct order for the events which occur.

As it gets dark, the resistance of the light dependent resistor (LDR) increases. The input to the logic gate will be ..... so the output will be ..... . Then the ..... will be switched on, the ..... will be switched on and the ..... will be switched on. *(5 marks)*

(ii) Explain why a diode is included in the circuit.

.....

.....

.....

..... *(2 marks)*

(iii) Why is the diode reverse-biased?

.....

..... *(1 mark)*

(iv) The system, in the diagram, can be modified to control a garden water fountain. This can be done by changing the output device to an electric pump.

The input sensing circuit could be modified so that the water fountain would operate only during the day.

Suggest **two** alternative ways in which the input sensing circuit could be modified so that it would have this result.

1 .....

.....

2 .....

..... *(2 marks)*

13

4.2.4.1 Power

Question 02

June 2004 | 3451H | Original Q2 | Legacy

2 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;

.....

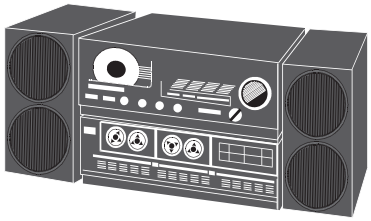
(1 mark)

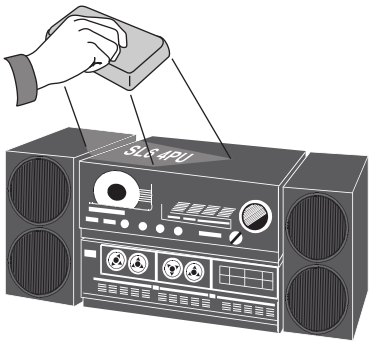
(ii) to send a signal to a TV from a remote control.

.....

(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)

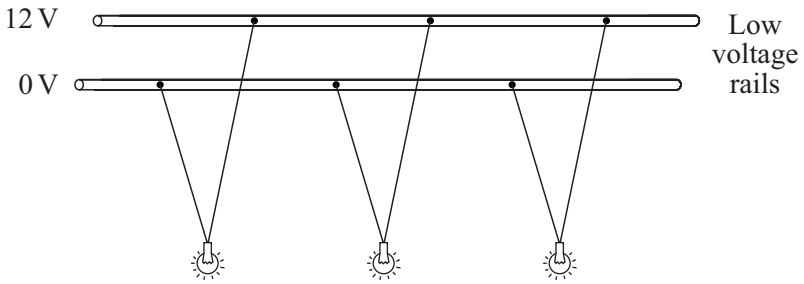
9

4.2.4.1 Power

Question 03

June 2004 | 3451H | Original Q13 | Legacy

13 (a) The diagram shows a 12 volt lighting system. Each lamp has a power of 32 watts.



(i) Write down the equation that links current, potential difference and power.

.....

(1 mark)

(ii) Calculate the input current to the lighting system. Show clearly how you work out your answer.

.....

.....

current =.....A

(2 marks)

(b) A transformer is used to reduce the 230 V a.c. mains to the 12 V supply required for the lighting system. The transformer has 1150 turns on its primary coil.

(i) Write down the equation which links the number of turns of each transformer coil to the voltage across each transformer coil.

.....

.....

(1 mark)

(ii) Calculate the number of turns on the secondary coil of the transformer. Show clearly how you work out your answer.

.....

.....

.....

number of turns on the secondary coil =.....

(2 marks)

6

4.2.4.1 Power

Question 04

June 2004 | 3462H3 | Original Q2 | Legacy

2 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;

.....

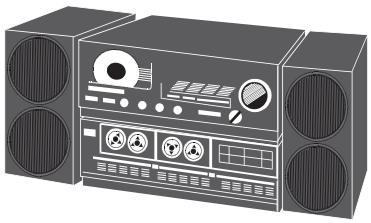
(1 mark)

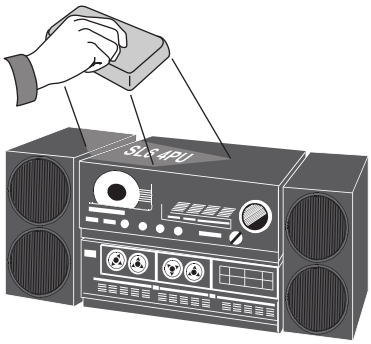
(ii) to send a signal to a TV from a remote control.

.....

(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 04 · 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)

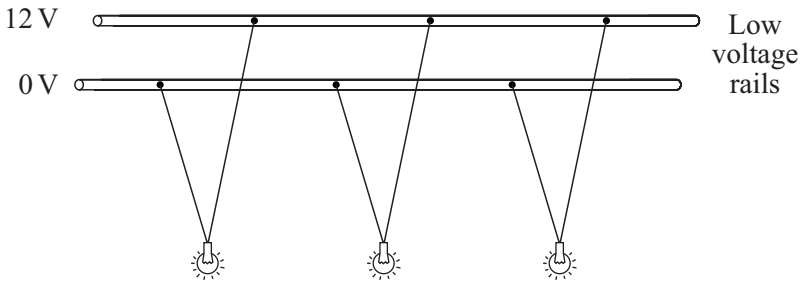
9

4.2.4.1 Power

Question 05

June 2004 | 3462H3 | Original Q11 | Legacy

11 (a) The diagram shows a 12 volt lighting system. Each lamp has a power of 32 watts.



(i) Write down the equation that links current, potential difference and power.

.....

(1 mark)

(ii) Calculate the input current to the lighting system. Show clearly how you work out your answer.

.....

.....

current =.....A

(2 marks)

(b) A transformer is used to reduce the 230 V a.c. mains to the 12 V supply required for the lighting system. The transformer has 1150 turns on its primary coil.

(i) Write down the equation which links the number of turns of each transformer coil to the voltage across each transformer coil.

.....

.....

(1 mark)

(ii) Calculate the number of turns on the secondary coil of the transformer. Show clearly how you work out your answer.

.....

.....

.....

number of turns on the secondary coil =.....

(2 marks)

6

4.2.4.1 Power

Question 06

November 2007 | PHY1A | Original Q8 | Legacy

QUESTION EIGHT

Transformers are used in the National Grid.

8A Two types of transformer are used in various parts of the National Grid.

Which row in the table shows the correct locations of the two types of transformer?

	Between generators and power lines	Between power lines and substation	Between substation and people's homes
1	step-down	step-down	step-up
2	step-down	step-up	step-up
3	step-up	step-down	step-down
4	step-up	step-up	step-down

8B Transformers alter the potential difference across the power lines and the current through the power lines. These changes affect the efficiency of the power lines.

Which row in the table is correct?

	Potential difference across power lines	Current through power lines	Efficiency of transmission
1	decreased	decreased	decreased
2	decreased	increased	increased
3	increased	decreased	increased
4	increased	increased	increased

4.2.4.1 Power

Question 06 · continued

8C The table shows the percentage of energy wasted as heat and sound by four different transformers.

Which transformer has the highest efficiency?

Transformer	Percentage of energy supplied to transformer which is wasted as sound	Percentage of energy supplied to transformer which is wasted as heat
1	1.1	7.4
2	1.2	4.7
3	1.3	5.4
4	1.4	6.9

8D The amount of electricity that a device transforms depends on the rate at which the device transforms energy and . . .

1 how long the device is switched on.

2 the current through the device.

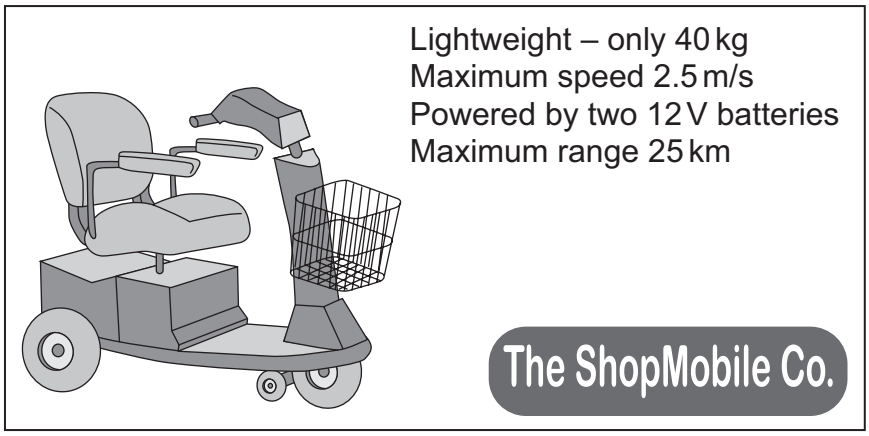
3 the potential difference across the device.

4 the power of the device.

4.2.4.1 Power

Question 07

3 The picture shows an advert for an electric mobility scooter.



(a) The batteries are joined in series.

(i) What is the potential difference provided by the batteries to the motor?

.....

(1 mark)

(ii) The batteries supply a *direct current (d.c.)*.

What is a *direct current (d.c.)*?

.....

.....

(1 mark)

(b) At 2.5 m/s on flat ground, the motor takes a current of 3.0 A from the batteries.

(i) Explain why a bigger current is taken from the batteries when the scooter is going uphill at 2.5 m/s.

.....

.....

.....

.....

(2 marks)

4.2.4.1 Power

Question 07 · continued

BLANK

(ii) What effect does travelling uphill have on the range of the scooter?

.....

(1 mark)

(c) The mass of the scooter driver is 80 kg.

Use the equation in the box to calculate the kinetic energy of the scooter **and** driver when they are travelling at maximum speed.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

Show clearly how you work out your answer.

.....

.....

Kinetic energy = ... J

(2 marks)

(d) A battery which has run down is recharged in 8 hours. The average current delivered by the battery charger is 1.5 A.

Use the equation in the box to calculate the maximum charge stored by **both** batteries.

$$\text{charge} = \text{current} \times \text{time}$$

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

.....

.....

Charge stored = ...

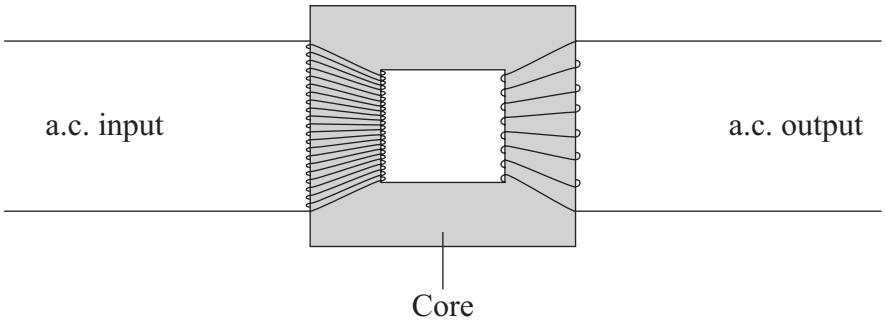
(3 marks)

10

4.2.4.1 Power

Question 08

6 (a) The diagram shows a transformer.



(i) Is the transformer in the diagram being used as a step-up transformer or as a step-down transformer?

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

a step-up transformer ☐

a step-down transformer ☐

Explain your answer.

.....

.....

(1 mark)

(ii) Why is insulated wire, and not uninsulated wire, used to make the coils?

.....

.....

(1 mark)

(iii) Why is the core made of iron?

.....

.....

(1 mark)

4.2.4.1 Power

Question 08 · continued

BLANK

(b) A transformer has 500 turns on its primary coil and 7500 turns on its secondary coil. The potential difference across the primary coil is 150 volts.

Use the equation in the box to calculate the potential difference across the secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

Show clearly how you work out your answer.

.....

.....

.....

Potential difference across the secondary coil = ... volts

(2 marks)

(c) Step-down transformers are used between power lines and people's houses.

Explain why.

.....

.....

.....

(2 marks)

(d) Before 1926, large towns had their own local power stations. After 1926, these power stations were connected to form the National Grid.

Explain the advantage of having a National Grid system.

.....

.....

.....

.....

(2 marks)

9

4.2.4.1 Power

Question 09

January 2009 | PHY2H | Original Q5 | Legacy

5 (a) Describe the difference between an alternating current (a.c.) and a direct current (d.c.).

.....

.....

.....

.....

(2 marks)

5 (b) The diagram shows the information plate on the bottom of an electric wallpaper steamer.

230 V a.c.	50 Hz	2.3 kW

5 (b) (i) Use the equation in the box to calculate the current used by the steamer.

power = current × potential difference

Show clearly how you work out your answer.

.....

.....

Current ..... A

(2 marks)

5 (b) (ii) Which **one** of the following fuses should be used inside the plug of the steamer?

Draw a ring around your answer.

1 A **3 A** **5 A** **10 A** **13 A**

(1 mark)

5

4.2.4.1 Power

Question 10

March 2009 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about power stations and the distribution of electricity.

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

A generator

B grid

C transformer

D turbine

In most power stations, steam is used to drive a . . . **1** . . . .

Electricity is produced at a power station by a . . . **2** . . . .

The voltage of the electricity is stepped up by a . . . **3** . . . .

Electricity is transferred from the power station to our homes by the national . . . **4** . . . .

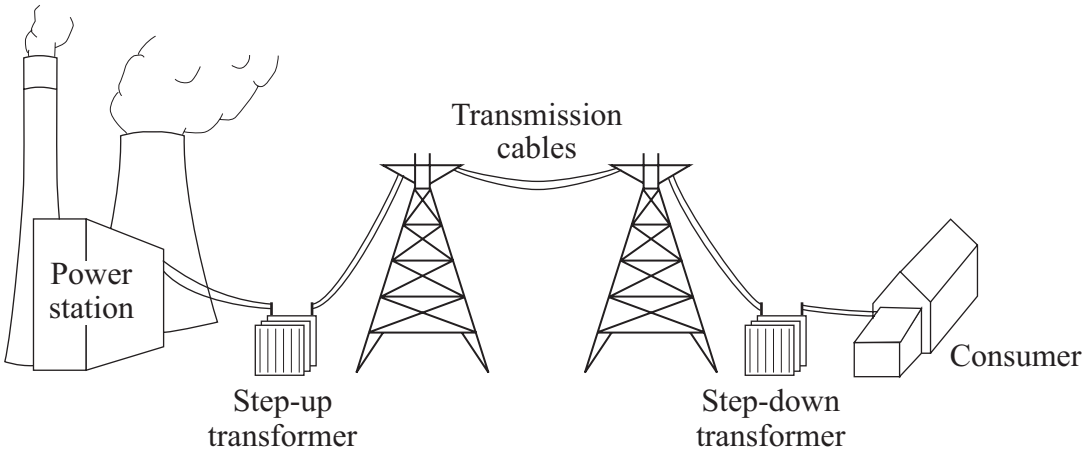
4.2.4.1 Power

Question 11

June 2009 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows how electricity is distributed from a coal-fired power station to consumers.



5A Which row in the table shows what happens at the step-up transformer?

	Current	Voltage
1	decreased	decreased
2	decreased	increased
3	increased	decreased
4	increased	increased

5B The purpose of the step-up transformer is to . . .

1 allow the electricity to travel further.

2 increase the speed of the electricity through the cables.

3 reduce energy losses from the cables.

4 reduce vibrations in the cables.

4.2.4.1 Power

Question 11 · continued

5C Which one of the following power stations has the shortest start-up time?

1 coal

2 gas

3 nuclear

4 oil

5D Which of these fuels undergoes nuclear fission to produce heat in a power station?

1 coal

2 gas

3 oil

4 uranium

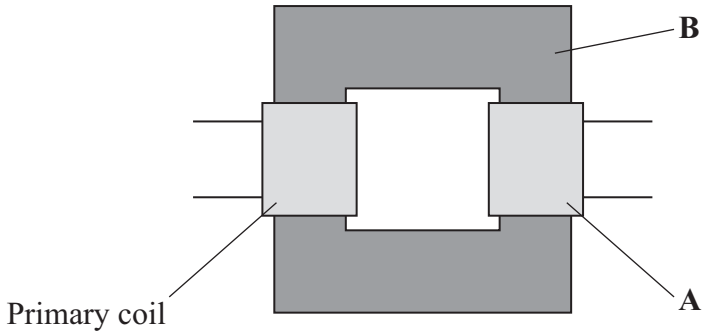
Turn over for the next question

4.2.4.1 Power

Question 12

June 2009 | PHY3H | Original Q1 | Legacy

1 (a) The diagram shows a transformer.



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

.....

(1 mark)

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

.....

.....

(2 marks)

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

.....

.....

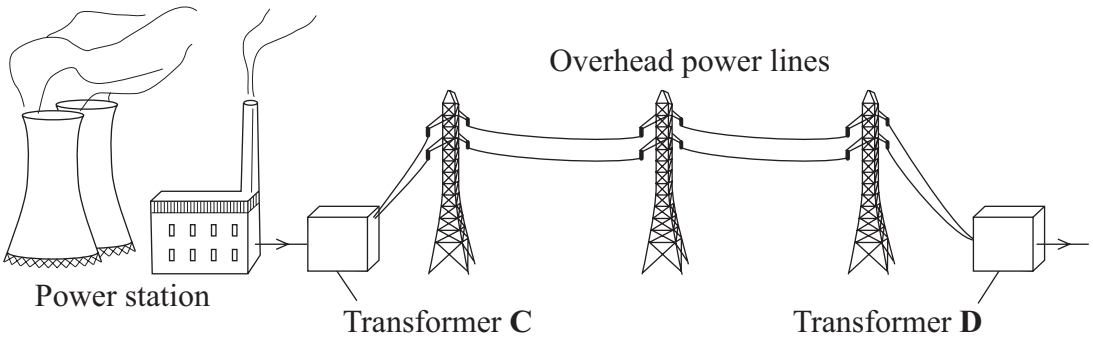
(2 marks)

4.2.4.1 Power

Question 12 · continued

for mark

1 (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)*

1 (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

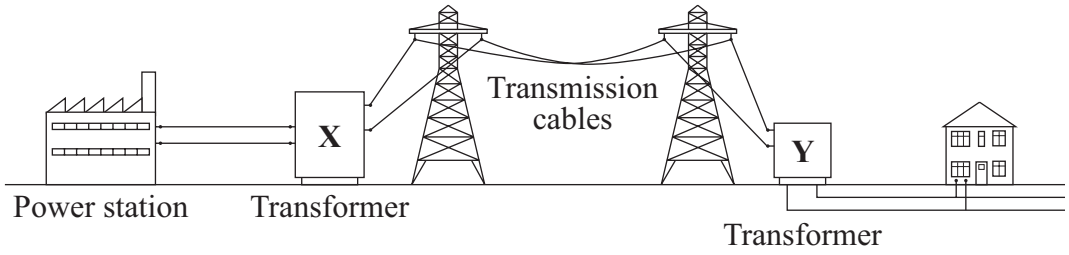
4.2.4.1 Power

Question 13

November 2009 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

Power stations produce electricity and the National Grid distributes it to our homes and to factories.



5A Electricity is transferred along the transmission cables at high voltage so that . . .

1 fewer pylons need to be used.

2 less energy is lost in the cables.

3 the current in the cables is also high.

4 thicker cables can be used.

5B The two transformers, **X** and **Y**, are needed to . . .

1 change heat to electrical energy at **X** and electrical energy to heat at **Y**.

2 change the current at **X** to a higher value and the current at **Y** to a lower value.

3 change the voltage at **X** from ac to dc and the voltage at **Y** from dc to ac.

4 change the voltage at **X** to a higher value and the voltage at **Y** to a lower value.

5C Power stations use gas, coal, oil or uranium as the fuel.

Which of these fuels does **not** produce carbon dioxide when it is used?

1 coal

2 gas

3 oil

4 uranium

4.2.4.1 Power

5D A hydroelectric power station does not release carbon dioxide into the atmosphere.

Which row in the table gives a correct advantage and a correct disadvantage of hydroelectric power stations?

	Advantage	Disadvantage
1	Valleys are flooded to form large lakes.	The building costs are very high.
2	There are no fuel costs.	They take a long time to start up.
3	They can be started up quickly.	Habitats are flooded to make large lakes.
4	No wildlife habitats are destroyed during construction.	Valleys are flooded to produce large lakes.

Turn over for the next question

4.2.4.1 Power

Question 14

June 2010 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

In a recent speech, a politician called for a European energy policy that gives sustainable, affordable and secure energy resources. The issues in the policy are given in the table.

	Policy issue
L	Break the dependency on fossil fuels, which are damaging the atmosphere
M	Guarantee realistic and stable costs to customers
N	Free citizens from dependence on unreliable energy suppliers

9A Which row in the table below describes correctly the issues in the energy policy?

	L	M	N
1	economic	environmental	political
2	environmental	economic	political
3	environmental	environmental	economic
4	economic	economic	environmental

9B The politician also stated that the electricity would be transferred by energy-efficient cables.

The cables would be *energy-efficient* so that . . .

1 energy would be created along the cables.

2 energy would be transformed along the cables.

3 energy loss in the cables would be kept to a minimum.

4 energy would be destroyed along the cables.

9C Part of the policy is to transfer electricity from renewable sources along a 'Super Grid'. This *Super Grid* could use transformers to achieve energy efficiency.

Just before the electricity entered the *Super Grid*, the transformer would . . .

1 decrease the voltage and decrease the current.

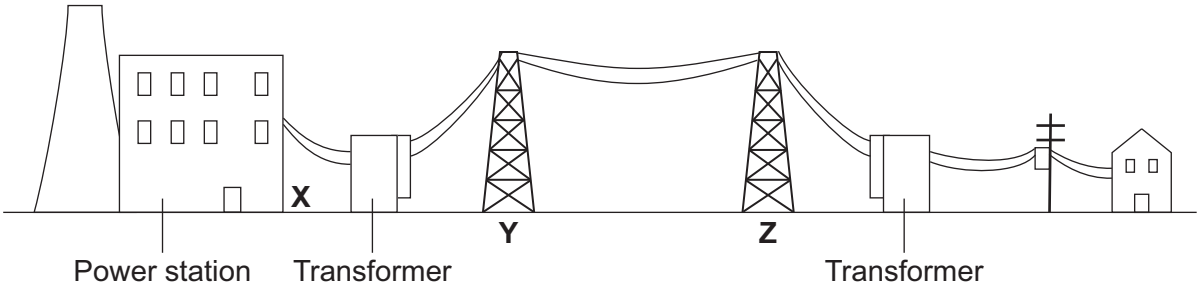
2 decrease the voltage and increase the current.

3 increase the voltage and decrease the current.

4 increase the voltage and increase the current.

Question 14 · continued

9D In the UK, electricity is transferred by the National Grid.



Which row in the table could give the correct voltages at **X**, **Y** and **Z**?

	X	Y	Z
1	25 kV	400 kV	25 kV
2	25 kV	400 kV	400 kV
3	400 kV	25 kV	25 kV
4	400 kV	400 kV	25 kV

END OF TEST

4.2.4.1 Power

Question 15

June 2010 | PHY2H | Original Q7 | Legacy

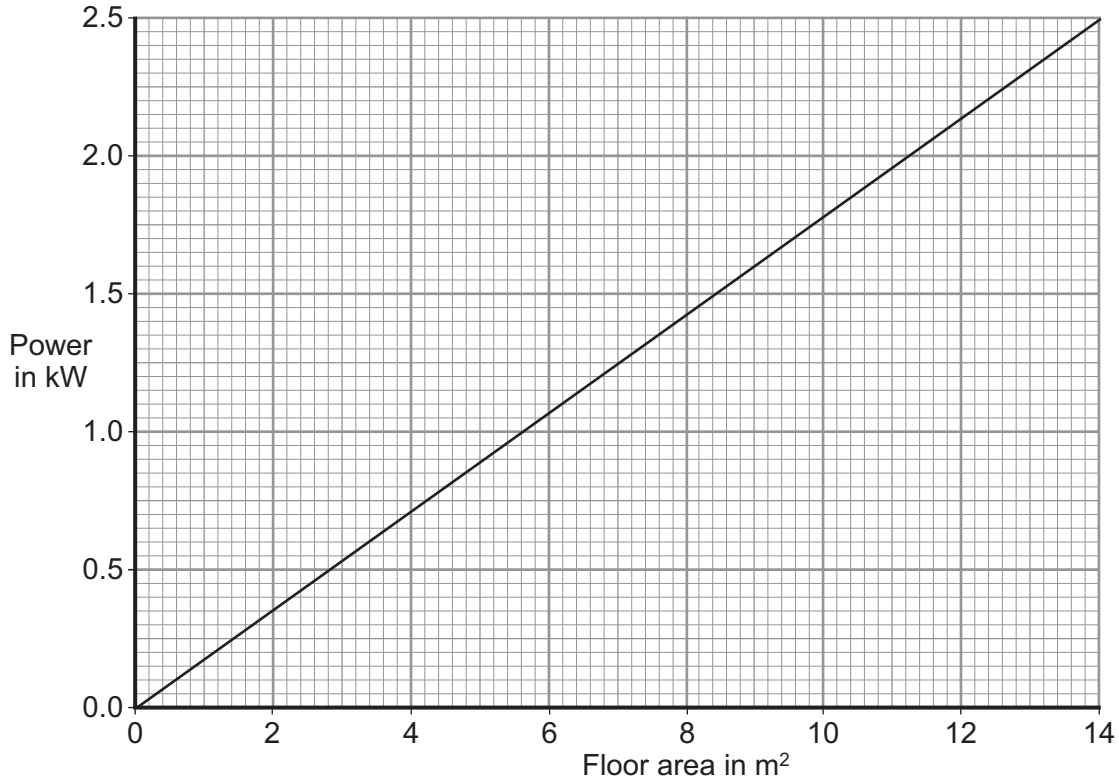
7 A homeowner has installed electric underfloor heating in the kitchen. When the heating is switched on, an electric current flows through wires running under the tiled floor surface.

7 (a) What is an electric current?

.....

(1 mark)

7 (b) The graph shows how the power output of an underfloor heating system depends on the area of the floor that is heated.



The area of the homeowner's kitchen floor is 9.0 m^2.

Use the graph and the equation in the box to calculate the current drawn from the 230 V mains supply by the heating system.

power = current × potential difference

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

.....

.....

.....

.....

Current = ...

(4 marks)

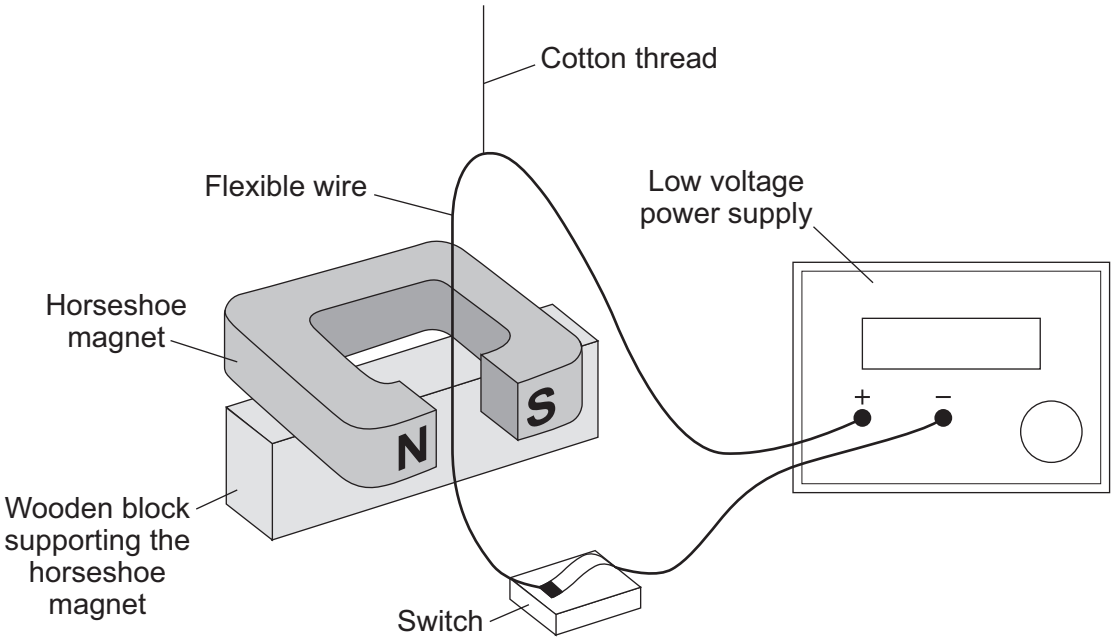
5

4.2.4.1 Power

Question 16

June 2010 | PHY3H | Original Q5 | Legacy

5 (a) A laboratory technician sets up a demonstration.



A flexible wire is suspended between the ends of a horseshoe magnet. The flexible wire hangs from a cotton thread. When the switch is closed, the wire kicks forward.

Identify the effect which is being demonstrated.

.....

(1 mark)

4.2.4.1 Power

Question 16 · continued

5 (b) A teacher makes some changes to the set-up of the demonstration.

What effect, if any, will each of the following changes have?

5 (b) (i) A more powerful horseshoe magnet is used.

.....

.....

(1 mark)

5 (b) (ii) The connections to the power supply are reversed.

.....

.....

(1 mark)

3

Turn over for the next question

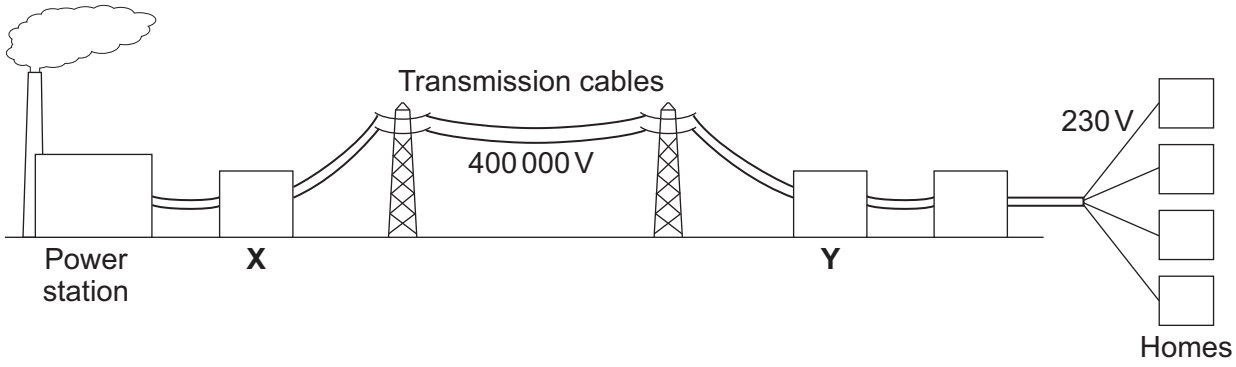
4.2.4.1 Power

Question 17

November 2010 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows a power station connected to the National Grid. The National Grid distributes the electrical energy to homes.



7A Which row in the table correctly describes the transformers **X** and **Y**?

	X	Y
1	step-down	step-down
2	step-down	step-up
3	step-up	step-down
4	step-up	step-up

7B Why is the voltage (potential difference) across the transmission cables of the National Grid very high?

1 so that the electricity travels faster

2 so that the electric current is large

3 to make the transmission of electricity safe

4 to reduce energy loss from the cables

7C A transformer changes both the voltage and the current.

Which row in the table correctly describes the changes of current in transformers **X** and **Y**?

	X	Y
1	decrease	decrease
2	decrease	increase
3	increase	decrease
4	increase	increase

4.2.4.1 Power

Question 17 · continued

7D In the power station, the boiler has an efficiency of 0.75. The turbine and generator system have an efficiency of 0.80.

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

For every 1000 J of energy supplied to the boiler, what is the useful output energy from the turbine and generator system?

1 600 J

2 750 J

3 800 J

4 1670 J

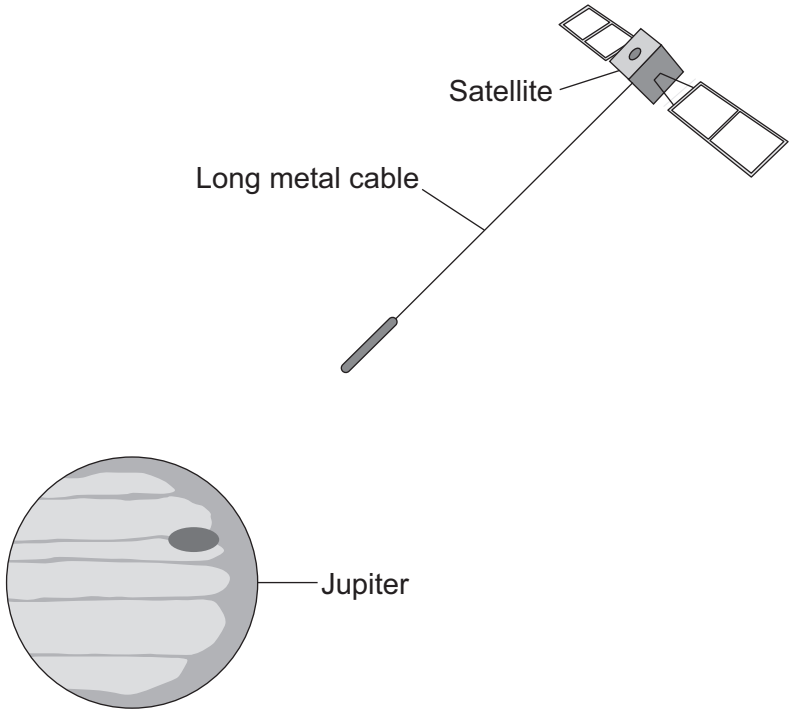
Turn over for the next question

4.2.4.1 Power

Question 18

7 Jupiter has a magnetic field which is more powerful than the magnetic field of any other planet in the Solar System.

Some scientists have suggested that, in the future, a long metal cable could hang from a satellite which orbits Jupiter. The cable would be part of a complete circuit.
This arrangement would produce electricity for the satellite.



7 (a) (i) What is the name of the effect that would produce electricity for the satellite?

.....

(1 mark)

7 (a) (ii) Describe how a potential difference is produced across the ends of the metal cable.

.....

.....

.....

.....

(2 marks)

4.2.4.1 Power

Question 18 · continued

7 (a) (iii) Why will the potential difference produce an electric current?

.....

.....

(1 mark)

7 (b) Other satellites in the Solar System could use the same effect to produce electricity in a similar way.

Suggest **two** reasons why the potential difference produced for another satellite might be **smaller** than the potential difference for the satellite in the diagram.

1 .....

.....

2 .....

.....

(2 marks)

6

4.2.4.1 Power

Question 19

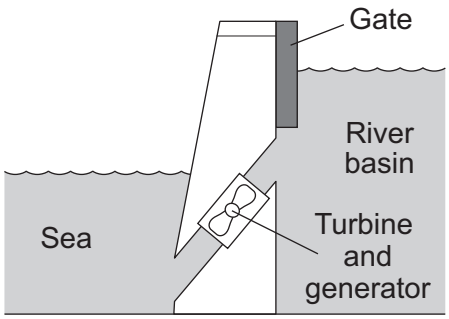
March 2011 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

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.

3A 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

4.2.4.1 Power

Question 19 · continued March 2011 | PHY1AP | Original Q3 | Legacy

3B 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.

3C 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.

3D 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.

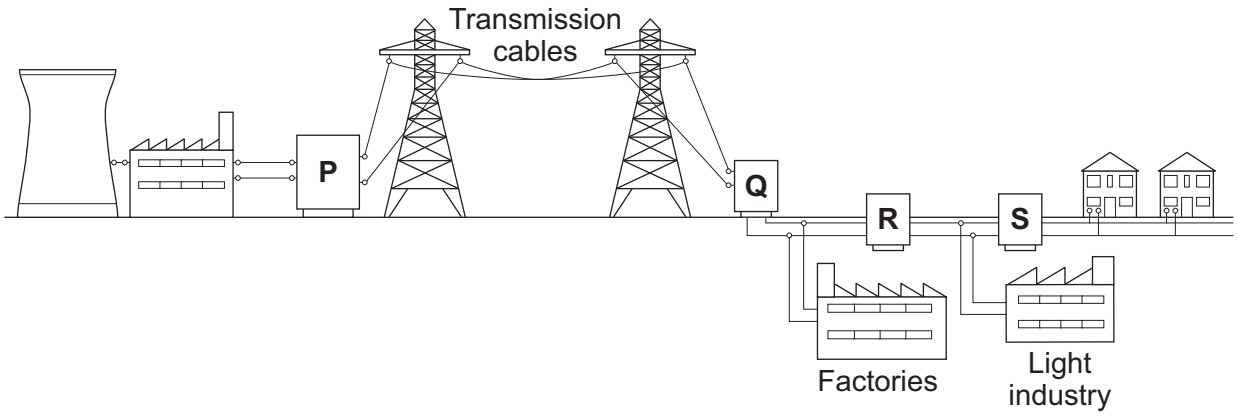
4.2.4.1 Power

Question 20

March 2011 | PHY1AP | Original Q8 | Legacy

QUESTION EIGHT

The diagram shows a power station supplying electricity to the National Grid. There are four transformers in the system, labelled **P**, **Q**, **R** and **S**.



8A Which row in the table correctly describes each transformer?

	P	Q	R	S
1	step up	step down	step down	step down
2	step down	step up	step up	step up
3	step up	step down	step up	step down
4	step up	step up	step down	step down

8B The voltage across the overhead transmission cables is very high.

The best explanation for this is that . . .

1 it allows thinner cables to be used and the energy loss from the cables is reduced.

2 the energy loss from the cables is reduced and it allows the distance between pylons to be reduced.

3 the distance between the pylons can be reduced and thicker cables can be used.

4 it allows the current to travel more slowly and thicker cables can be used.

Question 20 · continued

8C Changing the voltage between the power station and the transmission cables using transformer **P** also changes the current flowing and the efficiency of distribution.

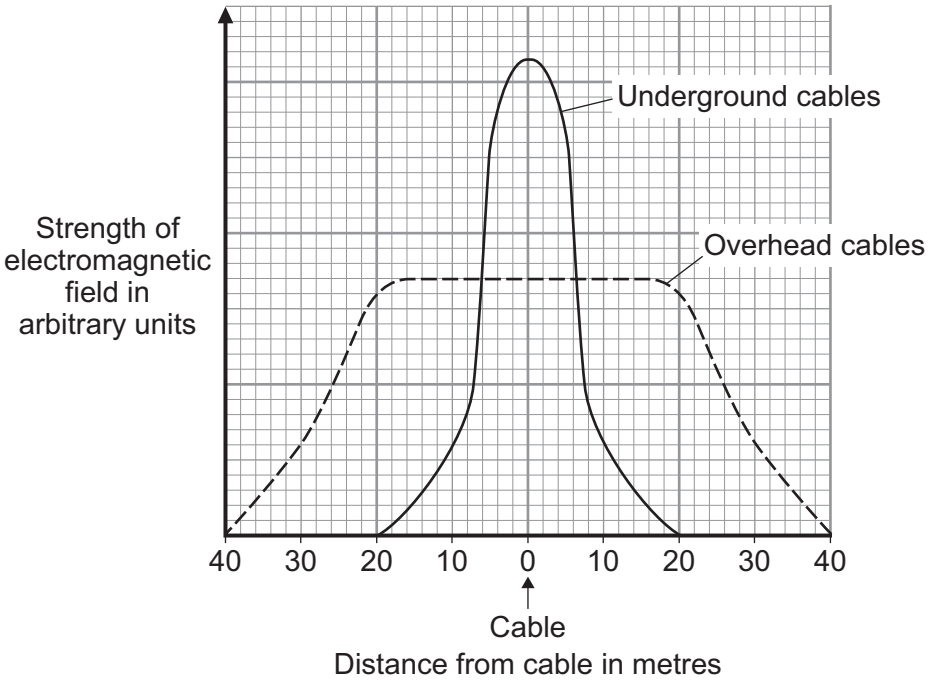
Which row of the table correctly shows these changes?

	Voltage	Current	Efficiency
1	increases	increases	increases
2	decreases	decreases	increases
3	decreases	decreases	decreases
4	increases	decreases	increases

8D Transmission cables can either be suspended from pylons above ground or they can be buried underground.

An electromagnetic field is produced when an electric current flows through a cable. Some people think that these fields can cause a health risk.

The graph shows how the strength of the electromagnetic field varies with distance from the cable for both overhead cables and underground cables.



Which of the following conclusions could be made from the graph?

1 When you are within 5 metres of the cable, the possible risk to health is bigger with an underground cable.

2 The possible health risk from overhead cables falls to zero when you are 20 metres away.

3 The biggest possible health risk from overhead cables occurs when you are 40 metres away.

4 Between 10 and 40 metres away, the biggest possible health risk is from underground cables.

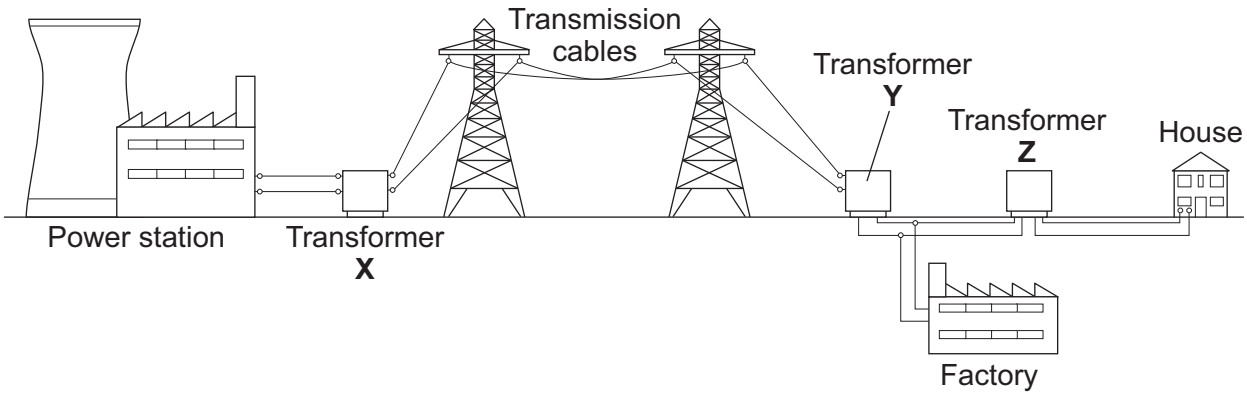
4.2.4.1 Power

Question 21

June 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

Transformers are used in the National Grid.



7A Both step-up transformers and step-down transformers are used in the National Grid.

Which row in the table shows the correct types of transformer?

	Transformer X	Transformer Y	Transformer Z
1	step-up	step-down	step-up
2	step-up	step-up	step-up
3	step-up	step-down	step-down
4	step-up	step-up	step-down

7B Transformer **X** changes the voltage between the power station and the transmission cables. It also changes the current. These changes affect the efficiency of the transmission cables.

Which row in the table correctly describes the changes produced by transformer **X**?

	Voltage	Current	Efficiency of transmission
1	decreased	decreased	decreased
2	decreased	increased	increased
3	increased	decreased	increased
4	increased	increased	increased

4.2.4.1 Power

Question 21 · continued

7C The table shows the percentage of energy wasted as heat and sound by four different transformers.

Which transformer has the highest efficiency?

Transformer	Percentage of energy supplied to transformer which is wasted as sound	Percentage of energy supplied to transformer which is wasted as heat
1	1.1	7.4
2	1.2	4.7
3	1.3	5.4
4	1.4	6.9

7D The amount of electricity that a device uses depends on the rate at which the device transforms energy and . . .

1 how long the device is switched on.

2 the current through the device.

3 the potential difference across the device.

4 the power of the device.

4.2.4.1 Power

Question 22

June 2011 | PHY2H | Original Q1 | Legacy

1 **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.

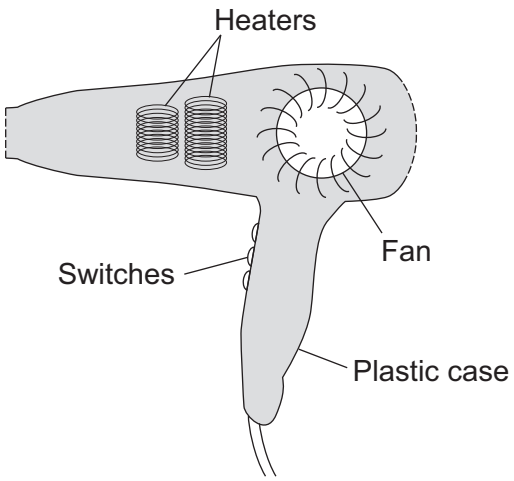


Diagram 1

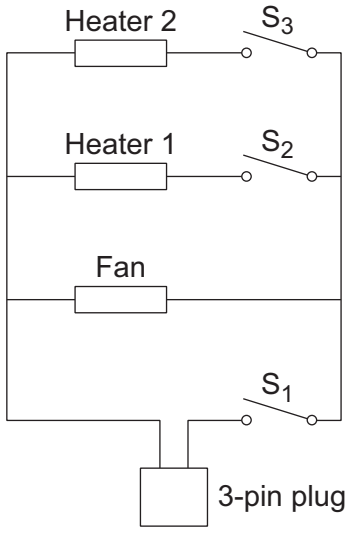


Diagram 2

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

.....

(1 mark)

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

.....

.....

(1 mark)

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

1 (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 22 · continued

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

Explain why.

.....

.....

.....

.....

.....

(2 marks)

1 (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 23

June 2011 | PHY3H | Original Q7 | Legacy

7 (a) In the National Grid, very large step-up transformers link power stations to the transmission cables.

A transformer used for this purpose has 800 turns on its primary coil and 12 800 turns on its secondary coil. The p.d. (potential difference) across its primary coil is 25 kV.

Use the equation in the box to calculate the p.d. across its secondary coil.

$$\frac{\text{p.d. across primary}}{\text{p.d. across secondary}} = \frac{\text{number of turns on primary}}{\text{number of turns on secondary}}$$

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

.....

.....

p.d. across secondary coil = ...

(3 marks)

7 (b) The primary and secondary coils of a transformer are made of insulated wire.

Why is this insulation necessary?

.....

.....

(1 mark)

7 (c) Describe what happens when an alternating potential difference is applied across the primary coil of a transformer.

.....

.....

.....

.....

.....

.....

(3 marks)

7

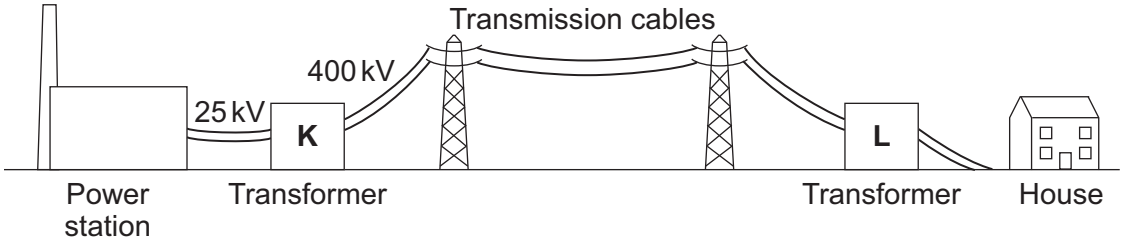
4.2.4.1 Power

Question 24

November 2011 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

Electricity is transmitted around the country through the National Grid.



6A The voltage from the power station is stepped up from 25 kV to 400 kV in transformer **K** so that . . .

1 the current decreases.

2 the current increases.

3 the current travels faster.

4 the current travels more slowly.

6B Increasing the voltage also . . .

1 increases energy losses from the cables.

2 makes the National Grid more efficient.

3 makes the National Grid safer.

4 means a step-down transformer is not needed.

6C Which row of the table shows what happens in transformer **L**?

	Current	Voltage
1	decreases	decreases
2	decreases	increases
3	increases	decreases
4	increases	increases

4.2.4.1 Power

6D The amount of electrical energy that a device transfers depends on . . .

1 the current flowing through the device only.

2 for how long the device is switched on only.

3 the power of the device only.

4 the power of the device and for how long it is switched on.

Turn over for the next question

4.2.4.1 Power

Question 25

January 2013 | PH1HP | Original Q6 | Legacy

6 About half of the UK's electricity is generated in coal-burning power stations and nuclear power stations.

6 (a) Coal-burning power stations and nuclear power stations provide a reliable way of generating electricity.

What is meant by *a reliable way of generating electricity*?

.....

.....

(1 mark)

6 (b) Over the next few years, most of the older nuclear power stations in the UK will be closed down, and the process of decommissioning will start.

What does it mean to *decommission* a nuclear power station?

.....

.....

(1 mark)

6 (c) Climate change has been strongly linked to the emission of carbon dioxide. Many governments around the world are committed to reducing carbon dioxide emissions.

Generating electricity can increase carbon dioxide emissions.

The companies generating electricity could reduce carbon dioxide emissions.

Give **two** ways the companies could do this.

1 .....

.....

2 .....

.....

(2 marks)

4.2.4.1 Power

Question 25 · continued

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

The voltage across the overhead cables of the National Grid needs to be much higher than the output voltage from the power station generators.

Explain why.

.....

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.....

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.....

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(3 marks)

7

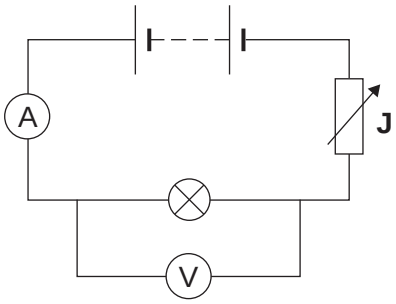
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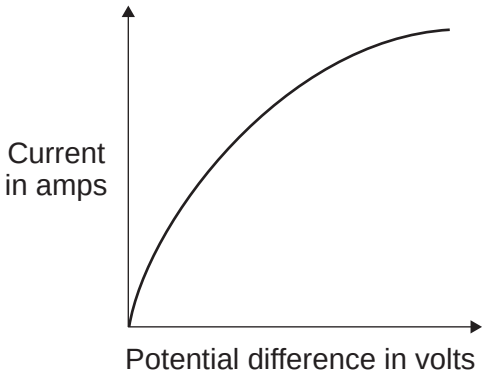
4.2.4.1 Power

Question 26

June 2013 | PH2HP | Original Q2 | Legacy

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





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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

2 (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 26 · continued

2 (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.

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(6 marks)

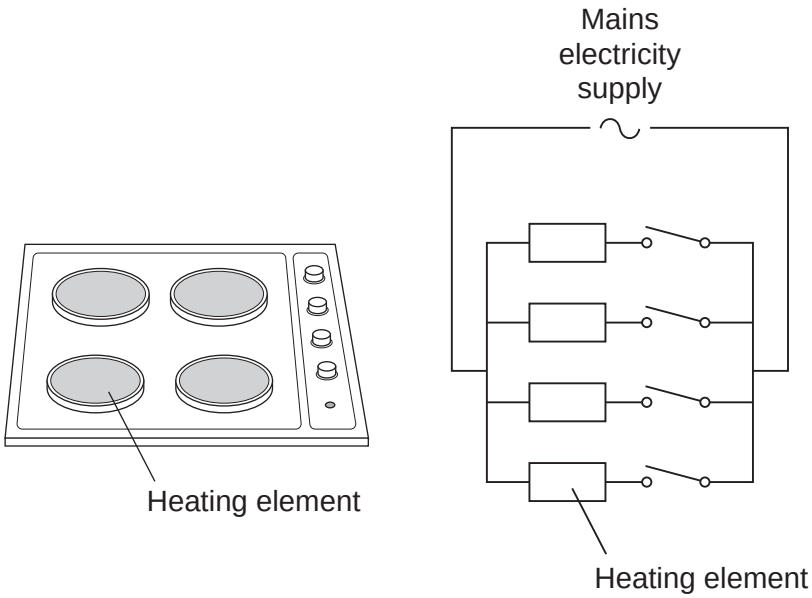
11

4.2.4.1 Power

Question 27

June 2013 | PH2HP | Original Q6 | Legacy

6 The picture shows an electric cooker hob. The simplified circuit diagram shows how the four heating elements connect to the mains electricity supply. The heating elements are identical.



When all four heating elements are switched on at full power the hob draws a current of 26 A from the 230 V mains electricity supply.

6 (a) Calculate the resistance of one heating element when the hob is switched on at full power.

Use the correct equation from the Physics Equations Sheet.

Give your answer to 2 significant figures.

.....

.....

.....

Resistance = ... Ω

(3 marks)

Question 6 continues on the next page

4.2.4.1 Power

Question 27 · continued

6 (b) The table gives the maximum current that can safely pass through copper wires of different cross-sectional area.

Cross-sectional area in mm^2	Maximum safe current in amps
1.0	11.5
2.5	20.0
4.0	27.0
6.0	34.0

6 (b) (i) The power sockets in a home are wired to the mains electricity supply using cables containing 2.5 mm^2 copper wires. Most electrical appliances are connected to the mains electricity supply by plugging them into a standard power socket.

It would **not** be safe to connect the electric cooker hob to the mains electricity supply by plugging it into a standard power socket.

Why?

.....

.....

.....

.....

(2 marks)

6 (b) (ii) Describe the structure of the cable that should be used to connect the electric cooker hob to the mains electricity supply.

.....

.....

.....

.....

.....

.....

.....

.....

(3 marks)

4.2.4.1 Power

Question 27 · continued

6 (c) Mains electricity is an alternating current supply. Batteries supply a direct current.

What is the difference between an alternating current and a direct current?

.....

.....

.....

.....

(2 marks)

10

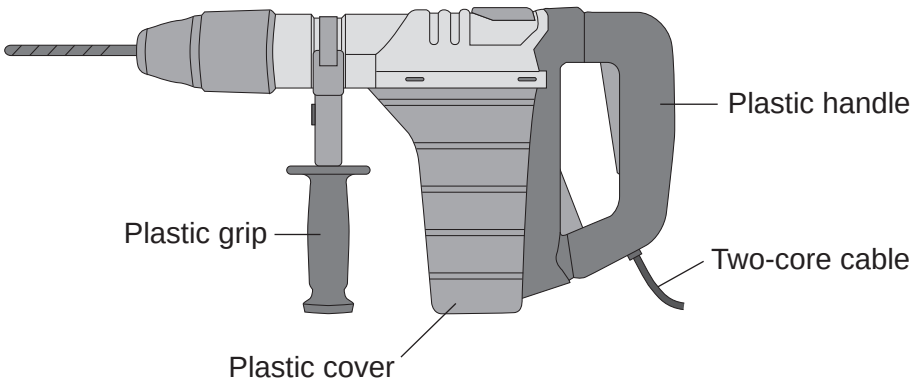
4.2.4.1 Power

Question 28

June 2014 | PH2HP | Original Q7 | Legacy

7 **Figure 8** shows an electric drill.

Figure 8



The information in the box is taken from the booklet supplied with the drill.

- This drill is fitted with a two-core cable
- Power supply: 230 V a.c. 50 Hz
- Power input: 1012 W
- Mass: 6 kg

7 (a) Why is it safe for this drill to be fitted with a two-core cable rather than a three-core cable?

[1 mark]

.....

.....

.....

7 (b) Calculate the current drawn from the mains electricity supply by the drill.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Current = ... A

4.2.4.1 Power

Question 28 · continued

7 (c) It is advisable to use all 230 V power tools with a residual current circuit breaker (RCCB).

How does an RCCB operate?

[1 mark]

.....

.....

.....

4

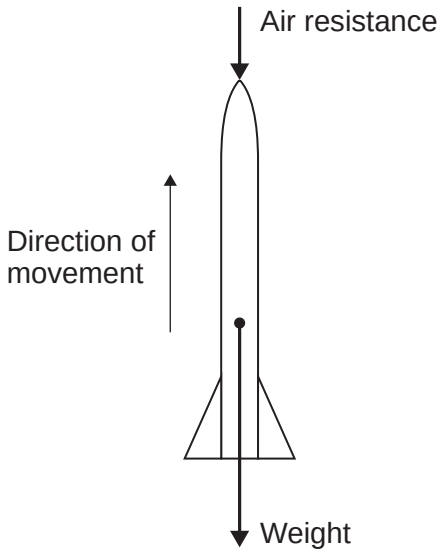
4.2.4.1 Power

Question 29

June 2015 | PH2HP | Original Q6 | Legacy

6 (a) **Figure 7** shows the forces acting on a model air-powered rocket just after it has been launched vertically upwards.

Figure 7



6 (a) (i) How does the velocity of the rocket change as the rocket moves **upwards**?

[2 marks]

.....

Give a reason for your answer.

.....

.....

6 (a) (ii) The velocity of the rocket is not the same as the speed of the rocket.

What is the difference between the velocity of an object and the speed of an object?

[1 mark]

.....

.....

.....

4.2.4.1 Power

Question 29 · continued

6 (b) The speed of the rocket just after being launched is 12 m/s.
The mass of the rocket is 0.05 kg.

6 (b) (i) Calculate the kinetic energy of the rocket just after being launched.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Kinetic energy = ... J

6 (b) (ii) As the rocket moves upwards, it gains gravitational potential energy.

State the maximum gravitational potential energy gained by the rocket.

Ignore the effect of air resistance.

[1 mark]

Maximum gravitational potential energy = ... J

6 (b) (iii) Calculate the maximum height the rocket will reach.

Ignore the effect of air resistance.

Gravitational field strength = 10 N/kg.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Maximum height = ... m

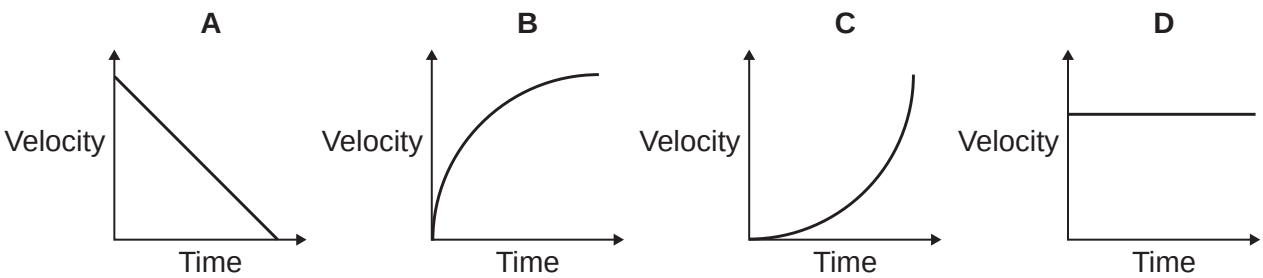
Question 6 continues on the next page

4.2.4.1 Power

Question 29 · continued

6 (b) (iv) **Figure 8** shows four velocity–time graphs.

Figure 8



Taking air resistance into account, which graph, **A**, **B**, **C** or **D**, shows how the velocity of the rocket changes as it **falls** from the maximum height it reached until it just hits the ground?

[1 mark]

Write the correct answer in the box.

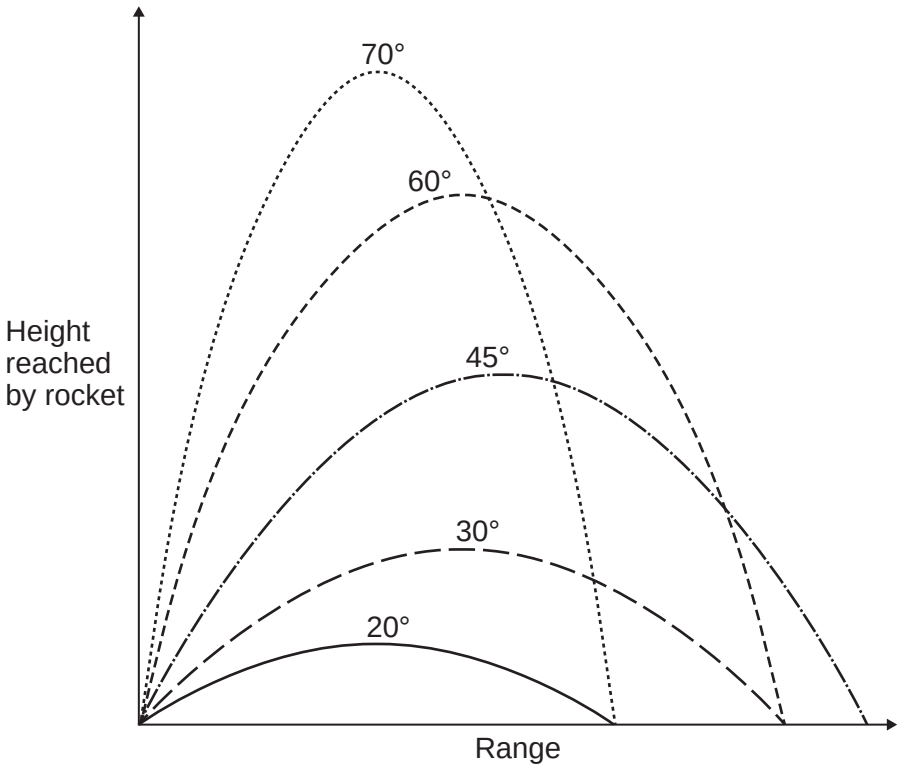
4.2.4.1 Power

Question 29 · continued

6 (c) The rocket can be launched at different angles to the horizontal.
The horizontal distance the rocket travels is called the range.

Figure 9 shows the paths taken by the rocket when launched at different angles.
Air resistance has been ignored.

Figure 9



What pattern links the angle at which the rocket is launched and the range of the rocket?

[2 marks]

.....

.....

.....

.....

11

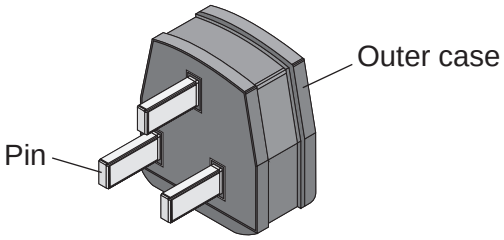
4.2.4.1 Power

Question 30

June 2016 | PH2HP | Original Q4 | Legacy

4 (a) A washing machine is connected to the mains electricity supply using a cable and three-pin plug.
Figure 9 shows a three-pin plug.

Figure 9



Name the materials used in the structure of a plug. Give the reason why each material is used.

[2 marks]

Pin _____

_____

Outer case _____

_____

4 (b) The three-pin plug contains a fuse. The fuse is connected to one of the wires inside the cable.

4 (b) (i) Which **one** of the wires inside the cable is the fuse connected to?

[1 mark]

_____

4 (b) (ii) The fuse is a thin wire inside a closed glass tube. The wire acts as a resistor.

What effect does a current through a wire have on the wire?

[1 mark]

_____

4.2.4.1 Power

Question 30 · continued

4 (b) (iii) The power of the washing machine varies between 0.7 kW and 2 kW depending on which part of the wash cycle is operating.

Calculate the maximum current drawn from the mains electricity supply by the washing machine.

The mains electricity supply is at a potential difference of 230 V.

Use the correct equation from the Physics Equations Sheet.

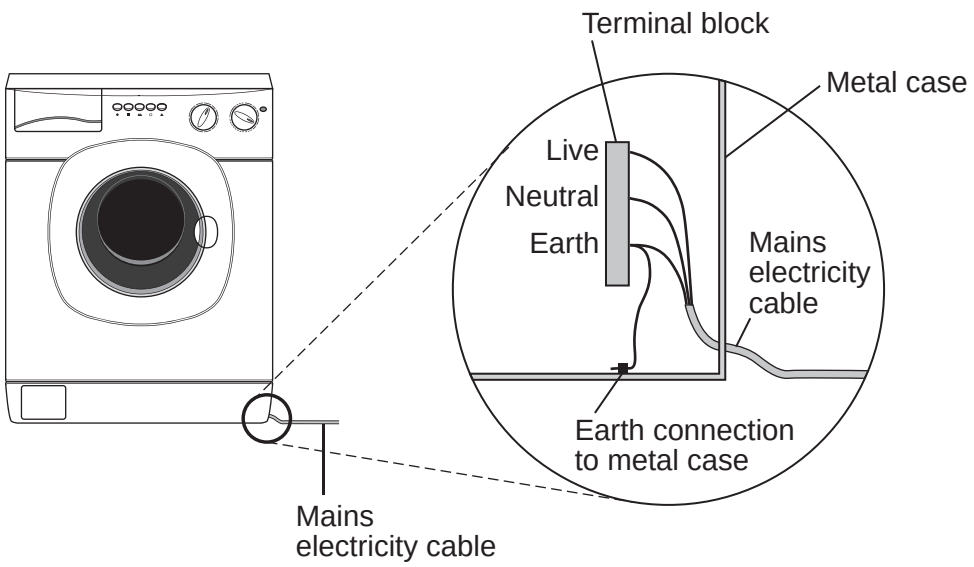
[2 marks]

Current = _____ A

Question 4 continues on the next page

4 (c) **Figure 10** shows how the mains electricity cable is connected to the washing machine.
The earth wire is connected to the metal case of the washing machine.

Figure 10



If a fault makes the metal case live, the earth wire and fuse inside the plug prevent the mains cable from overheating and causing a fire.

Explain how.

[2 marks]

4 (d) New research has shown that many people underestimate the hazards of using mains electricity.

It is important that people do understand the hazards of using mains electricity.
Suggest why.

[1 mark]

9

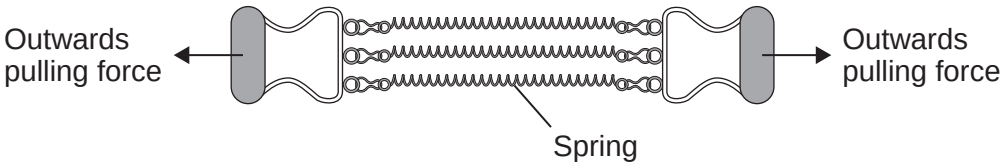
4.2.4.1 Power

Question 31

June 2016 | PH2HP | Original Q5 | Legacy

5 **Figure 11** shows an exercise device called a chest expander. The three springs are identical.

Figure 11



A person pulls outwards on the handles and does work to stretch the springs.

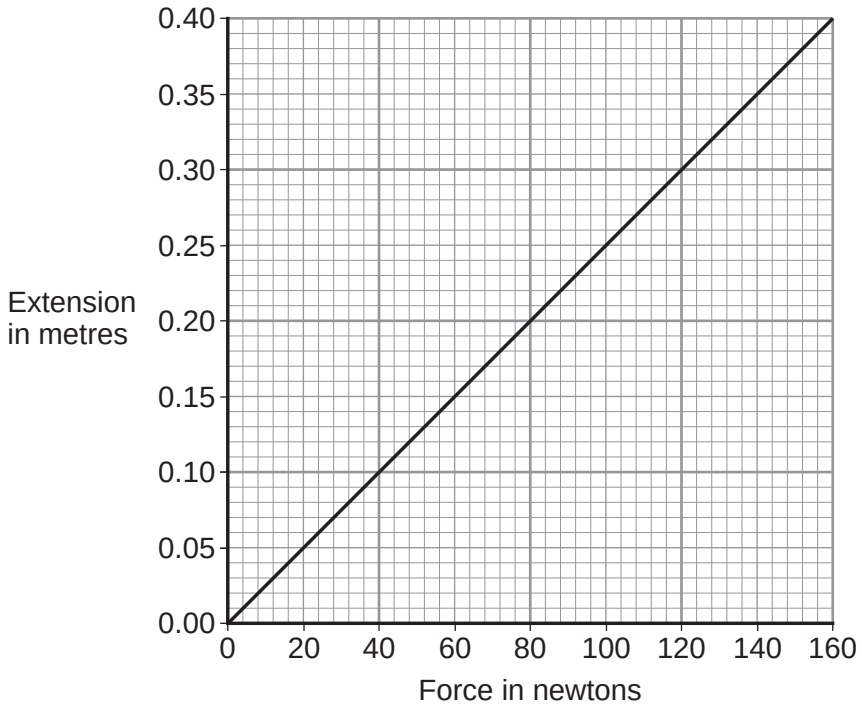
5 (a) Complete the following sentence.

[1 mark]

When the springs are stretched _____ _____ energy is stored in the springs.

5 (b) **Figure 12** shows how the extension of a single spring from the chest expander depends on the force acting on the spring.

Figure 12



4.2.4.1 Power

Question 31 · continued

5 (b) (i) How can you tell, from **Figure 12**, that the limit of proportionality of the spring has not been exceeded?

[1 mark]

_____

_____

5 (b) (ii) Use data from **Figure 12** to calculate the spring constant of the spring.
Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

_____

_____

_____

Spring constant = _____ Unit _____

5 (b) (iii) Three identical resistors joined in parallel in an electrical circuit share the total current in the circuit.

In a similar way, the three springs in the chest expander share the total force exerted.

By considering this similarity, use **Figure 12** to determine the total force exerted on the chest expander when each spring is stretched by 0.25 m.

[2 marks]

_____

_____

Total force = _____ N

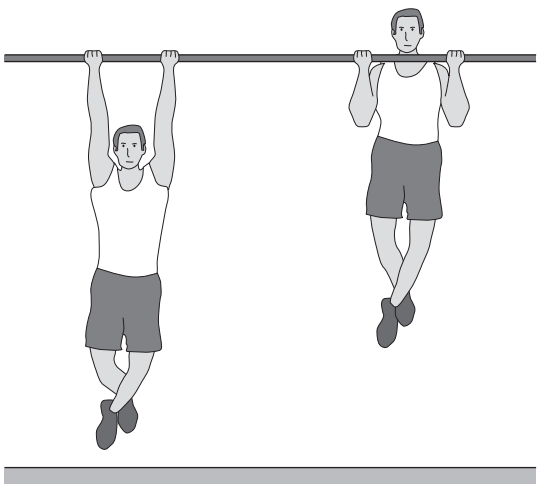
Question 5 continues on the next page

4.2.4.1 Power

Question 31 · continued

5 (c) The student in **Figure 13** is doing an exercise called a chin-up.

Figure 13



Each time the student does one chin-up he lifts his body 0.40 m vertically upwards.
The mass of the student is 65 kg.
The student is able to do 12 chin-ups in 60 seconds.

Calculate the power developed by the student.

Gravitational field strength = 10 N/kg

Use the correct equations from the Physics Equations Sheet.

[3 marks]

Power = _____ W

10

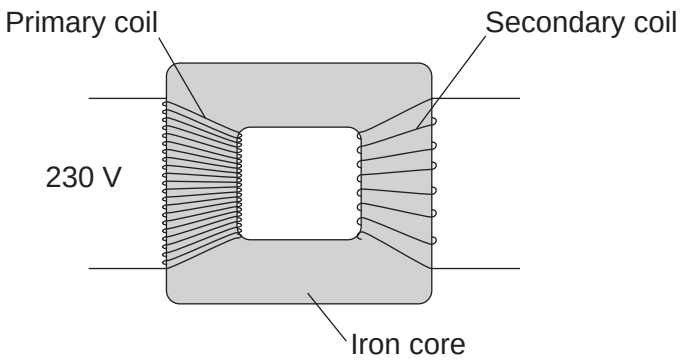
4.2.4.1 Power

Question 32

June 2016 | PH3HP | Original Q2 | Legacy

2 **Figure 2** shows the structure of a traditional transformer.

Figure 2



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

State what is produced in the iron core.

[2 marks]

_____

_____

2 (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 2 continues on the next page

Question 32 · continued

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

State why.

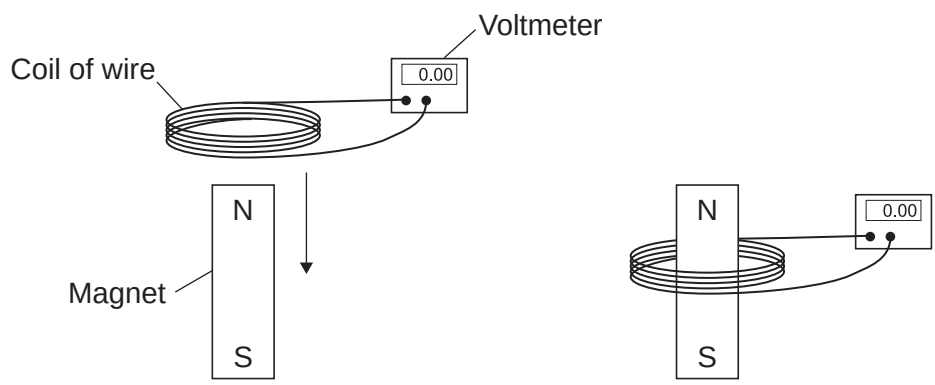
[1 mark]

_____

_____

2 (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 3**.

Figure 3



The students recorded the maximum potential difference for coils with different numbers of turns of wire. The results are shown in **Table 1**.

Table 1

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 32 · continued

2 (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 _____

_____

2 (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]

_____

_____

2 (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]

_____

_____

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

[1 mark]

_____

2 (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

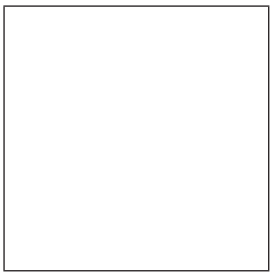
Question 33

June 2017 | PH2HP | Original Q5 | Legacy

5 The lighting in a home may be provided by LED bulbs, filament bulbs or halogen bulbs.

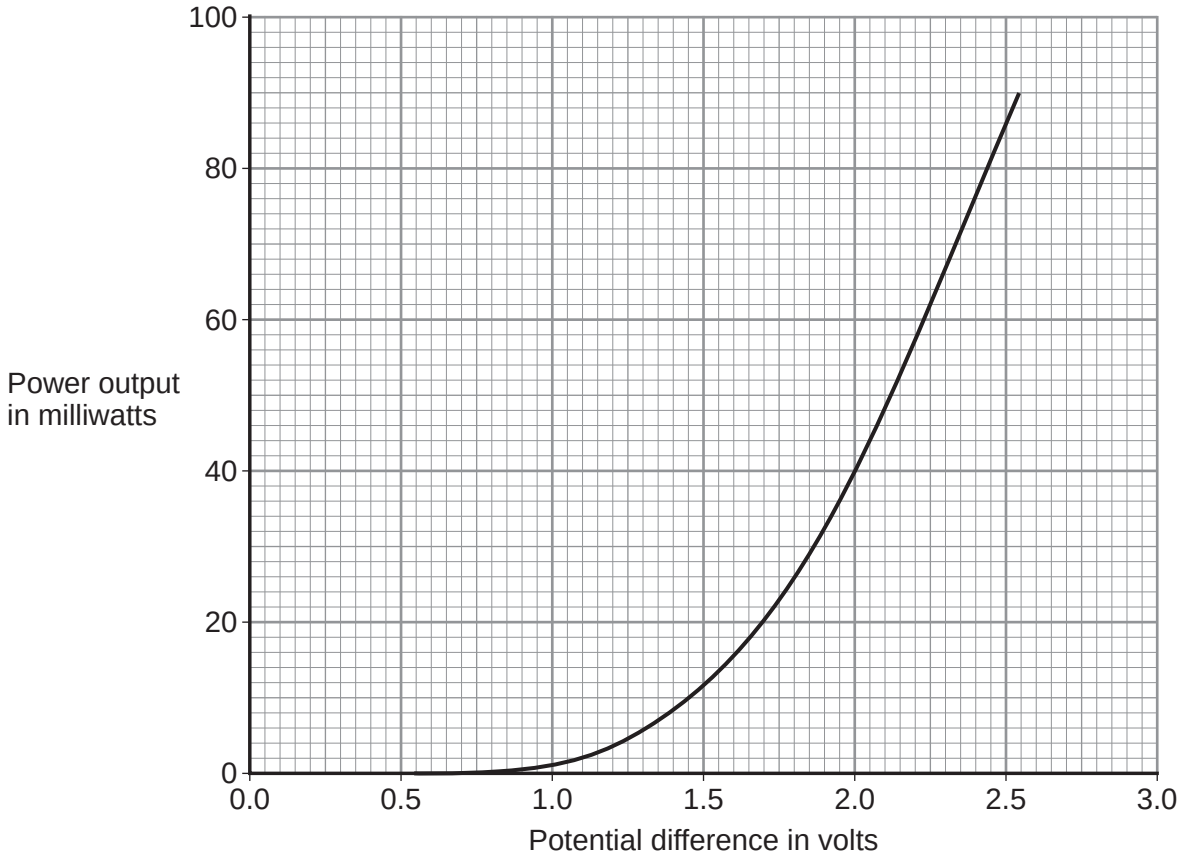
5 (a) (i) In the box below, draw the circuit symbol for an LED.

[1 mark]



5 (a) (ii) **Figure 6** shows how the power output from one type of LED varies with the potential difference across the LED.

Figure 6



1 milliwatt = 0.001 W

4.2.4.1 Power

Question 33 · continued

The LED is connected in series with a battery and resistor.
The potential difference across the LED is 2.0 V

Use data from **Figure 6** to calculate the energy transferred by the LED in 5 minutes.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Energy transferred = _____ J

5 (b) The resistance of a filament bulb increases as the temperature of the filament increases.

Explain, in terms of the electrons and ions inside the filament, why the resistance increases.

[2 marks]

5 (c) Why are LED bulbs cheaper to use than filament bulbs or halogen bulbs that produce the same brightness of light?

[1 mark]

7

4.2.4.1 Power

Question 34

June 2018 | 8463/1H | Original Q4

0 4 **Figure 5** shows a cyclist riding along a straight, level road at a constant speed.

Figure 5



0 4 . 1 Complete the sentences.

[2 marks]

As the cyclist rides along the road, the _____ energy store in the cyclist's body decreases.

The speed of the cyclist is constant when the work done by the cyclist is _____ the work done against air resistance.

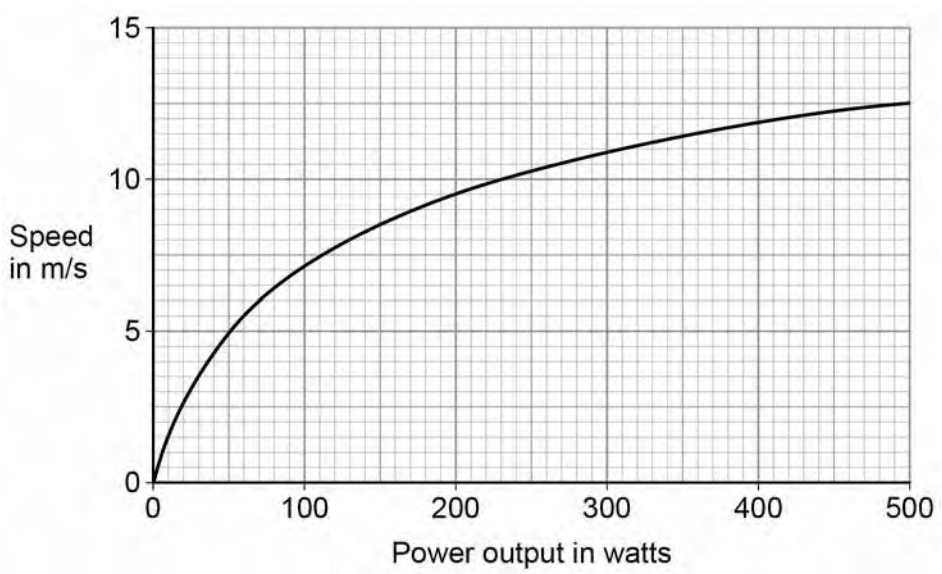
Question 4 continues on the next page

4.2.4.1 Power

Question 34 · continued

Figure 6 shows how the speed changes as the power output of the cyclist changes.

Figure 6



0 4 . 2 Write down the equation that links power, time and work done.

[1 mark]

0 4 . 3 Calculate the work done by the cyclist when his power output is 200 W for 1800 seconds.

[3 marks]

Work done = _____ J

4.2.4.1 Power

Question 34 · continued

0 4 . 4 Calculate the percentage increase in speed of the cyclist when the power output changes from 200 W to 300 W.

[2 marks]

Percentage increase in speed = _____

0 4 . 5 The maximum speed this cyclist can travel on a level road is 14 m/s.

How does cycling uphill affect the maximum speed of this cyclist?

Explain your answer.

[3 marks]

11

4.2.4.1 Power

Question 35

June 2018 | 8463/1H | Original Q5

0 5 . 1 Complete the sentence. Choose answers from the box.

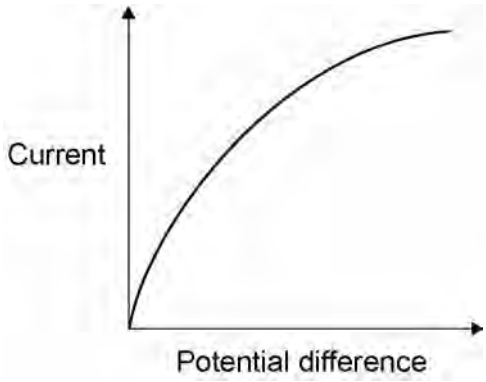
[2 marks]

charge	**potential difference**	**power**	**temperature**	**time**

The current through an ohmic conductor is directly proportional to the _____ across the component, provided that the _____ remains constant.

0 5 . 2 **Figure 7** shows a current – potential difference graph for a filament lamp.

Figure 7



Explain how the resistance of a filament lamp changes as the potential difference across it increases.

[3 marks]

4.2.4.1 Power

Question 35 · continued

0 5 . 3 Many householders are replacing their filament lamps with LED lamps which are more energy efficient.

What does more energy efficient mean?

[1 mark]

Question 5 continues on the next page

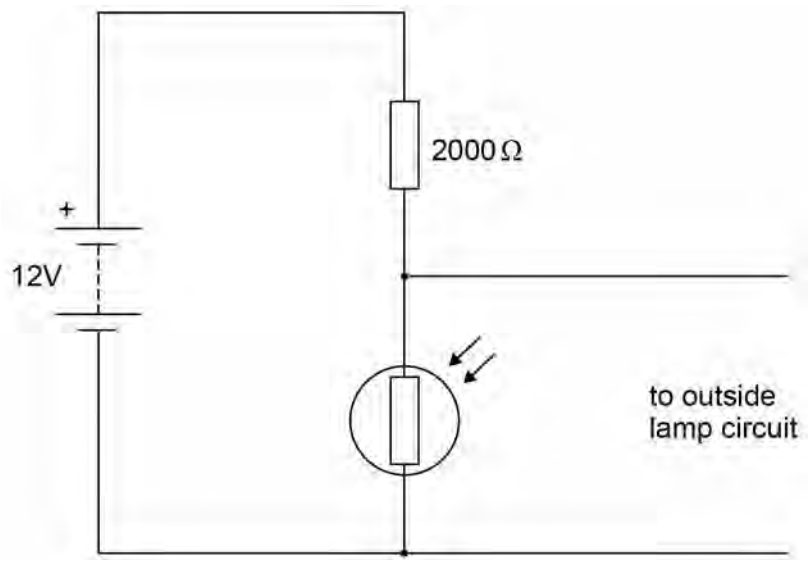
4.2.4.1 Power

Question 35 · continued

A Light Dependent Resistor (LDR) is used to turn on an outside lamp when it gets dark.

Part of the circuit is shown in **Figure 8**.

Figure 8



0 5 . 4 The light intensity decreases.

What happens to the potential difference across the LDR and the current in the LDR?

[2 marks]

Potential difference _____

Current _____

0 5 . 5 What is the resistance of the LDR when the potential difference across it is 4 V?

Give a reason for your answer.

[2 marks]

Resistance = _____ Ω

Reason _____

_____

_____

4.2.4.1 Power

Question 35 · continued

0 5 . 6 Calculate the current through the LDR when the resistance of the LDR is 5000 Ω.

Give your answer to 2 significant figures.

[4 marks]

Current = _____ A

14

Turn over for the next question

4.2.4.1 Power

Question 36

June 2018 | 8463/1H | Original Q9

0 9 **Figure 15** shows a coffee machine. The coffee machine uses an electric element to heat water.

Figure 15



0 9 . 1 The coffee machine has a metal case.

Why would it be dangerous for the live wire of the electric cable to touch the metal case?

[1 mark]

0 9 . 2 The power output of the coffee machine is 2.53 kW.

The mains potential difference is 230 V.

Calculate the current in the coffee machine.

[3 marks]

Current = _____ A

4.2.4.1 Power

Question 36 · continued

0 9 . 3 The coffee machine heats water from 20 °C to 90 °C.

The power output of the coffee machine is 2.53 kW.

The specific heat capacity of water is 4200 J/kg °C.

Calculate the mass of water that the coffee machine can heat in 14 seconds.

[5 marks]

Mass = _____ kg

9

4.2.4.1 Power

Question 37

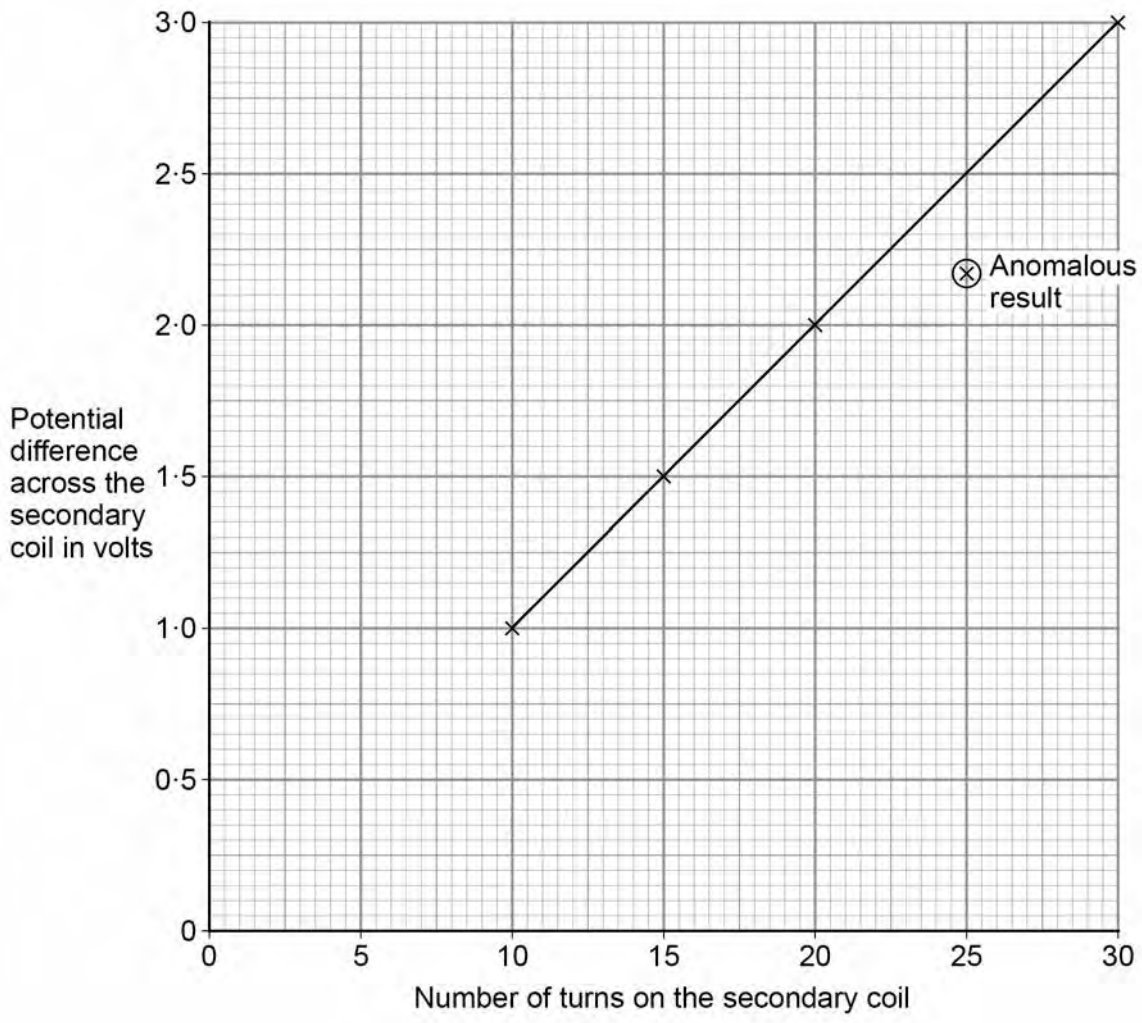
June 2018 | 8463/2H | Original Q7

0 7 A student used a simple transformer to investigate how the number of turns on the secondary coil affects the potential difference (p.d.) across the secondary coil.

The student kept the p.d. across the primary coil fixed at 2V.

Figure 12 shows the results collected by the student.

Figure 12



0 7 . 1 **Figure 12** contains one anomalous result.

Suggest **one** possible reason why this anomalous result occurred.

[1 mark]

4.2.4.1 Power

Question 37 · continued

0 7 . 2 The transformer changes from being a step-down to a step-up transformer.

How can you tell from **Figure 12** that this happens?

[1 mark]

Question 7 continues on the next page

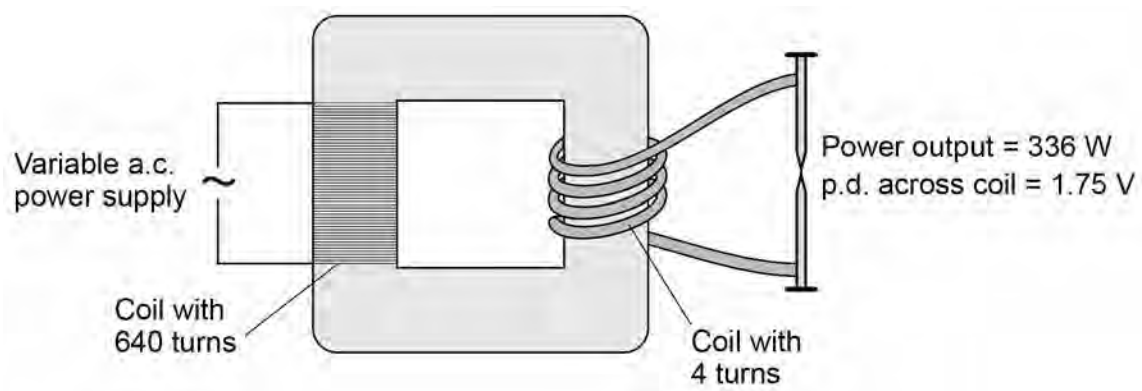
4.2.4.1 Power

Question 37 · continued

A spot-welder is a device that uses a transformer to produce a large current to join sheets of metal together.

Figure 13 shows a transformer demonstrating how a large current can heat and join two nails together.

Figure 13



0 7 . 3 How does the amount of infrared radiation emitted by the nails change when the power supply is switched on?

[1 mark]

0 7 . 4 Calculate the current from the power supply needed to provide a power output of 336 W.

Use the data in **Figure 13**.

The transformer is 100% efficient.

[5 marks]

Current = _____ A

8

4.2.4.1 Power

Question 38

June 2019 | 8463/1H | Original Q1

0 1 Light bulbs are labelled with a power input.

0 1 . 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 1 . 2 Write down the equation which links current, potential difference and power.

[1 mark]

_____

0 1 . 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 38 · continued

Table 1 shows information about three different light bulbs.

Table 1

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 1 . 4 Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

0 1 . 5 Calculate the value of **X** in **Table 1**.

[3 marks]

X = _____ W

0 1 . 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]

11

4.2.4.1 Power

Question 39

June 2019 | 8463/1H | Original Q6

0 6 **Figure 7** shows a person using an electric lawn mower.

Figure 7



0 6 . 1 The lawn mower is connected to the mains electricity supply.

What is the frequency of the mains electricity supply in the UK?

[2 marks]

Frequency = _____ Unit _____

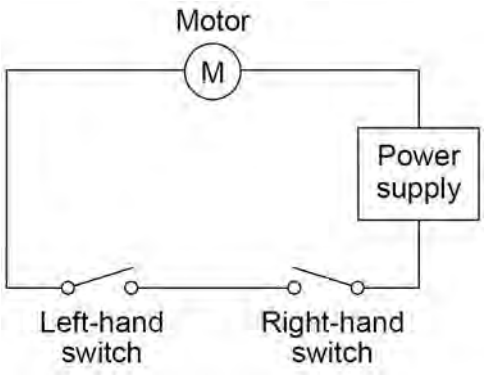
4.2.4.1 Power

Question 39 · continued

The lawn mower has a switch on each side of the handle.

Figure 8 shows the circuit diagram for the lawn mower.

Figure 8



0 6 . 2 The motor in the lawn mower can only be turned on when the person using it holds the handle of the lawn mower with both hands.

Explain why.

[2 marks]

0 6 . 3 The power input to the motor is 1.8 kW

The resistance of the motor is 32 Ω

Calculate the current in the motor.

[3 marks]

Current = _____ A

4.2.4.1 Power

Question 39 · continued

0 6 . 4 The useful power output from the motor is 1.5 kW

Calculate the time it takes for the motor to transfer 450 000 J of useful energy.

[3 marks]

Time = _____ seconds

1

4.2.4.1 Power

Question 40

November 2020 | 8463/1H | Original Q2

0 2 **Figure 3** shows an LED torch.

Figure 3

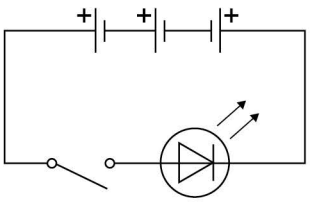


0 2 . 1 The torch contains one LED, one switch and three cells.

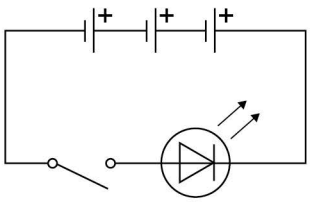
Which diagram shows the correct circuit for the torch?

[1 mark]

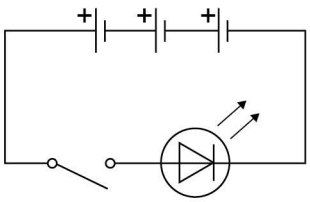
Tick (✓) **one** box.



☐



☐



☐

4.2.4.1 Power

Question 40 · continued

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

[1 mark]

0 2 . 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 2 . 4 When replaced, the cells were put into the torch the wrong way around.

Explain why the torch did not work.

[2 marks]

Question 2 continues on the next page

4.2.4.1 Power

Question 40 · continued

0 2 . 5 Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

0 2 . 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

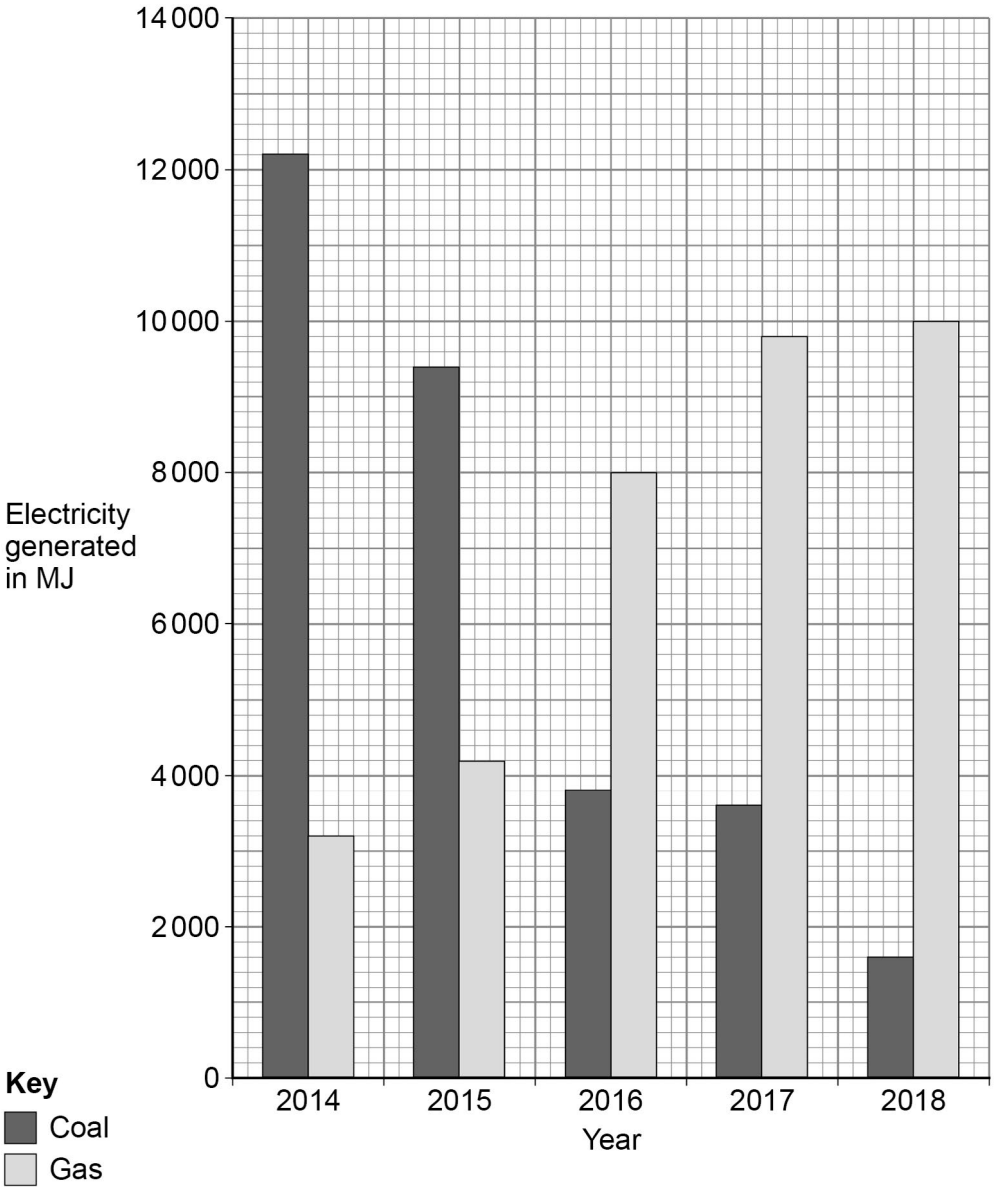
4.2.4.1 Power

Question 41

November 2020 | 8463/1H | Original Q4

0 4 **Figure 6** shows how much electricity was generated using coal-fired and gas-fired power stations in January for 5 years in the UK.

Figure 6



0 4 . 1 Determine the percentage increase in electricity generated using gas-fired power stations from 2014 to 2018.

[2 marks]

Percentage increase = _____ %

4.2.4.1 Power

Question 41 · continued

0 4 . 2 Give **two** environmental advantages of using a gas-fired power station to generate electricity compared with using a coal-fired power station.

[2 marks]

1 _____

_____

2 _____

_____

Question 4 continues on the next page

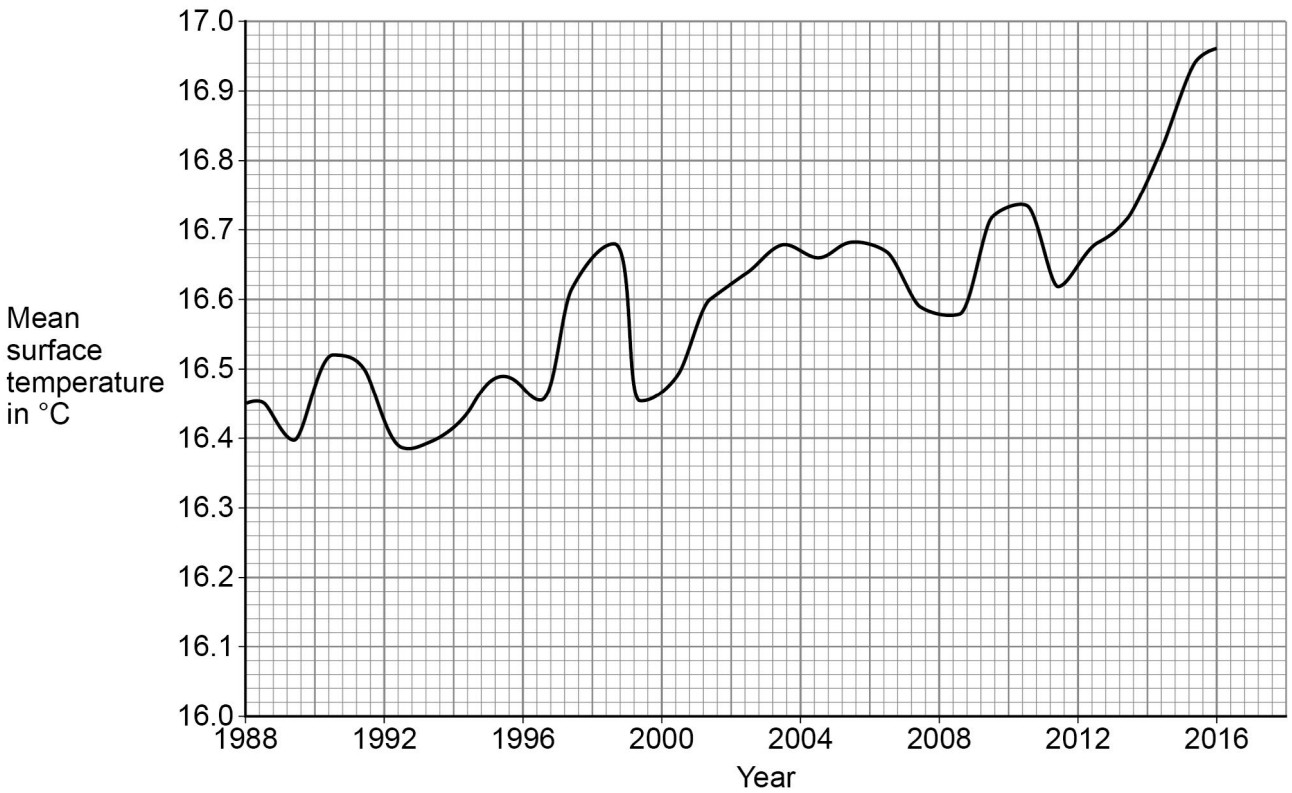
Question 41 · continued

The mean surface temperature of the sea changes throughout the year.

A change in the mean surface temperature from year to year indicates climate change.

Figure 7 shows how the mean surface temperature changed between 1988 and 2016.

Figure 7



0 4 . 3 A student does not believe that climate change is occurring.

Explain how the data in **Figure 7** suggests the student is wrong.

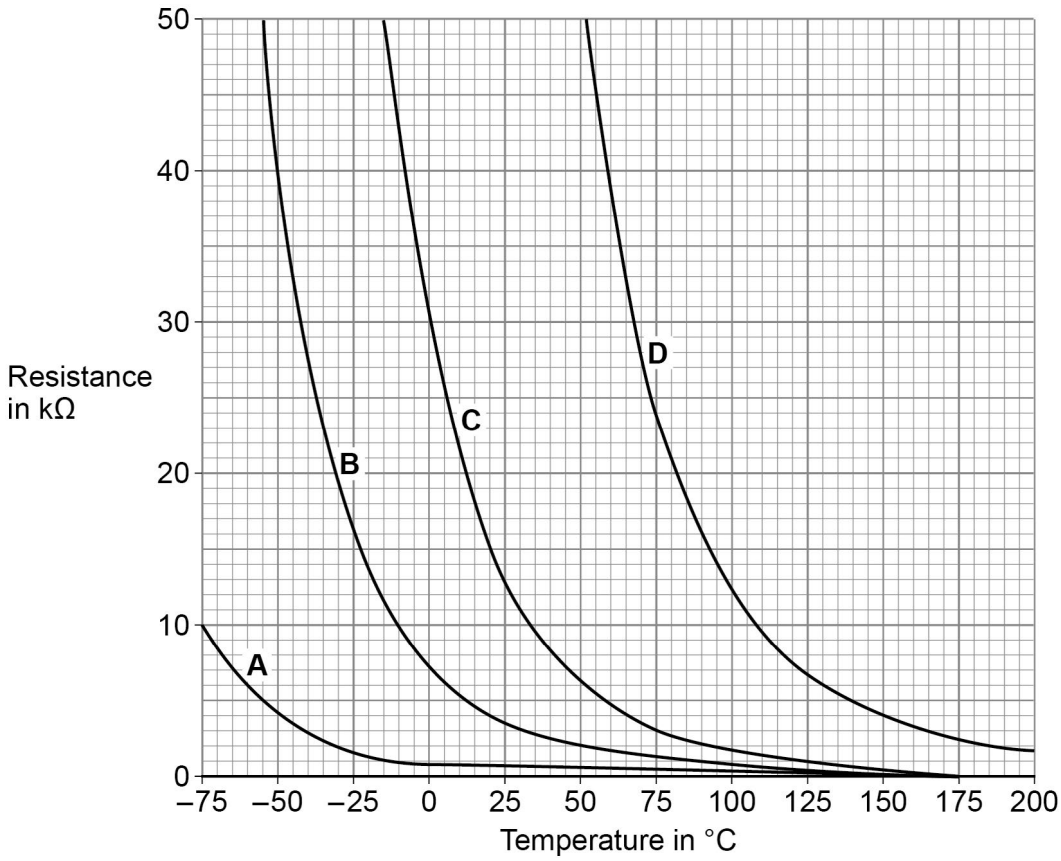
[2 marks]

Question 41 · continued

0 4 . 4 A thermistor can be used to measure temperature.

Figure 8 shows how the resistance of four different thermistors A, B, C and D, varies with temperature.

Figure 8



Which of the four thermistors would be the most suitable to measure the surface temperature of the sea?

Tick (✓) **one** box.

Explain your answer.

[3 marks]

A	B	C	D
☐	☐	☐	☐

9

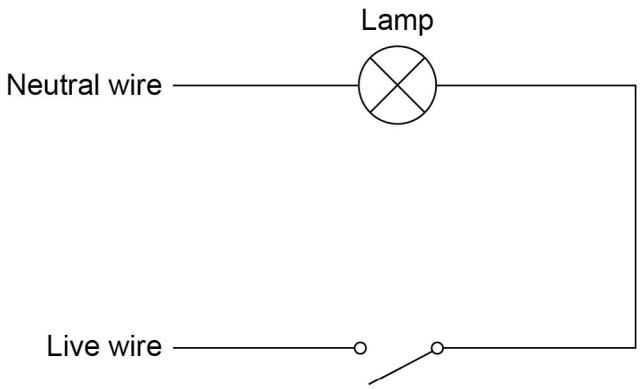
4.2.4.1 Power

Question 42

November 2020 | 8463/1H | Original Q9

0 9 **Figure 13** shows part of a mains electricity lighting circuit in a house.

Figure 13



0 9 . 1 A fault in the switch caused a householder to receive a mild electric shock before a safety device switched the circuit off.

The mean power transfer to the person was 5.75 W.

The potential difference across the person was 230 V.

Calculate the resistance of the person.

[5 marks]

Resistance = _____ Ω

4.2.4.1 Power

Question 42 · continued

0 9 . 2 An electrician replaced the switch.

The electrician would have received an electric shock unless the circuit was disconnected from the mains supply.

Explain why.

[3 marks]

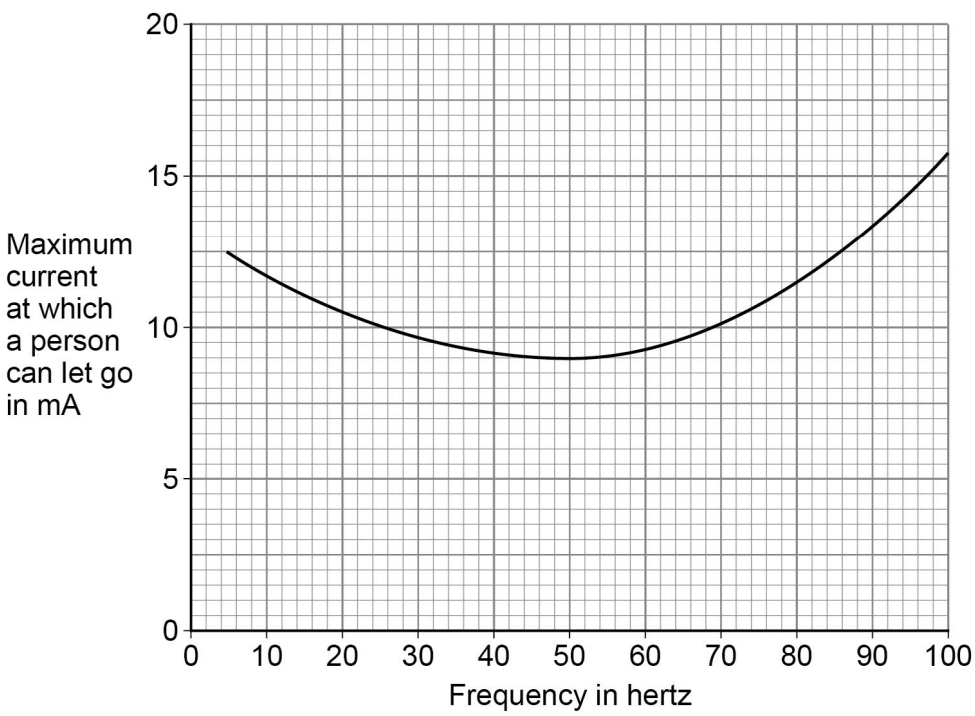
Question 9 continues on the next page

Question 42 · continued

0 9 . 3 The current from an electric shock causes a person's muscles to contract. The person cannot let go of the electrical circuit if the current is too high.

Figure 14 shows how the maximum current at which a person can let go depends on the frequency of the electricity supply.

Figure 14



The UK mains frequency is 50 Hz.

Explain why it would be safer if the UK mains frequency was **not** 50 Hz.

[2 marks]

10

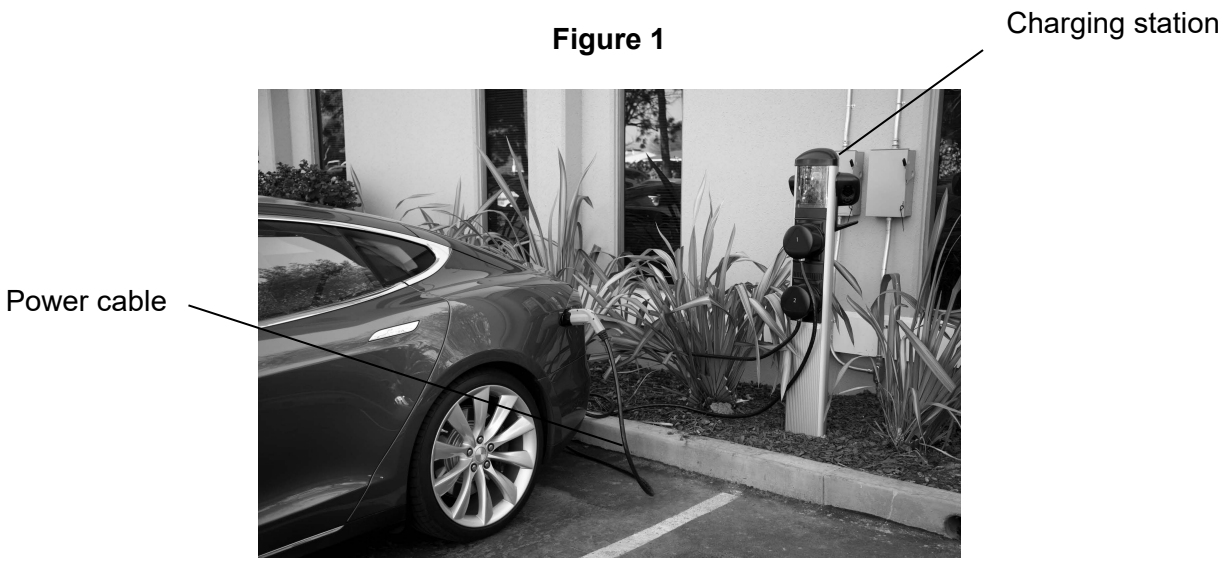
4.2.4.1 Power

Question 43

November 2021 | 8463/1H | Original Q1

0 1 **Figure 1** shows an electric car being recharged.

Figure 1



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

What does 'direct potential difference' mean?

[1 mark]

Question 1 continues on the next page

4.2.4.1 Power

Question 43 · continued

0 1 . 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 1 . 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 43 · continued

0 1 . 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 1 . 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 1 continues on the next page

4.2.4.1 Power

Question 43 · continued

0 1 . 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 44

November 2021 | 8463/1H | Original Q5

0 5 . 1 During one year, 1.25×10^{18} J of energy was transferred from the National Grid.

number of seconds in 1 year = 3.16×10^{7}

Calculate the mean energy transferred from the National Grid each second.

Give your answer to 3 significant figures.

[2 marks]

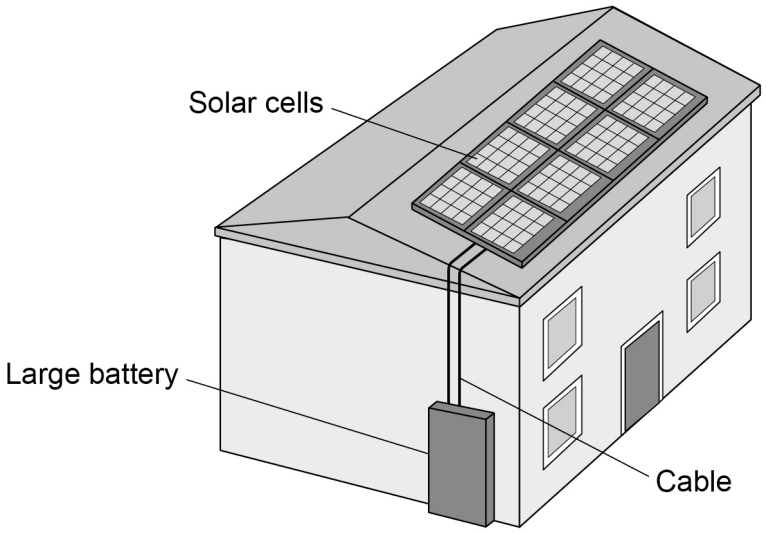
Energy each second (3 significant figures) = _____ J

Figure 5 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 5



4.2.4.1 Power

Question 44 · continued

0 5 . 2 The charge flow through the cable between the solar cells and the battery in 24 hours was 27 000 coulombs.

Calculate the mean current in the cable.

[4 marks]

Mean current = _____ A

0 5 . 3 At one time, the total power input to the solar cells was 7.8 kW.

The efficiency of the solar cells was 0.15

Calculate the useful power output of the solar cells.

[3 marks]

Useful power output = _____ W

Question 5 continues on the next page

4.2.4.1 Power

Question 44 · continued

0 5 . 4 It is unlikely that **all** of the electricity that the UK needs can be generated by solar power systems.

Explain why.

[2 marks]

11

4.2.4.1 Power

Question 45

November 2021 | 8463/1H | Original Q7

0 7 A student investigated how the current in a series circuit varied with the resistance of a variable resistor.

Figure 8 shows the circuit used.

Figure 8

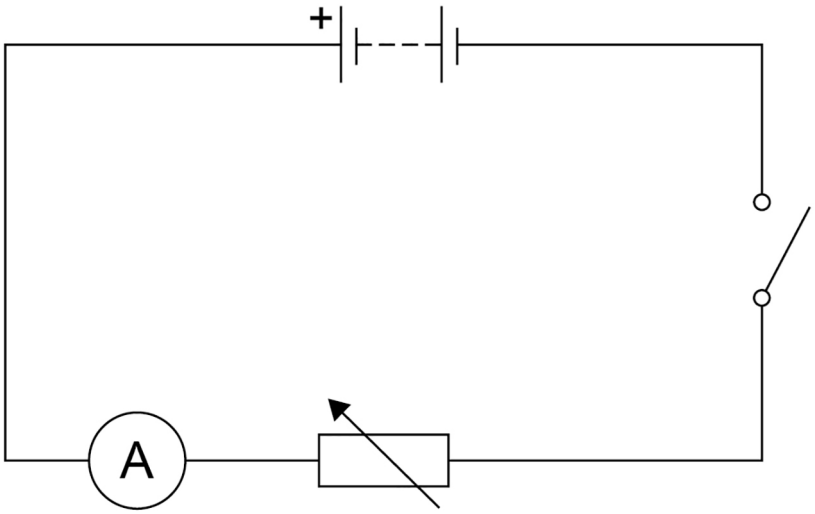
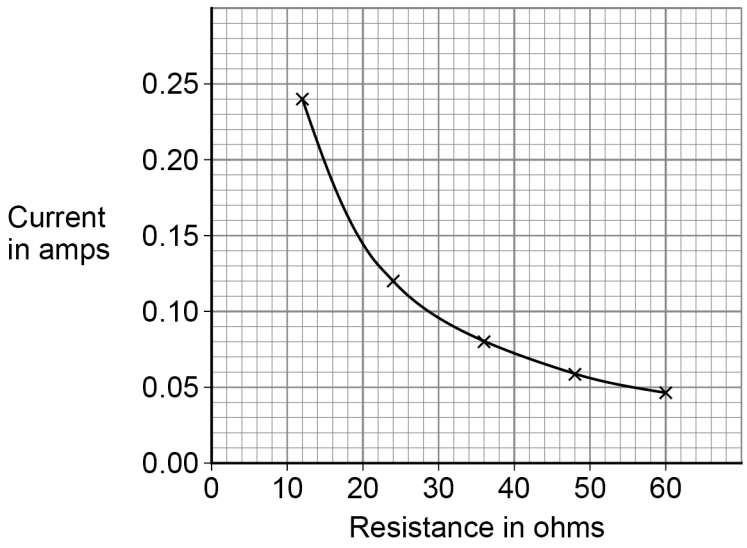


Figure 9 shows the results.

Figure 9



4.2.4.1 Power

Question 45 · continued

0 7 . 1 The battery had a power output of 230 mW when the resistance of the variable resistor was 36 Ω.

Determine the potential difference across the battery.

[4 marks]

Potential difference = _____ V

0 7 . 2 The student concluded:

'the current in the circuit was inversely proportional to the resistance of the variable resistor.'

Explain how **Figure 9** shows that the student is correct.

[2 marks]

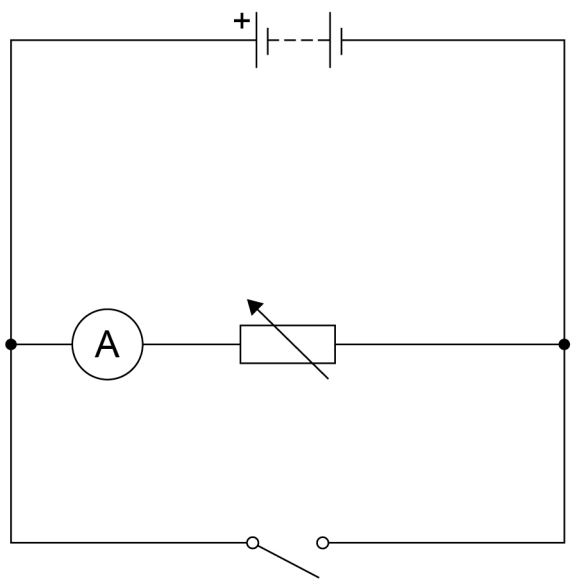
Question 7 continues on the next page

4.2.4.1 Power

Question 45 · continued

0 7 . 3 **Figure 10** shows a circuit with a switch connected incorrectly.

Figure 10



Explain how closing the switch would affect the current in the variable resistor.

[2 marks]

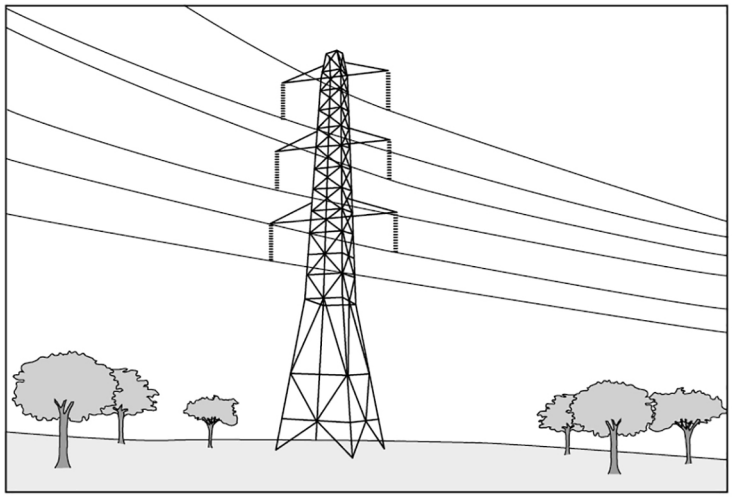
8

4.2.4.1 Power

Question 46

1 0 **Figure 13** shows some overhead power cables in the National Grid.

Figure 13



1 0 . 1 Explain the advantage of transmitting electricity at a very high potential difference.

[3 marks]

4.2.4.1 Power

Question 46 · continued

1 0 . 2 It is dangerous for a person to fly a kite near an overhead power cable.

Figure 14 shows a person flying a kite.

Figure 14



The person could receive a fatal electric shock if the kite was very close to, but not touching the power cable.

Explain why.

[3 marks]

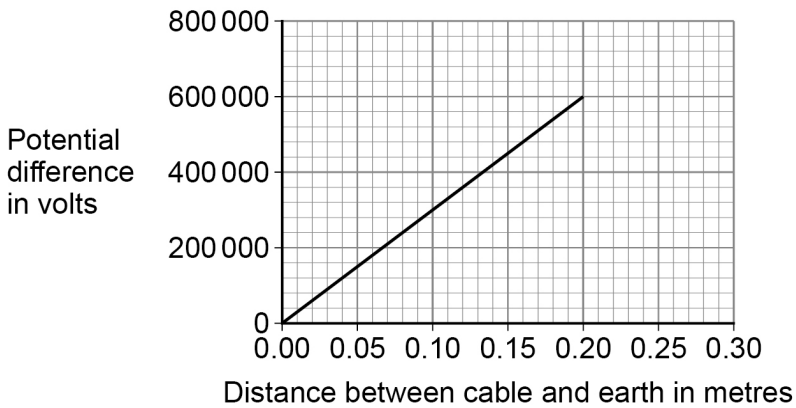
Question 10 continues on the next page

Question 46 · continued

A scientist investigated how the potential difference needed for air to conduct charge varies with the distance between a cable and earth.

Figure 15 shows the results.

Figure 15



10.3 The data in **Figure 15** gives the relationship between potential difference and distance when the air is dry.

When the humidity of air increases the air becomes a better conductor of electricity.

Draw a line on **Figure 15** to show how the potential difference changes with distance if the humidity of the air increases.

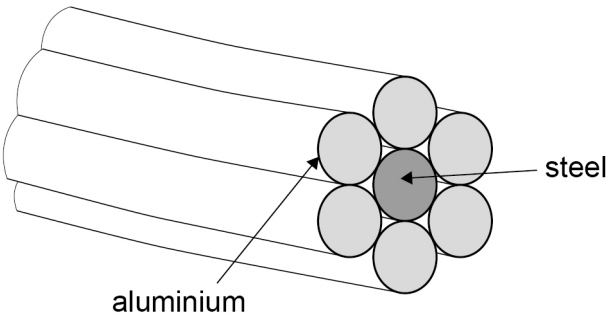
[2 marks]

4.2.4.1 Power

Question 46 · continued

10.4 **Figure 16** shows a cross-section through a power cable.

Figure 16



A 1 metre length of a single aluminium wire is a better conductor than a 1 metre length of the steel wire.

The individual wires behave as if they are resistors connected in parallel.

Explain why the current in the steel wire is different to the current in a single aluminium wire.

[2 marks]

10

4.2.4.1 Power

Question 47

0 3 An engineering company has invented pavement tiles that generate electricity as people walk on them.

Figure 3 shows someone walking on the pavement tiles.

Figure 3



Use the Physics Equations Sheet to answer questions **03.1** and **03.2**.

0 3 . 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 47 · continued

0 3 . 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 3 continues on the next page

4.2.4.1 Power

Question 47 · continued

Use the Physics Equations Sheet to answer questions **03.3** and **03.4**.

0 3 . 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 ☐

0 3 . 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

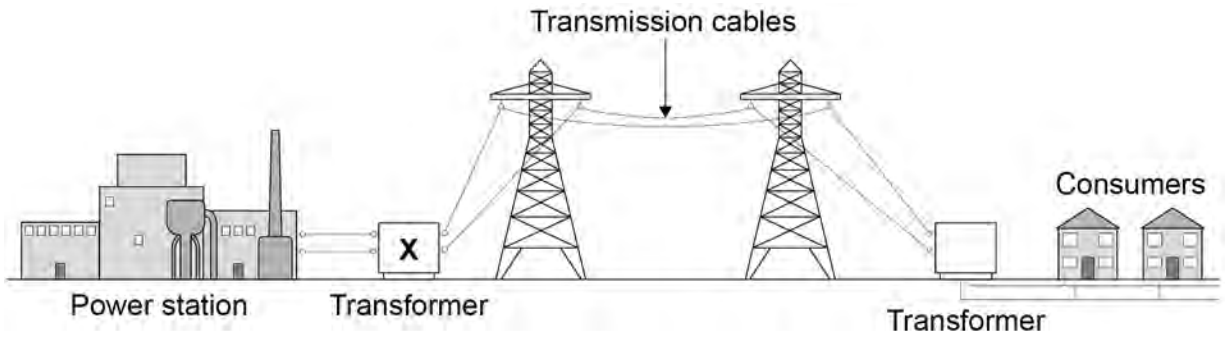
4.2.4.1 Power

Question 48

June 2023 | 8463/1H | Original Q1

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

Figure 1



0 1 . 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 **01.2** and **01.3**.

0 1 . 2 Which equation links current (I), power (P) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{I}{R}$ ☐

$P = \frac{I}{R^2}$ ☐

$P = I^2 R$ ☐

$P = IR$ ☐

4.2.4.1 Power

Question 48 · continued

0 1 . 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 **01.4** and **01.5**.

0 1 . 4 Write down the equation which links efficiency, total energy input and useful energy output.

[1 mark]

0 1 . 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

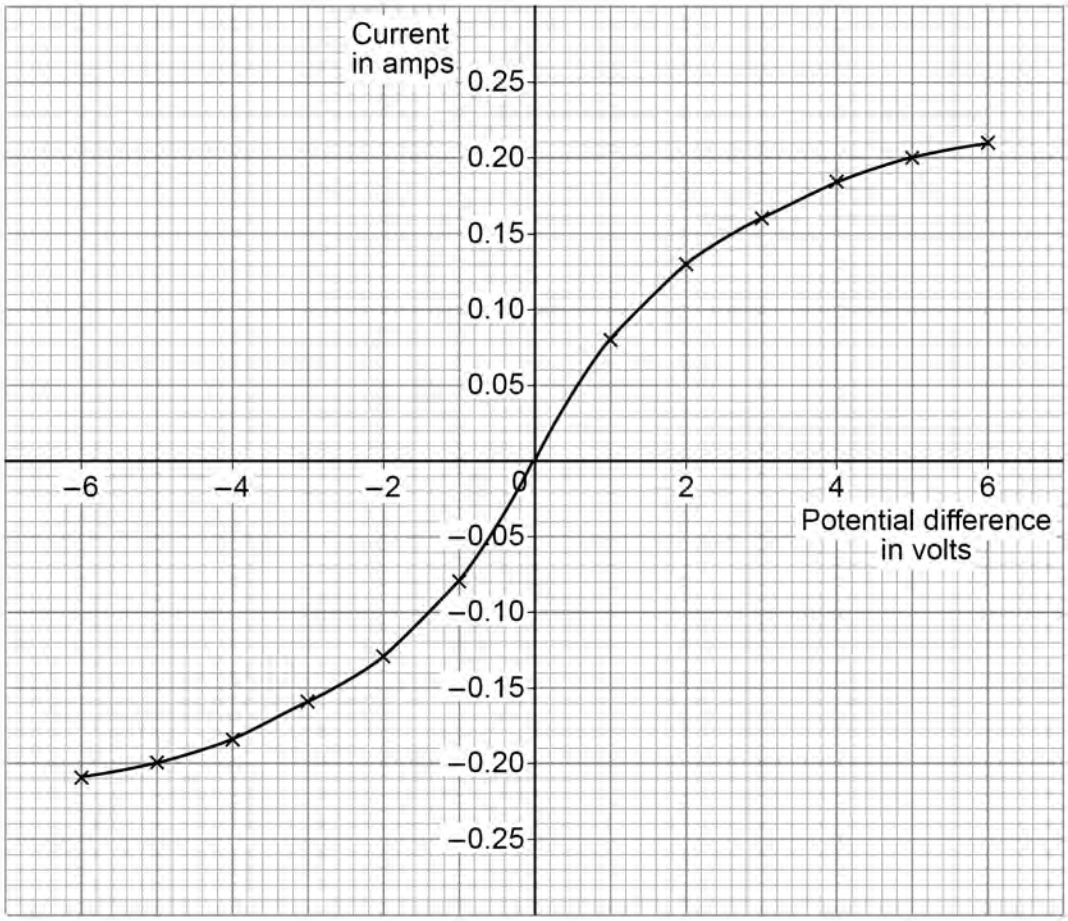
Question 49

June 2023 | 8463/1H | Original Q6

0 6 A student investigated how the current in a filament lamp varies with the potential difference across the filament lamp.

Figure 6 shows the results.

Figure 6



4.2.4.1 Power

Question 49 · continued

0 6 . 1 Describe a method the student could use to obtain these results.

You should include a circuit diagram.

[6 marks]

4.2.4.1 Power

Question 49 · continued

0 6 . 2 Determine the resistance of the filament lamp when the potential difference across it is +3.0 V.

Use the Physics Equations Sheet.

Use **Figure 6** on page 18.

[3 marks]

Resistance = _____ Ω

0 6 . 3 The current in the lamp is 0.21 A when the potential difference across the lamp is 6.0 V.

Calculate the energy transferred by the filament lamp in 30 minutes.

Use the Physics Equations Sheet.

[5 marks]

Energy transferred = _____ J

4.2.4.1 Power

Question 49 · continued

0 6 . 4 The power output of the lamp is 1.0 W when the potential difference across the lamp is 5.0 V.

A student predicts that the power output would be 4.0 W if the potential difference was doubled.

Explain why the student is **not** correct.

[2 marks]

16

Turn over for the next question

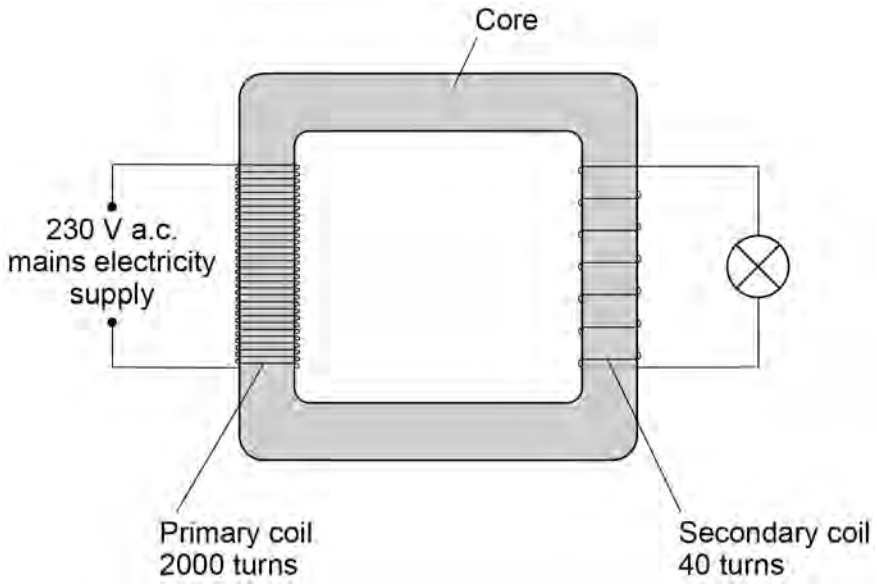
4.2.4.1 Power

Question 50

June 2023 | 8463/2H | Original Q8

0 8 **Figure 21** shows a transformer used to power a lamp using the mains electricity supply.

Figure 21



0 8 . 1 What material is used to make the core of the transformer?

Give the reason for using this material.

[2 marks]

Material _____

Reason _____

_____

4.2.4.1 Power

Question 50 · continued

0 8 . 2 Determine the current in the secondary coil when the power output of the transformer is 6.9 W.

The transformer is 100% efficient.

Use the Physics Equations Sheet.

[5 marks]

Current in the secondary coil = _____ A

7

4.2.4.1 Power

Question 51

0 5 **Figure 7** shows a student putting a coin into a vending machine that sells food.

Figure 7



0 5 . 1 The vending machine is connected to the mains electricity supply.

What is the frequency and the potential difference of the mains electricity supply in the UK?

[2 marks]

Frequency = _____ Hz

Potential difference = _____ V

The vending machine identifies the value of the coin by measuring the resistance of the coin.

0 5 . 2 The power dissipated by the coin is 340 mW when the current in the coin is 0.75 A.

Calculate the resistance of the coin.

Use the Physics Equations Sheet.

[4 marks]

Resistance = _____ Ω

0 5 . 3 Coins that are dirty are **not** recognised by the vending machine.

Suggest **one** reason why.

[1 mark]

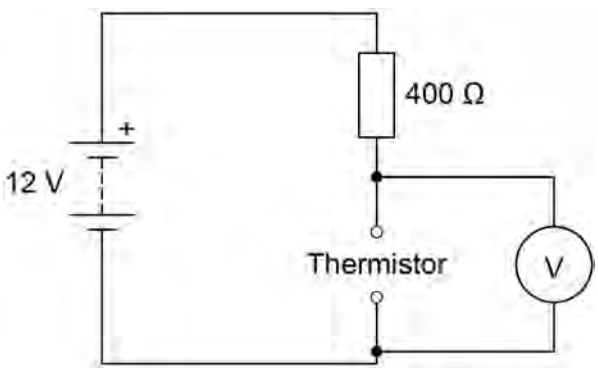
Question 5 continues on the next page

4.2.4.1 Power

Question 51 · continued

Figure 8 shows part of a different circuit that is used to monitor the temperature inside the vending machine.

Figure 8



0 5 . 4 The circuit symbol for a thermistor has not been included.

Draw the circuit symbol for a thermistor in the box below.

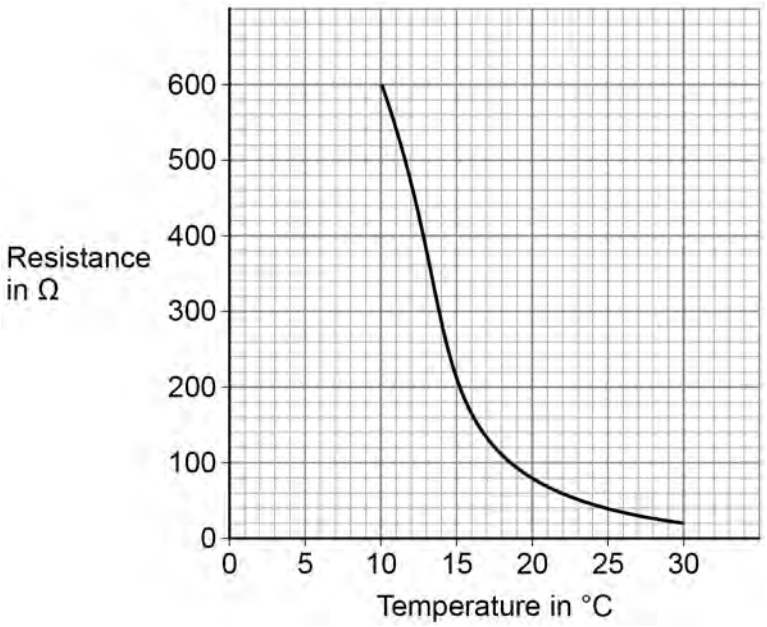
[1 mark]

4.2.4.1 Power

Question 51 · continued

Figure 9 shows how the resistance of the thermistor varies with temperature.

Figure 9



0 5 . 5 The cooling system inside the vending machine turns on when the temperature of the thermistor is above 20 °C.

Determine the potential difference across the thermistor when the temperature is 20 °C.

Use the Physics Equations Sheet.

[5 marks]

Potential difference = _____ V

13

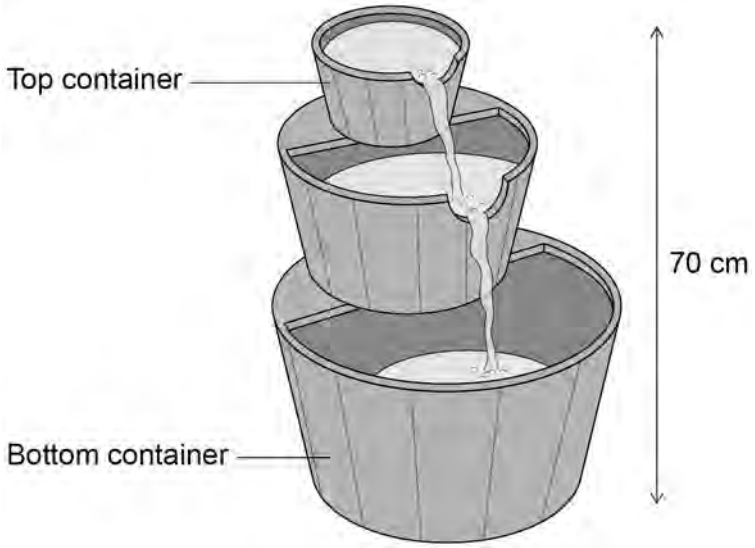
4.2.4.1 Power

Question 52

June 2025 | 8463/1H | Original Q9

0 9 **Figure 11** shows a garden water feature.

Figure 11



The water feature has an electric motor that pumps water from the bottom container to the top container.

0 9 . 1 The pump transfers 0.343 J of gravitational potential energy to the water each second.

gravitational field strength = 9.8 N/kg

Determine the mass of water passing through the pump each second.

Use the Physics Equations Sheet.

[4 marks]

Mass = _____ kg

4.2.4.1 Power

Question 52 · continued

0 9 . 2 The power of the pump motor is 4.86 W.

The resistance of the pump motor is 6.0 Ω.

Calculate the charge flow through the motor in 30 minutes.

Use the Physics Equations Sheet.

[6 marks]

Charge flow = _____ C

0 9 . 3 The pump motor breaks and is replaced with a new motor.

The new pump motor has the same power input, but has a greater efficiency.

Explain how the new pump motor would affect the flow of water in the water feature.

[2 marks]

12