AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.4.2

Energy transfers in everyday appliances

Past-paper questions

Tier	**Foundation**
Question groups	**105**
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:** _____

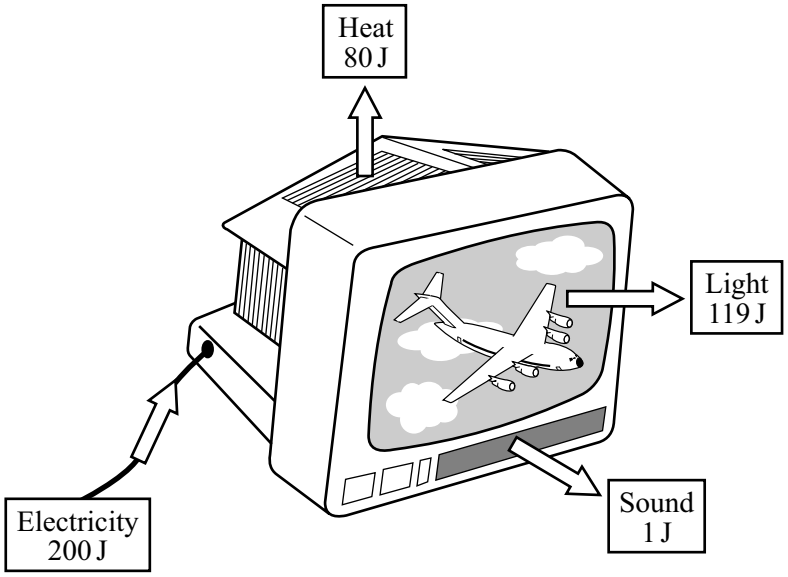
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.2.4.2 Energy transfers in everyday appliances

Question 01

June 2003 | 3451F | Original Q4 | Legacy

4 (a) The drawing shows the energy transferred each second by a television set.



(i) What form of energy is transferred as waste energy by the television set?

.....

(1 mark)

(ii) What effect will the waste energy have on the air around the television set?

.....

(1 mark)

(iii) Use the following equation to calculate the efficiency of the television set.

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

.....

.....

Efficiency = ...

(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 01 · continued

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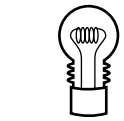
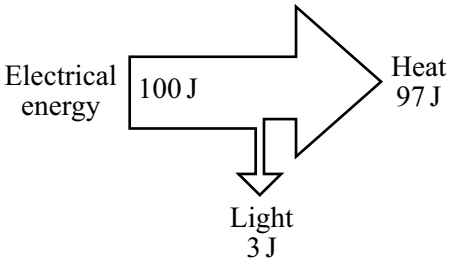
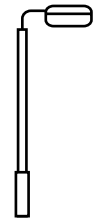
(b) The diagrams show the energy transferred each second for three different types of lamp. For each lamp the electrical energy input each second is 100 joules.

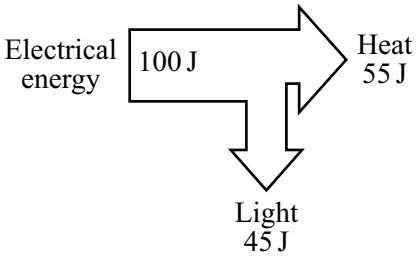


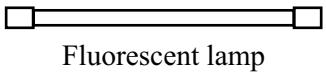
Filament lamp



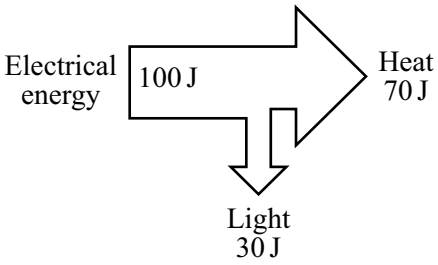


Street lamp





Fluorescent lamp



Which type of lamp is the most efficient?

.....

Give a reason for your choice.

.....

.....

(2 marks)

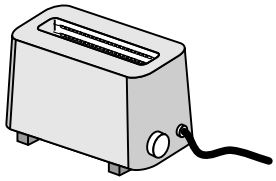
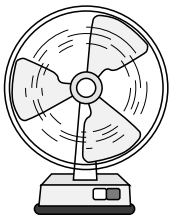
6

4.2.4.2 Energy transfers in everyday appliances

Question 02

June 2003 | 3451F | Original Q7 | Legacy

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

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

(3 marks)

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

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

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

.....

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 02 · continued

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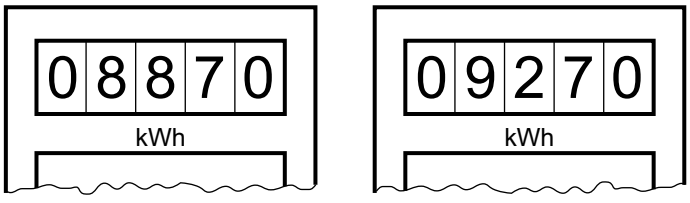
(c) The diagrams show the readings on a domestic electricity meter in April and July.



April July

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

.....

.....

Number of Units = ...

(1 mark)

(ii) One Unit costs 6p.

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

total cost = number of Units × cost per Unit

.....

.....

Cost = ...

(2 marks)

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

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

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

.....

.....

Energy transferred = ...kWh

(2 marks)

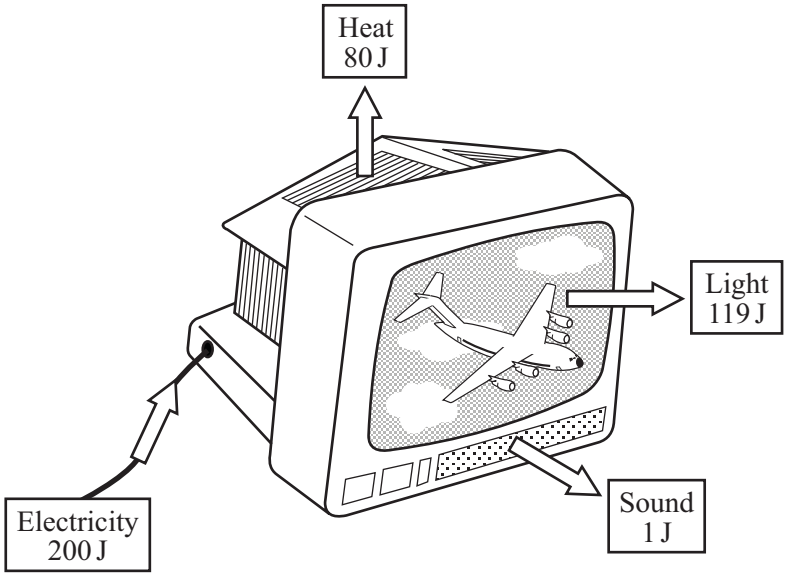
9

4.2.4.2 Energy transfers in everyday appliances

Question 03

June 2003 | 3462F3 | Original Q4 | Legacy

4 (a) The drawing shows the energy transferred each second by a television set.



(i) What form of energy is transferred as waste energy by the television set?

.....

(1 mark)

(ii) What effect will the waste energy have on the air around the television set?

.....

(1 mark)

(iii) Use the following equation to calculate the efficiency of the television set.

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

.....

.....

Efficiency = ...

(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 03 · continued

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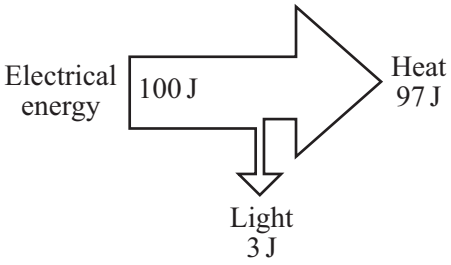
(b) The diagrams show the energy transferred each second for three different types of lamp. For each lamp the electrical energy input each second is 100 joules.

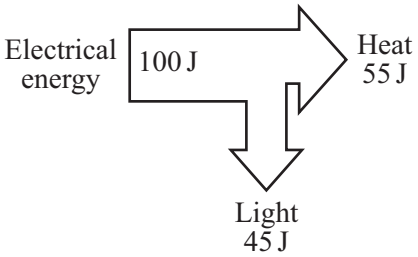


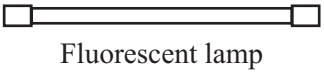
Filament lamp



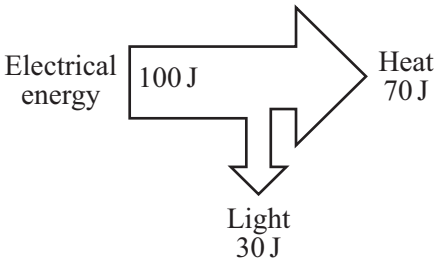


Street lamp





Fluorescent lamp



Which type of lamp is the most efficient?

.....

Give a reason for your choice.

.....

.....

(2 marks)

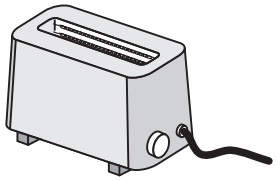
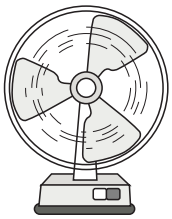
6

4.2.4.2 Energy transfers in everyday appliances

Question 04

June 2003 | 3462F3 | Original Q7 | Legacy

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

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

(3 marks)

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

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

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

.....

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 04 · continued

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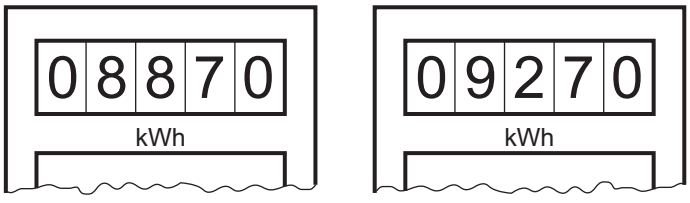
(c) The diagrams show the readings on a domestic electricity meter in April and July.



April July

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

.....

.....

Number of Units = ...

(1 mark)

(ii) One Unit costs 6p.

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

total cost = number of Units × cost per Unit

.....

.....

Cost = ...

(2 marks)

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

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

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

.....

.....

Energy transferred = ...kWh

(2 marks)

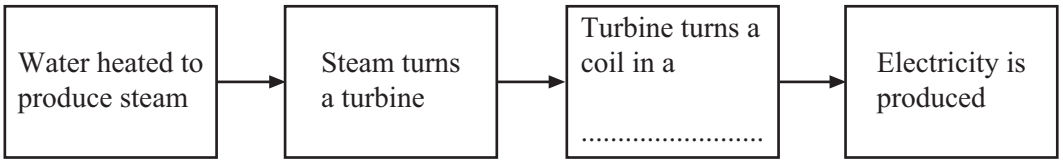
9

4.2.4.2 Energy transfers in everyday appliances

Question 05

June 2004 | 3451F | Original Q3 | Legacy

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



(1 mark)

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

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

.....

(1 mark)

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

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

.....

.....

efficiency = ...

(2 marks)

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

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

4.2.4.2 Energy transfers in everyday appliances

Question 05 · continued

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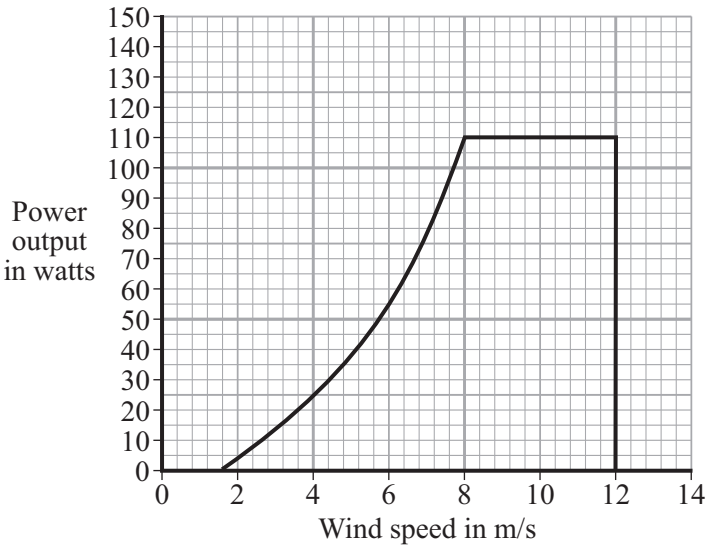
(d) A small wind generator is used to charge a battery. The graph shows the power output of the generator at different wind speeds.



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

..... watts
(1 mark)

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

At what wind speed does the generator stop working?

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

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

.....

.....
(1 mark)

10

4.2.4.2 Energy transfers in everyday appliances

Question 06

June 2004 | 3451F | Original Q11 | Legacy

11 The diagram represents the electromagnetic spectrum.

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

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

(i) to sterilise surgical instruments;

.....

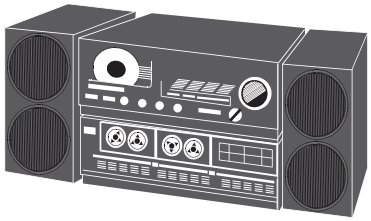
(1 mark)

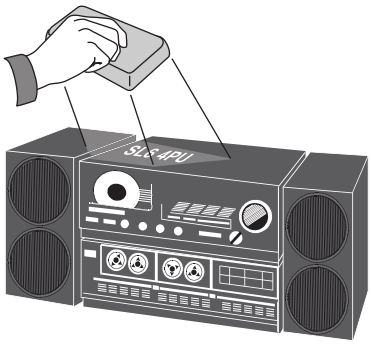
(ii) to send a signal to a TV from a remote control.

.....

(1 mark)

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





Explain what happens to make the ink visible.

.....

.....

.....

.....

(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 06 · continued

MARGIN BLANK

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

.....

.....

.....

.....

(2 marks)

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

Voltage	230 V
Microwave power	0.65 kW
Grill power	1.15 kW

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

..... and .....

(1 mark)

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

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

energy transferred = power × time

.....

.....

.....

energy transferred =.....kWh

(2 marks)

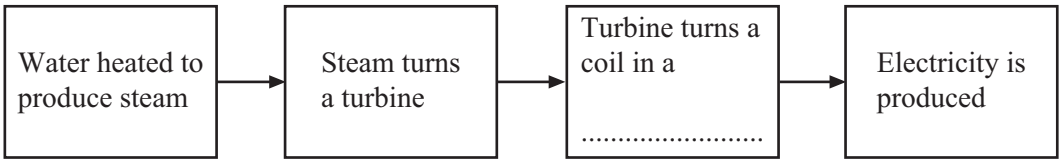
9

4.2.4.2 Energy transfers in everyday appliances

Question 07

June 2004 | 3462F3 | Original Q3 | Legacy

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



(1 mark)

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

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

.....

(1 mark)

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

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

.....

.....

efficiency = ...

(2 marks)

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

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

4.2.4.2 Energy transfers in everyday appliances

Question 07 · continued

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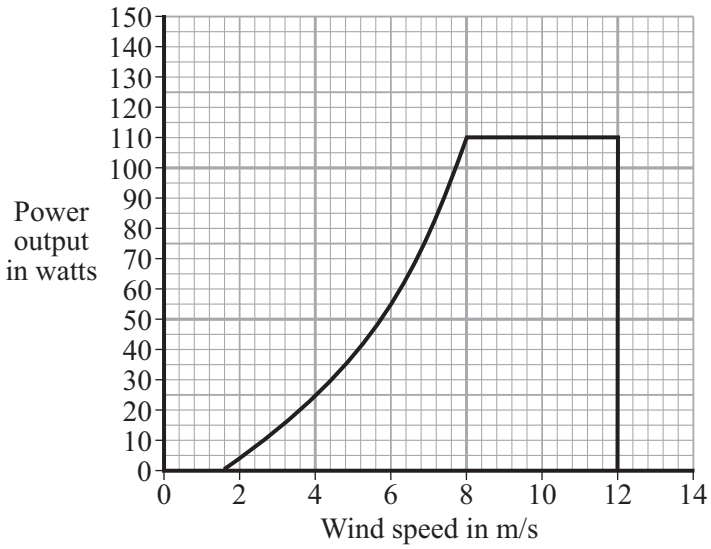
(d) A small wind generator is used to charge a battery. The graph shows the power output of the generator at different wind speeds.



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

..... watts
(1 mark)

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

At what wind speed does the generator stop working?

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

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

.....

.....
(1 mark)

10

4.2.4.2 Energy transfers in everyday appliances

Question 08

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;

.....

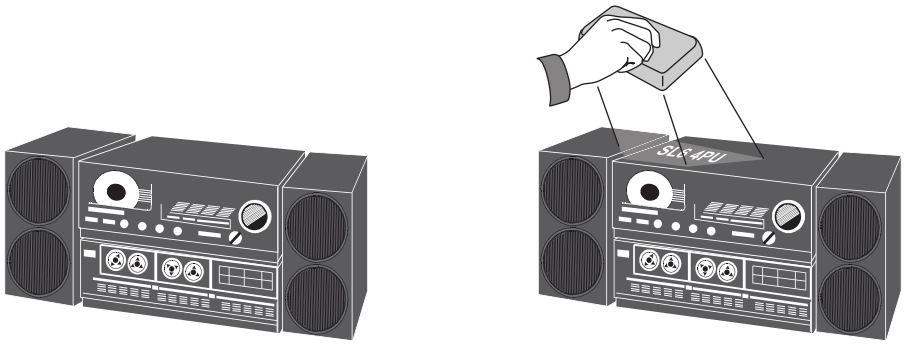
(1 mark)

(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)

4.2.4.2 Energy transfers in everyday appliances

Question 08 · 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)

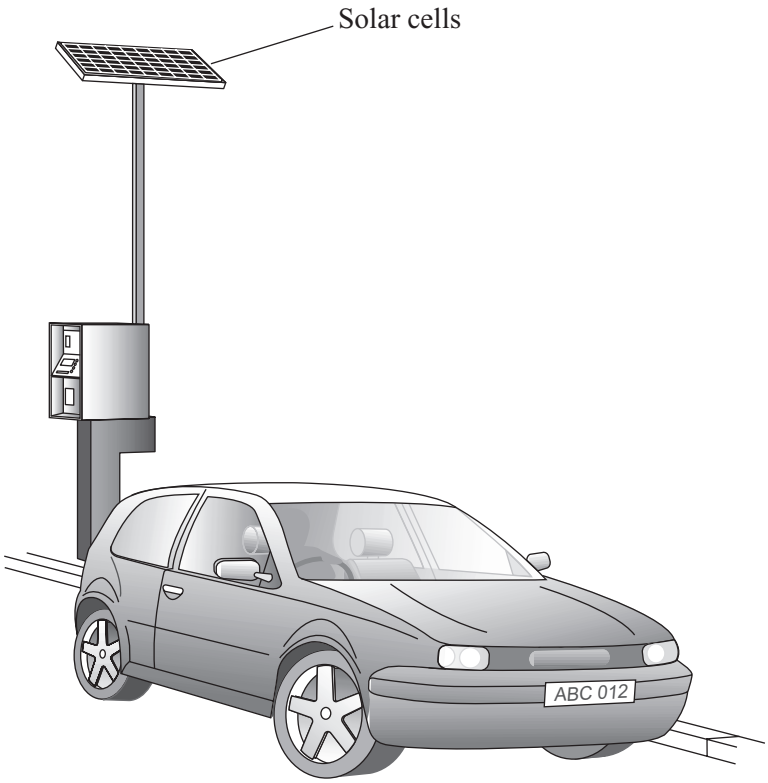
9

4.2.4.2 Energy transfers in everyday appliances

Question 09

June 2005 | 3451 | Original Q4 | Legacy

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



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

Each word may be used once or not at all.

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

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

(1 mark)

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

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 09 · continued

MARGIN BLANK

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

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

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

.....

.....

Efficiency = ...

(2 marks)

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

Tick (✓) the box next to your choice.

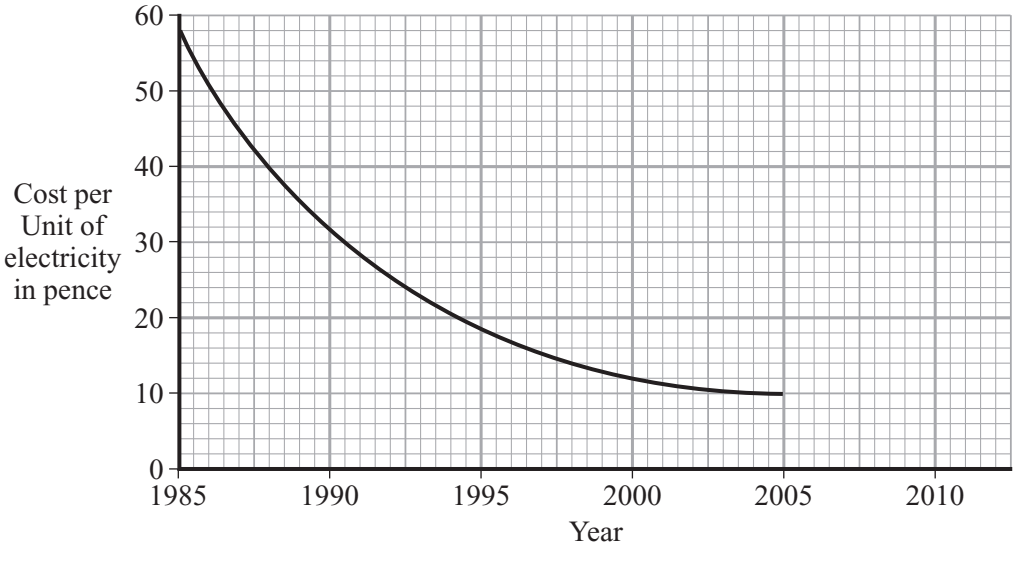
Solar cells give a constant supply of electricity. ☐

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

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

(1 mark)

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



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

.....

(1 mark)

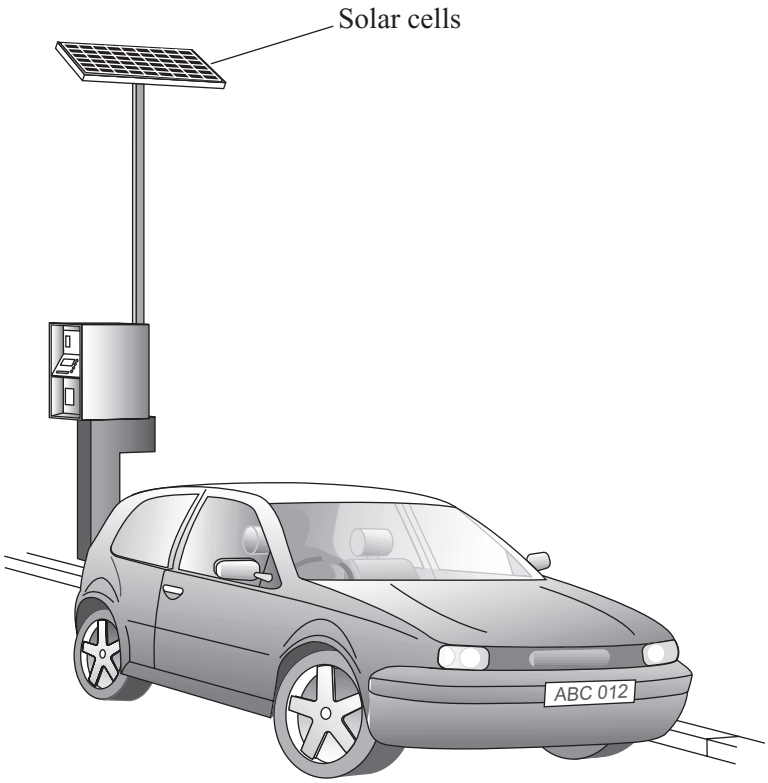
6

4.2.4.2 Energy transfers in everyday appliances

Question 10

June 2005 | 3462 | Original Q4 | Legacy

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



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

Each word may be used once or not at all.

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

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

(1 mark)

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

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 10 · continued

MARGIN BLANK

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

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

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

.....

.....

Efficiency = ...

(2 marks)

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

Tick (✓) the box next to your choice.

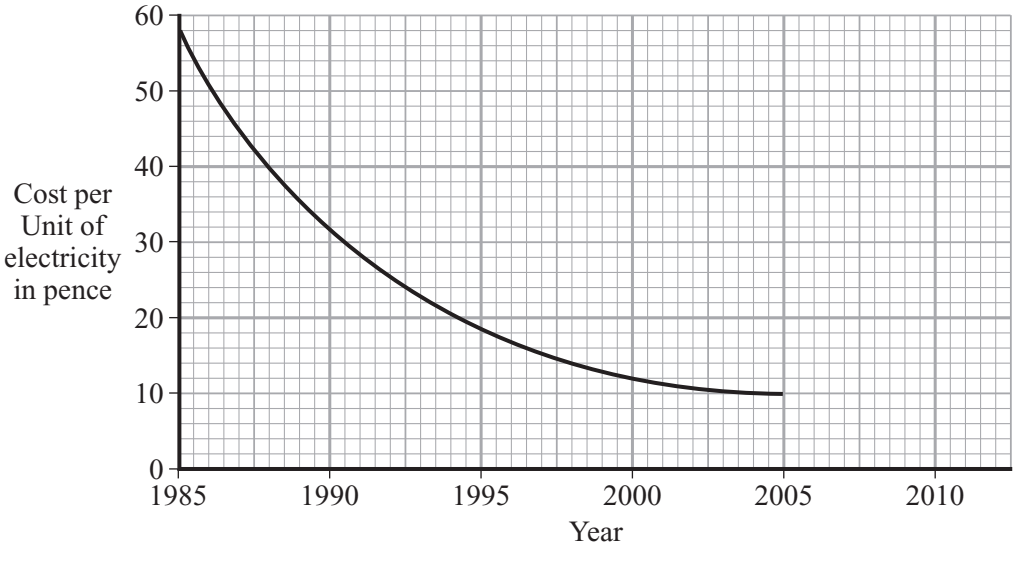
Solar cells give a constant supply of electricity. ☐

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

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

(1 mark)

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



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

.....

(1 mark)

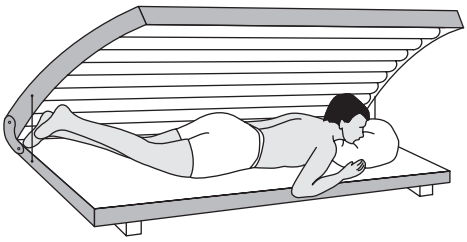
6

4.2.4.2 Energy transfers in everyday appliances

Question 11

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 11 · continued

BLANK

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

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

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

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

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

The sunbed transfers 1.8 joules of energy every second. ☐

(1 mark)

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

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

Show clearly how you work out your answer.

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

.....

.....

Energy transferred = ... kWh

(2 marks)

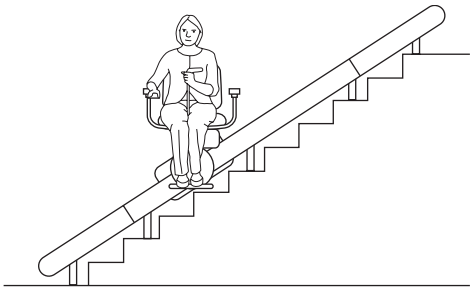
5

4.2.4.2 Energy transfers in everyday appliances

Question 12

June 2006 | 3451 | Original Q7 | Legacy

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



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

Each word may be used once or not at all.

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

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

energy to ..... energy.

(2 marks)

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

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

(2 marks)

Question 12 · continued

BLANK

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

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

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

.....

.....

Power = ... J/s

(2 marks)

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

Draw a ring around your answer.

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

(1 mark)

(c) The forces on the stairlift are balanced.

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

The stairlift is not moving. ☐

The stairlift is moving at a constant speed. ☐

The stairlift is speeding up. ☐

The stairlift is slowing down. ☐

(1 mark)

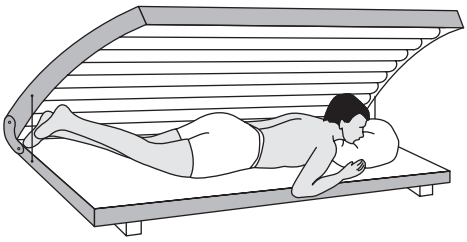
8

4.2.4.2 Energy transfers in everyday appliances

Question 13

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 13 · continued

BLANK

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

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

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

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

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

The sunbed transfers 1.8 joules of energy every second. ☐

(1 mark)

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

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

Show clearly how you work out your answer.

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

.....

.....

Energy transferred = ... kWh

(2 marks)

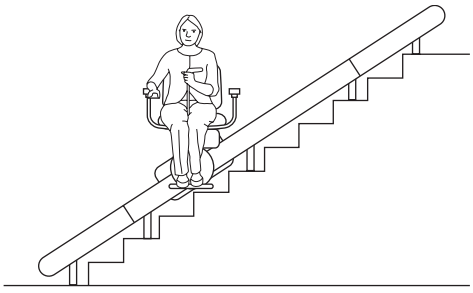
5

4.2.4.2 Energy transfers in everyday appliances

Question 14

June 2006 | 3462 | Original Q7 | Legacy

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



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

Each word may be used once or not at all.

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

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

energy to ..... energy.

(2 marks)

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

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

(2 marks)

Question 14 · continued

BLANK

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

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

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

.....

.....

Power = ... J/s

(2 marks)

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

Draw a ring around your answer.

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

(1 mark)

(c) The forces on the stairlift are balanced.

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

The stairlift is not moving. ☐

The stairlift is moving at a constant speed. ☐

The stairlift is speeding up. ☐

The stairlift is slowing down. ☐

(1 mark)

8

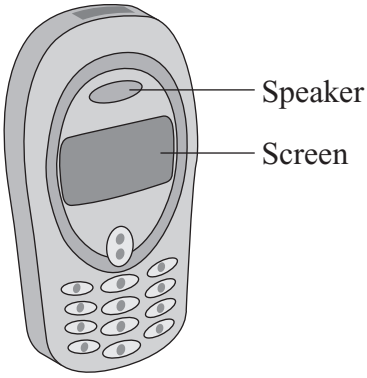
4.2.4.2 Energy transfers in everyday appliances

Question 15

November 2006 | PHY1A | Original Q1 | Legacy

QUESTION ONE

Most people now have a mobile phone. Mobile phones transform energy.



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

A electrical

B heat

C light

D sound

The energy input to the mobile phone is . . . **1** . . . energy.

The useful energy output from the speaker is . . . **2** . . . energy.

The useful energy output from the screen is . . . **3** . . . energy.

The wasted energy output from the mobile phone is . . . **4** . . . energy.

4.2.4.2 Energy transfers in everyday appliances

Question 16

November 2006 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

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



7A One model has a sticker which reads:

More efficient than any other washing machine at this price

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

1 cost less to run.

2 use less electrical energy.

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

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

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

1 being easier to recycle in the future.

2 having less impact on the environment.

3 using less water.

4.2.4.2 Energy transfers in everyday appliances

Question 16 · continued

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

2400 watts is equal to . . .

1 0.24 kW

2 2.40 kW

3 24 kW

4 240 kW

7D

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

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

1 2.4

2 40

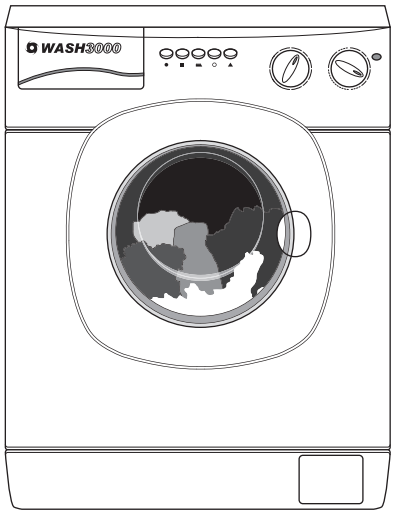
3 144

4 144 000

4.2.4.2 Energy transfers in everyday appliances

Question 17

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



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

kinetic	**light**	**sound**

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

..... energy.

(1 mark)

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

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

4.2.4.2 Energy transfers in everyday appliances

Question 17 · continued

BLANK

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

energy transferred = power × time

.....

.....

Energy transferred = ... kWh

(2 marks)

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

.....

.....

(1 mark)

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

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

.....

.....

(1 mark)

5

4.2.4.2 Energy transfers in everyday appliances

Question 18

March 2007 | PHY1A | Original Q8 | Legacy

QUESTION EIGHT

Electrical appliances usefully transform only part of the energy that is supplied to them. The rest of the energy is wasted.

Chefs often use electric mixers to combine ingredients.



8A A mixer **usefully** transforms electrical energy to . . .

1 kinetic energy.

2 light energy.

3 sound energy.

4 thermal energy.

8B The energy that is **not** usefully transformed by the mixer is wasted as . . .

1 heat and sound.

2 heat only.

3 sound and kinetic energy.

4 sound only.

4.2.4.2 Energy transfers in everyday appliances

Question 18 · continued

March 2007 | PHY1A | Original Q8 | Legacy

8C Which of the following statements is **false**?

1 The energy transformed by the mixer becomes difficult to use for other energy transformations.

2 The energy transformed by the mixer ends up making the surroundings a little warmer.

3 The energy transformed by the mixer ends up very spread out.

4 The energy transformed by the mixer no longer exists.

8D A second mixer transforms useful energy at the same rate as this one however, it wastes more energy.

This means that the second mixer . . .

1 costs less per minute to run.

2 is less efficient.

3 is more efficient.

4 transforms energy at a slower rate.

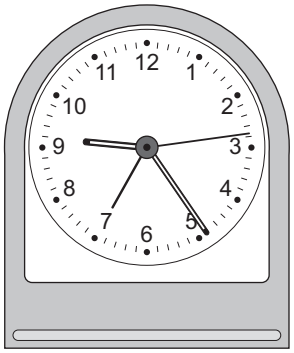
4.2.4.2 Energy transfers in everyday appliances

Question 19

June 2007 | PHY1A | Original Q1 | Legacy

QUESTION ONE

The drawing shows a battery-operated alarm clock.



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

A chemical

B electrical

C kinetic

D thermal

The clock contains a battery and an electric motor.

The battery is designed to transform . . . **1** . . . energy to . . . **2** . . . energy.

The motor is designed to transform electrical energy to . . . **3** . . . energy.

In the motor, some energy is wasted as . . . **4** . . . energy.

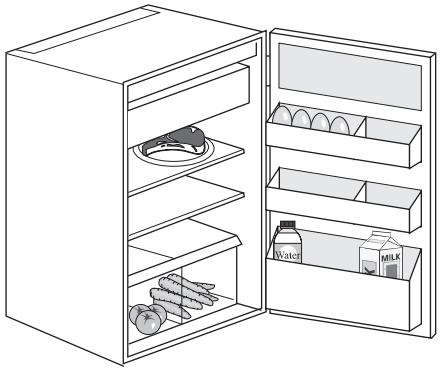
4.2.4.2 Energy transfers in everyday appliances

Question 20

June 2007 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

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



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

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

7A How much did this electricity cost?

1 20 p

2 £2.00

3 £2.20

4 £220.00

4.2.4.2 Energy transfers in everyday appliances

Question 20 · continued June 2007 | PHY1A | Original Q7 | Legacy

7B The fridge has a power of 50 W.

How much energy does it transfer in 24 hours?

1 1.2 kWh

2 2.4 kWh

3 50 kWh

4 1200 kWh

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

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

1 it will keep food colder.

2 it will keep food fresh longer.

3 it will use less electricity.

4 it will not break down.

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

1 people will be better off.

2 less carbon dioxide will be released into the atmosphere.

3 less food will be wasted.

4 more jobs will be created.

4.2.4.2 Energy transfers in everyday appliances

Question 21

June 2007 | PHY1A | Original Q9 | Legacy

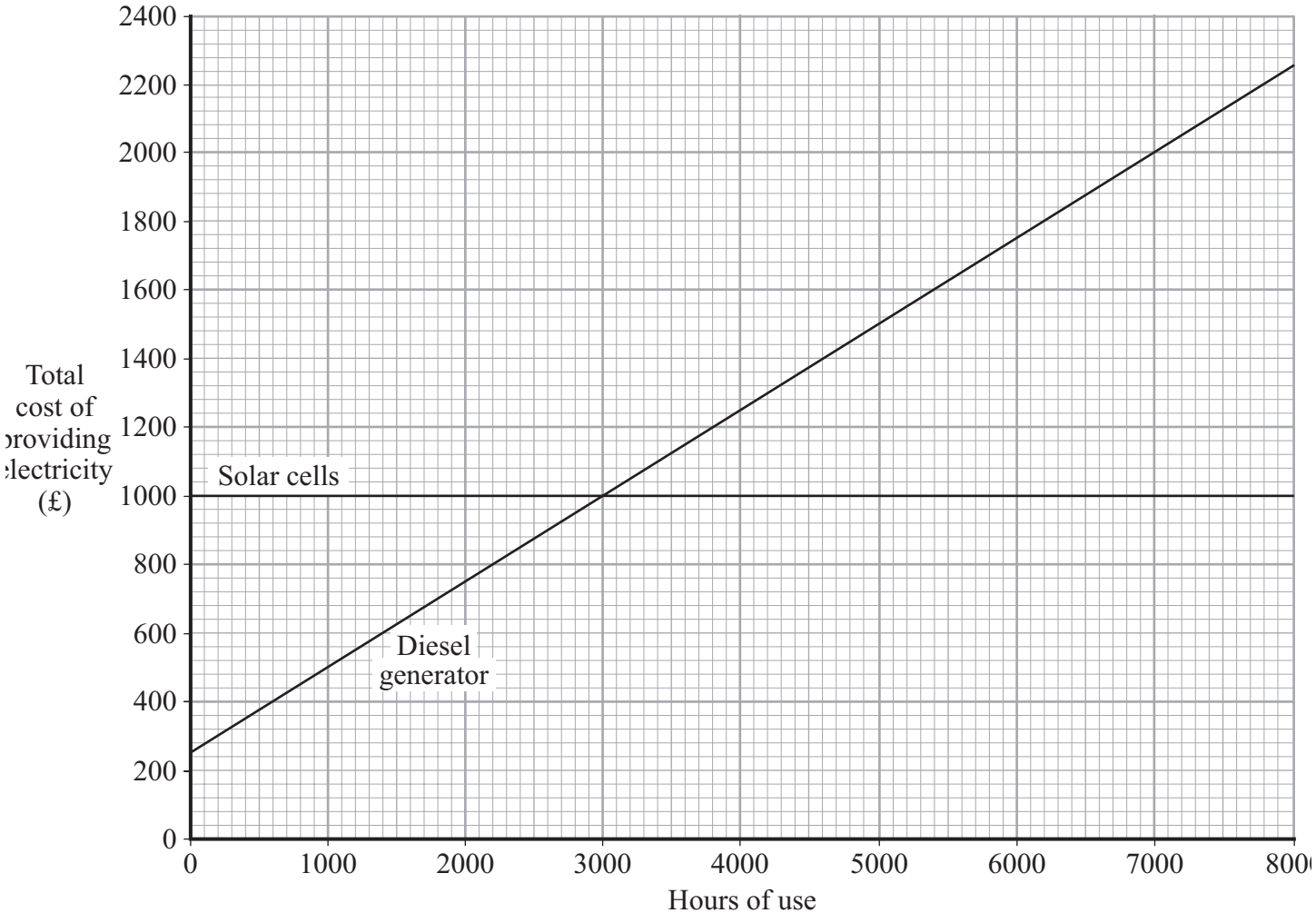
QUESTION NINE

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

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

They need an electricity supply to operate the pump.

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



9A The graph shows that . . .

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

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

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

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

4.2.4.2 Energy transfers in everyday appliances

Question 21 · continued

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

1 twice as much.

2 three times as much.

3 four times as much.

4 five times as much.

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

1 1000 hours of use.

2 2000 hours of use.

3 3000 hours of use.

4 4000 hours of use.

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

1 solar cells have no moving parts.

2 solar cells do not produce exhaust gases.

3 solar cells operate at lower temperatures than diesel generators.

4 solar cells work only during the day.

END OF TEST

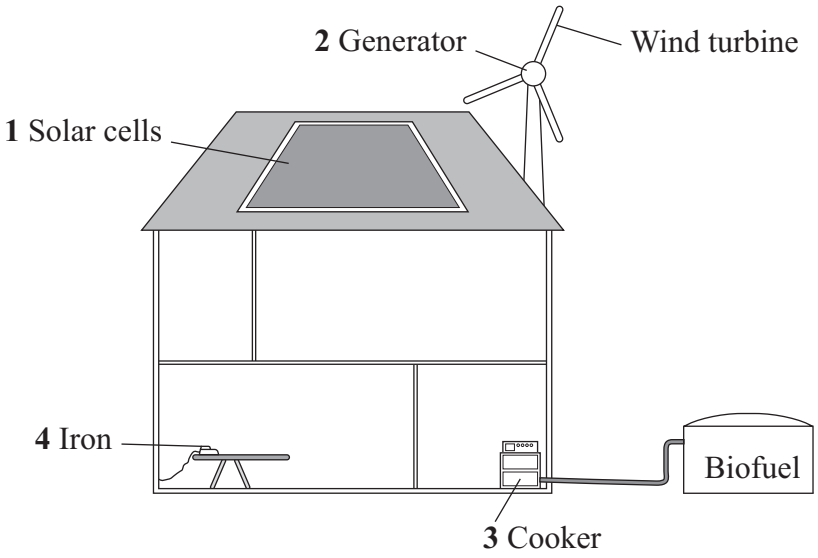
4.2.4.2 Energy transfers in everyday appliances

Question 22

November 2007 | PHY1A | Original Q1 | Legacy

QUESTION ONE

The diagram shows an eco-friendly house.



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

A chemical energy to heat

B electrical energy to heat

C light energy to electrical energy

D kinetic energy to electrical energy

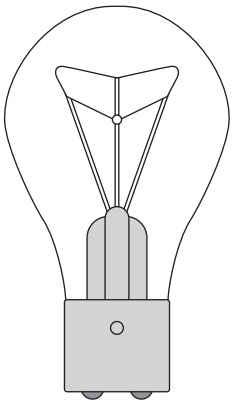
4.2.4.2 Energy transfers in everyday appliances

Question 23

November 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a lamp.



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

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

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

A 0.05

B 5

C 95

D 100

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

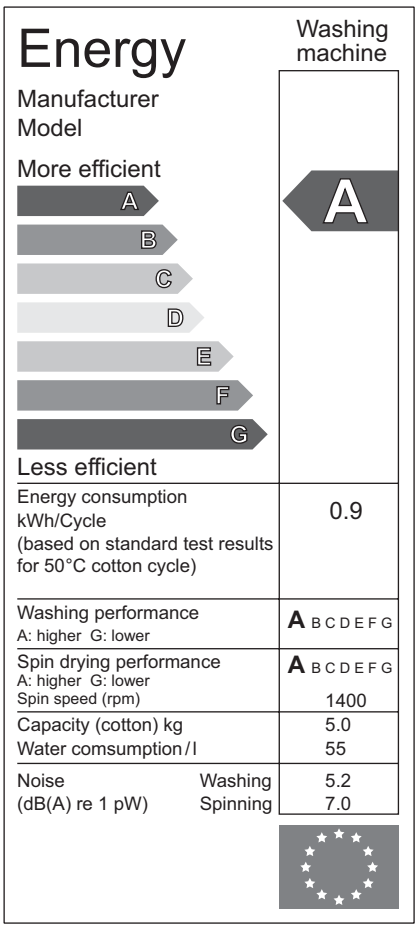
4.2.4.2 Energy transfers in everyday appliances

Question 24

November 2007 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

The energy label gives information about a washing machine.



7A The energy label states that this washing machine has an efficiency rating of **A**.

Another washing machine has an efficiency rating of **C**.

This means that the washing machine described by this label . . .

1 uses less energy for each wash cycle than the C-rated washing machine.

2 uses more energy for each wash cycle than the C-rated washing machine.

3 wastes more energy for each wash cycle than the C-rated washing machine.

4 wastes less energy for each wash cycle than the C-rated washing machine.

4.2.4.2 Energy transfers in everyday appliances

Question 24 · continued

7B Washing machines do **not** transfer all of the supplied energy into useful forms.

Information on the energy label suggests that energy is wasted as . . .

1 heat.

2 light.

3 kinetic energy.

4 sound.

7C The A-rated washing machine is used for 300 standard washing cycles per year.

How much energy does this number of cycles transfer?

1 270 kWh

2 1500 kWh

3 2700 kWh

4 3600 kWh

7D

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

A large family uses the A-rated washing machine for 500 standard washing cycles in a year.

1 kilowatt-hour of electricity costs 12 p.

How much does the washing machine cost to run each year?

1 £40

2 £41.60

3 £54

4 £60

4.2.4.2 Energy transfers in everyday appliances

Question 25

January 2008 | PHY1F | Original Q1 | Legacy

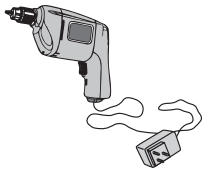
1 (a) Each letter **A**, **B**, **C**, **D** and **E** represents an energy transformation.

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

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

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

Drill



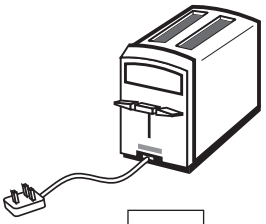
☐

MP3 player



☐

Toaster



☐

(3 marks)

Question 1 continues on the next page

Question 25 · continued

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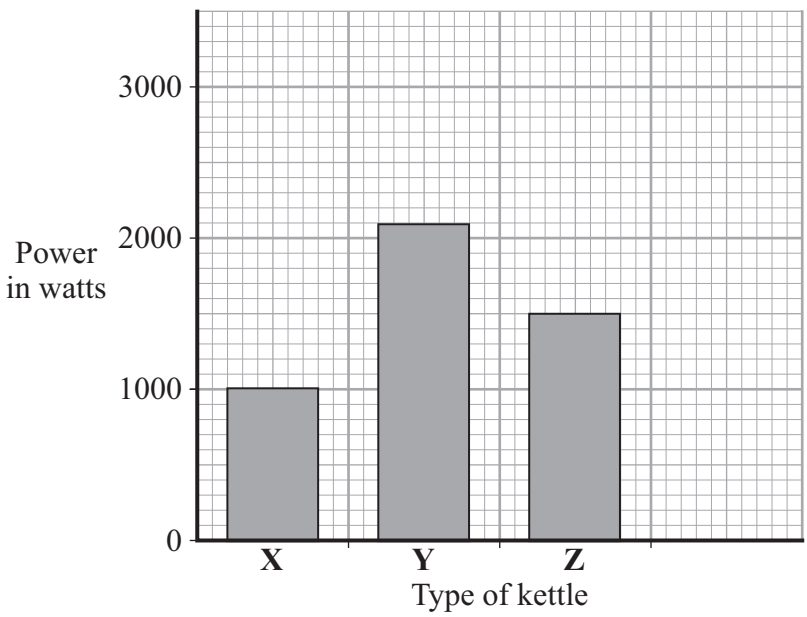
(b) The bar chart shows the power of three electric kettles.



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

.....

(1 mark)

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

Which kettle costs the most to use?

.....

(1 mark)

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

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

4.2.4.2 Energy transfers in everyday appliances

Question 25 · continued

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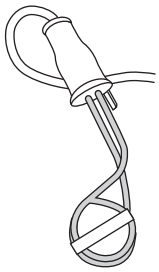
(c) Some friends are going on holiday. They want to be able to boil water to make their own hot drinks. They cannot decide which to take, a travel kettle or a small portable immersion heater that can be placed in a mug.





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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

8

4.2.4.2 Energy transfers in everyday appliances

Question 26

March 2008 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

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

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



At the start of the day

At the end of the day

Each kilowatt-hour of electricity costs 11 p.

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

A 10

B 44

C 56

D 2000

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

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

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

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

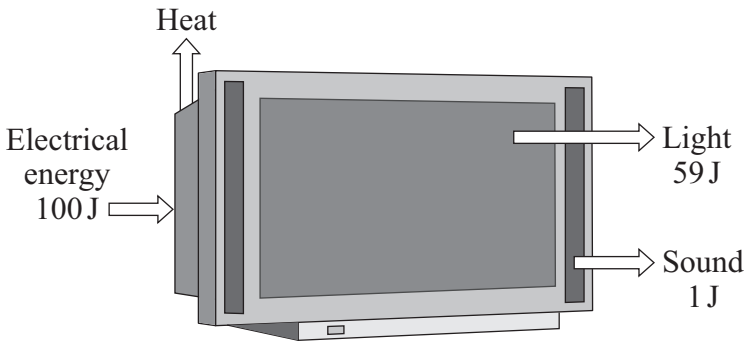
4.2.4.2 Energy transfers in everyday appliances

Question 27

March 2008 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows energy transformations in a television.



7A How much energy is usefully transferred by the television?

1 1 J

2 40 J

3 59 J

4 60 J

7B How much energy is wasted by the television?

1 0 J

2 1 J

3 40 J

4 59 J

4.2.4.2 Energy transfers in everyday appliances

Question 27 · continued

7C

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

What is the efficiency of the television?

1 0.01

2 0.4

3 0.6

4 0.99

7D What eventually happens to the energy wasted by the television?

1 It gradually fades away.

2 It is recycled.

3 It increases the greenhouse effect.

4 It becomes increasingly spread out.

4.2.4.2 Energy transfers in everyday appliances

Question 28

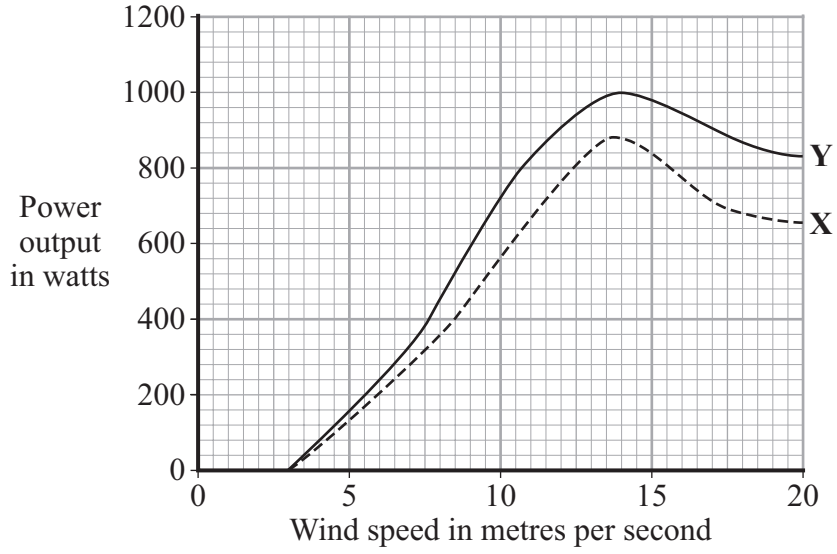
March 2008 | PHY1AP | Original Q9 | Legacy

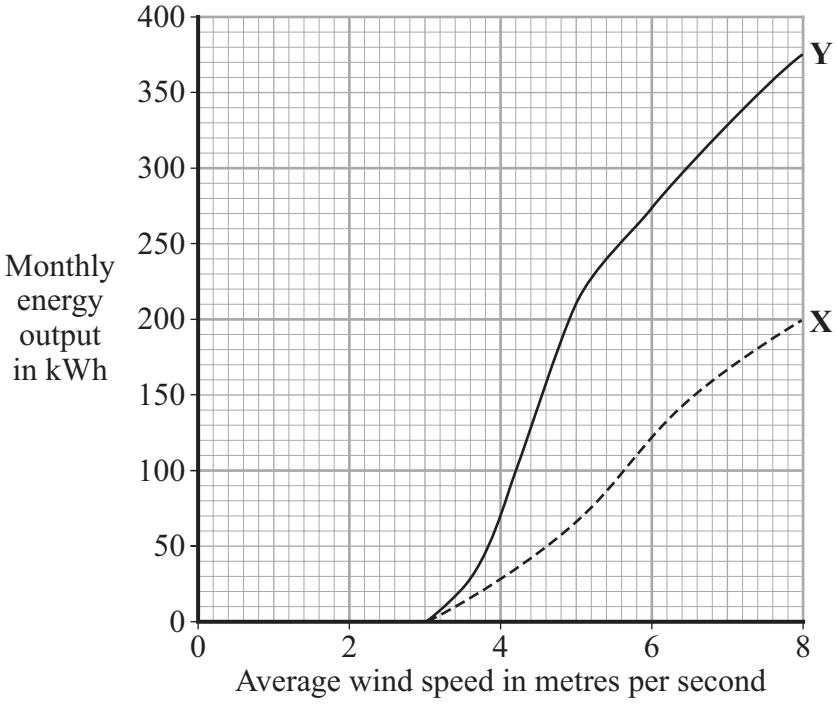
QUESTION NINE

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

A customer has to decide which turbine to install.

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





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

1 80 W

2 120 W

3 880 W

4 1000 W

Question 28 · continued

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

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

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

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

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

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

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

Is the advice given by the salesman the best advice?

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

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

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

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

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

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

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

2 the turbine is a health risk.

3 the turbine will cause air pollution.

4 having a turbine is a status symbol.

END OF TEST

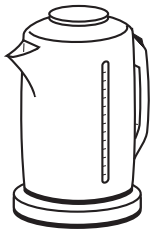
4.2.4.2 Energy transfers in everyday appliances

Question 29

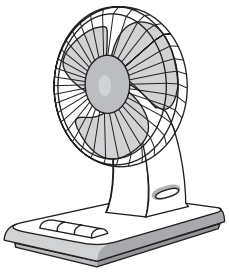
June 2008 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

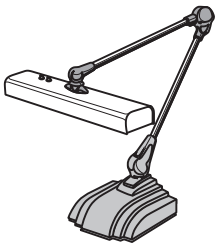
These devices transform electrical energy into other useful forms of energy.



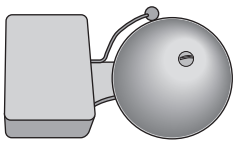
1
Kettle



2
Fan



3
Reading lamp



4
Bell

Match the useful forms of energy, **A**, **B**, **C** and **D**, with the devices numbered **1–4**.

A heat (thermal energy)

B light

C movement (kinetic energy)

D sound

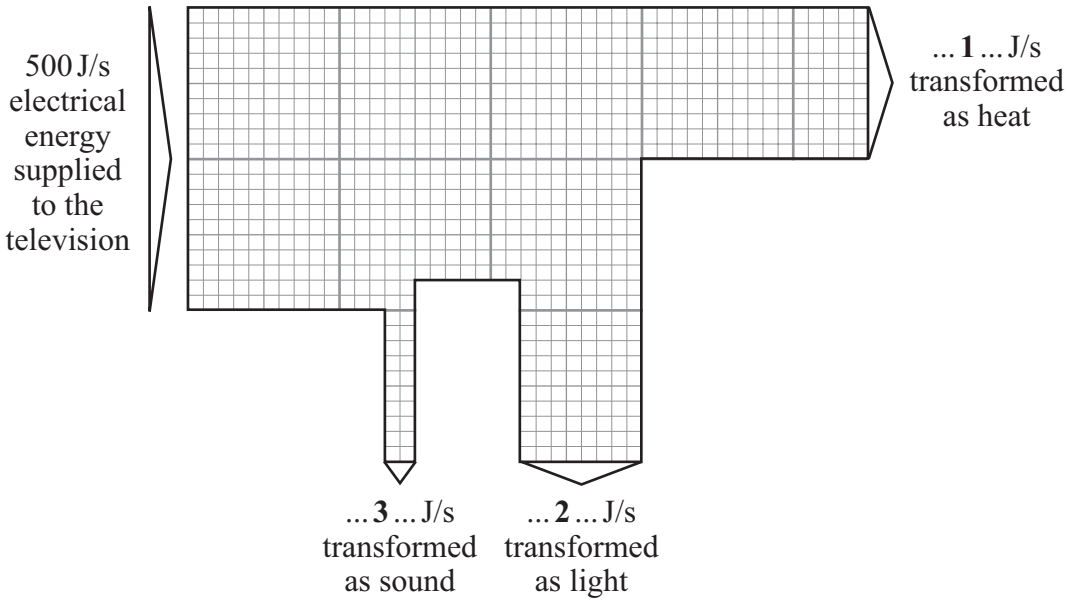
4.2.4.2 Energy transfers in everyday appliances

Question 30

June 2008 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

The Sankey diagram shows the energy flow for a television.



The efficiency of the television is ... **4** ...

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

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

A 0.50

B 50

C 200

D 250

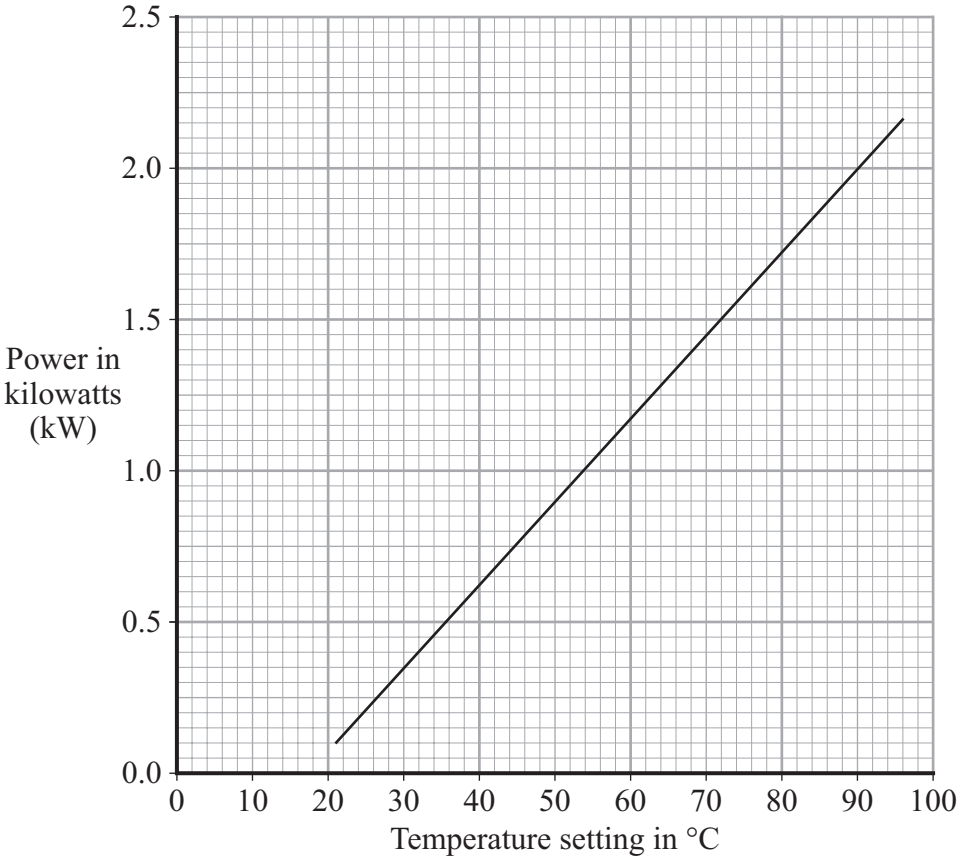
4.2.4.2 Energy transfers in everyday appliances

Question 31

June 2008 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

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



7A What relationship does the graph show?

1 As the temperature setting increases, the power increases.

2 As the temperature setting increases, the power decreases.

3 As the temperature setting decreases, the power increases.

4 There is no relationship.

4.2.4.2 Energy transfers in everyday appliances

Question 31 · continued June 2008 | PHY1AP | Original Q7 | Legacy

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

1 1.90 kW

2 1.95 kW

3 2.00 kW

4 2.10 kW

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

1 70 °C

2 71 °C

3 72 °C

4 75 °C

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

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

How many kilowatt-hours of energy will it use?

1 0.50

2 0.75

3 3.00

4 3.50

4.2.4.2 Energy transfers in everyday appliances

Question 32

June 2008 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

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

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

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

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

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

1 coal

2 gas

3 nuclear

4 hydroelectric

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

1 coal

2 gas

3 nuclear

4 wind

Question 32 · continued

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

Why might this be a good idea?

1 Transport costs for the fuel would be higher.

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

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

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

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

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

1 gas

2 hydroelectric (falling water)

3 nuclear

4 wind

END OF TEST

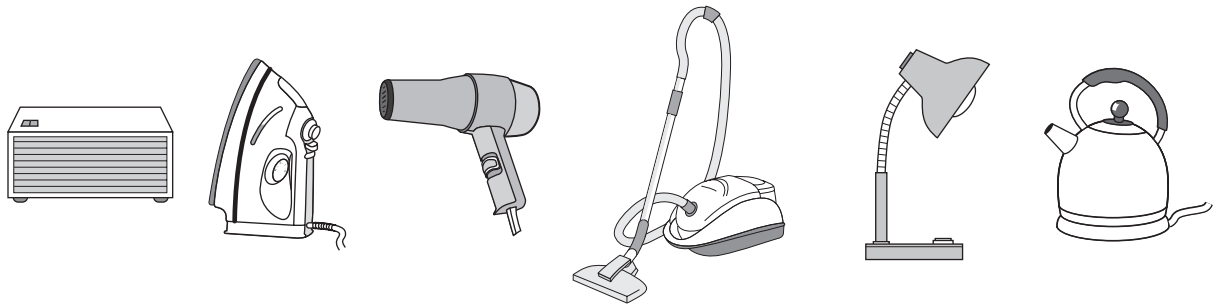
4.2.4.2 Energy transfers in everyday appliances

Question 33

June 2008 | PHY1F | Original Q1 | Legacy

1 The pictures show six different household appliances.

Fan heater | Iron | Hairdryer | Vacuum cleaner | Table lamp | Kettle



1 (a) Four of the appliances, including the fan heater, are designed to transform electrical energy into heat.

Name the other **three** appliances designed to transform electrical energy into heat.

1 .....

2 .....

3 .....

(3 marks)

1 (b) Complete the following sentence using **one** of the words from the box.

chemical	**heat**	**kinetic**	**sound**

Energy that is not usefully transformed by the fan heater is wasted as

..... energy.

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 33 · continued

for mark

1 (c) The table gives information about two different fan heaters.

	Useful energy transferred each second in joules	Wasted energy transferred each second in joules
Fan heater **L**	1200	10
Fan heater **M**	1200	20

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

Fan heater **L** | is more efficient than / has the same efficiency as / is less efficient than | fan heater **M**.

(1 mark)

5

4.2.4.2 Energy transfers in everyday appliances

Question 34

June 2008 | PHY1F | Original Q5 | Legacy

5 A householder was out shopping when her electricity meter reading should have been taken. The electricity company estimated the reading and sent the following bill. Unfortunately, the bill was damaged in the post.

AQA electricity

Customer reference: 2634724983
Date sent out: 18 September 2007

Your electricity bill

Present reading: 62740 (e) taken on 13 September
Previous reading: 62580 taken on 12 June

Used: 160 kWh

Cost per kWh = 12p (e) = estimated reading
Cost of electricity used =

5 (a) Use the equation in the box to calculate the cost of the electricity used between 12 June and 13 September.

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

Show clearly how you work out your answer.

.....

.....

Total cost = ...

(2 marks)

5 (b) The estimated reading shown on the bill was not very accurate. The correct reading was 62920.

How many kilowatt-hours of electricity had the householder actually used between the 12 June and the 13 September?

.....

.....

(2 marks)

4

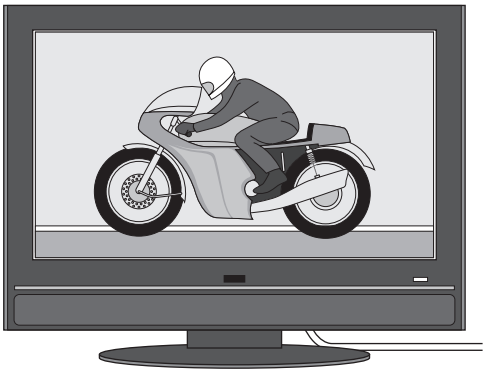
4.2.4.2 Energy transfers in everyday appliances

Question 35

November 2008 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

The drawing shows a television set.



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

A electrical

B heat

C light

D sound

The television is designed to transform . . . **1** . . . energy into . . . **2** . . . energy at the screen.

The loudspeaker transforms kinetic energy into . . . **3** . . . energy.

Some energy is wasted as . . . **4** . . . .

4.2.4.2 Energy transfers in everyday appliances

Question 36

November 2008 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

This is part of a report in a newspaper.

Tidal Barrage will power Britain

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

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

1 burning fossil fuels releases harmful gases into the atmosphere.

2 tidal power is less expensive than fossil fuels.

3 tidal power is more efficient than fossil fuels.

4 we have no fossil fuels left.

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

Tidal power stations . . .

1 are a predictable source of energy.

2 endanger wildlife and destroy habitats.

3 create jobs.

4 release no harmful gases in the atmosphere.

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

The turbines are connected to a . . .

1 boiler.

2 generator.

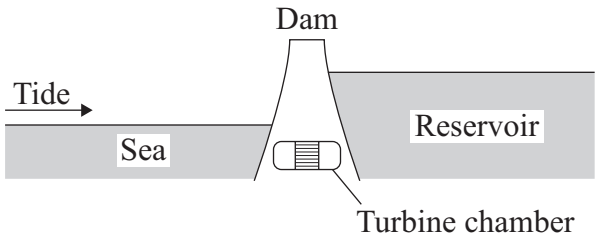
3 pump.

4 transformer.

4.2.4.2 Energy transfers in everyday appliances

Question 36 · continued

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



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

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

1 from kinetic to gravitational potential to electrical.

2 from gravitational potential to kinetic to electrical.

3 from chemical to kinetic to electrical.

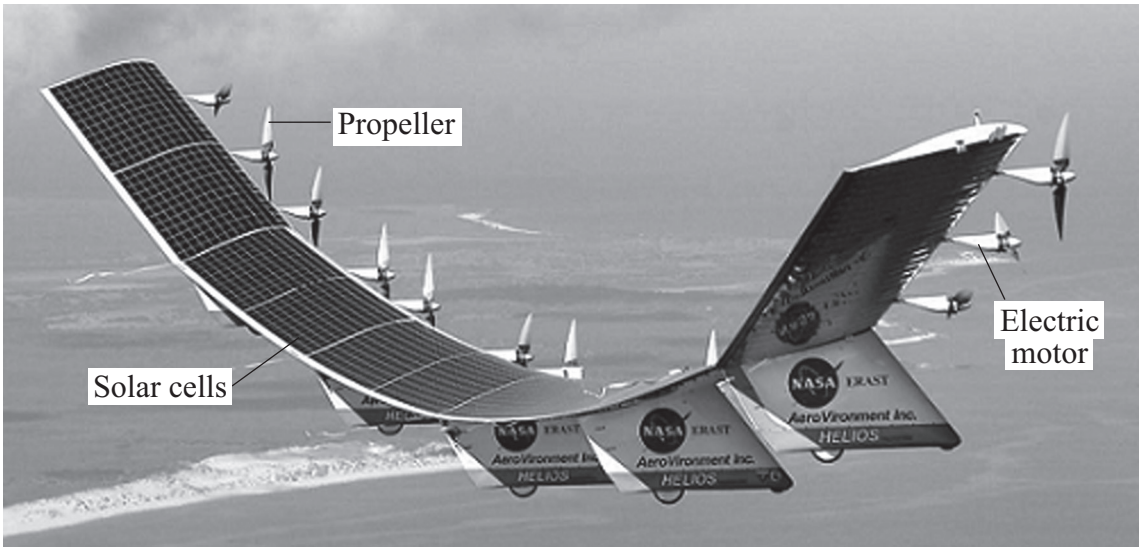
4 from kinetic to heat to electrical.

4.2.4.2 Energy transfers in everyday appliances

Question 37

January 2009 | PHY1F | Original Q3 | Legacy

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



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

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

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

..... energy.

(2 marks)

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

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

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 37 · continued

for mark

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

.....

(1 mark)

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

.....

.....

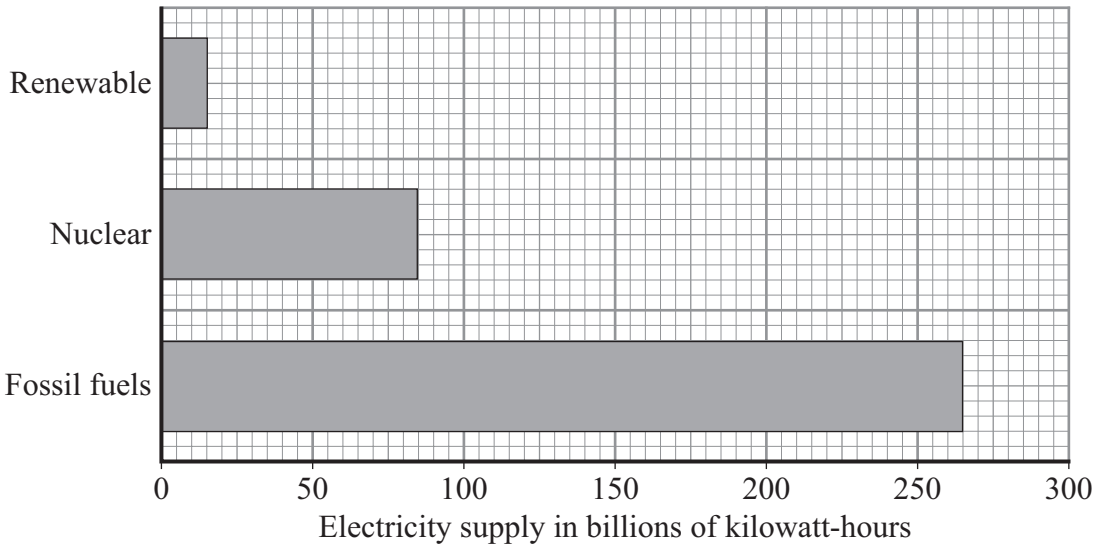
(1 mark)

8

4.2.4.2 Energy transfers in everyday appliances

Question 38

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



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

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

.....

(1 mark)

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

Using less fossil fuels to generate electricity will

decrease
not change
increase

the

amount of carbon dioxide emitted into the atmosphere.

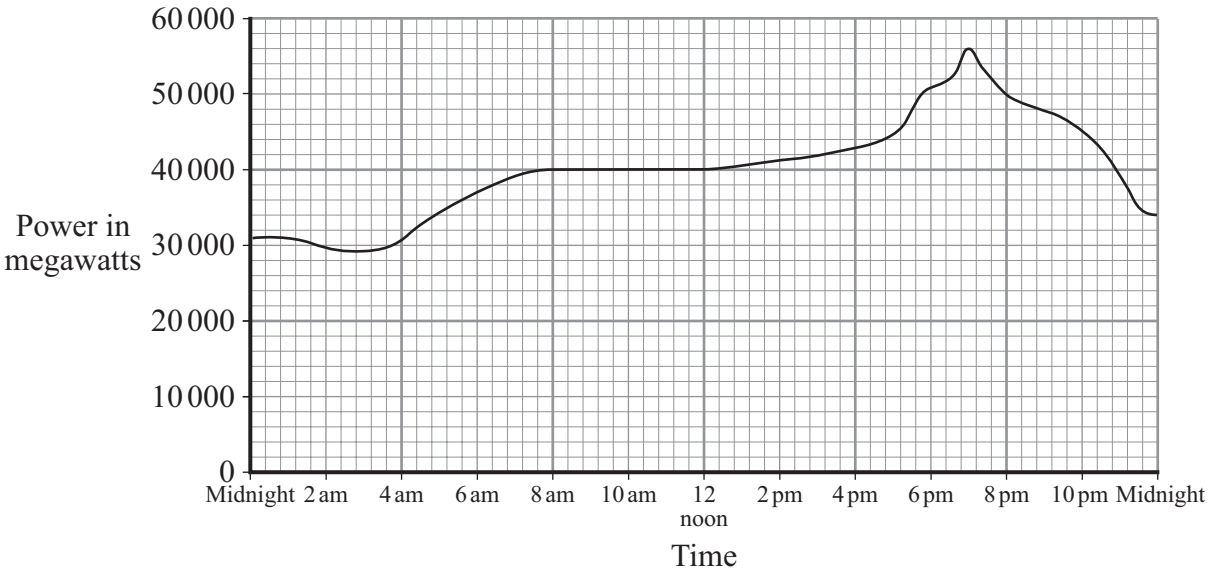
(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 38 · continued

for mark

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



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

.....

.....

.....

.....

(2 marks)

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

Draw a ring around your answer.

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

(1 mark)

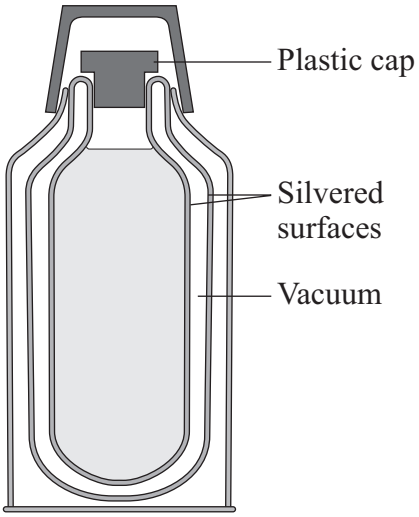
5

4.2.4.2 Energy transfers in everyday appliances

Question 39

January 2009 | PHY1F | Original Q6 | Legacy

6 A vacuum flask is designed to reduce the rate of heat transfer.



6 (a) (i) Complete the table to show which methods of heat transfer are reduced by each of the features labelled in the diagram.

The first row has been done for you.

Feature	Conduction	Convection	Radiation
vacuum	✓	✓	
silvered surfaces			
plastic cap			

(2 marks)

6 (a) (ii) Explain why the vacuum between the glass walls of the flask reduces heat transfer by conduction and convection.

.....

.....

.....

.....

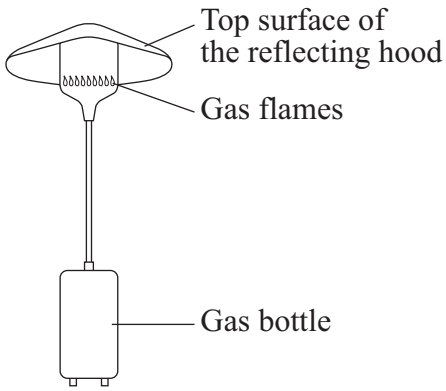
(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 39 · continued

for mark

6 (b) The diagram shows a gas flame patio heater.



6 (b) (i) Explain why the top surface of the reflecting hood should be a light, shiny surface rather than a dark, matt surface.

.....

.....

.....

(2 marks)

6 (b) (ii) Most of the chemical energy in the gas is transformed into heat. A **small** amount of chemical energy is transformed into light.

Draw and label a Sankey diagram for the patio heater.

(2 marks)

6 (b) (iii) State why the total energy supplied to the patio heater must always equal the total energy transferred by the patio heater.

.....

.....

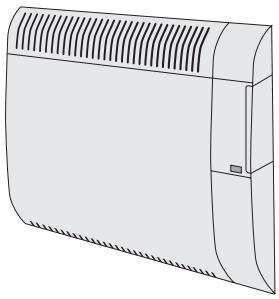
(1 mark)

9

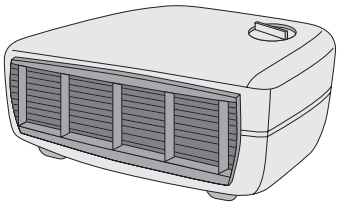
4.2.4.2 Energy transfers in everyday appliances

Question 40

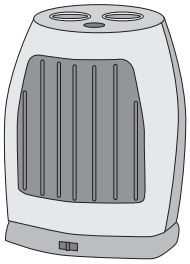
7 The pictures show three different types of electric heater.



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



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



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

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

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

energy transferred = power × time

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kilowatt-hours

(2 marks)

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

.....

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 40 · continued

for mark

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

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

oil-filled panel heater .....

.....

fan heater .....

.....

ceramic heater .....

.....

(3 marks)

6

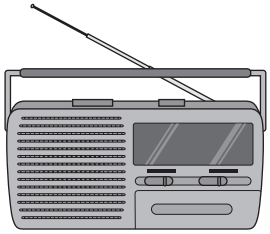
4.2.4.2 Energy transfers in everyday appliances

Question 41

March 2009 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

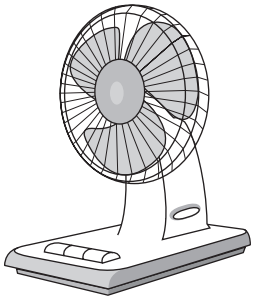
This question is about useful energy transformations in domestic appliances.



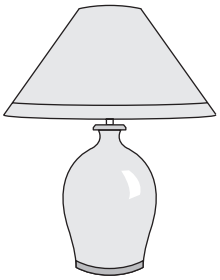
A
Radio



B
Toaster



C
Fan



D
Lamp

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

	Useful energy transformations
1	electrical to heat
2	electrical to kinetic
3	electrical to light
4	electrical to sound

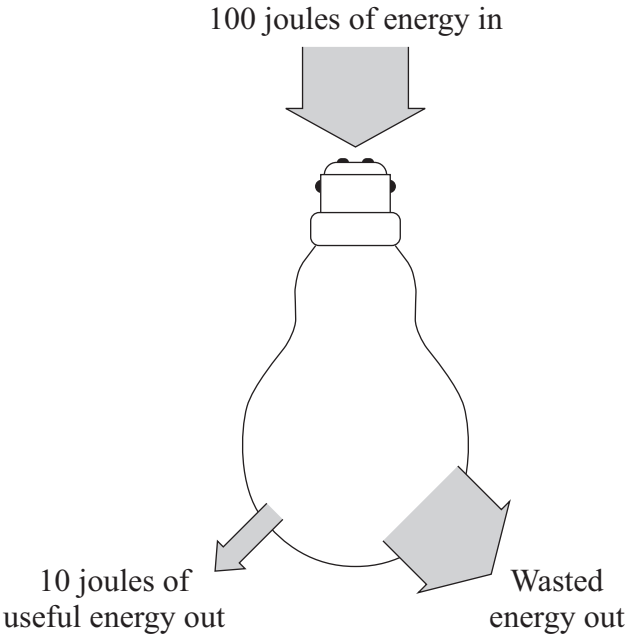
4.2.4.2 Energy transfers in everyday appliances

Question 42

March 2009 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows a tungsten filament lamp and the energy used by the lamp in one second.



7A How many joules of energy are wasted each second?

1 10

2 80

3 90

4 100

7B What type of wasted energy is produced by the lamp?

1 electrical

2 heat

3 light

4 sound

4.2.4.2 Energy transfers in everyday appliances

Question 42 · continued March 2009 | PHY1AP | Original Q7 | Legacy

7C What happens to the wasted energy?

1 It is transformed into useful energy.

2 It is destroyed.

3 It spreads out and becomes easier to use.

4 It spreads out and becomes more difficult to use.

7D What is the efficiency of the lamp?

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

1 0.1

2 0.8

3 0.9

4 1.0

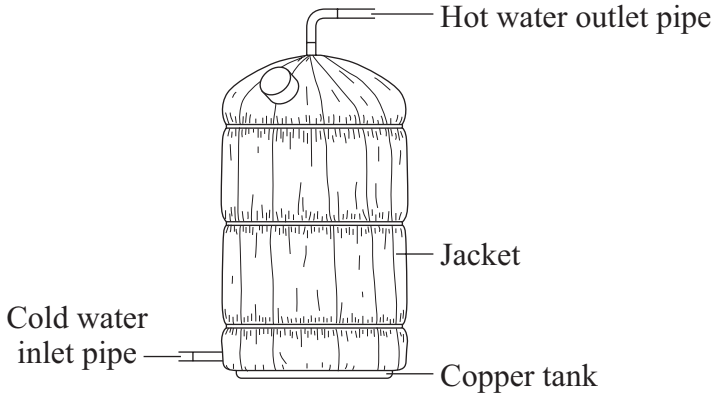
4.2.4.2 Energy transfers in everyday appliances

Question 43

March 2009 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

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



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

Trapped air reduces heat loss by . . .

1 conduction only.

2 conduction and radiation.

3 conduction and convection.

4 conduction, convection and radiation.

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

This is because dark matt surfaces are . . .

1 good conductors.

2 poor conductors.

3 good radiators.

4 poor radiators.

4.2.4.2 Energy transfers in everyday appliances

Question 43 · continued March 2009 | PHY1AP | Original Q9 | Legacy

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

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

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

1 0.5

2 18

3 500

4 18 000

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

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

How much was the bill?

1 £200

2 £600

3 £20 000

4 £60 000

END OF TEST

4.2.4.2 Energy transfers in everyday appliances

Question 44

June 2009 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

This question is about useful electrical devices.

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

A fan

B lamp

C oven

D radio

1	an electrical device designed to produce sound energy
2	an electrical device designed to produce light energy
3	an electrical device designed to produce kinetic energy
4	an electrical device designed to produce heat (thermal energy)

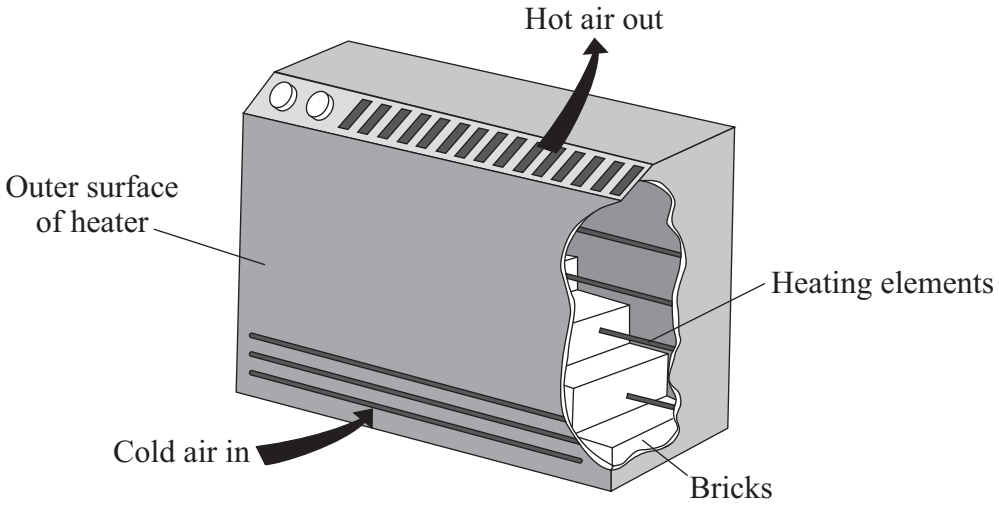
4.2.4.2 Energy transfers in everyday appliances

Question 45

June 2009 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

The diagram shows the construction of one type of heater. The bricks inside the heater warm up during the night when the cost of electricity is lower. The bricks then emit heat (thermal energy) during the day.



6A The bricks warm up because they . . .

1 absorb heat.

2 insulate heat.

3 radiate heat.

4 reflect heat.

6B The diagram shows the main thermal energy transfer of the heater as it warms the room.

By what process does this heater transfer most of its energy throughout a room in a house?

1 conduction from the bricks

2 conduction from the outside surface of the heater

3 convection currents in the air

4 radiation from the outside surface of the heater

Question 45 · continued

6C To give out the most heat, what would be the best outside surface for the heater?

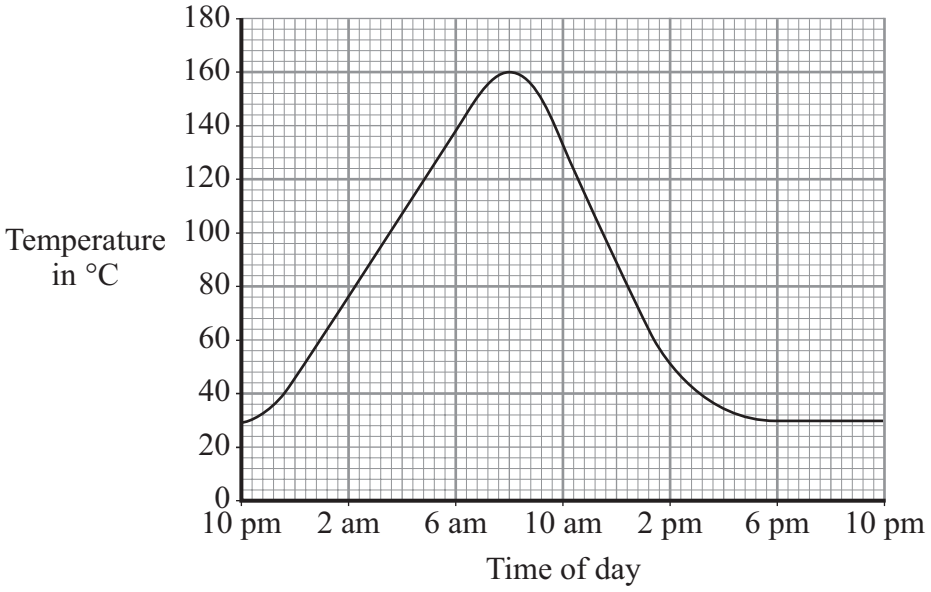
1 dark, matt

2 dark, shiny

3 light, shiny

4 light, matt

6D The graph shows how the temperature of the bricks changes during a 24-hour period.



At what time did the bricks reach their highest temperature?

1 8 am

2 10 am

3 6 pm

4 10 pm

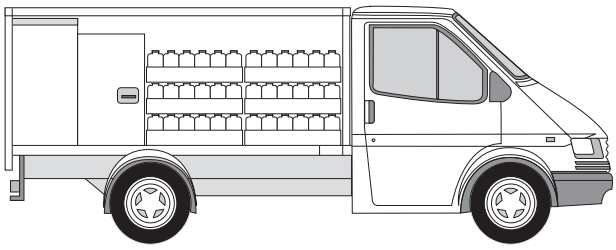
4.2.4.2 Energy transfers in everyday appliances

Question 46

June 2009 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The diagram shows an electrically powered milk float.



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

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

1 electrical energy to kinetic energy.

2 kinetic energy to chemical energy.

3 chemical energy to electrical energy.

4 kinetic energy to electrical energy.

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

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

The energy transferred to the batteries is . . .

1 0.3 kWh

2 3.3 kWh

3 7.5 kWh

4 75 kWh

4.2.4.2 Energy transfers in everyday appliances

Question 46 · continued June 2009 | PHY1AP | Original Q9 | Legacy

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

What is the efficiency of the motor?

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

1 0.4

2 2.5

3 2400

4 5600

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

This is because . . .

1 the batteries store energy.

2 it produces no harmful waste gases.

3 the batteries can be recharged many times.

4 the top speed is only 20 km/h.

END OF TEST

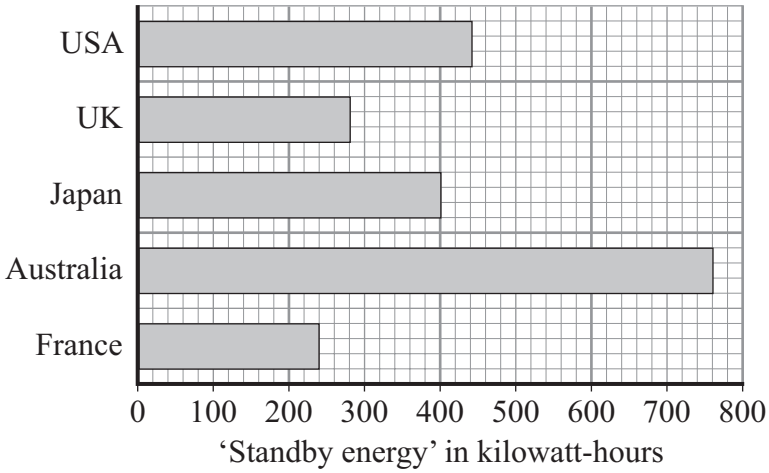
4.2.4.2 Energy transfers in everyday appliances

Question 47

June 2009 | PHY1F | Original Q5 | Legacy

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

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



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

Draw a ring around your answer.

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

(1 mark)

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

.....

.....

(1 mark)

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

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

.....

.....

(1 mark)

Question 47 · continued

for mark

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

Wasting less electricity would be good for the Australian environment.

Explain why.

.....

.....

.....

.....

(2 marks)

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

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

Draw a ring around your answer.

hertz **joule** **watt**

(1 mark)

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

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

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

Show clearly how you work out your answer.

Give your answer in pence.

.....

.....

Cost = ... pence

(3 marks)

Question 5 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 47 · continued

for mark

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

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

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

A nuclear power station is very expensive to build. ☐

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

It is easy to store nuclear waste safely. ☐

(1 mark)

10

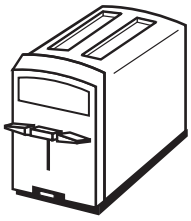
4.2.4.2 Energy transfers in everyday appliances

Question 48

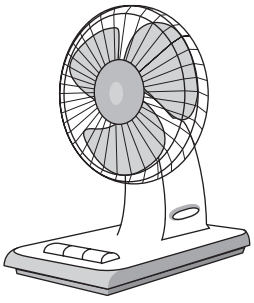
November 2009 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

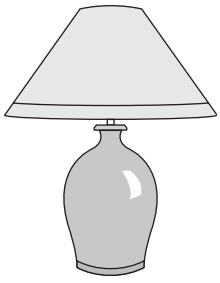
The diagrams show four electrical appliances.



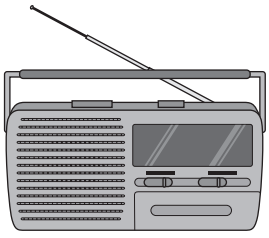
A
Toaster



B
Fan



C
Lamp



D
Radio

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

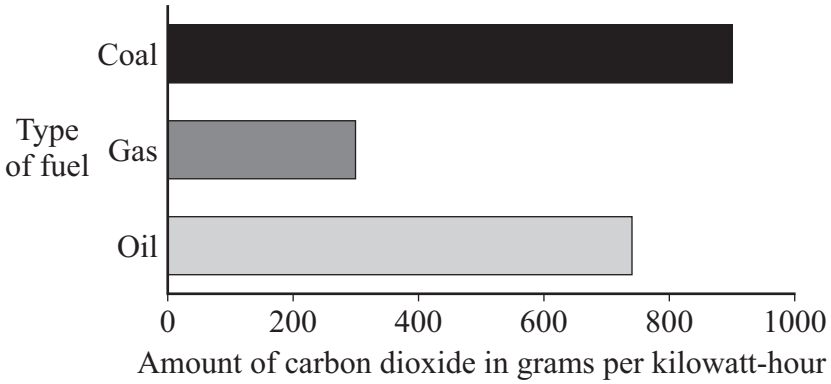
	Useful energy	Wasted energy
1	sound	heat
2	kinetic	heat and sound
3	light	heat
4	heat	light

4.2.4.2 Energy transfers in everyday appliances

Question 49

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

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



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

.....

(1 mark)

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

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

Both variables are categoric. ☐

Both variables are continuous. ☐

One variable is categoric, the other is continuous. ☐

(1 mark)

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

.....

.....

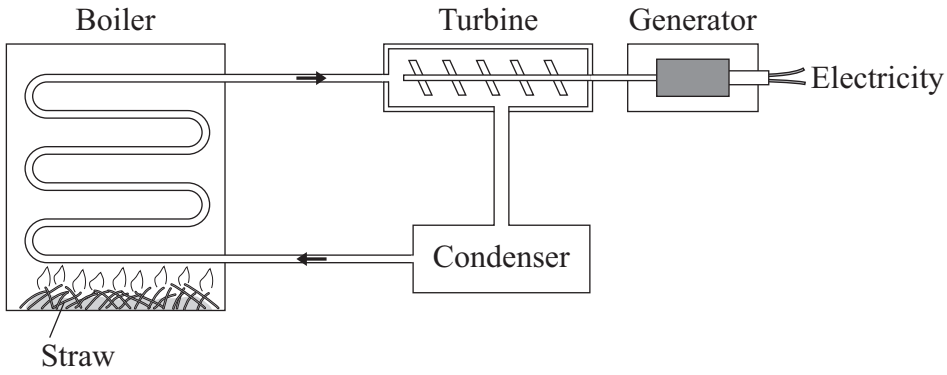
(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 49 · continued

for mark

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



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

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

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

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

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

(4 marks)

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

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

.....

(1 mark)

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

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

Show clearly how you work out your answer.

.....

.....

Number of homes = ...

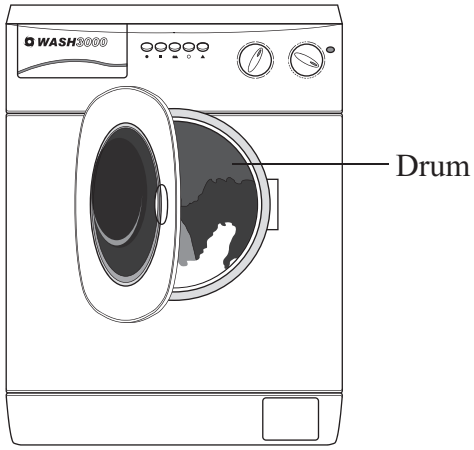
(2 marks)

10

4.2.4.2 Energy transfers in everyday appliances

Question 50

7 The picture shows a new washing machine. When the door is closed and the machine switched on, an electric motor rotates the drum and washing.



7 (a) Complete the following sentences.

7 (a) (i) An electric motor is designed to transform electrical energy into

..... energy.

(1 mark)

7 (a) (ii) Some of the electrical energy supplied to the motor is wasted as

..... energy and ..... energy.

(1 mark)

7 (b) What happens to the energy wasted by the electric motor?

.....

.....

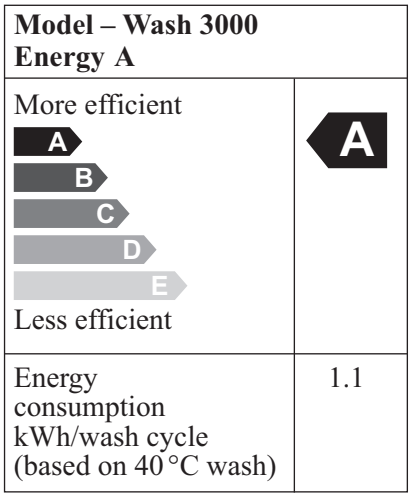
(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 50 · continued

for mark

7 (c) The diagram shows the label from the new washing machine.



An 'A' rated washing machine is *more energy efficient* than a 'C' rated washing machine.

Explain what being *more energy efficient* means.

.....

.....

.....

.....

(2 marks)

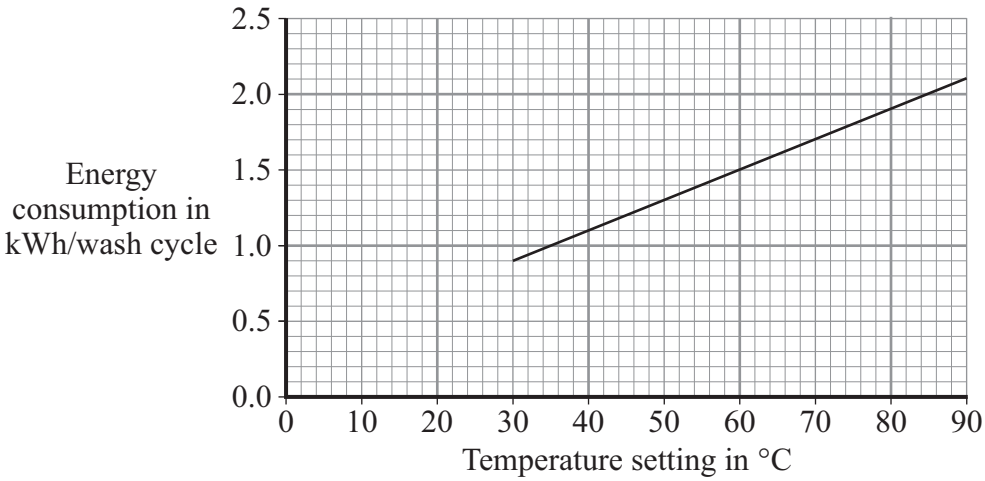
Question 7 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 50 · continued

for mark

7 (d) The graph shows that washing clothes at a lower temperature uses less energy than washing them at a higher temperature. Using less energy will save money.



7 (d) (i) Electricity costs 12 p per kilowatt-hour (kWh).
The temperature setting is turned down from 40 °C to 30 °C.

Use the graph and equation in the box to calculate the money saved each wash cycle.

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

Show clearly how you work out your answer.

.....

.....

Money saved = ... p

(2 marks)

7 (d) (ii) Suggest why reducing the amount of energy used by washing machines could reduce the amount of carbon dioxide emitted into the atmosphere.

.....

.....

(1 mark)

8

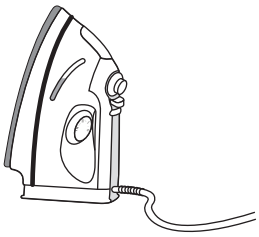
4.2.4.2 Energy transfers in everyday appliances

Question 51

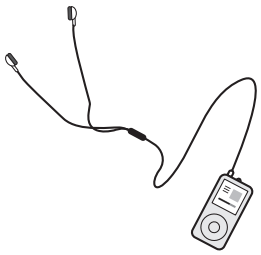
March 2010 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

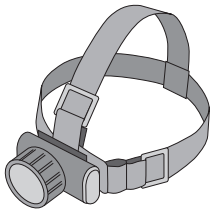
These devices transform electrical energy into other useful forms of energy.



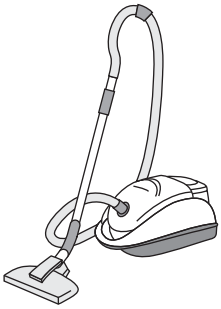
1
Iron



2
MP3 player



3
Head torch



4
Vacuum cleaner

Match the useful forms of energy, **A**, **B**, **C** and **D**, with the devices **1–4**.

A heat (thermal energy)

B light

C movement (kinetic energy)

D sound

4.2.4.2 Energy transfers in everyday appliances

Question 52

March 2010 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

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

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

$$\text{energy transferred (kilowatt-hour, kWh)} = \text{power (kilowatt, kW)} \times \text{time (hour, h)}$$

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

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

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

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

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

4.2.4.2 Energy transfers in everyday appliances

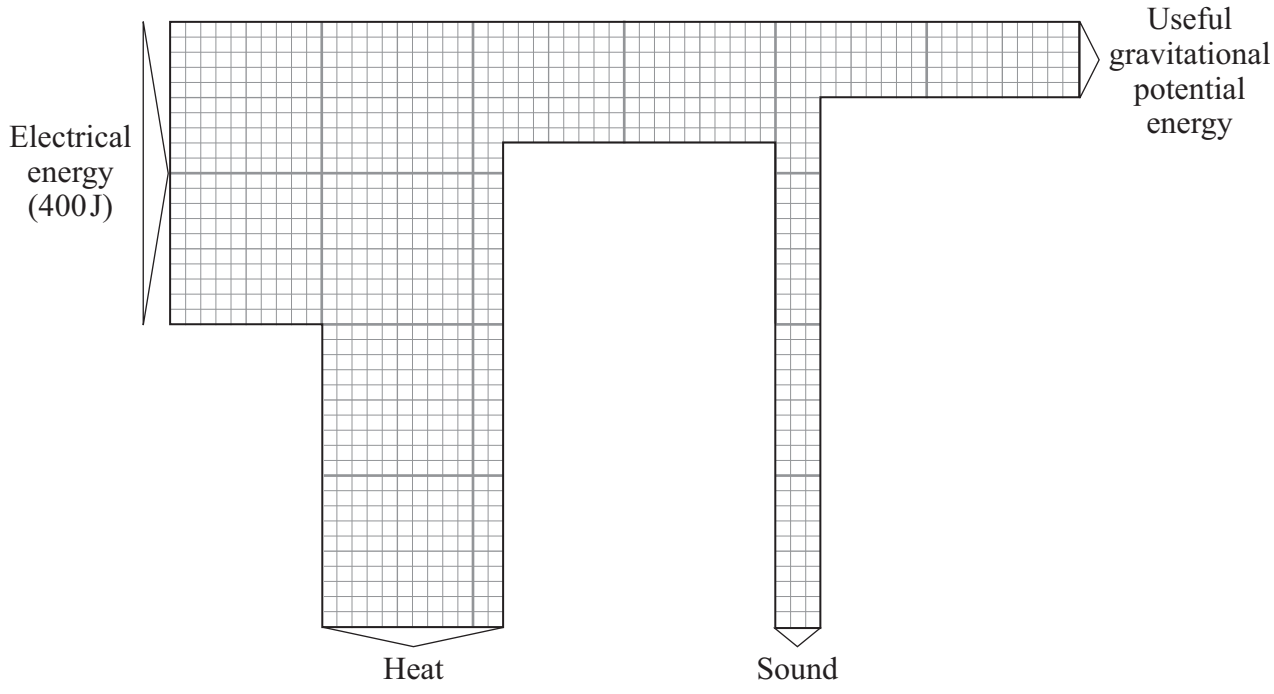
Question 53

March 2010 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

An electric motor is used to lift a weight.

The Sankey diagram shows the energy transformations that take place each second in the electric motor.



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

A 0.25

B 60

C 100

D 240

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

The useful gravitational potential energy gained each second is . . . **1** . . . J.

The heat (thermal energy) produced each second is . . . **2** . . . J.

The sound energy produced each second is . . . **3** . . . J.

The total energy wasted each second is 300 J. The efficiency of the electric motor is . . . **4** . . . .

4.2.4.2 Energy transfers in everyday appliances

Question 54

March 2010 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

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

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

1 Electricity can be switched on and off easily.

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

3 Electricity cannot be stored in the home.

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

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

82913
May

83713
August

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

1 600 kWh

2 650 kWh

3 700 kWh

4 800 kWh

4.2.4.2 Energy transfers in everyday appliances

Question 54 · continued March 2010 | PHY1AP | Original Q6 | Legacy

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

Electricity costs 15 pence per kilowatt-hour.

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

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

1 £80

2 £90

3 £100

4 £110

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

People usually make this change for . . .

1 economic reasons.

2 environmental reasons.

3 ethical reasons.

4 social reasons.

4.2.4.2 Energy transfers in everyday appliances

Question 55

June 2010 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

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

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

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

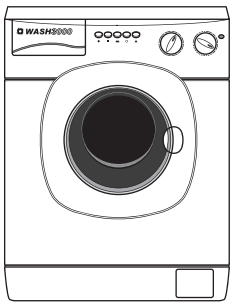
1	produces the cheapest electricity
2	is renewable
3	contributes least to global warming
4	contributes most to global warming

4.2.4.2 Energy transfers in everyday appliances

Question 56

June 2010 | PHY1AP | Original Q6 | Legacy

QUESTION SIX



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

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

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

1 chemical energy.

2 kinetic energy.

3 light energy.

4 sound energy.

Question 56 · continued

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

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

1 3.6 kWh

2 3.2 kWh

3 0.8 kWh

4 0.4 kWh

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

1 The HOT cycle has the lowest average power.

2 The HOT cycle takes the shortest time to run.

3 More energy is transferred during the HOT cycle.

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

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

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

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

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

1 £1.20

2 12 p

3 1.2 p

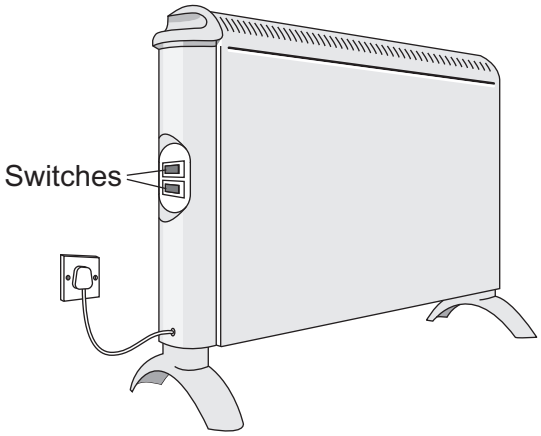
4 0.12 p

4.2.4.2 Energy transfers in everyday appliances

Question 57

June 2010 | PHY1F | Original Q3 | Legacy

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



Setting	Power in kW
Low	0.5
Medium	1.5
High	

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

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

.....

Power = ... kW

(1 mark)

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

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

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

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 57 · continued

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

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

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

Show clearly how you work out your answer.

.....

.....

Total cost = ... pence

(2 marks)

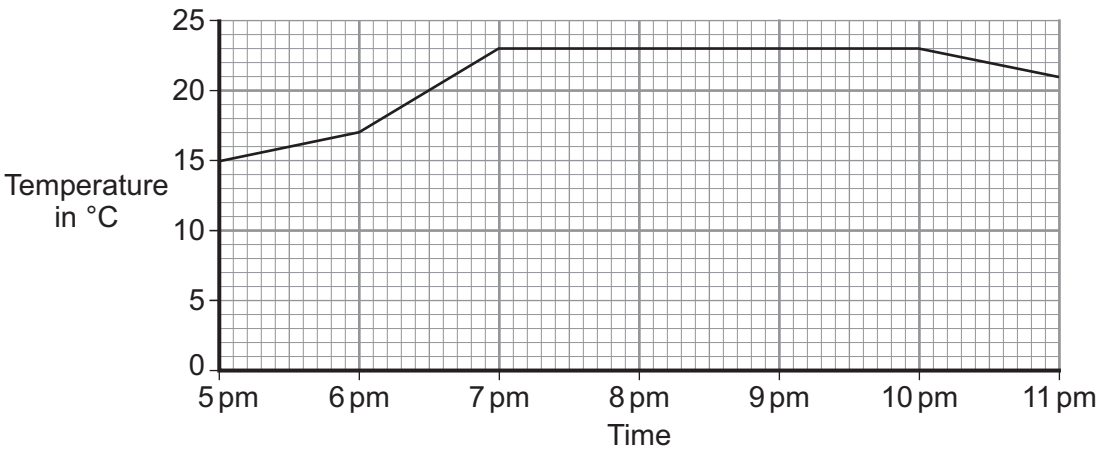
Question 3 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 57 · continued

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

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



The heater was first used on the medium setting.

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

.....

Give a reason for your answer.

.....

.....

.....

(2 marks)

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

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

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

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

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

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

(1 mark)

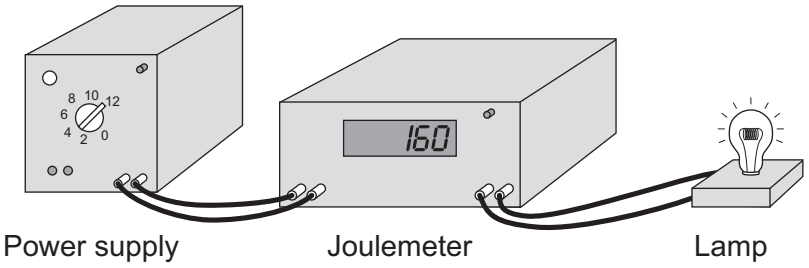
8

4.2.4.2 Energy transfers in everyday appliances

Question 58

June 2010 | PHY2F | Original Q1 | Legacy

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



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

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

(1 mark)

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

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

Show clearly how you work out your answer.

.....

.....

Power = ...

(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 58 · continued

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

Draw a ring around your answer.

joule **newton** **watt**

(1 mark)

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

larger than	the same as	smaller than

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

(1 mark)

5

Turn over for the next question

4.2.4.2 Energy transfers in everyday appliances

Question 59

QUESTION THREE

An inventor has designed a way of charging a mobile phone battery as a person is walking. The charger unit contains a generator. The unit is strapped to a leg.



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

A chemical

B electrical

C heat

D kinetic

As the person walks, . . . **1** . . . energy from food is transformed to . . . **2** . . . energy of the moving legs.

The generator produces useful . . . **3** . . . energy.

Some energy is wasted as . . . **4** . . . .

4.2.4.2 Energy transfers in everyday appliances

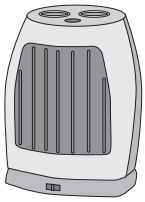
Question 60

November 2010 | PHY1AP | Original Q6 | Legacy

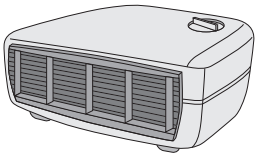
QUESTION SIX

The pictures show four different types of electric heater.

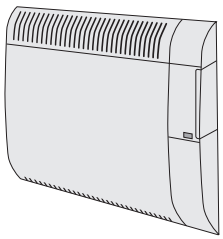
1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out



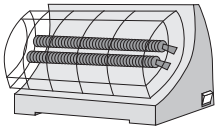
3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



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



2 kW radiant heater
- 2 heat settings



6A Which heater is the most powerful?

1 the ceramic heater

2 the fan heater

3 the oil-filled panel heater

4 the radiant heater

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

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

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

1 0.75

2 3.0

3 7.0

4 12.0

4.2.4.2 Energy transfers in everyday appliances

Question 60 · continued

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

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

Electricity costs 14p per kWh

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

1 £0.14

2 £1.40

3 £14.00

4 £140.00

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

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

2 The fan heater has a power indicator light.

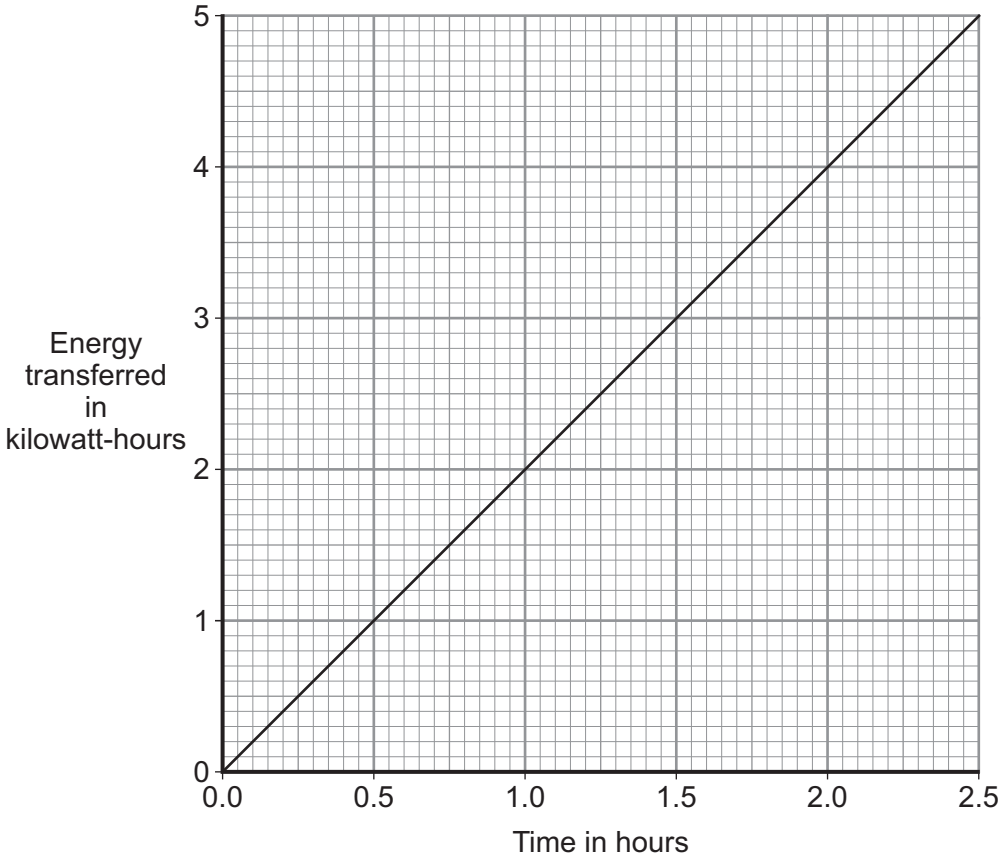
3 The fan heater has a safety overheat cut-out.

4 The fan heater has more than one heat setting.

4.2.4.2 Energy transfers in everyday appliances

Question 61

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



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

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

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

Show clearly how you work out your answer.

.....

.....

Cost = ... p

(2 marks)

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

(1 mark)

3

4.2.4.2 Energy transfers in everyday appliances

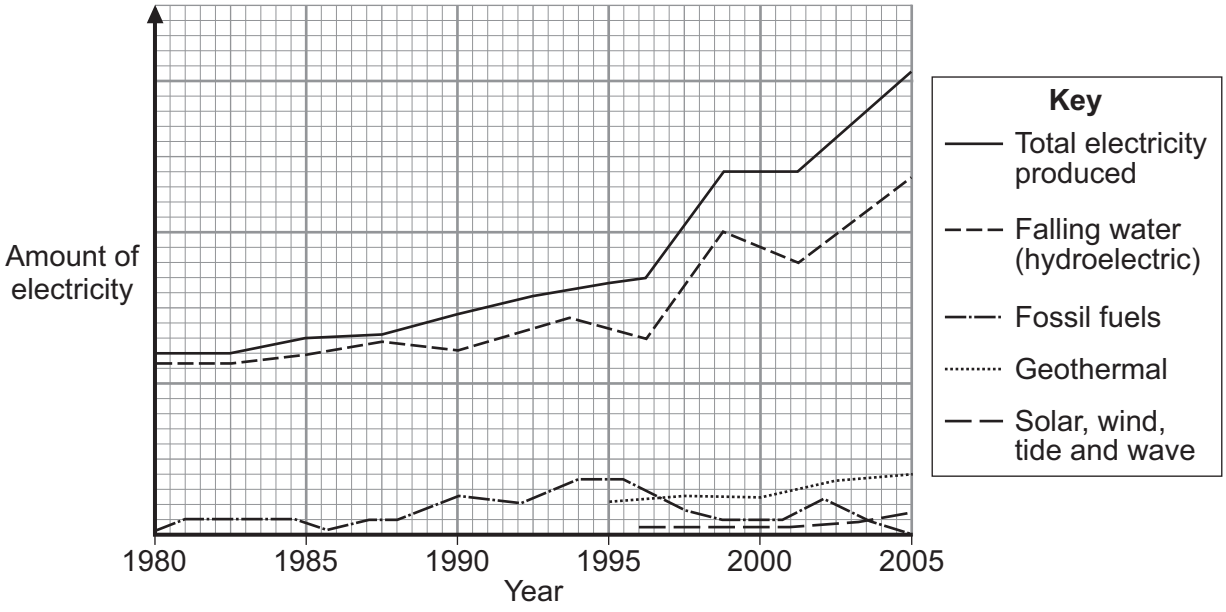
Question 62

March 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

Costa Rica is a country in Central America.

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



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

1 falling water (hydroelectric)

2 fossil fuels

3 geothermal

4 solar, wind, tide and wave

7B Which energy source was first used in 1995?

1 falling water (hydroelectric)

2 fossil fuels

3 geothermal

4 solar, wind, tide and wave

Question 62 · continued

7C The graph shows . . .

1 a decrease in the total amount of electricity produced.

2 an increase in the total amount of electricity produced.

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

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

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

1 does not produce much polluting gas.

2 does not use renewable energy sources.

3 has very few mountains.

4 uses mainly fossil fuels.

Turn over for the next question

4.2.4.2 Energy transfers in everyday appliances

Question 63

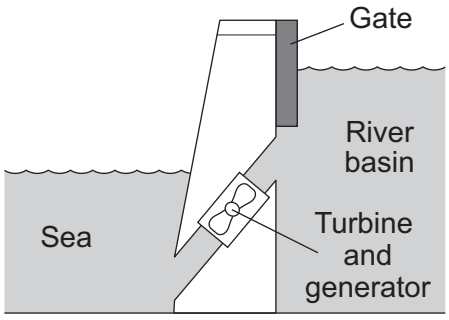
March 2011 | PHY1AP | Original Q8 | Legacy

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.

Question 63 · continued

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

1 cause noise pollution.

2 destroy the habitat of wading birds.

3 produce gases that pollute the atmosphere.

4 produce radioactive waste.

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

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

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

1 tidal barrage, underwater current, wind farm.

2 underwater current, wind farm, tidal barrage.

3 wind farm, tidal barrage, underwater current.

4 wind farm, underwater current, tidal barrage.

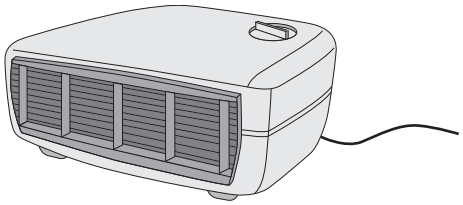
4.2.4.2 Energy transfers in everyday appliances

Question 64

March 2011 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

A fan heater is used to heat air and to move it around a room.



Fan heater

9A The fan heater usefully transforms electrical energy to . . .

1 kinetic and sound energy.

2 light and thermal energy.

3 sound and light energy.

4 thermal and kinetic energy.

9B Energy that is not usefully transformed by the fan heater is wasted as . . .

1 chemical energy.

2 kinetic energy.

3 sound energy.

4 thermal energy.

9C The fan heater moves hot air around the room.

This method of heat transfer is sometimes called forced . . .

1 conduction.

2 convection.

3 evaporation.

4 radiation.

4.2.4.2 Energy transfers in everyday appliances

Question 64 · continued

March 2011 | PHY1AP | Original Q9 | Legacy

9D The fan heater transfers 3 kWh of energy as it warms a room.

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

Electricity costs 15p per kWh

What is the cost of this energy?

1 5p

2 45p

3 £5

4 £45

END OF TEST

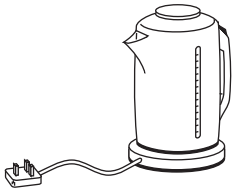
4.2.4.2 Energy transfers in everyday appliances

Question 65

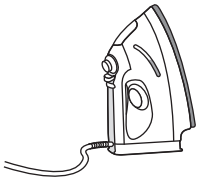
June 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

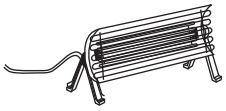
The diagrams show four electrical heating devices.



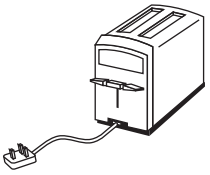
2 kW
Kettle



500 W
Iron



1 kW
Fire



0.5 kW
Toaster

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

1 the kettle and the iron

2 the iron and the toaster

3 the toaster and the fire

4 the fire and the kettle

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

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

How much energy does the kettle transfer?

1 1 kWh

2 4 kWh

3 1000 kWh

4 4000 kWh

4.2.4.2 Energy transfers in everyday appliances

Question 65 · continued June 2011 | PHY1AP | Original Q7 | Legacy

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

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

Electricity costs 14 p per kWh

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

1 7 p

2 14 p

3 28 p

4 56 p

7D The kettle casing is made of plastic.

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

1 plastic is an electrical insulator.

2 plastic is a thermal insulator.

3 plastic has a higher density than metal.

4 plastic is cheaper than metal.

4.2.4.2 Energy transfers in everyday appliances

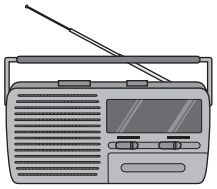
Question 66

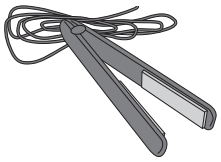
June 2011 | PHY1F | Original Q5 | Legacy

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


Kettle


Toaster


Radio


Hair straighteners

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

.....

Give a reason for your answer.

.....

.....

(2 marks)

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

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

Each appliance is switched on for 5 minutes.

Which appliance transforms the most energy?

.....

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 66 · continued

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

Electricity costs 15 p per kilowatt-hour.

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

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

Show clearly how you work out your answer.

.....

.....

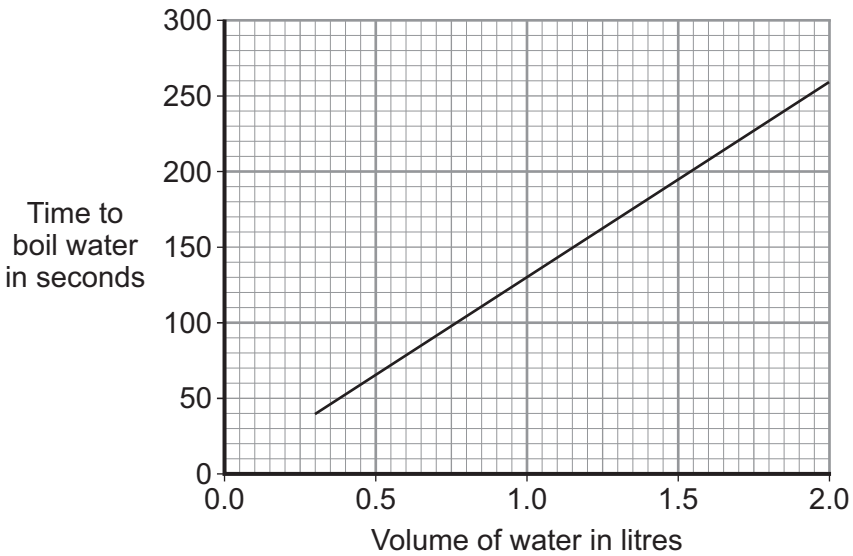
Total cost = ... pence
(2 marks)

Question 5 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 66 · continued

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



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

Explain how the householder is wasting money.

.....

.....

.....

.....

.....

.....

(3 marks)

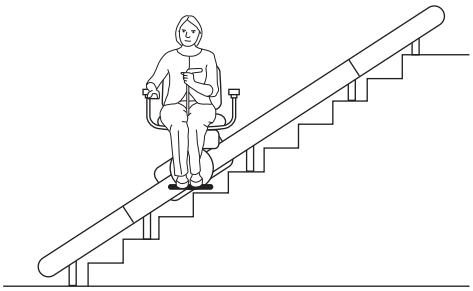
8

4.2.4.2 Energy transfers in everyday appliances

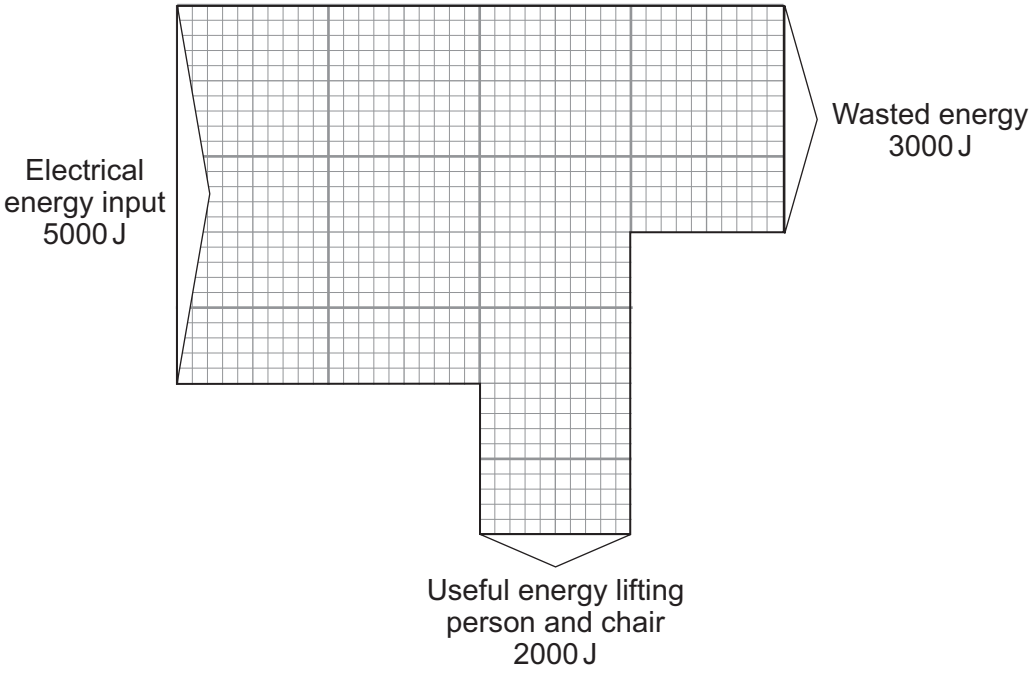
Question 67

June 2011 | PHY1F | Original Q6 | Legacy

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



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



6 (a) Complete the following sentence.

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

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 67 · continued

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

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

3

Turn over for the next question

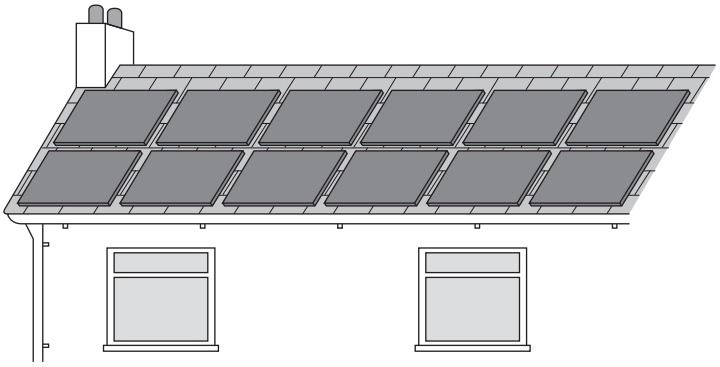
4.2.4.2 Energy transfers in everyday appliances

Question 68

November 2011 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

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



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

1 electrical to light.

2 electrical to heat.

3 heat to electrical.

4 light to electrical.

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

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

1 15 W

2 15 kW

3 2160 W

4 2160 kW

4.2.4.2 Energy transfers in everyday appliances

Question 68 · continued

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

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

Electricity from the mains supply costs 15 p per kWh

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

1 £2.40

2 £24

3 £240

4 £24 000

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

1 fuel costs.

2 habitats destroyed.

3 polluting gases given off.

4 radioactive waste products.

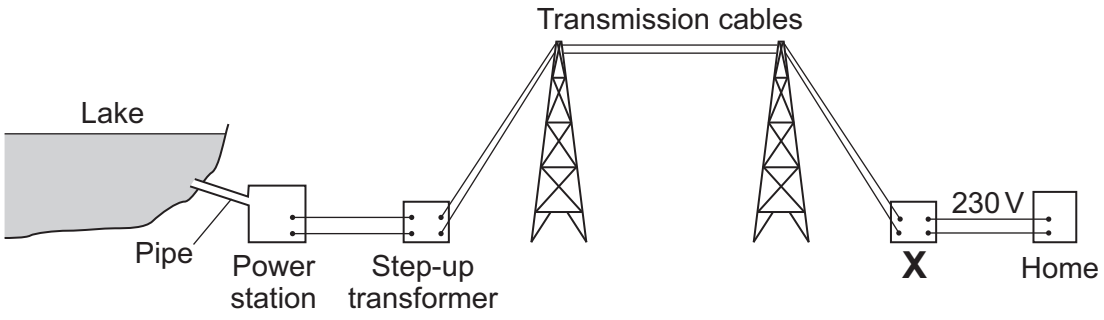
4.2.4.2 Energy transfers in everyday appliances

Question 69

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.

Question 69 · 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

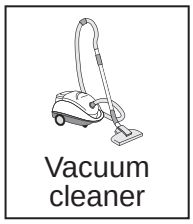
Turn over for the next question

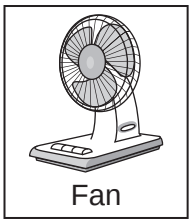
4.2.4.2 Energy transfers in everyday appliances

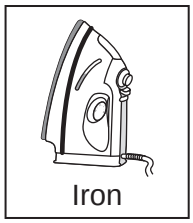
Question 70

June 2012 | PH1FP | Original Q1 | Legacy

1 The appliances shown below transfer electrical energy to other types of energy.

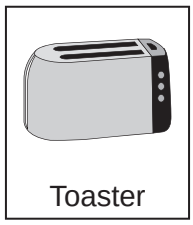

Vacuum cleaner


Fan


Iron


Drill


Washing machine


Toaster


Television

1 (a) The vacuum cleaner is designed to transfer electrical energy to kinetic energy.

Three more of the appliances are also designed to transfer electrical energy to kinetic energy. Which **three**?

Draw a ring around each correct appliance.

(3 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 70 · continued

1 (b) Which **two** of the following statements are true?

Tick (✓) **two** boxes.

Appliances only transfer part of the energy usefully. ☐

The energy transferred by appliances will be destroyed. ☐

The energy transferred by appliances makes the surroundings warmer. ☐

The energy output from an appliance is bigger than the energy input. ☐

(2 marks)

5

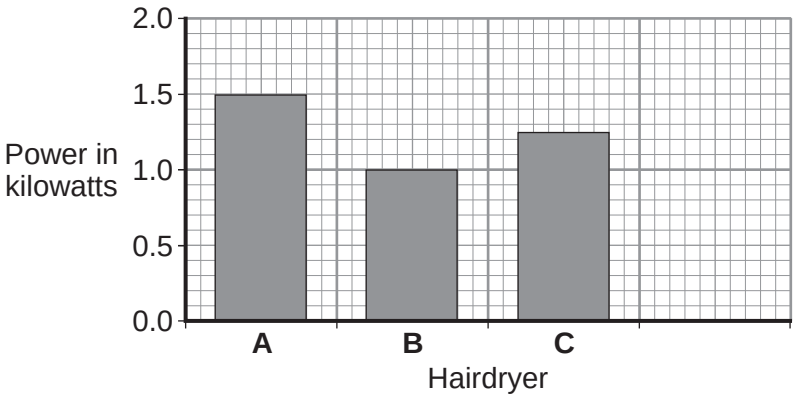
Turn over for the next question

4.2.4.2 Energy transfers in everyday appliances

Question 71

June 2012 | PH1FP | Original Q4 | Legacy

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



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

Write the correct answer in the box. ☐

(1 mark)

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

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

(1 mark)

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

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

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 71 · continued

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

Calculate the cost of using the hairdryer for 2 hours.

Show clearly how you work out your answer.

.....

.....

Cost = ... pence
(2 marks)

6

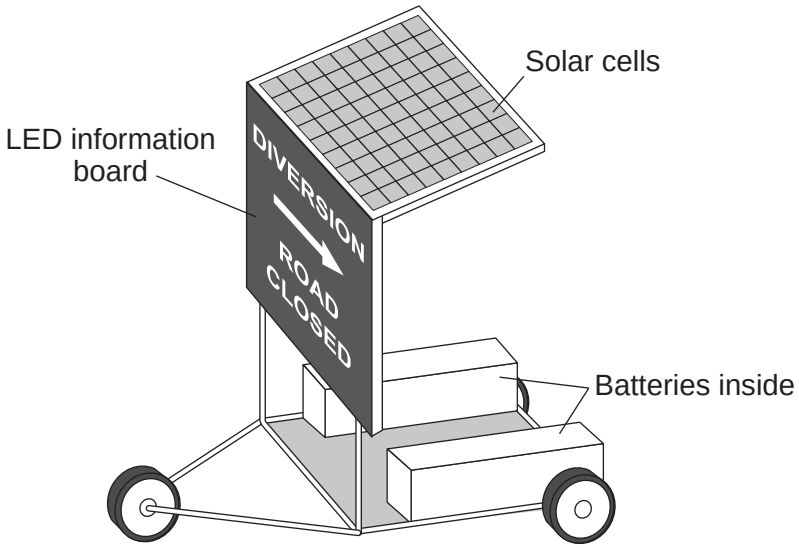
Turn over for the next question

4.2.4.2 Energy transfers in everyday appliances

Question 72

January 2013 | PH1FP | Original Q2 | Legacy

2 The picture shows a temporary road traffic information board.



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

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

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

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

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

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

(3 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 72 · continued

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

Calculate the efficiency of the solar cells.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Efficiency = ...

(2 marks)

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

Tick (✓) **one** box.

Solar cells will charge the batteries day and night. ☐

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

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

(1 mark)

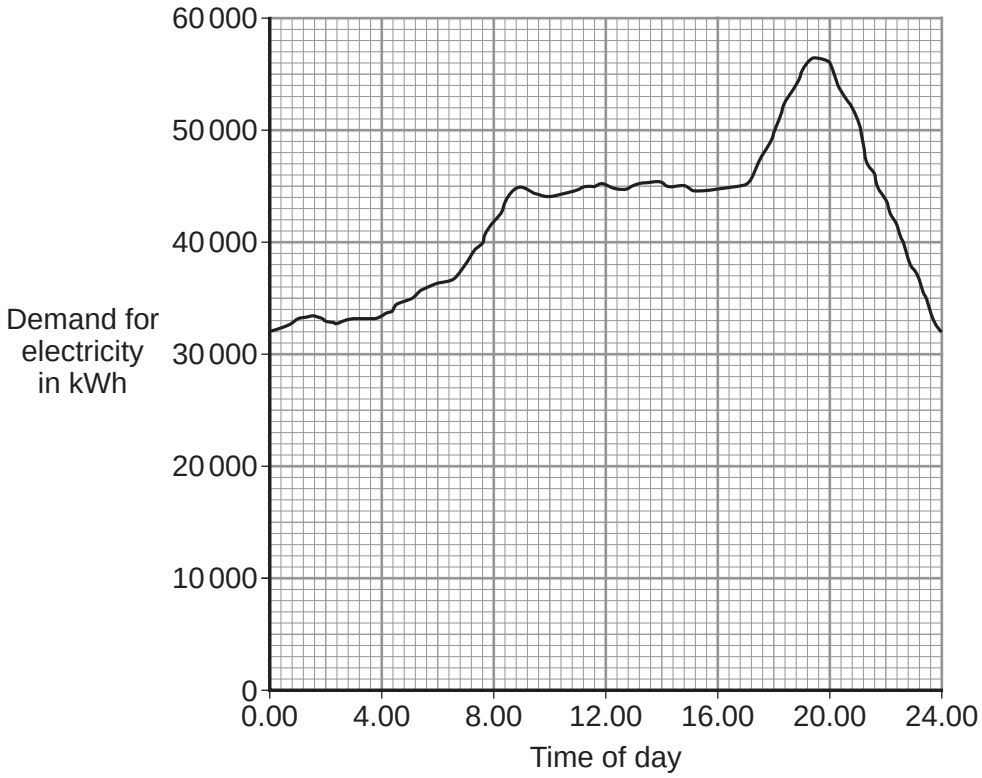
6

4.2.4.2 Energy transfers in everyday appliances

Question 73

January 2013 | PH1FP | Original Q8 | Legacy

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



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

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

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

.....

.....

.....

.....

.....

.....

(3 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 73 · continued

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

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

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

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

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

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

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

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(6 marks)

9

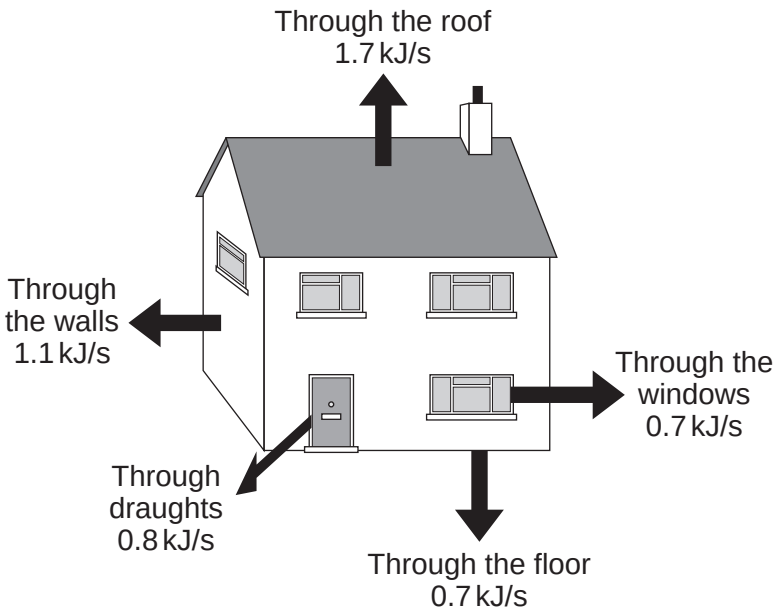
4.2.4.2 Energy transfers in everyday appliances

Question 74

January 2013 | PH1FP | Original Q9 | Legacy

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

Diagram 1



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

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

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

.....

Power of the heating system = ... kW

(1 mark)

4.2.4.2 Energy transfers in everyday appliances

Question 74 · continued

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

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

Use the correct equation from the Physics Equations Sheet.

.....

.....

Energy transferred each day = ... kWh

(2 marks)

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

Calculate the cost of heating the house for one day.

.....

Cost = ...

(1 mark)

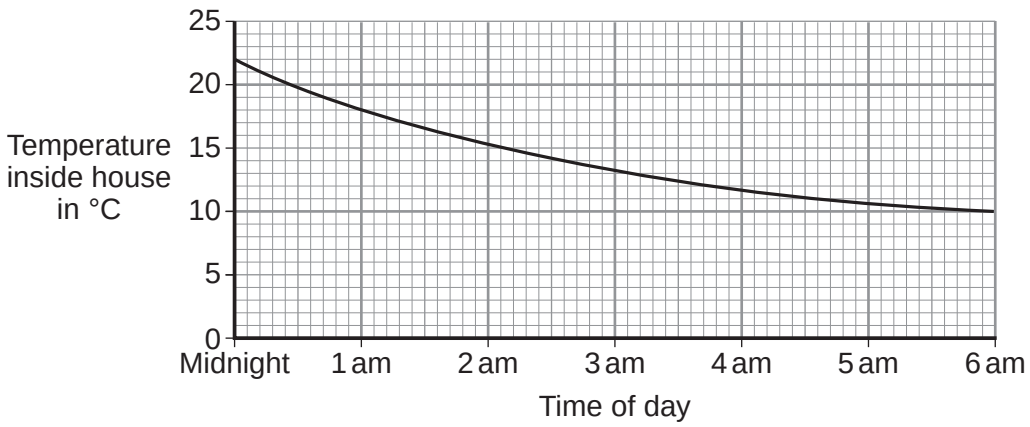
Question 9 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 74 · continued

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

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



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

Between midnight and 6 am the rate of energy transfer from

the house

decreases.
decreases then stays constant.
increases.

Give the reason for your answer.

.....

.....

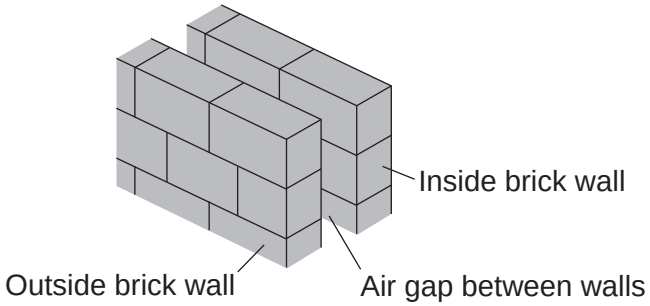
(2 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 74 · continued

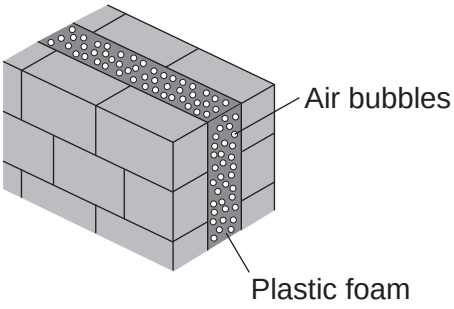
9 (b) **Diagram 2** shows how the walls of the house are constructed.
Diagram 3 shows how the insulation of the house could be improved by filling the air gap between the two brick walls with plastic foam.

Diagram 2



U-value of the wall = 0.7

Diagram 3



U-value of the wall = 0.3

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

Explain why.

.....

.....

.....

.....

(2 marks)

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

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

.....

.....

(1 mark)

Question 9 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 74 · continued

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

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

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

.....

.....

.....

.....

.....

(2 marks)

11

4.2.4.2 Energy transfers in everyday appliances

Question 75

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**

.....

.....

.....

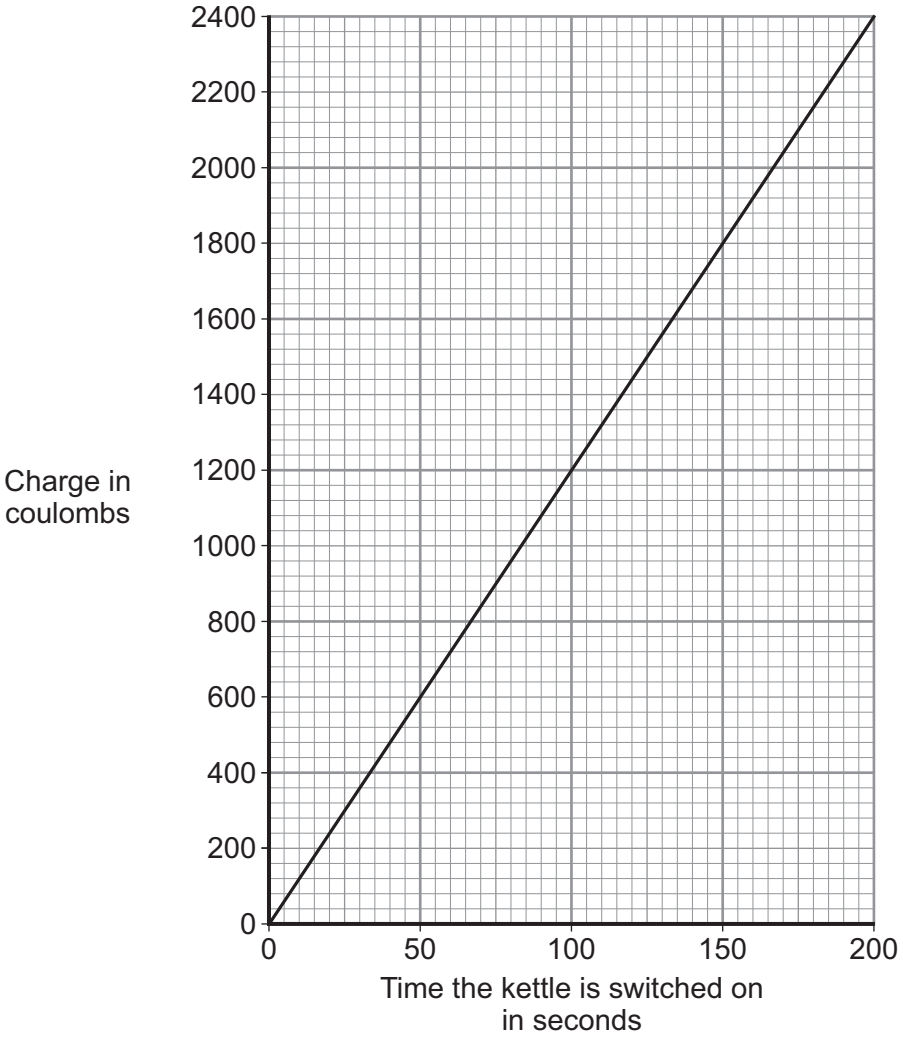
Current = ...

(3 marks)

4.2.4.2 Energy transfers in everyday appliances

Question 75 · 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)

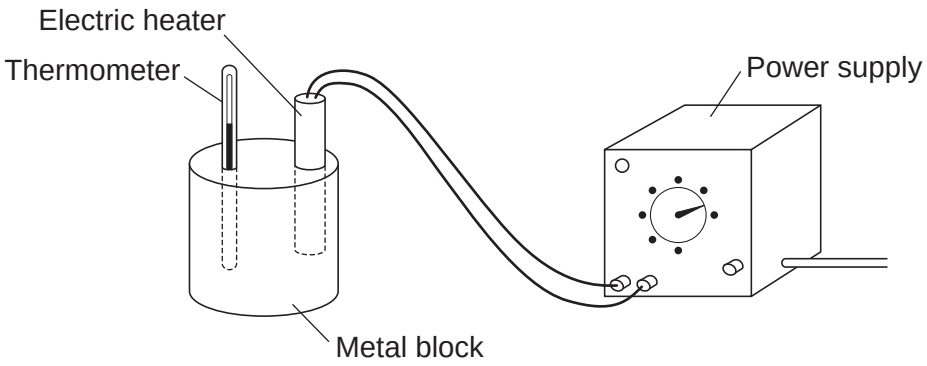
7

4.2.4.2 Energy transfers in everyday appliances

Question 76

June 2013 | PH1FP | Original Q6 | Legacy

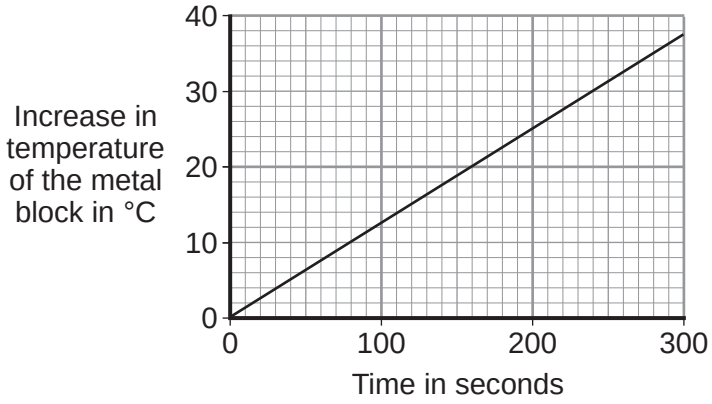
6 (a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.



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

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

Graph A



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

.....

.....

.....

.....

(2 marks)

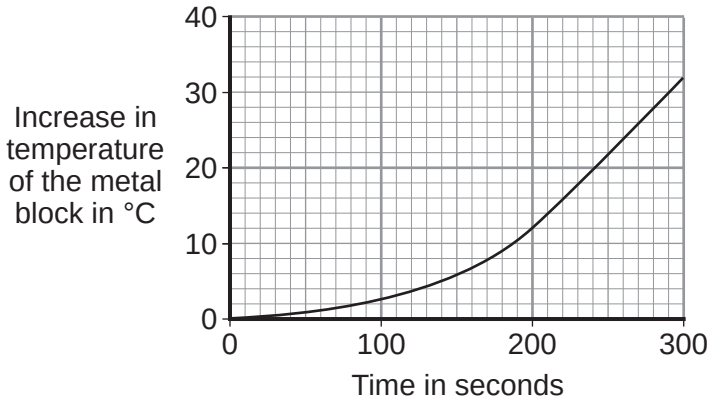
4.2.4.2 Energy transfers in everyday appliances

Question 76 · continued

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

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

Graph B



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

Suggest **one** reason why.

.....

.....

(1 mark)

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

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

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Energy transferred = ... J

(2 marks)

Question 6 continues on the next page

Question 76 · continued

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

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

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

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

Draw a ring around the correct answer.

aluminium **iron** **lead**

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

.....

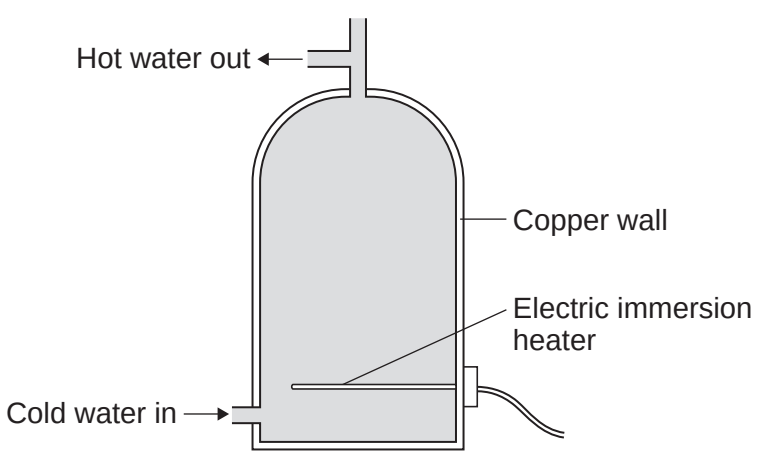
.....

.....

.....

(2 marks)

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



4.2.4.2 Energy transfers in everyday appliances

Question 76 · continued June 2013 | PH1FP | Original Q6 | Legacy

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

Energy is transferred through the water by

conduction.
convection.
evaporation.

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

conduction.
convection.
evaporation.

(2 marks)

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

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

Calculate the pay-back time for the insulating jacket.

.....

.....

Pay-back time = ... years
(2 marks)

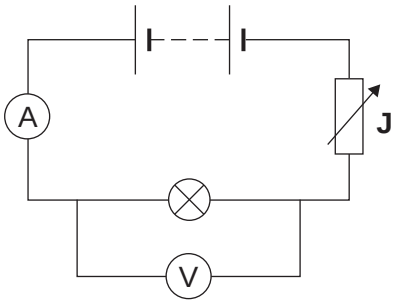
11

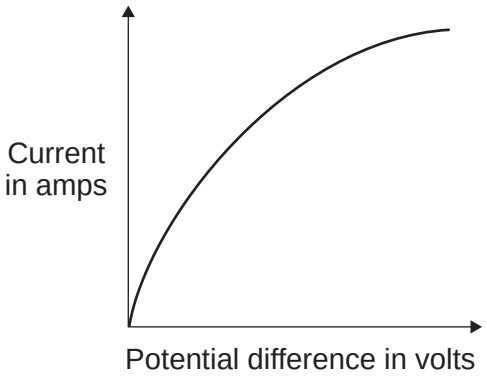
4.2.4.2 Energy transfers in everyday appliances

Question 77

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)

4.2.4.2 Energy transfers in everyday appliances

Question 77 · 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.

.....

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(6 marks)

11

4.2.4.2 Energy transfers in everyday appliances

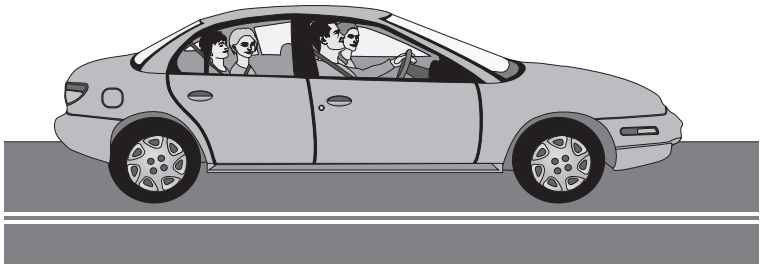
Question 78

June 2014 | PH1FP | Original Q1 | Legacy

1 **Figure 1** shows a car with an electric motor.

The car is moving along a flat road.

Figure 1



1 (a) (i) Use the correct answers from the box to complete each sentence.

[3 marks]

light	electrical	kinetic	potential	sound

The car's motor transfers ..... energy

into useful ..... energy as the car moves.

Some energy is wasted as ..... energy.

1 (a) (ii) What happens to the wasted energy?

[1 mark]

.....

.....

4.2.4.2 Energy transfers in everyday appliances

Question 78 · continued

1 (b) The electric motor has an input energy of 50 000 joules each second.

The motor transfers 35 000 joules of useful energy each second.

Calculate the efficiency of the electric motor.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Efficiency = ...

6

Turn over for the next question

4.2.4.2 Energy transfers in everyday appliances

Question 79

June 2014 | PH1FP | Original Q3 | Legacy

3 Energy can be transferred through some materials by convection.

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

[1 mark]

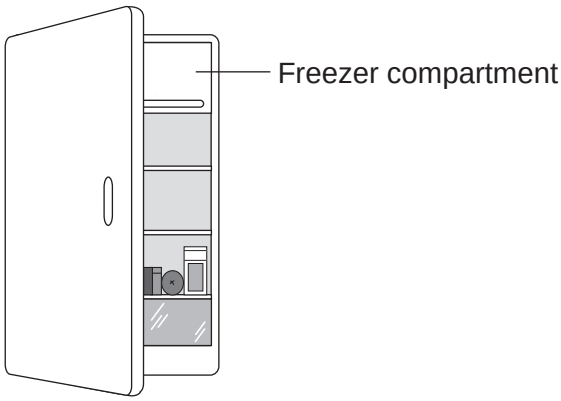
gas	liquid	solid

Energy **cannot** be transferred by convection through a ..... .

3 (b) **Figure 4** shows a fridge with a freezer compartment.

The temperature of the air inside the freezer compartment is –5 °C.

Figure 4



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

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

[3 marks]

decreased	unchanged	increased

When the air near the freezer compartment is cooled, the energy of the air particles is ..... .

The spaces between the air particles are ..... .

The density of the air is ..... .

4.2.4.2 Energy transfers in everyday appliances

Question 79 · continued

3 (c) **Table 1** shows some information about three fridges, **A**, **B** and **C**.

The efficiency of each fridge is the same.

Table 1

Fridge	Volume in litres	Energy used in one year in kWh
A	232	292
B	382	409
C	622	524

3 (c) (i) Which fridge, **A**, **B** or **C**, would cost the least to use for 1 year?

[2 marks]

Give **one** reason for your answer.

.....

.....

3 (c) (ii) A householder looks at the data in **Table 1**.

What should she conclude about the pattern linking the volume of the fridge and the energy it uses in one year?

[1 mark]

.....

.....

3 (c) (iii) The householder could not be certain that her conclusion is correct for all fridges.

Suggest **one** reason why not.

[1 mark]

.....

.....

8

4.2.4.2 Energy transfers in everyday appliances

Question 80

June 2014 | PH1FP | Original Q7 | Legacy

7 Electricity can be generated using various energy sources.

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

[2 marks]

Advantage .....

.....

Disadvantage .....

.....

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

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

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

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy output = ... kWh

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

[1 mark]

.....

.....

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

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

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

[1 mark]

.....

.....

6

4.2.4.2 Energy transfers in everyday appliances

Question 81

June 2015 | PH1FP | Original Q2 | Legacy

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

Figure 3



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

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

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

[3 marks]

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

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

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

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

Question 2 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 81 · continued

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

Calculate the efficiency of the leaf blower.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

.....

Efficiency = ...

5

4.2.4.2 Energy transfers in everyday appliances

Question 82

June 2015 | PH1FP | Original Q3 | Legacy

3 **Figure 4** shows a black metal casserole dish that is put inside a hot oven. Food is cooked inside the casserole dish.

Figure 4



3 (a) Energy is transferred quickly from the inside of the hot oven, through the metal casserole dish to the food.

3 (a) (i) Why are metals good conductors of energy?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
because they contain free atoms	
because they contain free electrons	
because they contain free ions	

Question 3 continues on the next page

Question 82 · continued

3 (a) (ii) Why do black surfaces become hot quickly?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
Because they are good absorbers of infrared radiation.	
Because they are good absorbers of ultraviolet radiation.	
Because they are good absorbers of visible light.	

3 (b) **Figure 5** shows a person removing a hot casserole dish from an oven, using oven gloves.

Figure 5



3 (b) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

conductors	insulators	radiators

The oven gloves are good ..... .

4.2.4.2 Energy transfers in everyday appliances

Question 82 · continued

3 (b) (ii) How would wearing oven gloves affect the rate of energy transfer to a person's hands compared with not wearing oven gloves?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
The rate of energy transfer would be higher.	
The rate of energy transfer would be lower.	
The rate of energy transfer would stay the same.	

3 (c) What **two** factors determine the amount of energy transferred by an electric oven?

[2 marks]

1 .....

2 .....

3 (d) A company has invented an 'app' that allows householders to control the electric oven in their home using their mobile phone.
The mobile phone can be used to switch the electric oven on and off.

Suggest **one** benefit of using a mobile phone to switch an electric oven on and off.

[1 mark]

.....

.....

7

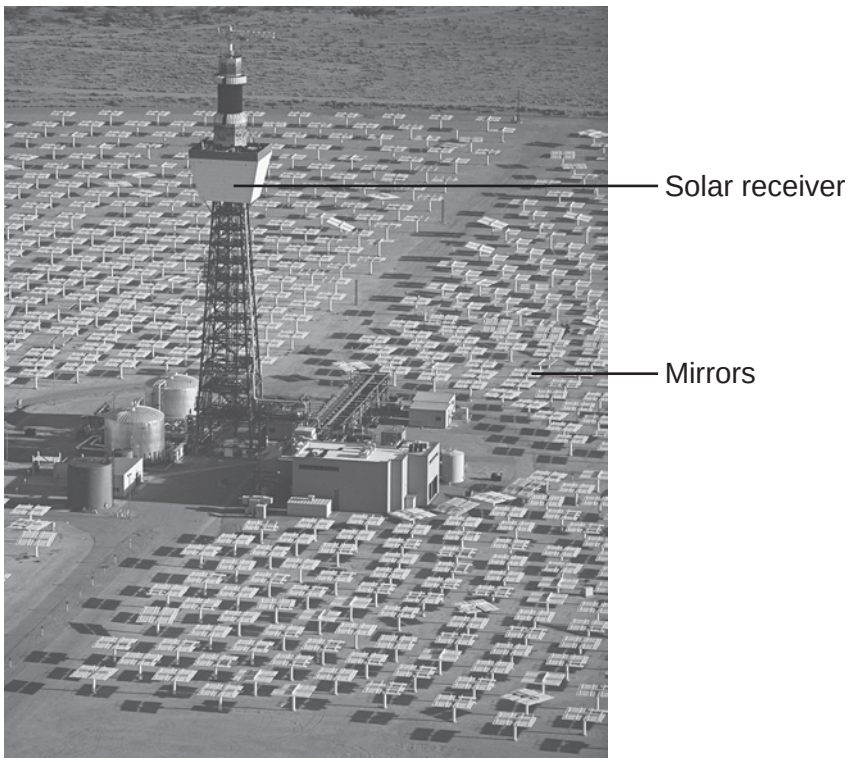
4.2.4.2 Energy transfers in everyday appliances

Question 83

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

4.2.4.2 Energy transfers in everyday appliances

Question 83 · 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

4.2.4.2 Energy transfers in everyday appliances

Question 83 · 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

4.2.4.2 Energy transfers in everyday appliances

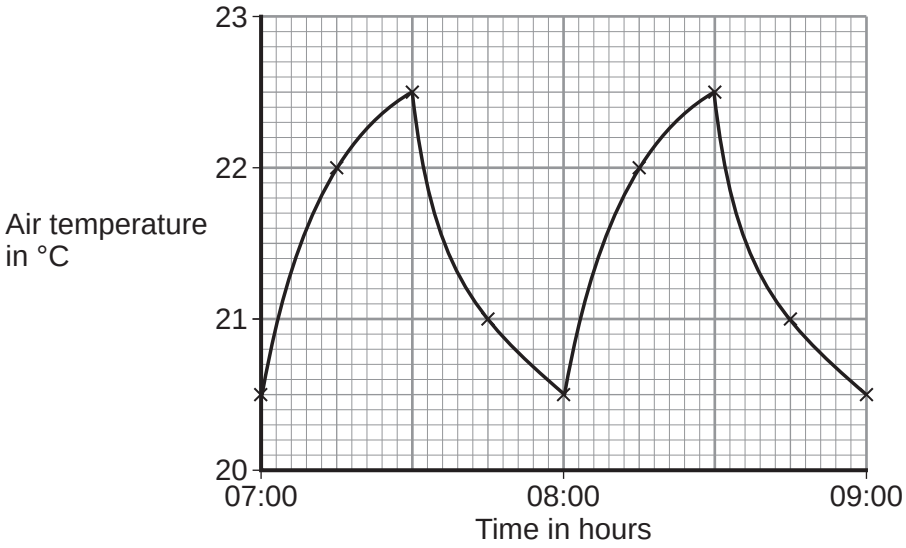
Question 84

June 2015 | PH1FP | Original Q8 | Legacy

8 A householder monitored how the air temperature inside his house changed over a 2-hour period. The householder measured the temperature every 15 minutes.

Figure 10 shows how the temperature changed with time.

Figure 10



8 (a) (i) The householder used a digital thermometer to measure the temperature.

What would be an appropriate resolution for the digital thermometer?

[1 mark]

Draw a ring around your answer.

0.5 °C **1 °C** **5 °C**

8 (a) (ii) The householder's results are shown on a line graph in **Figure 10**.

Why would it **not** be appropriate to use the results to plot a bar chart?

[1 mark]

.....

.....

4.2.4.2 Energy transfers in everyday appliances

Question 84 · continued

8 (b) The householder's heating is controlled by a thermostat. The thermostat switches the heating on when the temperature decreases below a certain temperature.

8 (b) (i) At what temperature does the thermostat switch the heating on?

[1 mark]

..... °C

8 (b) (ii) Use **Figure 10** to determine the number of minutes that the householder's heating was switched on between 07:00 and 09:00.

[1 mark]

.....

.....

Time = ... minutes

Question 8 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 84 · continued

8 (c) The householder read the following extract from a newspaper article about reducing energy use in the home.

> . . . decreasing the temperature setting on your thermostat by 1 °C will reduce your heating bill by 10% . . .

On Monday, the householder set his thermostat at 20.0 °C and recorded the energy, in kWh, used to heat his house.

On Tuesday, the householder set his thermostat at 19.0 °C and recorded the energy, in kWh, used to heat his house.

Table 2 shows the results of the householder's investigation.

Table 2

Thermostat setting in °C	Energy in kWh
20.0	8.0
19.0	7.2

8 (c) (i) The outside temperature was the same on both days.

Give **one** reason why this was important.

[1 mark]

.....

.....

8 (c) (ii) Explain how the results shown in **Table 2** support the extract from the newspaper article.

Justify your answer with a calculation.

[2 marks]

.....

.....

.....

.....

4.2.4.2 Energy transfers in everyday appliances

Question 84 · continued

8 (c) (iii) The statement in the extract is **not** valid for all situations.
Suggest why.

[2 marks]

.....

.....

.....

.....

9

4.2.4.2 Energy transfers in everyday appliances

Question 85

June 2016 | PH1FP | Original Q2 | Legacy

2 The electric kettle shown in **Figure 2** is used to boil water.

Figure 2



2 (a) After the water has boiled, the temperature of the water decreases by 22 °C.
The mass of water in the kettle is 0.50 kg.
The specific heat capacity of water is 4200 J/kg °C.

Calculate the energy transferred to the surroundings from the water.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Energy = _____ joules

2 (b) Why is the total energy input to the kettle higher than the energy used to heat the water?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
Energy is absorbed from the surroundings.	
Energy is used to heat the kettle.	
The kettle is more than 100% efficient.	

4.2.4.2 Energy transfers in everyday appliances

Question 85 · continued

2 (c) In one day, 0.6 kWh of energy is transferred from the mains electricity supply to the kettle.

The energy costs 15 pence per kWh.

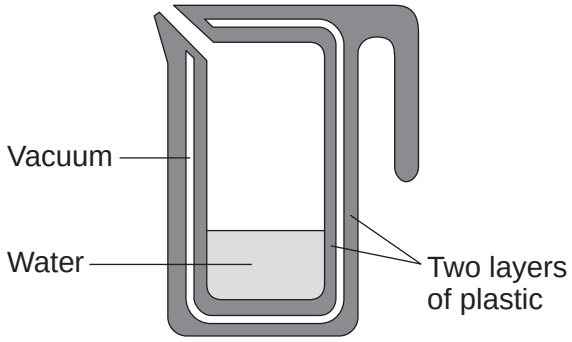
Calculate the cost of using the kettle for one day.

[2 marks]

Cost = _____ pence

2 (d) A new type of electric kettle is made from two layers of plastic separated by a vacuum. After the water in the kettle has boiled, the water stays hot for at least 2 hours. The new kettle is shown in **Figure 3**.

Figure 3



2 (d) (i) Which energy transfers does a vacuum reduce?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
conduction and radiation	
conduction and convection	
convection and radiation	

2 (d) (ii) Using the new kettle may reduce the householder's energy bill. Suggest **one** reason why.

[1 mark]

7

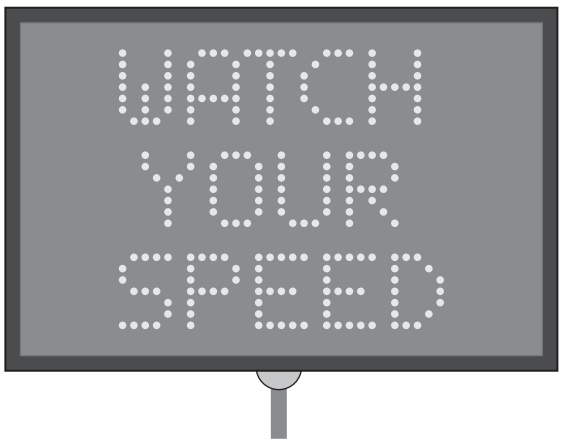
4.2.4.2 Energy transfers in everyday appliances

Question 86

June 2017 | PH1FP | Original Q2 | Legacy

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

Figure 2

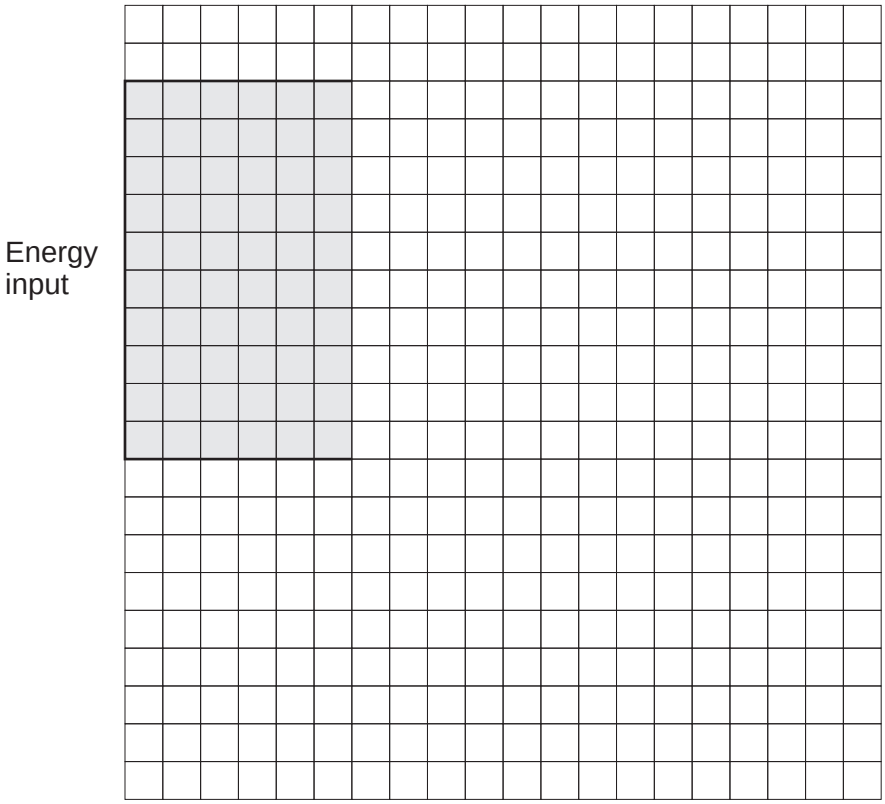


2 (a) The road sign is powered by an electrical generator which has an efficiency of 40%.

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

[2 marks]

Figure 3



4.2.4.2 Energy transfers in everyday appliances

Question 86 · continued

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

Tick (✓) **one** box.

[1 mark]

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

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

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

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

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ J

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

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

[2 marks]

1 _____

2 _____

7

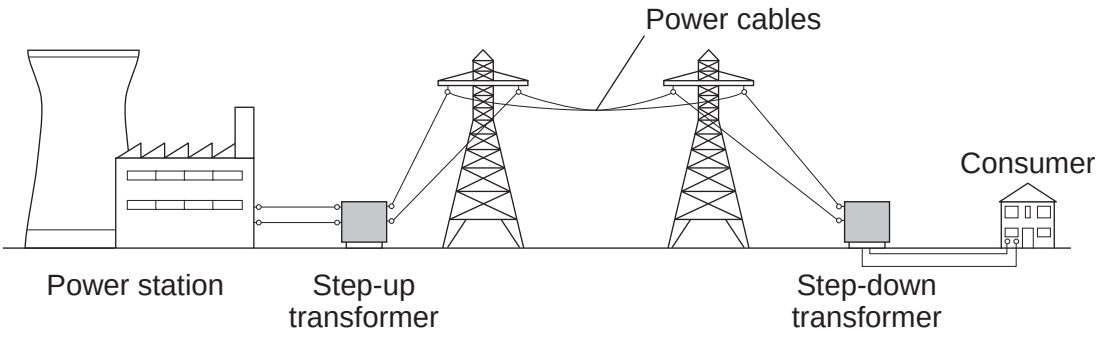
4.2.4.2 Energy transfers in everyday appliances

Question 87

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]

_____

_____

4.2.4.2 Energy transfers in everyday appliances

Question 87 · 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

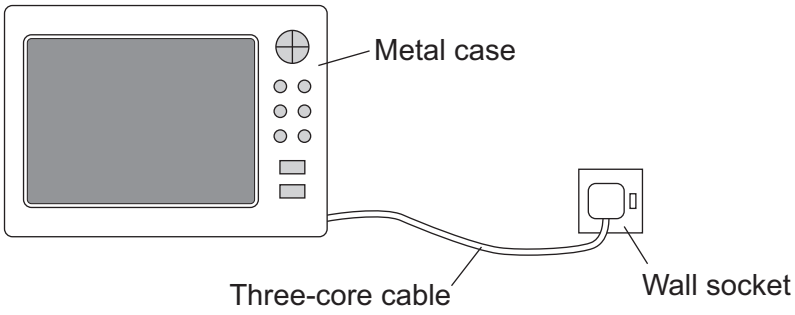
4.2.4.2 Energy transfers in everyday appliances

Question 88

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

4.2.4.2 Energy transfers in everyday appliances

Question 88 · 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

4.2.4.2 Energy transfers in everyday appliances

Question 89

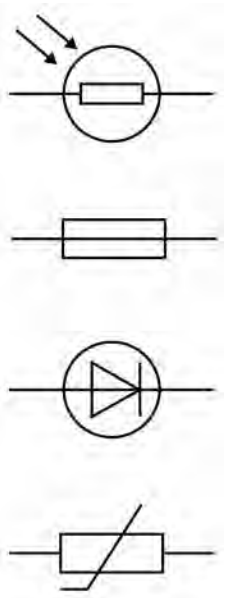
June 2018 | 8463/1F | Original Q7

0 7 The plug of an electrical appliance contains a fuse.

0 7 . 1 What is the correct circuit symbol for a fuse?

Tick **one** box.

[1 mark]



☐

☐

☐

☐

0 7 . 2 The appliance is connected to the mains electrical supply. The mains potential difference is 230 V.

Calculate the energy transferred when 13 C of charge flows through the appliance.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

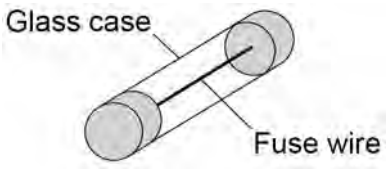
Energy transferred = _____ J

4.2.4.2 Energy transfers in everyday appliances

Question 89 · continued

Figure 9 shows the structure of a fuse.

Figure 9



0 7 . 3 Write down the equation that links charge flow, current and time.

[1 mark]

0 7 . 4 The fuse wire melts when 1.52 coulombs of charge flows through the fuse in 0.40 seconds.

Calculate the current at which the fuse wire melts.

[3 marks]

Current = _____ A

0 7 . 5 The mass of the fuse wire is 0.00175 kg. The specific latent heat of fusion of the fuse wire is 205 000 J/kg.

Calculate the energy needed to melt the fuse wire.

Use the Physics Equations Sheet.

[2 marks]

Energy = _____ J

9

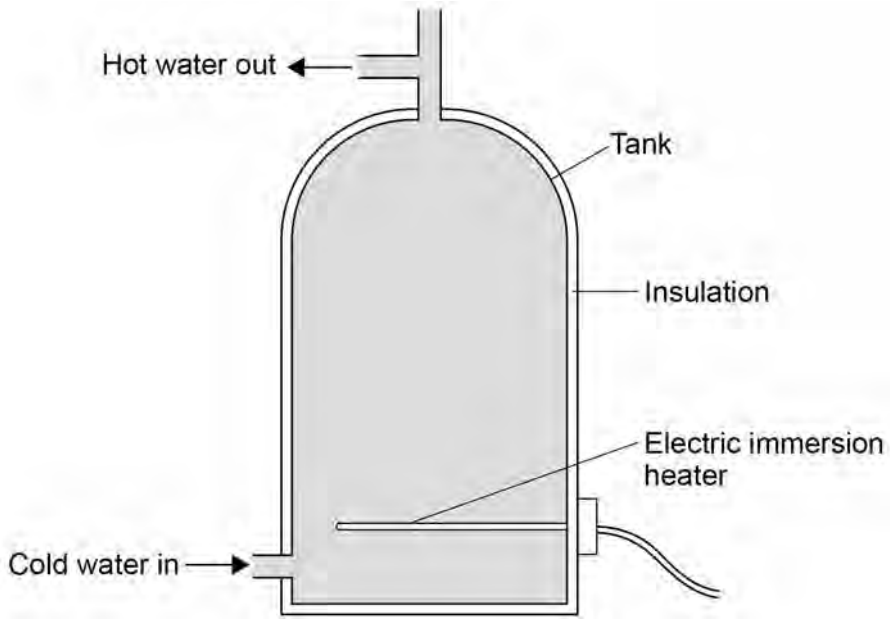
4.2.4.2 Energy transfers in everyday appliances

Question 90

June 2018 | 8463/1F | Original Q8

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

Figure 10



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

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

Tick **one** box.

[1 mark]

Higher ☐

Lower ☐

The same ☐

4.2.4.2 Energy transfers in everyday appliances

Question 90 · continued

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

Complete the sentences.

[2 marks]

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

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

Question 8 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 90 · continued

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

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

Figure 11

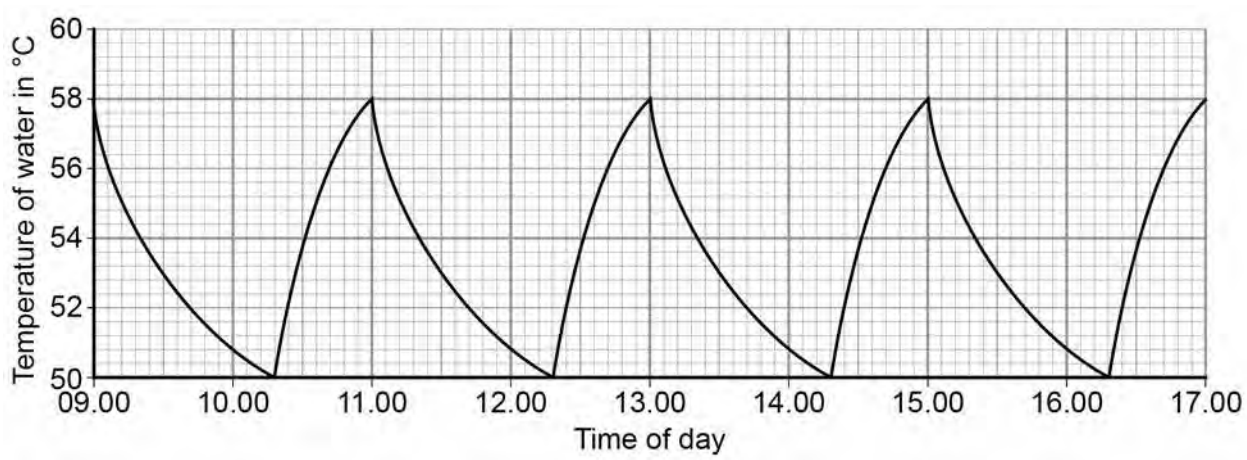
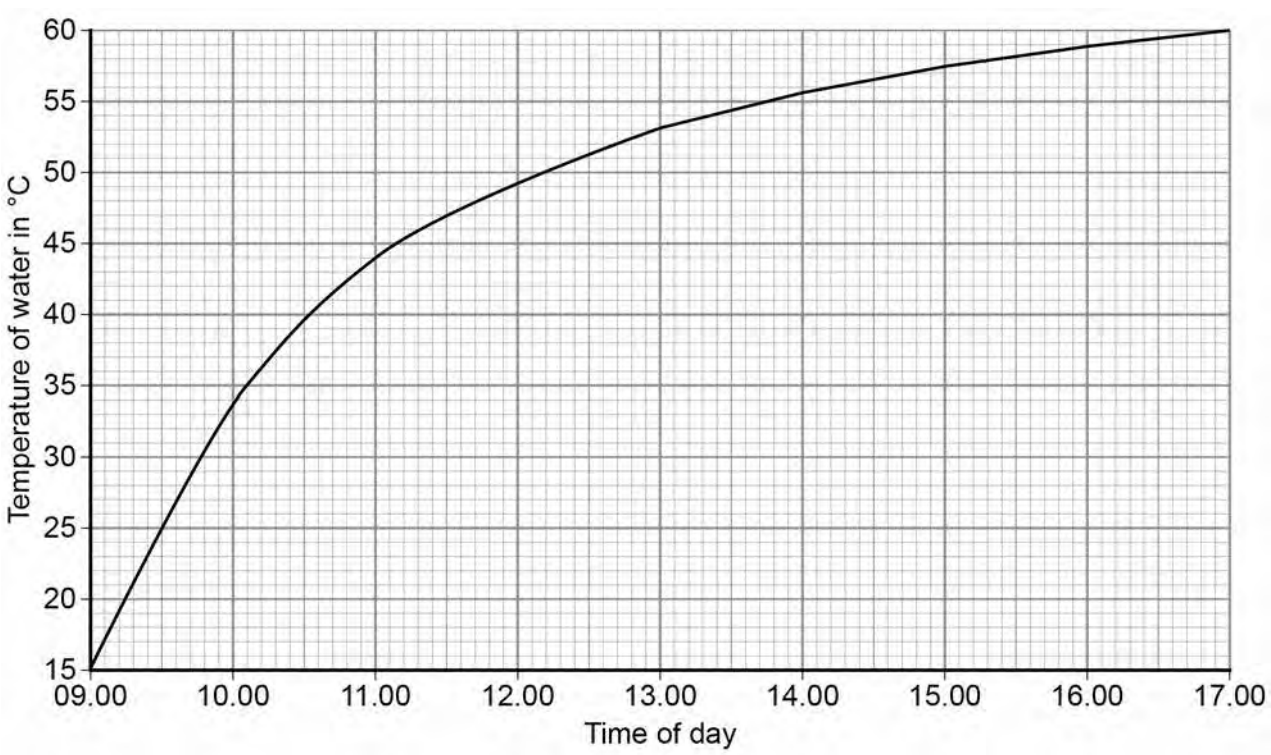


Figure 12



4.2.4.2 Energy transfers in everyday appliances

Question 90 · continued

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

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

[2 marks]

Advantage of solar panels _____

_____

_____

Disadvantage of solar panels _____

_____

_____

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

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

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

[2 marks]

_____

_____

_____

_____

Proportion of total energy = _____

Question 8 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 90 · continued

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

[1 mark]

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

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

Give the unit.

[4 marks]

Time = _____ Unit _____

1

4.2.4.2 Energy transfers in everyday appliances

Question 91

June 2019 | 8463/1F | Original Q6

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

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

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

Table 2

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

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

[2 marks]

1 _____

_____

2 _____

_____

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

The total mass of the electric car is 1610 kg

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

[2 marks]

_____

_____

_____

_____

Percentage of total mass = _____ %

4.2.4.2 Energy transfers in everyday appliances

Question 91 · continued

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

Suggest **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

Figure 8 shows an electric car being recharged.

Figure 8



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

[1 mark]

_____

_____

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

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

[3 marks]

_____

_____

_____

_____

Time = _____ s

10

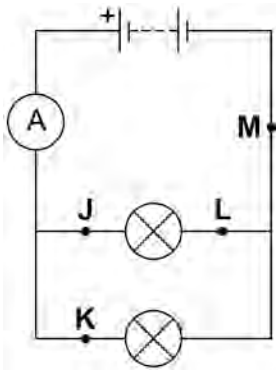
4.2.4.2 Energy transfers in everyday appliances

Question 92

June 2019 | 8463/1F | Original Q7

0 7 **Figure 9** shows a circuit diagram.

Figure 9



0 7 . 1 In which position could a switch be placed so that both lamps can be switched on or off at the same time?

[1 mark]

Tick (✓) **one** box.

J ☐ **K** ☐ **L** ☐ **M** ☐

0 7 . 2 Draw the circuit symbol for a switch in the box below.

[1 mark]

Question 92 · continued

0 7 . 3 In 30 seconds, 24 coulombs of charge flow through the battery.

Calculate the current in the battery.

Use the equation:

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

[2 marks]

Current = _____ A

0 7 . 4 There is a potential difference of 3.6 V across the battery.

Calculate the energy transferred by the battery when 60 coulombs of charge flows through the battery.

Use the equation:

$$\text{energy transferred} = \text{charge flow} \times \text{potential difference}$$

[2 marks]

Energy transferred = _____ J

Question 7 continues on the next page

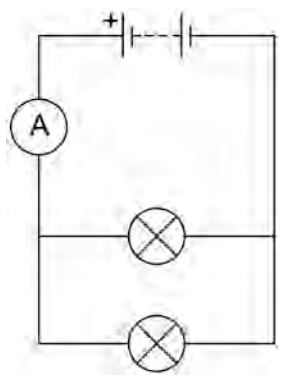
Question 92 · continued

A student built **Circuit X** and **Circuit Y** shown in **Figure 10**.

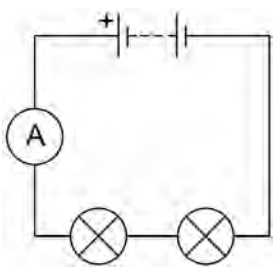
The components used in each circuit were identical.

Figure 10

Circuit X



Circuit Y



0 7 . 5 How would the reading on the ammeter in **Circuit Y** compare to the reading on the ammeter in **Circuit X**?

[1 mark]

Tick (✓) **one** box.

The reading in **Y** would be higher. ☐

The reading in **Y** would be lower. ☐

The readings would be the same. ☐

0 7 . 6 How does the total resistance of **Circuit Y** compare with the total resistance of **Circuit X**?

[1 mark]

Tick (✓) **one** box.

The total resistance of **Y** is greater. ☐

The total resistance of **Y** is less. ☐

The total resistance is the same. ☐

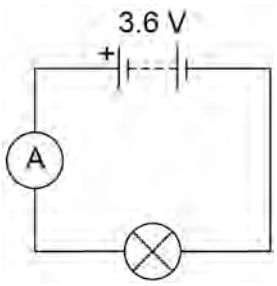
4.2.4.2 Energy transfers in everyday appliances

Question 92 · continued

June 2019 | 8463/1F | Original Q7

The student built another circuit which is shown in **Figure 11**.

Figure 11



0 7 . 7 Write down the equation which links current, potential difference and resistance.

[1 mark]

0 7 . 8 There is a potential difference of 3.6 V across the lamp in **Figure 11**.

The current through the lamp is 0.80 A

Calculate the resistance of the lamp.

[3 marks]

Resistance = _____ Ω

12

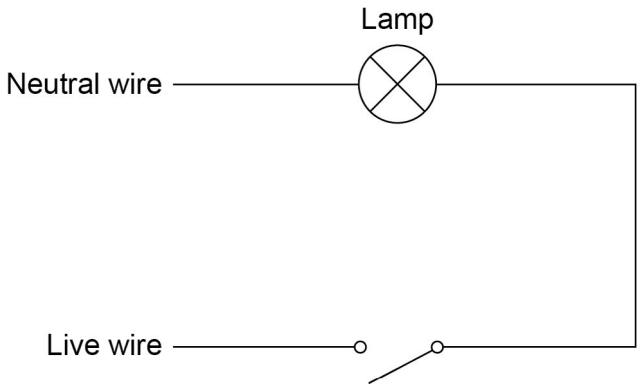
4.2.4.2 Energy transfers in everyday appliances

Question 93

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.

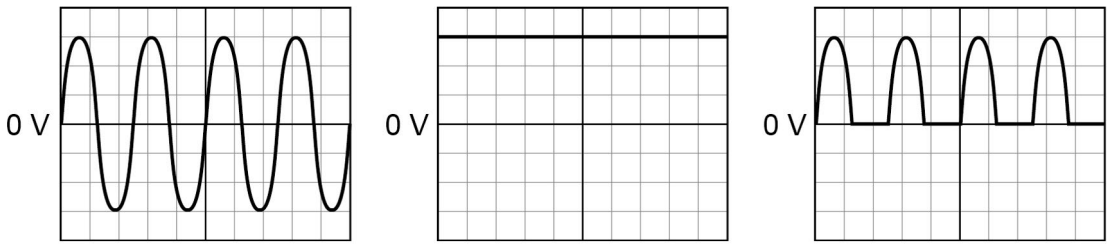
20 Hz ☐ 50 Hz ☐ 60 Hz ☐ 100 Hz ☐

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

Which diagram shows an alternating potential difference?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐

4.2.4.2 Energy transfers in everyday appliances

Question 93 · 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

4.2.4.2 Energy transfers in everyday appliances

Question 94

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

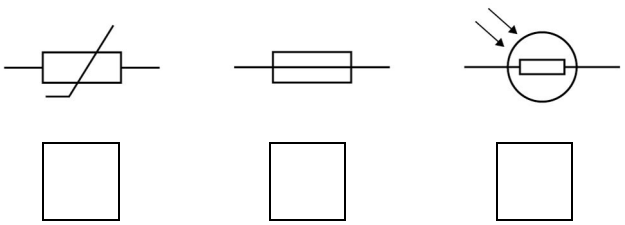
temperature of 1 _____ of the substance by 1 _____.

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.



4.2.4.2 Energy transfers in everyday appliances

Question 94 · 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

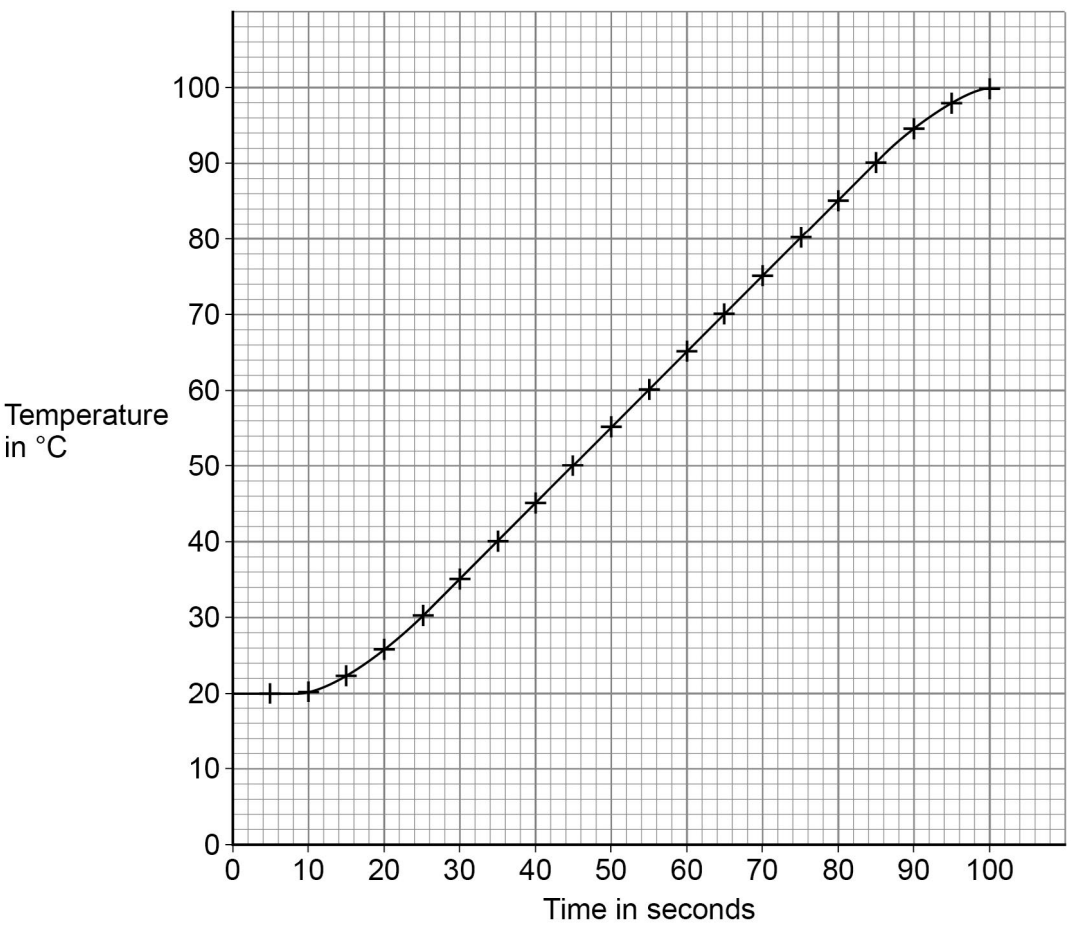
Question 7 continues on the next page

Question 94 · 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



4.2.4.2 Energy transfers in everyday appliances

Question 94 · continued

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

What is the reason for this?

[1 mark]

Tick (✓) **one** box.

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

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

[6 marks]

Question 7 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 94 · 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

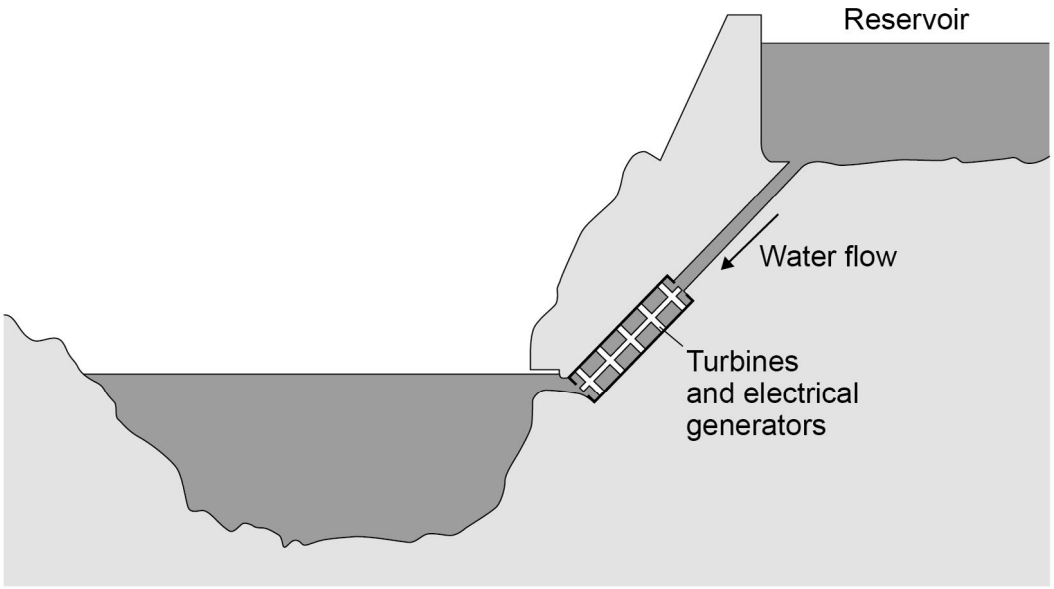
4.2.4.2 Energy transfers in everyday appliances

Question 95

November 2020 | 8463/1F | Original Q10

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

Figure 14



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

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

[1 mark]

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

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

Calculate the mass of water in the reservoir.

Give your answer in standard form.

[4 marks]

Mass (in standard form) = _____ kg

4.2.4.2 Energy transfers in everyday appliances

Question 95 · continued

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

[1 mark]

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

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

[3 marks]

Energy transferred = _____ J

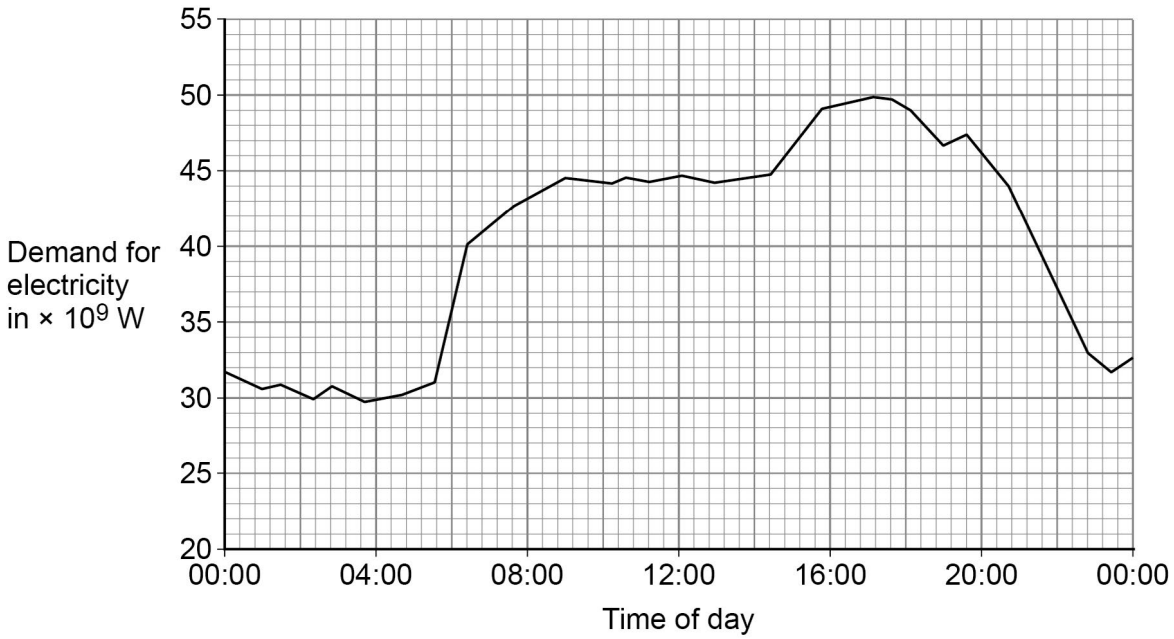
Question 10 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 95 · continued

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

Figure 15



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

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

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

11

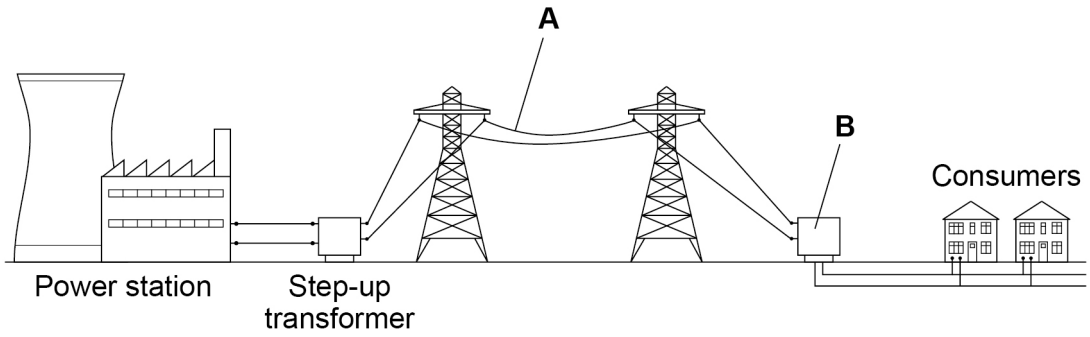
4.2.4.2 Energy transfers in everyday appliances

Question 96

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. ☐

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 96 · 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

4.2.4.2 Energy transfers in everyday appliances

Question 96 · 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

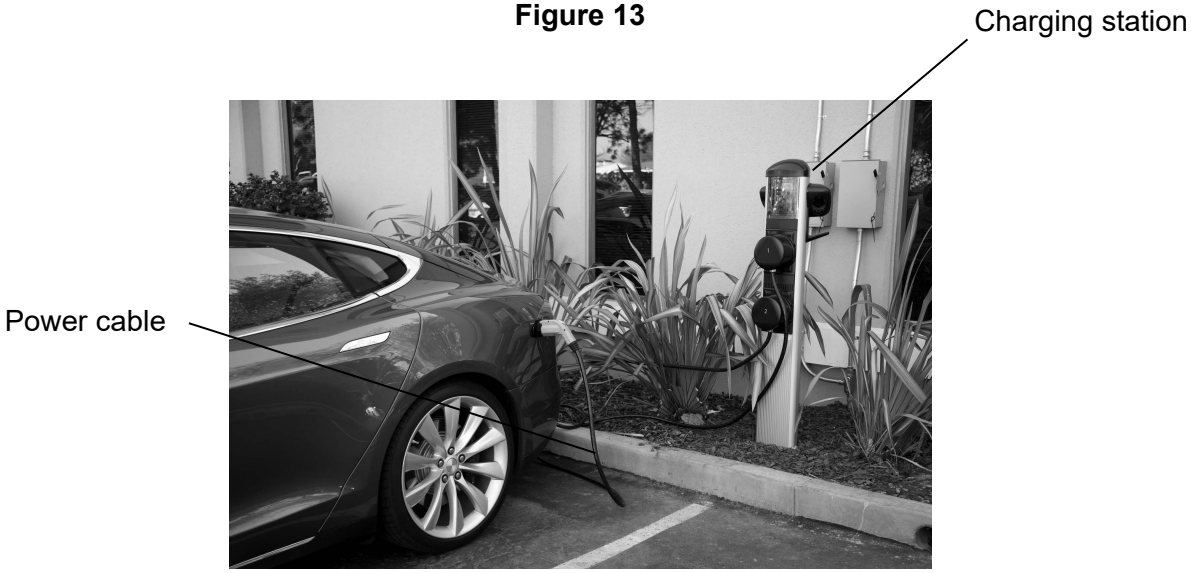
4.2.4.2 Energy transfers in everyday appliances

Question 97

November 2021 | 8463/1F | Original Q9

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

Figure 13



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

What does 'direct potential difference' mean?

[1 mark]

Question 9 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 97 · 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

4.2.4.2 Energy transfers in everyday appliances

Question 97 · 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

4.2.4.2 Energy transfers in everyday appliances

Question 97 · 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

4.2.4.2 Energy transfers in everyday appliances

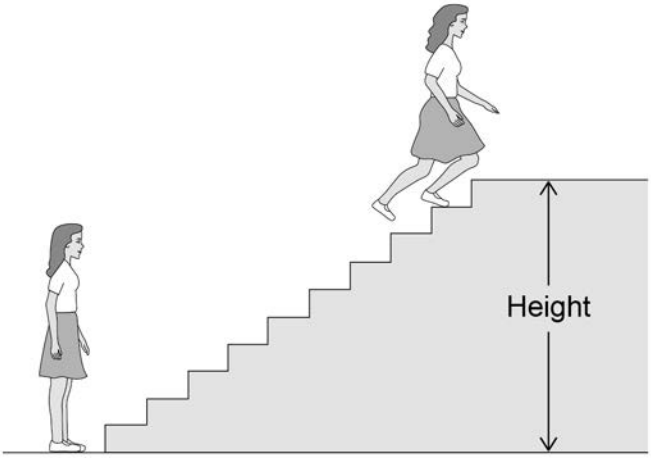
Question 98

June 2022 | 8463/1F | Original Q2

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

Figure 2 shows the stairs.

Figure 2



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

What measuring instrument should she have used?

[1 mark]

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

The mass of the girl was 50 kg.

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the girl.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

4.2.4.2 Energy transfers in everyday appliances

Question 98 · continued

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

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

Calculate the power of the boy.

Use the equation:

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

[2 marks]

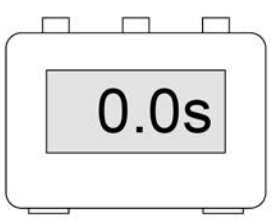
Power = _____ W

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

[1 mark]

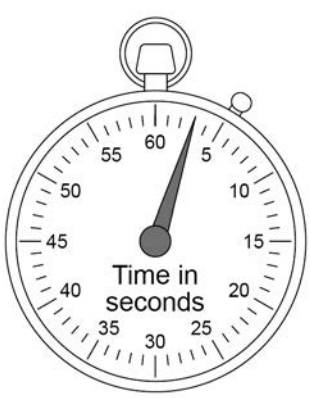
Tick (✓) **one** box.

Stop-clock A



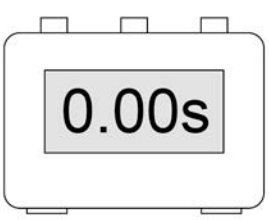
☐

Stop-clock B



☐

Stop-clock C



☐

4.2.4.2 Energy transfers in everyday appliances

Question 98 · continued

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

The mass of the boy was 70 kg.

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

Use the equation:

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

[2 marks]

Kinetic energy = _____ J

8

4.2.4.2 Energy transfers in everyday appliances

Question 99

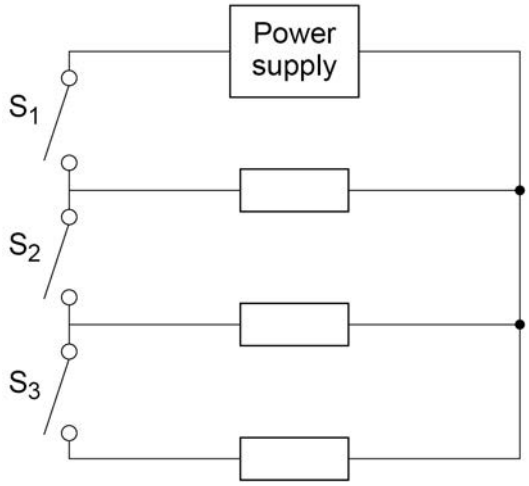
June 2022 | 8463/1F | Original Q6

0 6 A hair dryer contains three heating elements.

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

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

Figure 7



0 6 . 1 Complete the sentence.

[1 mark]

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

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

[1 mark]

Tick (✓) **one** box.

S_1 ☐

S_2 ☐

S_3 ☐

Question 99 · continued

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

[1 mark]

Tick (✓) **one** box.

S_1 and S_2 ☐

S_1 and S_3 ☐

S_1, S_2 and S_3 ☐

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

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

[1 mark]

_____

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

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

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

[3 marks]

_____

_____

_____

_____

_____

_____

Time = _____ s

4.2.4.2 Energy transfers in everyday appliances

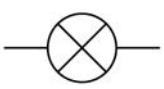
Question 99 · continued

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

What is the circuit symbol for an LED?

[1 mark]

Tick (✓) **one** box.



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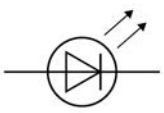

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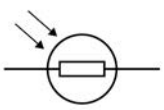

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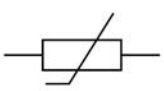


☐

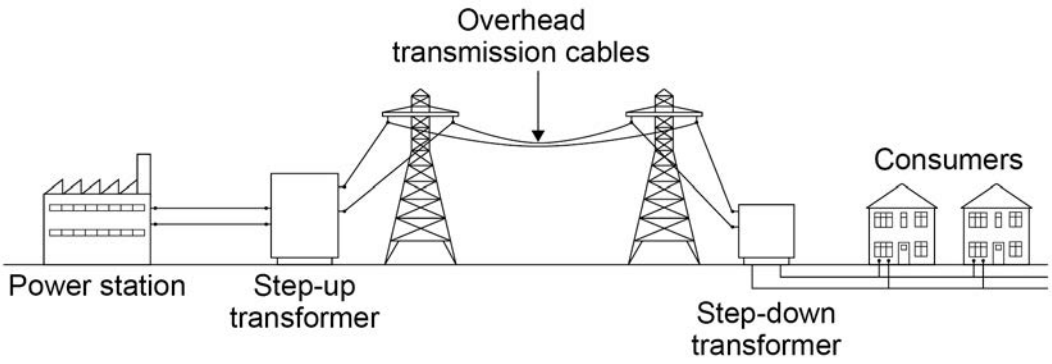
8

4.2.4.2 Energy transfers in everyday appliances

Question 100

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

4.2.4.2 Energy transfers in everyday appliances

Question 100 · 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 _____ .

4.2.4.2 Energy transfers in everyday appliances

Question 100 · 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

4.2.4.2 Energy transfers in everyday appliances

Question 101

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.

$P = \frac{V}{I}$ ☐

$P = V \times I$ ☐

$I = P \times V$ ☐

$V = I^2 \times P$ ☐

4.2.4.2 Energy transfers in everyday appliances

Question 101 · continued

June 2022 | 8463/1F | Original Q11

1 1 . 2 When a person walks on a tile, a potential difference of 40 V is induced across the tile.

The power output of the tile is 4.4 W.

Calculate the current in the tile.

[3 marks]

Current = _____ A

Question 11 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 101 · continued

June 2022 | 8463/1F | Original Q11

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

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

[1 mark]

Tick (✓) **one** box.

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

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

Efficiency = useful power output × total power input ☐

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

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

The efficiency of the LED light is 0.85

Calculate the useful power output of the LED light.

[3 marks]

Useful power output = _____ W

8

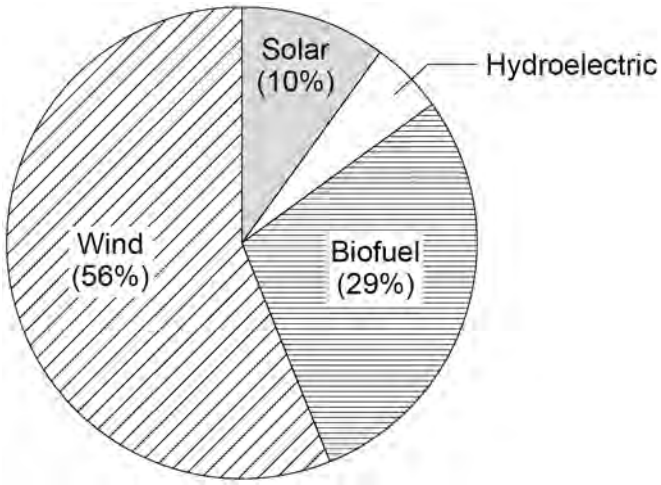
4.2.4.2 Energy transfers in everyday appliances

Question 102

0 4 The UK uses renewable energy resources to generate some of its electricity.

Figure 4 shows the proportion of electricity generated by different renewable energy resources in the UK in 2020.

Figure 4



0 4 . 1 Calculate the percentage of electricity generated using hydroelectric power.

[2 marks]

Percentage = _____ %

4.2.4.2 Energy transfers in everyday appliances

Question 102 · continued

A remote village in the UK uses a hydroelectric generator to provide electricity.

0 4 . 2 The mass of water that passes through the hydroelectric generator each day is 2 500 000 kg.

The change in vertical height of the water is 15.0 m.

gravitational field strength = 9.8 N/kg

Calculate the decrease in gravitational potential energy of the water.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Decrease in gravitational potential energy = _____ J

Question 4 continues on the next page

4.2.4.2 Energy transfers in everyday appliances

Question 102 · continued

Use the Physics Equations Sheet to answer questions **04.3** and **04.4**.

0 4 . 3 Write down the equation which links energy (*E*), power (*P*) and time (*t*).

[1 mark]

0 4 . 4 The hydroelectric generator transfers electrical power of 3000 W to the village.

Calculate the energy transferred to the village in 60 minutes.

[3 marks]

Energy transferred = _____ J

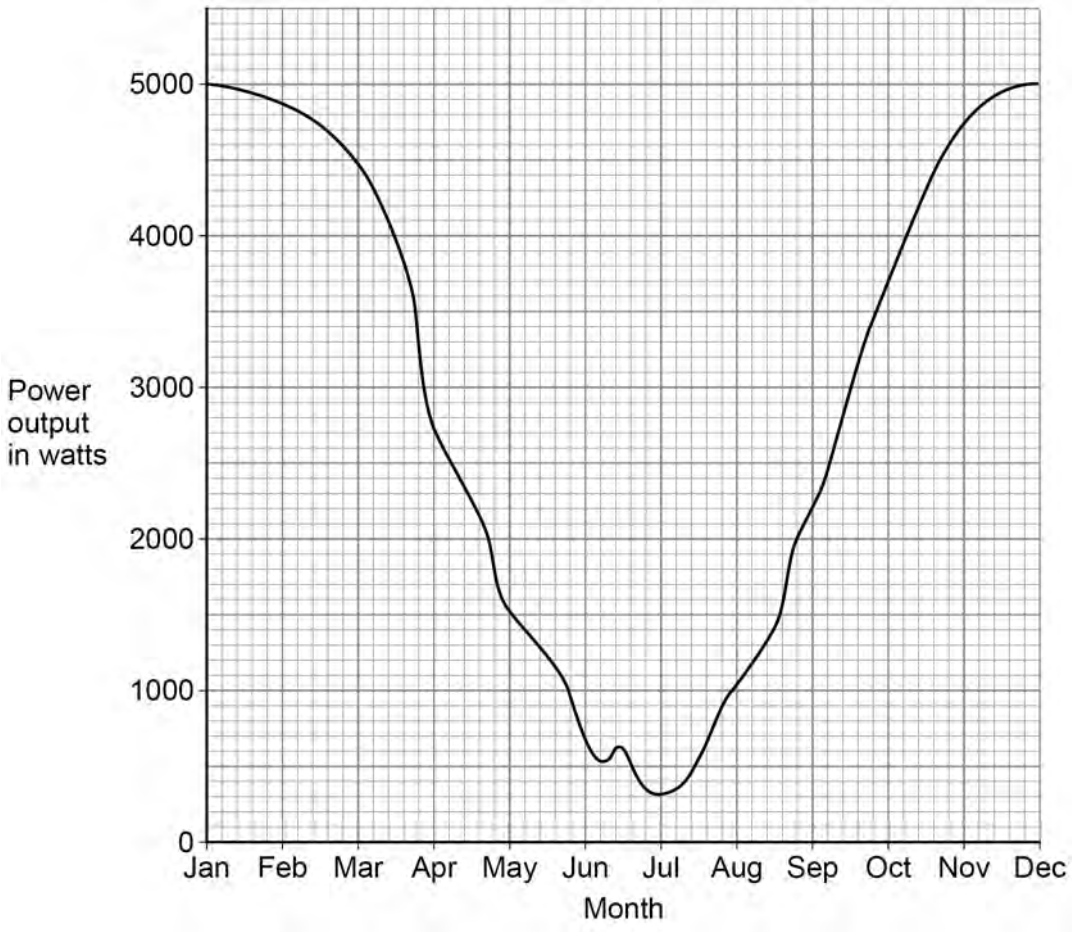
4.2.4.2 Energy transfers in everyday appliances

Question 102 · continued

0 4 . 5 The hydroelectric generator is turned by falling river water.

Figure 5 shows how the power output of the hydroelectric generator varied during one year.

Figure 5



Explain **one** reason why the power output varied.

[2 marks]

10

4.2.4.2 Energy transfers in everyday appliances

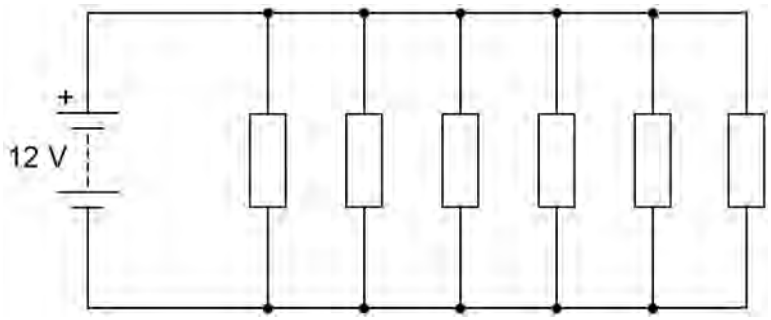
Question 103

June 2023 | 8463/1F | Original Q10

1 0 **Figure 14** shows an electrical circuit used to heat the windscreen of a car.

Each resistor in the circuit represents a heating element.

Figure 14



1 0 . 1 The 12 V battery supplies direct potential difference.

What is meant by 'direct potential difference'?

[1 mark]

Use the Physics Equations Sheet to answer questions **10.2** and **10.3**.

1 0 . 2 Which equation links charge flow (Q), energy (E) and potential difference (V)?

[1 mark]

Tick (✓) **one** box.

$E = \frac{V}{Q}$ ☐

$E = QV$ ☐

$E = \frac{Q}{V}$ ☐

$E = \frac{V^2}{Q}$ ☐

4.2.4.2 Energy transfers in everyday appliances

Question 103 · continued

10.3 Calculate the charge flow through the 12 V battery when the battery transfers 5010 J of energy.

[3 marks]

Charge flow = _____ C

10.4 Ice forms on the windscreen at a temperature of 0 °C.

The electrical circuit transfers 5010 J of energy to the ice.

A mass of 0.015 kg of ice melts.

Calculate the specific latent heat of fusion of water.

Use the Physics Equations Sheet.

[3 marks]

Specific latent heat of fusion of water = _____ J/kg

4.2.4.2 Energy transfers in everyday appliances

Question 103 · continued

10.5 The electrical circuit was left switched on while the ice changed from a solid to a liquid and increased in temperature to 5 °C.

Explain the changes in the arrangement **and** movement of the particles as the ice melted and the temperature increased to 5 °C.

[6 marks]

14

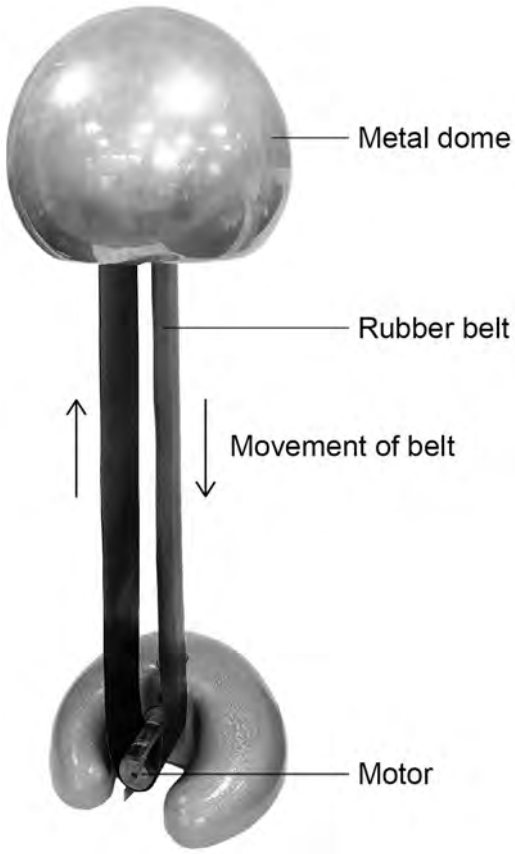
4.2.4.2 Energy transfers in everyday appliances

Question 104

June 2024 | 8463/1F | Original Q1

0 1 **Figure 1** shows a static electricity generator.

Figure 1



The rubber belt is turned by a motor.

As the rubber belt moves, charge is transferred from the rubber belt to the metal dome.

Question 104 · continued

Figure 2 shows a student touching the metal dome of the static electricity generator.

The dome is negatively charged.

Figure 2



0 1 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

negative	**neutral**	**positive**

When the student touches the negatively charged metal dome the student's hair gains a _____ charge.

Question 1 continues on the next page

Question 104 · continued

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

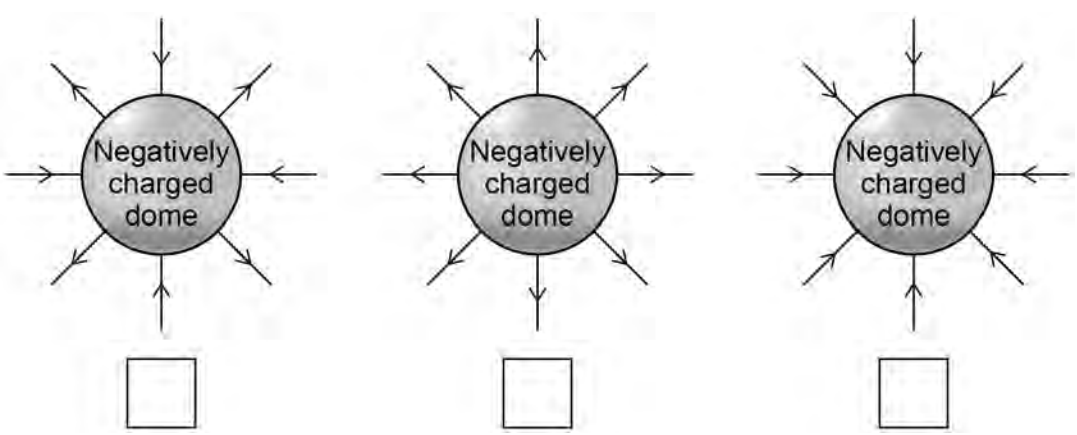
attraction	**gravity**	**repulsion**

The hair on the student's head stands up because the strands of hair experience forces of _____.

0 1 . 3 Which of the following diagrams shows the electric field pattern around the negatively charged metal dome?

[1 mark]

Tick (✓) **one** box.

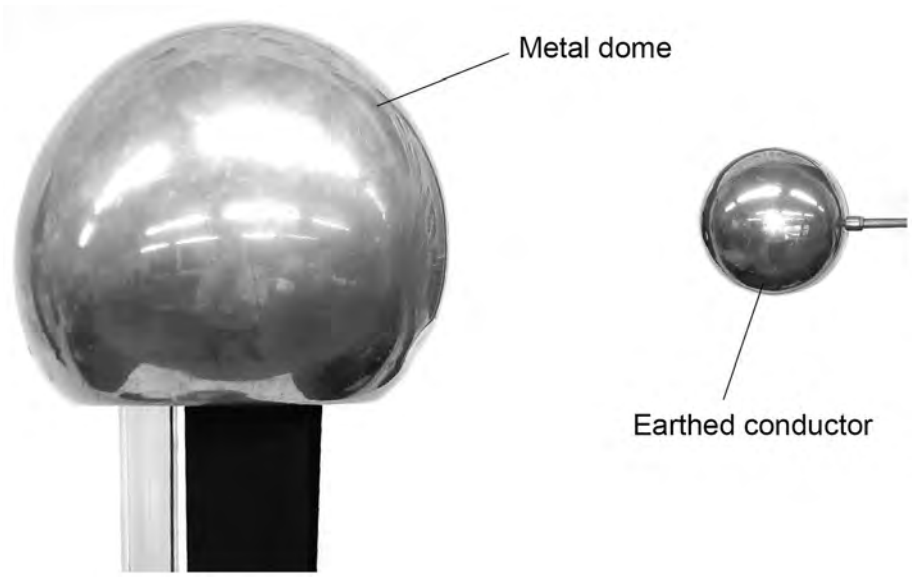


4.2.4.2 Energy transfers in everyday appliances

Question 104 · continued

Figure 3 shows the negatively charged metal dome and an earthed conductor.

Figure 3



0 1 . 4 The air between the dome and the earthed conductor is an insulator.

Complete the sentence.

Choose the answer from the box.

[1 mark]

efficiency	**resistance**	**temperature**

The air between the dome and the earthed conductor has

a high _____.

Question 1 continues on the next page

Question 104 · continued

The earthed conductor is moved closer to the metal dome.

A spark jumps from the dome to the earthed conductor.

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

earthed	**ionised**	**neutral**

The spark jumps because the air around the charged dome has

become _____.

0 1 . 6 Which particles are transferred when the spark jumps from the negatively charged metal dome to the earthed conductor?

[1 mark]

Tick (✓) **one** box.

- Electrons ☐
- Neutrons ☐
- Protons ☐

4.2.4.2 Energy transfers in everyday appliances

Question 104 · continued

0 1 . 7 The potential difference between the metal dome and earth is 300 000 V.

When the spark jumps there is a charge flow of 0.000 002 C.

Calculate the energy transferred by the spark.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

8

Turn over for the next question

4.2.4.2 Energy transfers in everyday appliances

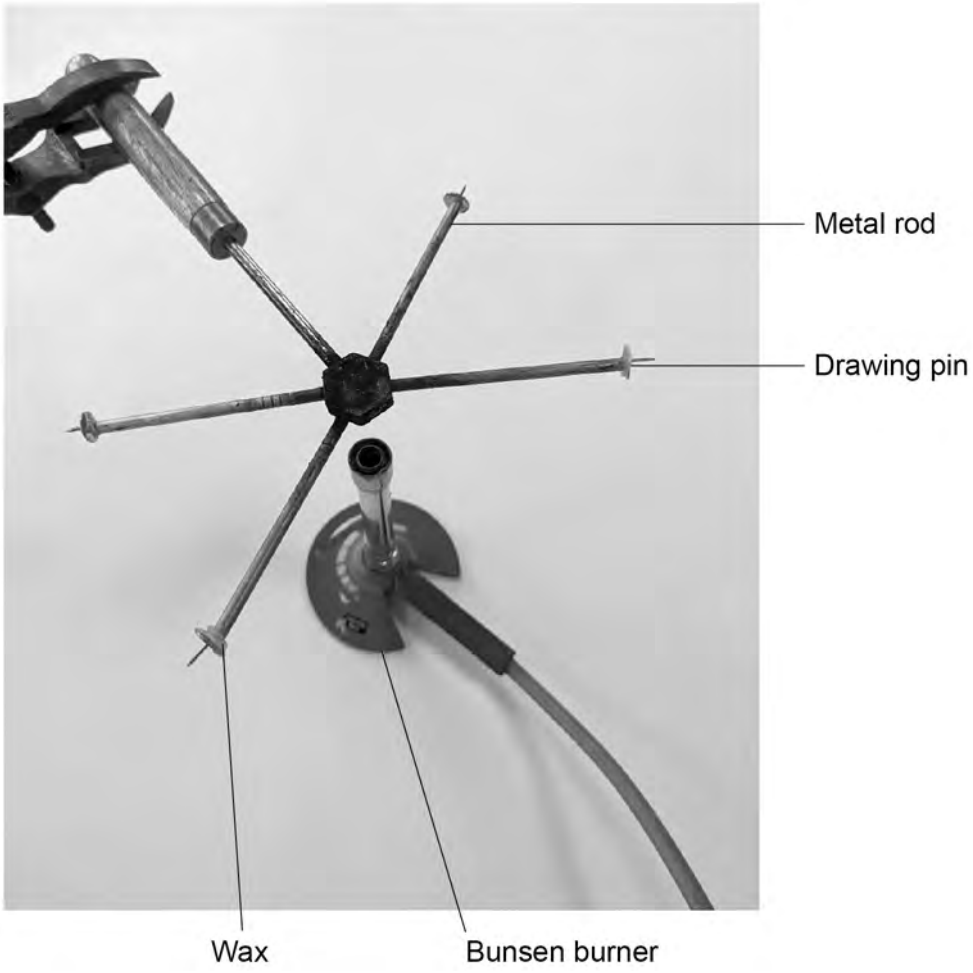
Question 105

June 2025 | 8463/1F | Original Q2

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

Figure 2 shows some of the apparatus used.

Figure 2



Each rod was made from a different metal.

The metal rods are joined at the centre.

The size of each metal rod was the same.

This is the method used.

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

Table 1 shows the results.

Table 1

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

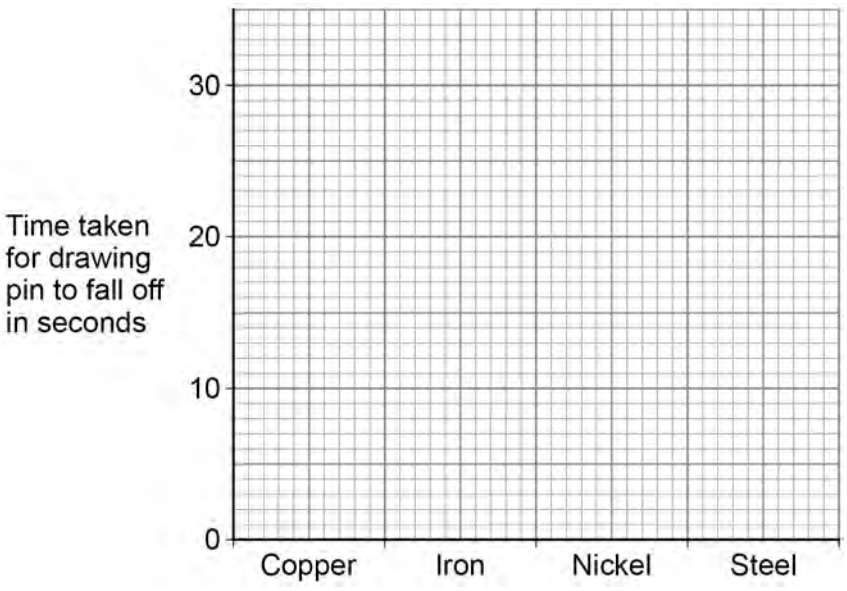
0 2 . 1 Complete **Figure 3**.

You should:

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

[3 marks]

Figure 3



Question 105 · continued

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

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Copper ☐ Iron ☐ Nickel ☐ Steel ☐

Reason _____

_____

_____

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

The temperature change of the rod was 20 °C.

mass of the nickel rod = 0.015 kg

Calculate the specific heat capacity of nickel.

Use the equation:

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

[2 marks]

_____

_____

_____

_____

Specific heat capacity = _____ J/kg °C

4.2.4.2 Energy transfers in everyday appliances

Question 105 · continued

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

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

[1 mark]

_____

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

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

The mean power transfer was 0.33 W.

Calculate the time taken for the energy transfer.

[3 marks]

_____

_____

_____

Time taken = _____ s

11