AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.2.2

Efficiency

Past-paper questions

Tier	**Foundation**
Question groups	**85**
Available paper years	**2003–2025**

Using this booklet

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

Name: _____ **Date:** _____

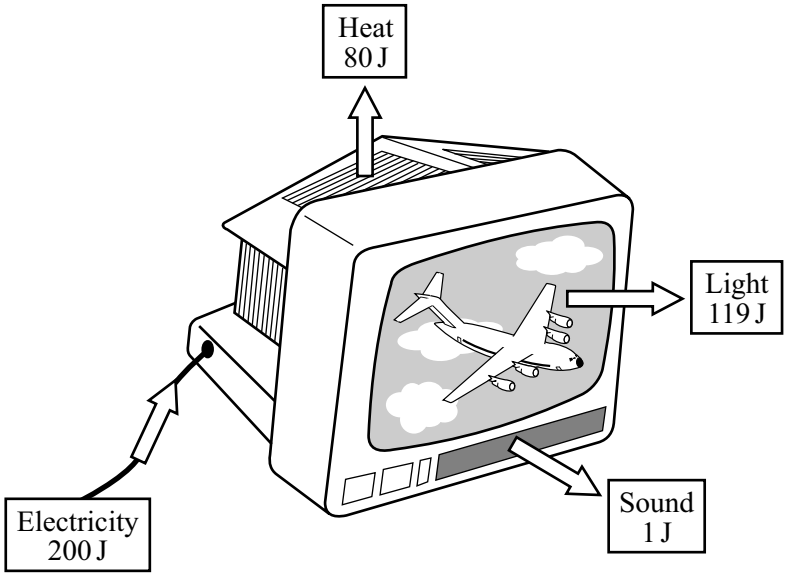
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.1.2.2 Efficiency

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)

4.1.2.2 Efficiency

Question 01 · continued

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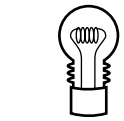
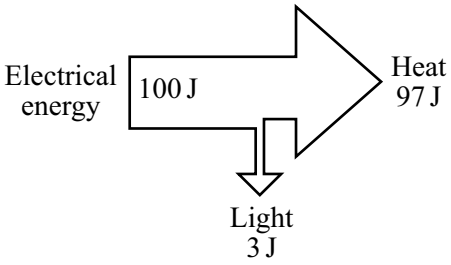
(b) The diagrams show the energy transferred each second for three different types of lamp. For each lamp the electrical energy input each second is 100 joules.

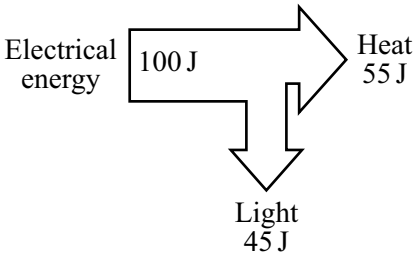


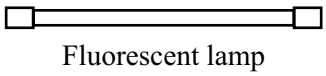
Filament lamp



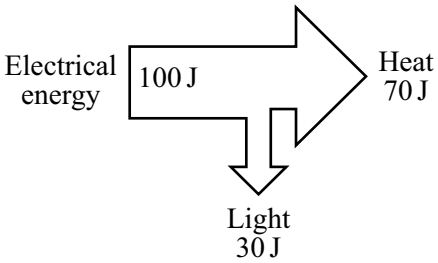


Street lamp





Fluorescent lamp



Which type of lamp is the most efficient?

.....

Give a reason for your choice.

.....

.....

(2 marks)

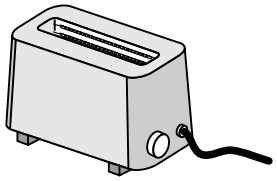
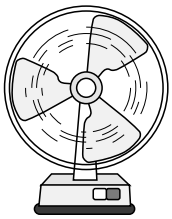
6

4.1.2.2 Efficiency

Question 02

June 2003 | 3451F | Original Q7 | Legacy

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

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

(3 marks)

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

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

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

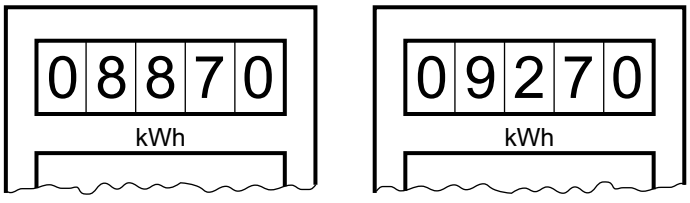
.....

(1 mark)

4.1.2.2 Efficiency

Question 02 · continued

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



April July

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

.....

.....

Number of Units = ...

(1 mark)

(ii) One Unit costs 6p.

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

total cost = number of Units × cost per Unit

.....

.....

Cost = ...

(2 marks)

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

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

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

.....

.....

Energy transferred = ...kWh

(2 marks)

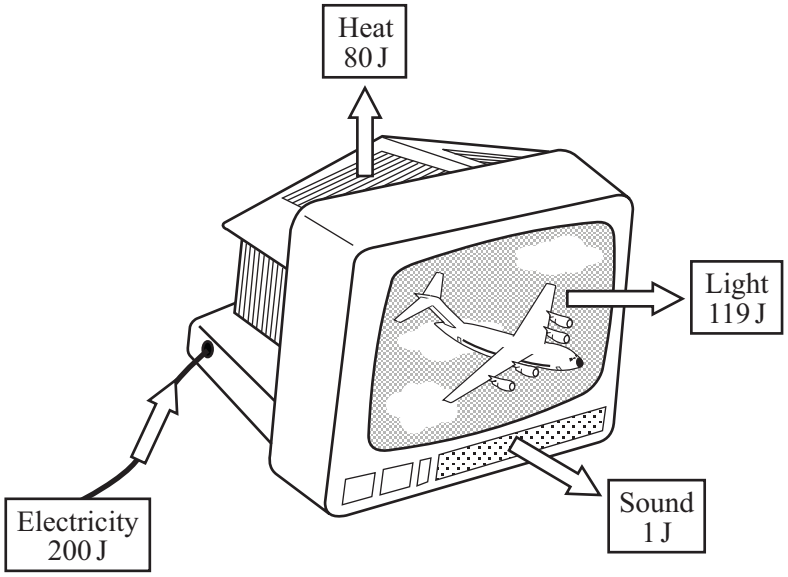
9

4.1.2.2 Efficiency

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)

4.1.2.2 Efficiency

Question 03 · continued

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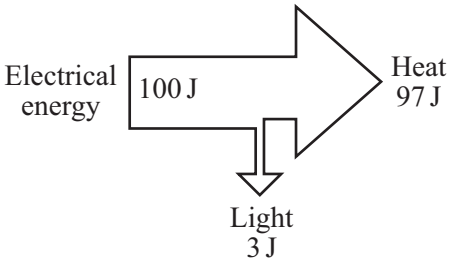
(b) The diagrams show the energy transferred each second for three different types of lamp. For each lamp the electrical energy input each second is 100 joules.

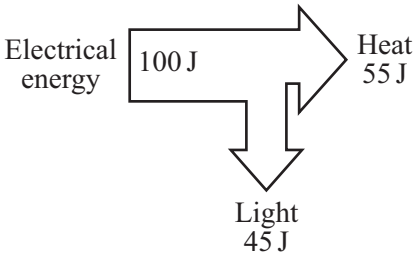


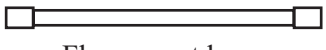
Filament lamp



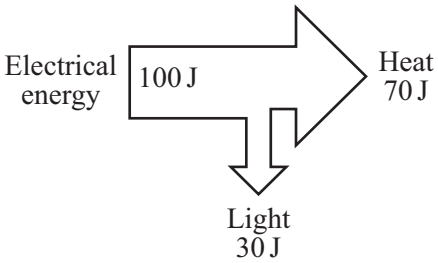


Street lamp





Fluorescent lamp



Which type of lamp is the most efficient?

.....

Give a reason for your choice.

.....

.....

(2 marks)

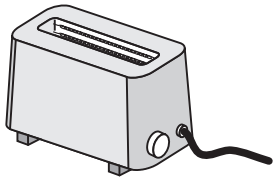
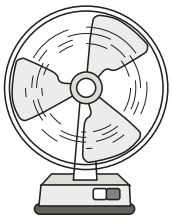
6

4.1.2.2 Efficiency

Question 04

June 2003 | 3462F3 | Original Q7 | Legacy

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

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

(3 marks)

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

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

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

.....

(1 mark)

4.1.2.2 Efficiency

Question 04 · continued

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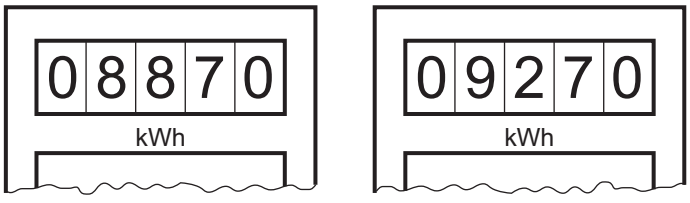
(c) The diagrams show the readings on a domestic electricity meter in April and July.



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)

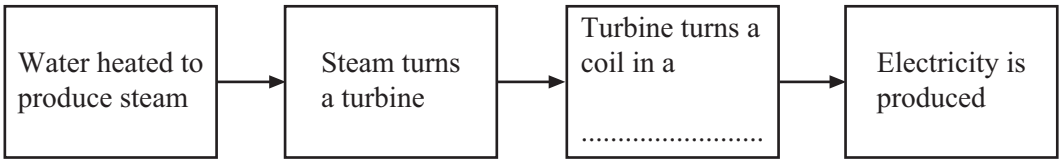
9

4.1.2.2 Efficiency

Question 05

June 2004 | 3451F | Original Q3 | Legacy

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



(1 mark)

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

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

.....

(1 mark)

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

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

.....

.....

efficiency = ...

(2 marks)

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

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

4.1.2.2 Efficiency

Question 05 · continued

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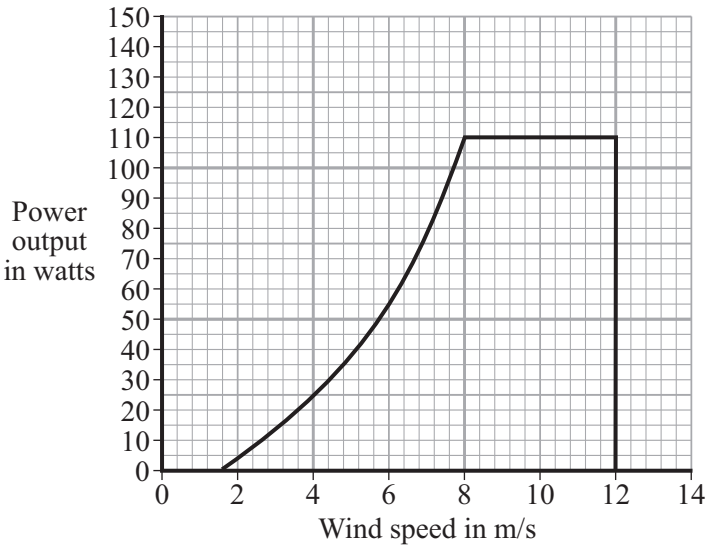
(d) A small wind generator is used to charge a battery. The graph shows the power output of the generator at different wind speeds.



(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)

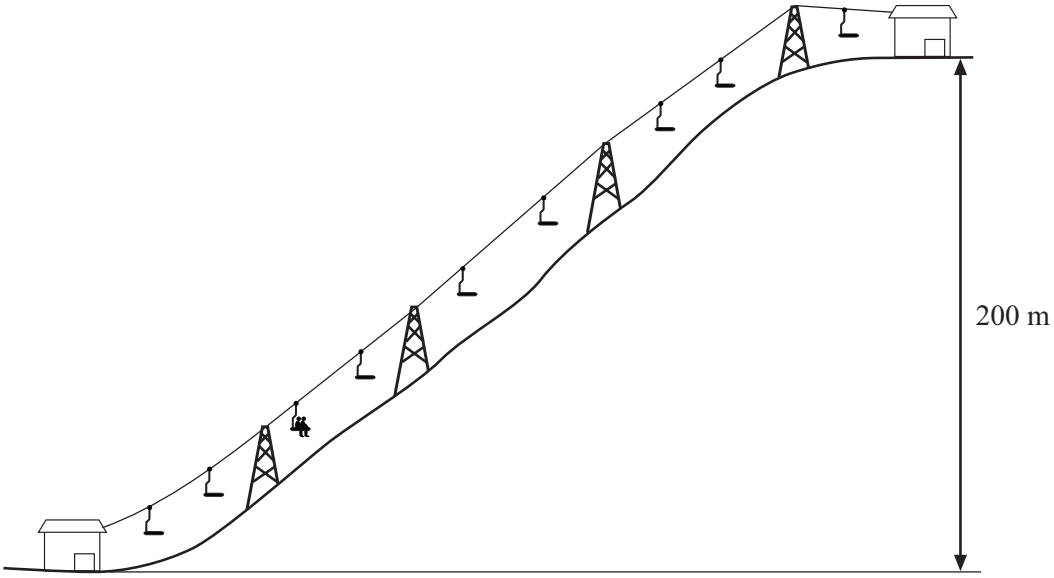
10

4.1.2.2 Efficiency

Question 06

June 2004 | 3451F | Original Q13 | Legacy

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



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

.....

(1 mark)

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

.....

.....

.....

work done =.....

(3 marks)

4.1.2.2 Efficiency

Question 06 · continued

MARGIN BLANK

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

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

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

.....

.....

power = ...watts

(2 marks)

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

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

.....

.....

(1 mark)

(ii) Complete the following sentence.

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

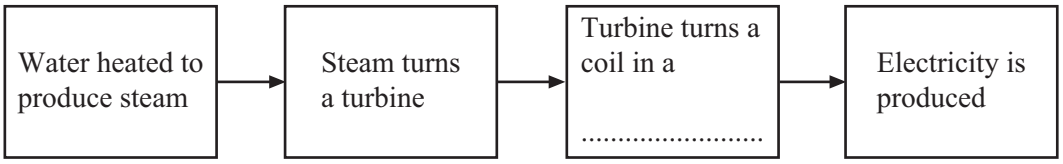
8

4.1.2.2 Efficiency

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.

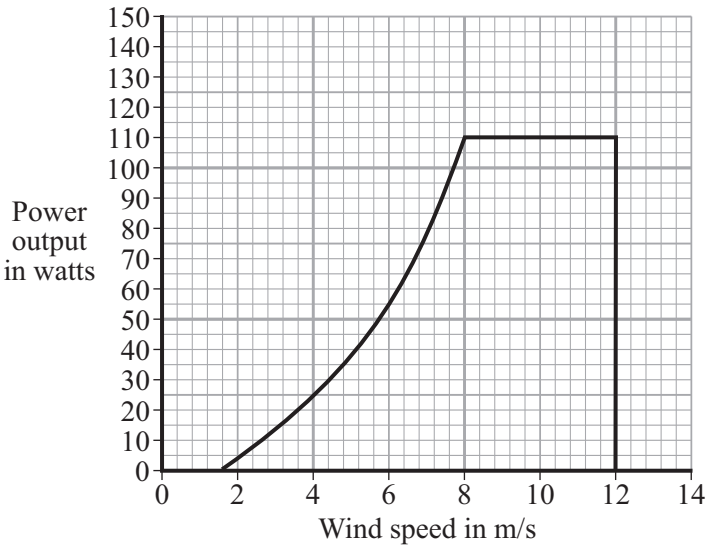
List A **Energy resource**	**List B** **Environmental problem that may be caused**
Wind	Destroys the habitat of wading birds in river estuaries
Tides	Produces a lot of noise
Falling water (hydroelectricity)	Produces the gas sulphur dioxide
	Floods land used for farming or forestry

4.1.2.2 Efficiency

Question 07 · continued

MARGIN BLANK

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



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

..... watts
(1 mark)

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

At what wind speed does the generator stop working?

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

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

.....

.....
(1 mark)

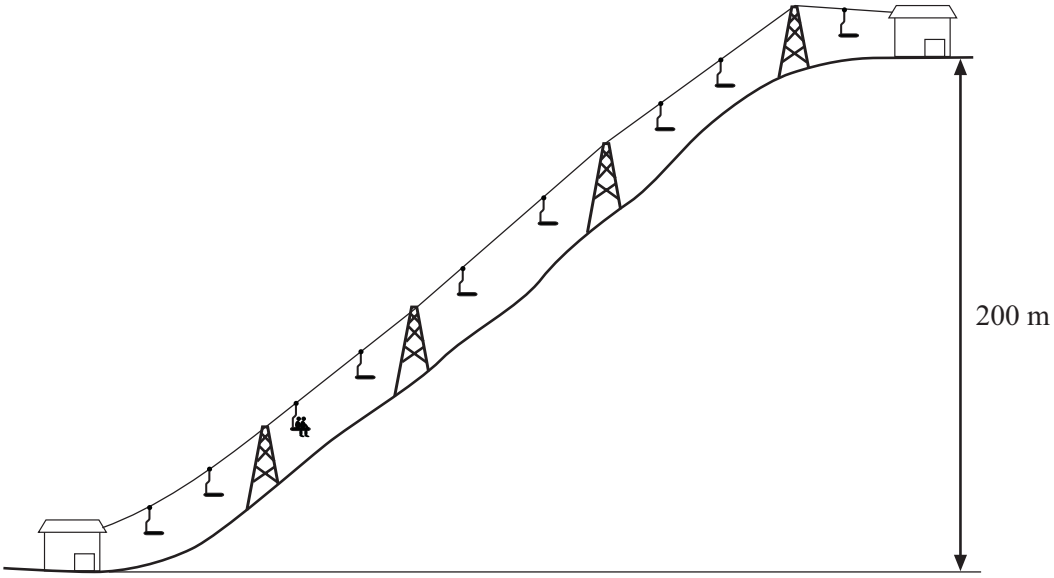
10

4.1.2.2 Efficiency

Question 08

June 2004 | 3462F3 | Original Q11 | Legacy

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



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

.....

(1 mark)

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

.....

.....

.....

work done =.....

(3 marks)

4.1.2.2 Efficiency

Question 08 · continued

MARGIN BLANK

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

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

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

.....

.....

power = ...watts

(2 marks)

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

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

.....

.....

(1 mark)

(ii) Complete the following sentence.

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

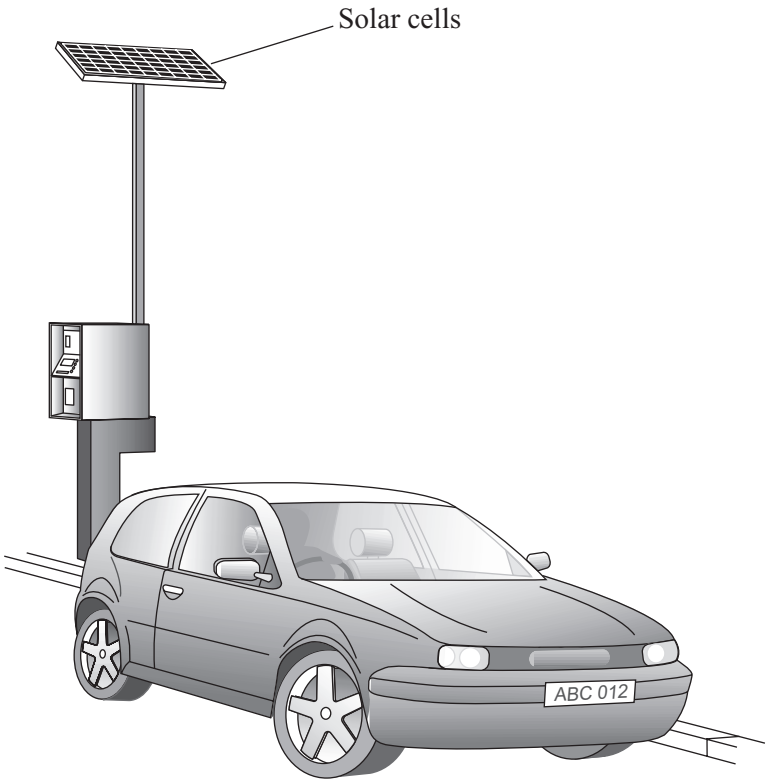
8

4.1.2.2 Efficiency

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)

4.1.2.2 Efficiency

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.

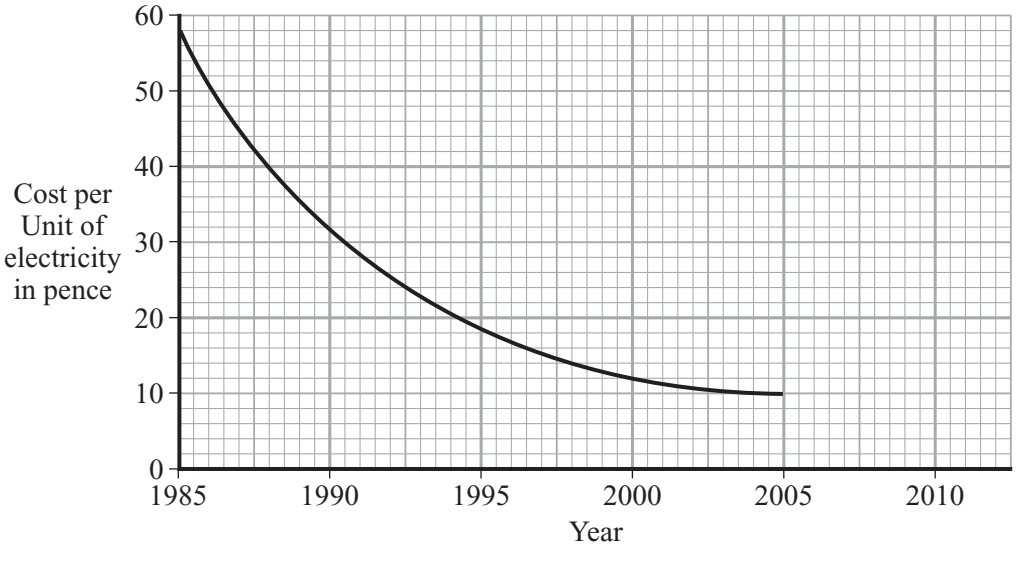
Solar cells give a constant supply of electricity. ☐

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)

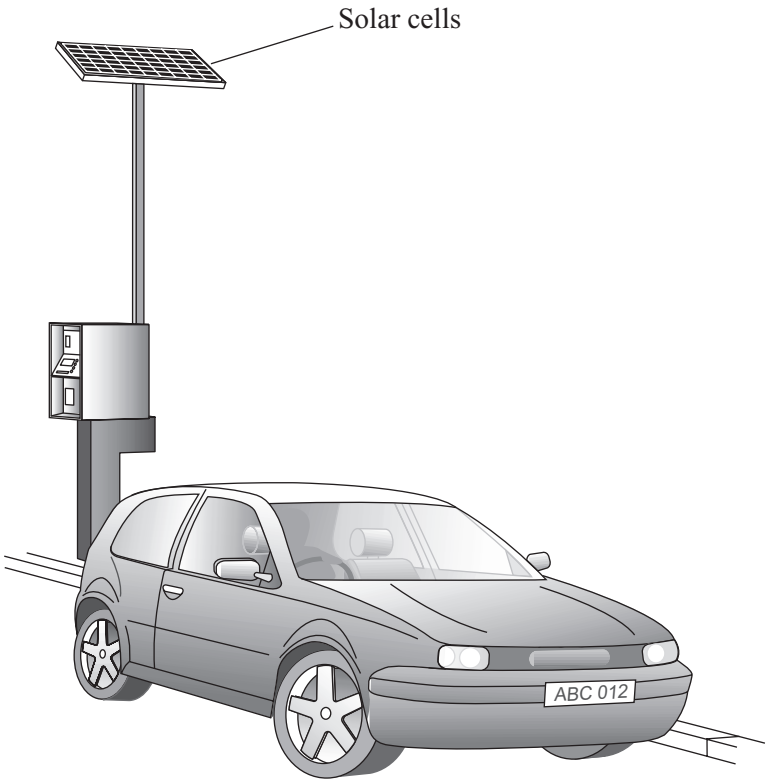
6

4.1.2.2 Efficiency

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)

4.1.2.2 Efficiency

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.

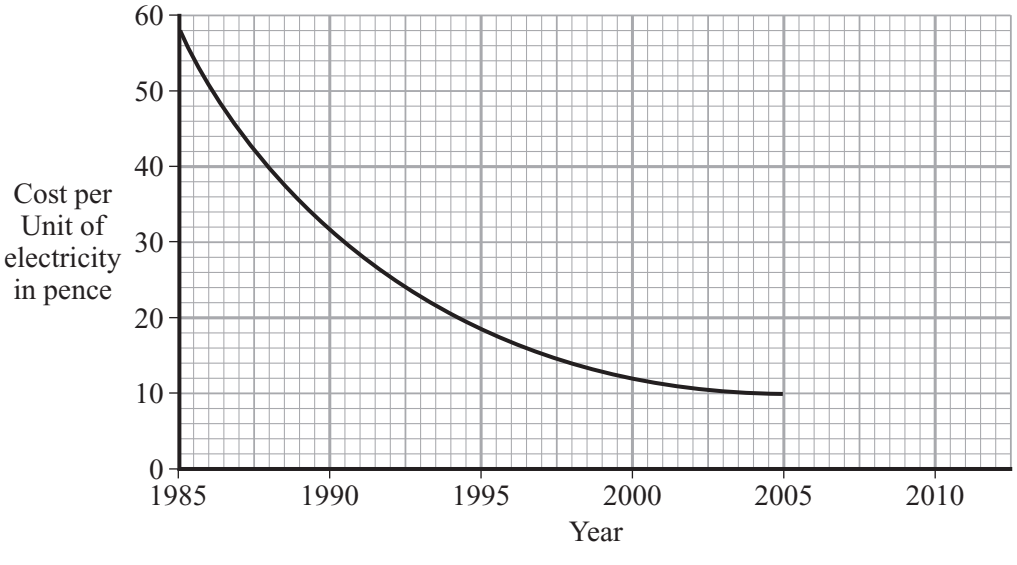
Solar cells give a constant supply of electricity. ☐

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)

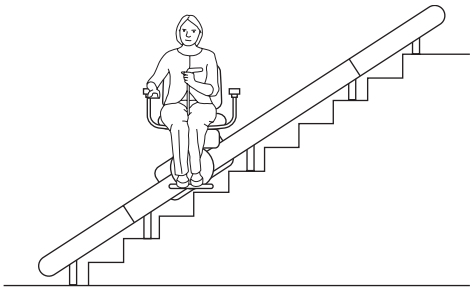
6

4.1.2.2 Efficiency

Question 11

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)

4.1.2.2 Efficiency

Question 11 · continued

BLANK

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

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

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

.....

.....

Power = ... J/s

(2 marks)

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

Draw a ring around your answer.

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

(1 mark)

(c) The forces on the stairlift are balanced.

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

The stairlift is not moving. ☐

The stairlift is moving at a constant speed. ☐

The stairlift is speeding up. ☐

The stairlift is slowing down. ☐

(1 mark)

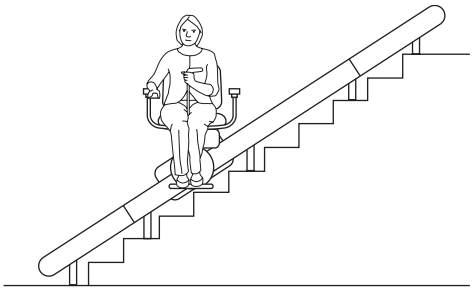
8

4.1.2.2 Efficiency

Question 12

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)

4.1.2.2 Efficiency

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

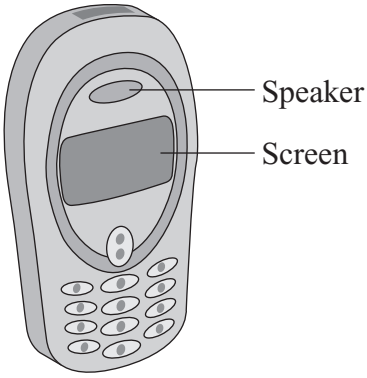
4.1.2.2 Efficiency

Question 13

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.

4.1.2.2 Efficiency

Question 14

November 2006 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

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



7A One model has a sticker which reads:

More efficient than any other washing machine at this price

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

1 cost less to run.

2 use less electrical energy.

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

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

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

1 being easier to recycle in the future.

2 having less impact on the environment.

3 using less water.

4.1.2.2 Efficiency

Question 14 · continued

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

2400 watts is equal to . . .

1 0.24 kW

2 2.40 kW

3 24 kW

4 240 kW

7D

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

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

1 2.4

2 40

3 144

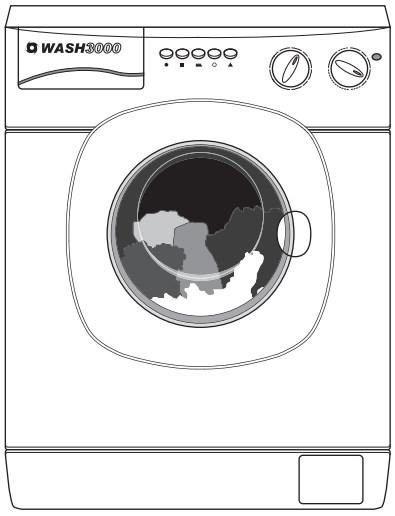
4 144 000

4.1.2.2 Efficiency

Question 15

January 2007 | PHY1F | Original Q5 | Legacy

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



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

kinetic	**light**	**sound**

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

..... energy.

(1 mark)

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

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

4.1.2.2 Efficiency

Question 15 · continued

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

energy transferred = power × time

.....

.....

Energy transferred = ... kWh

(2 marks)

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

.....

.....

(1 mark)

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

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

.....

.....

(1 mark)

5

4.1.2.2 Efficiency

Question 16

March 2007 | PHY1A | Original Q1 | Legacy

QUESTION ONE

Energy is supplied to a microwave oven by mains electricity.

The oven transforms this energy in various ways.

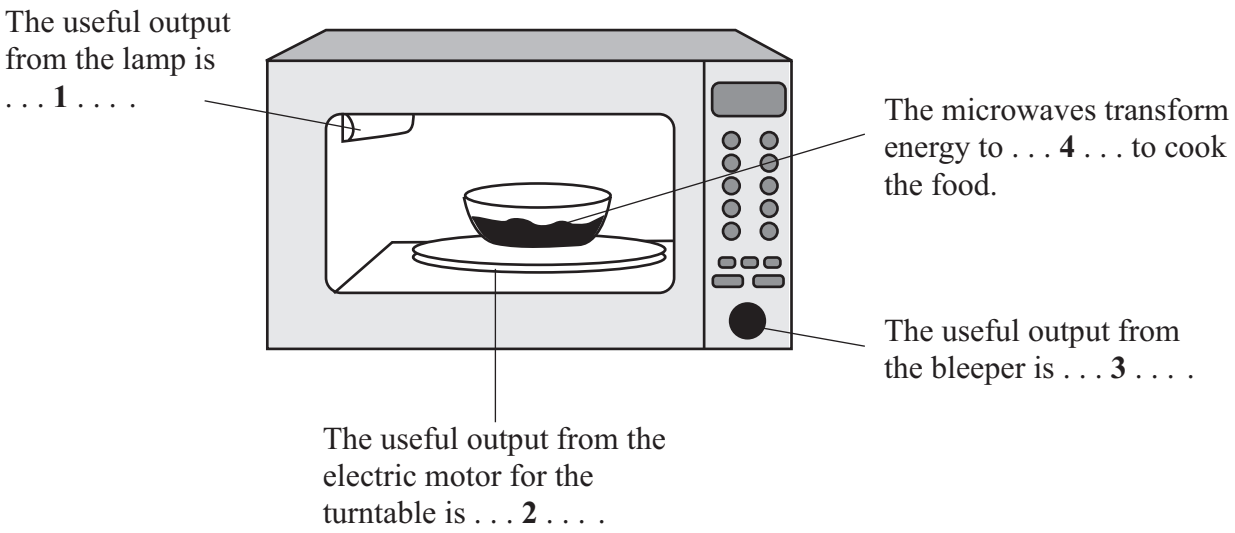
Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A heat

B light

C movement

D sound



4.1.2.2 Efficiency

Question 17

March 2007 | PHY1A | Original Q4 | Legacy

QUESTION FOUR

This question is about an electric kettle which is used to boil some water.

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

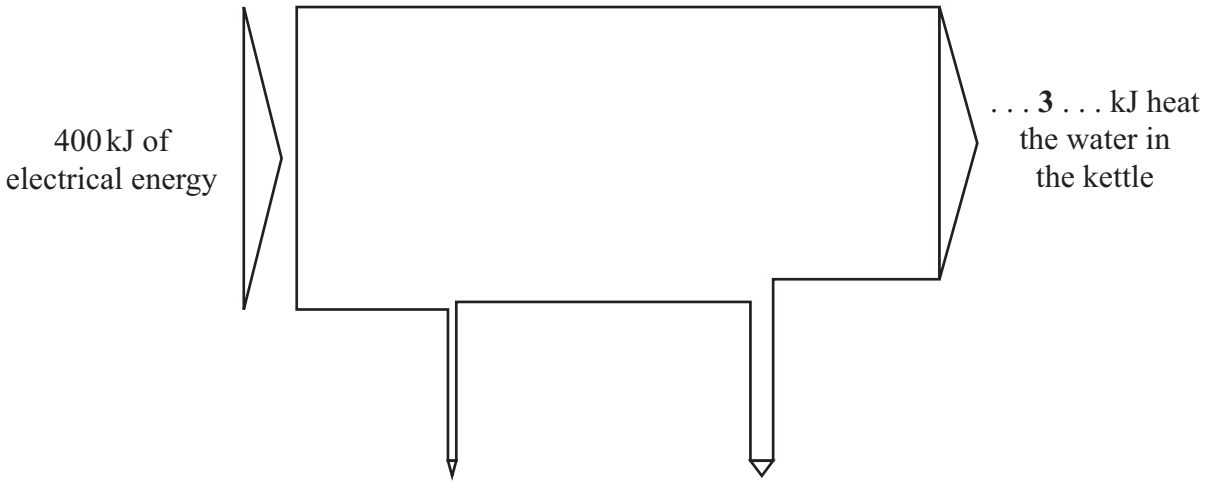
Match numbers, **A**, **B**, **C** and **D**, with the spaces **1–4**.

A 0.9

B 10

C 30

D 360



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

4.1.2.2 Efficiency

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.

4.1.2.2 Efficiency

Question 18 · continued

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.

4.1.2.2 Efficiency

Question 19

June 2007 | PHY1A | Original Q4 | Legacy

QUESTION FOUR

The Sankey diagram shows energy transfers in a petrol engine.

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

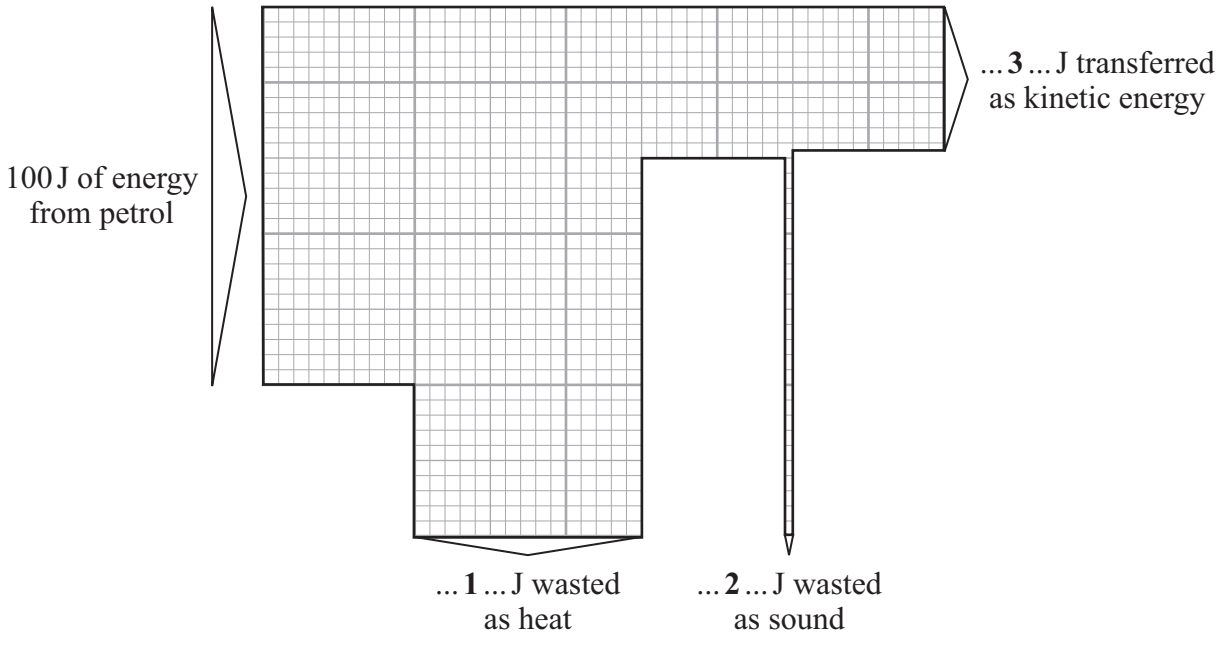
Match numbers, **A**, **B**, **C** and **D**, with the spaces **1–4** on the diagram.

A 0.38

B 2

C 38

D 60



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

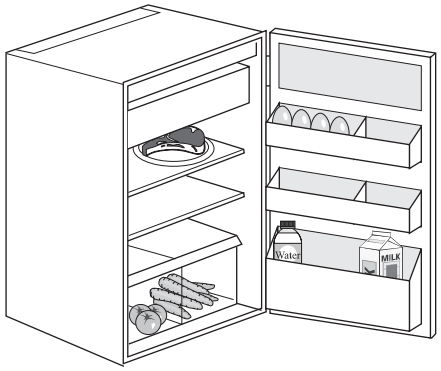
4.1.2.2 Efficiency

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

4.1.2.2 Efficiency

Question 20 · continued

7B The fridge has a power of 50 W.

How much energy does it transfer in 24 hours?

1 1.2 kWh

2 2.4 kWh

3 50 kWh

4 1200 kWh

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

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

1 it will keep food colder.

2 it will keep food fresh longer.

3 it will use less electricity.

4 it will not break down.

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

1 people will be better off.

2 less carbon dioxide will be released into the atmosphere.

3 less food will be wasted.

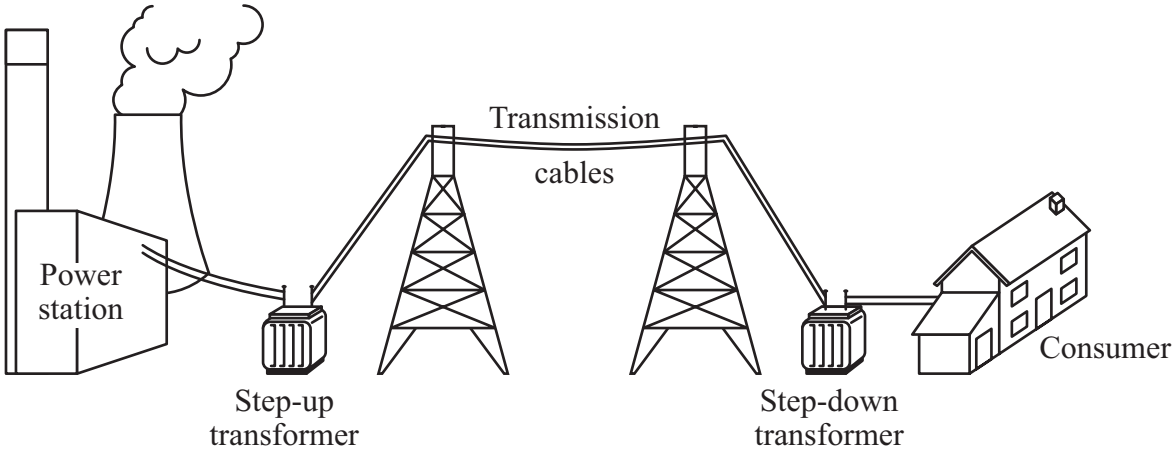
4 more jobs will be created.

4.1.2.2 Efficiency

Question 21

June 2007 | PHY1F | Original Q1 | Legacy

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



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

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

(1 mark)

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

(1 mark)

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

(1 mark)

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

(1 mark)

4.1.2.2 Efficiency

Question 21 · continued

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(b) Transformers always waste some energy.

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

.....

(1 mark)

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

Draw a ring around your answer.

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

(1 mark)

6

Turn over for the next question

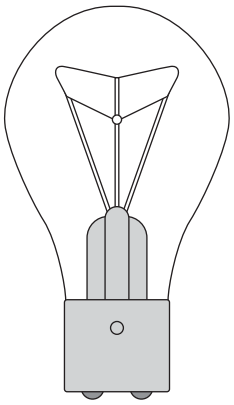
4.1.2.2 Efficiency

Question 22

November 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a lamp.



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

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

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

A 0.05

B 5

C 95

D 100

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

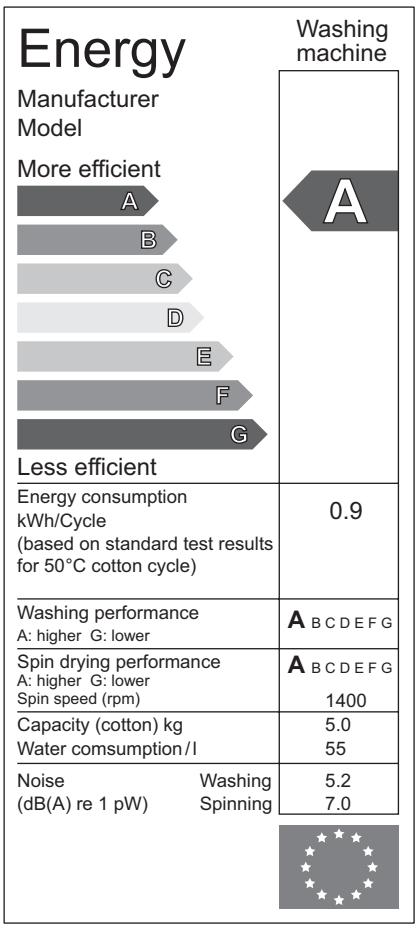
4.1.2.2 Efficiency

Question 23

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.

4.1.2.2 Efficiency

Question 23 · 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

4.1.2.2 Efficiency

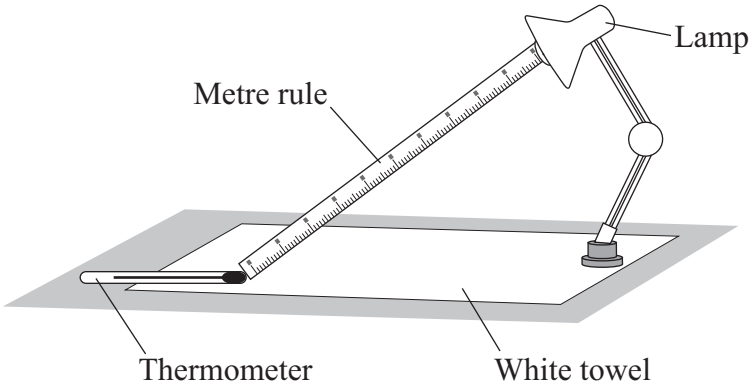
Question 24

November 2007 | PHY1A | Original Q8 | Legacy

QUESTION EIGHT

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

The diagram shows the apparatus she used.



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

The table shows her results.

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

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

1 categoric

2 continuous

3 dependent

4 ordered

4.1.2.2 Efficiency

Question 24 · continued

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

1 make of lamp

2 distance of thermometer from lamp

3 length of time the lamp was switched on

4 the white towel

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

1 **W**

2 **X**

3 **Y**

4 **Z**

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

1 **W**

2 **X**

3 **Y**

4 **Z**

4.1.2.2 Efficiency

Question 25

January 2008 | PHY1F | Original Q1 | Legacy

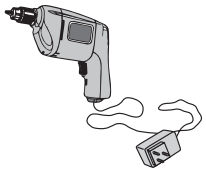
1 (a) Each letter **A**, **B**, **C**, **D** and **E** represents an energy transformation.

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



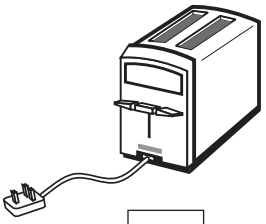
☐

MP3 player



☐

Toaster



☐

(3 marks)

Question 1 continues on the next page

4.1.2.2 Efficiency

Question 25 · continued

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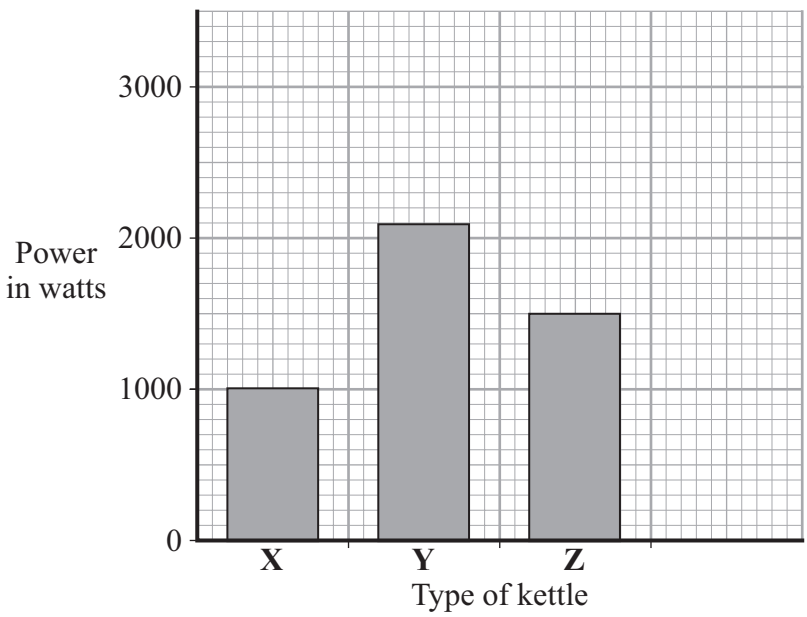
(b) The bar chart shows the power of three electric kettles.



(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)*

4.1.2.2 Efficiency

Question 25 · continued

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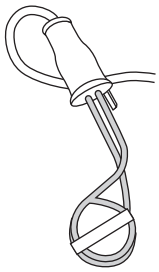
(c) Some friends are going on holiday. They want to be able to boil water to make their own hot drinks. They cannot decide which to take, a travel kettle or a small portable immersion heater that can be placed in a mug.





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)

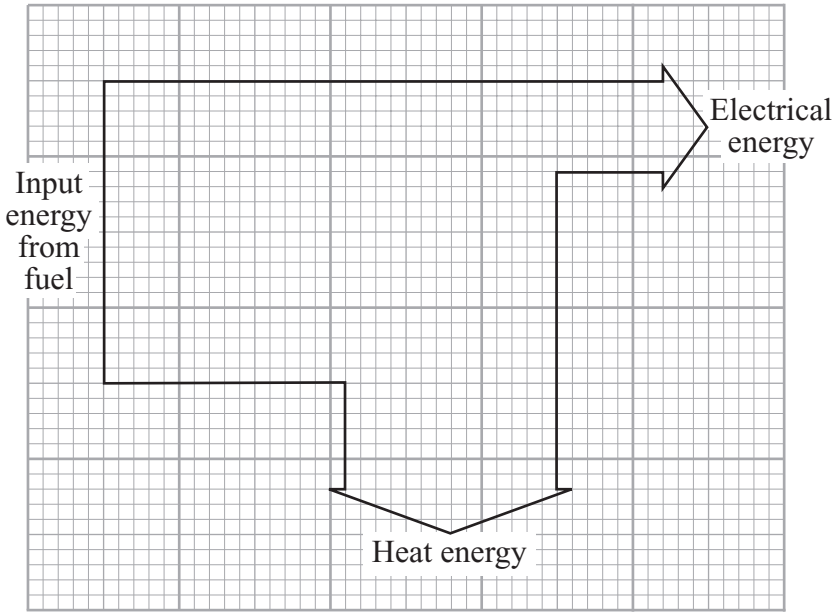
8

4.1.2.2 Efficiency

Question 26

January 2008 | PHY1F | Original Q6 | Legacy

6 (a) The diagram shows the energy transformations in a fuel burning power station.



(i) Name **one** fuel that is burned to provide the energy source for a power station.

.....

(1 mark)

(ii) Use the diagram and the equation in the box to calculate the efficiency of the power station.

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

(iii) Name the process by which a nuclear fuel provides the energy needed to generate electricity in a nuclear power station.

.....

(1 mark)

Question 6 continues on the next page

4.1.2.2 Efficiency

Question 26 · continued

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

(i) Transformers are part of the National Grid. Transformers are *efficient* devices.

What is meant by a device being *efficient*?

.....

.....

(1 mark)

(ii) When electricity flows through a cable, some energy is transformed into heat.

Explain how the National Grid system reduces the amount of energy lost as heat.

.....

.....

.....

.....

(2 marks)

(c) Read this information taken from a recent newspaper article.

- Researchers have found that children living close to overhead power cables are more likely to develop leukaemia.
- The researchers studied two groups of children. One group had developed leukaemia, the other group was healthy.
- Although the researchers found a link, they are unable to explain why it happened. They say that the results may have happened by chance.
- Other factors that have not been investigated, such as the environment, the geographical area or the children's genes, could be important.
- A cancer research charity said that childhood leukaemia was most likely to be caused by factors that parents were unable to control.

(i) Why did the researchers study a group of healthy children?

.....

.....

(1 mark)

4.1.2.2 Efficiency

Question 26 · continued

BLANK

(ii) The information does not say how many children were studied.

Why should this data have been included in the article?

.....

.....

(1 mark)

(iii) The researchers could not be certain that the overhead power cables were responsible for the increased chance of children developing leukaemia.

Explain why.

.....

.....

.....

.....

(2 marks)

(iv) The results of the research carried out by scientists may worry some people.

What do you think scientists should do?

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

Scientists should publish their research findings straight away. ☐

Scientists should not publish their research findings until they have found out as many facts as possible. ☐

Give a reason for your choice.

.....

.....

(1 mark)

12

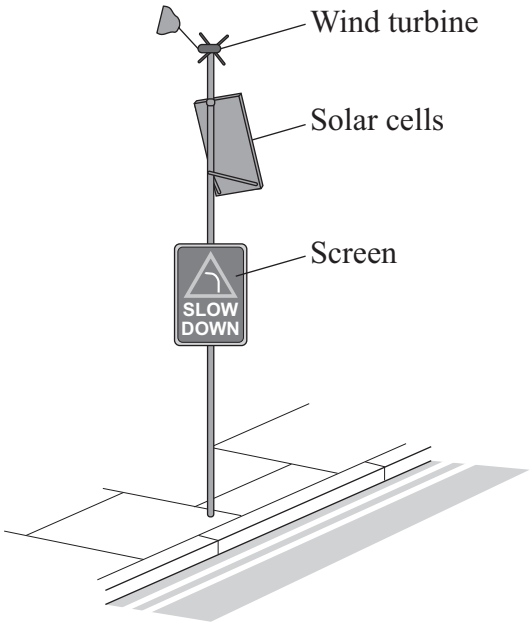
4.1.2.2 Efficiency

Question 27

March 2008 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

The diagram shows an electronic road sign.



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

A electrical energy

B thermal energy

C light energy

D kinetic energy

The useful energy output from the screen is . . . **1** . . . .

The energy input to the wind turbine is . . . **2** . . . .

The useful energy output from the solar cells is . . . **3** . . . .

The wasted energy output from the road sign is . . . **4** . . . .

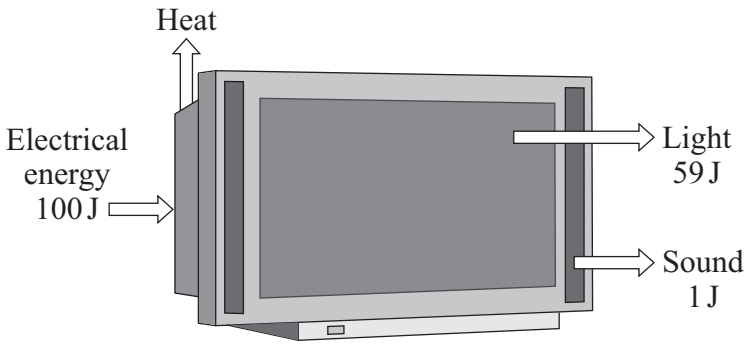
4.1.2.2 Efficiency

Question 28

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

4.1.2.2 Efficiency

Question 28 · 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.

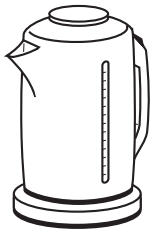
4.1.2.2 Efficiency

Question 29

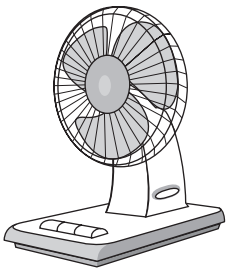
June 2008 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

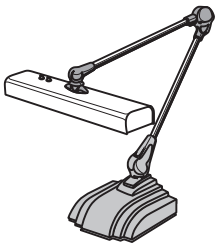
These devices transform electrical energy into other useful forms of energy.



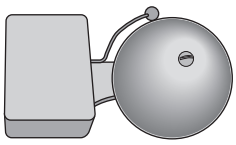
1
Kettle



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

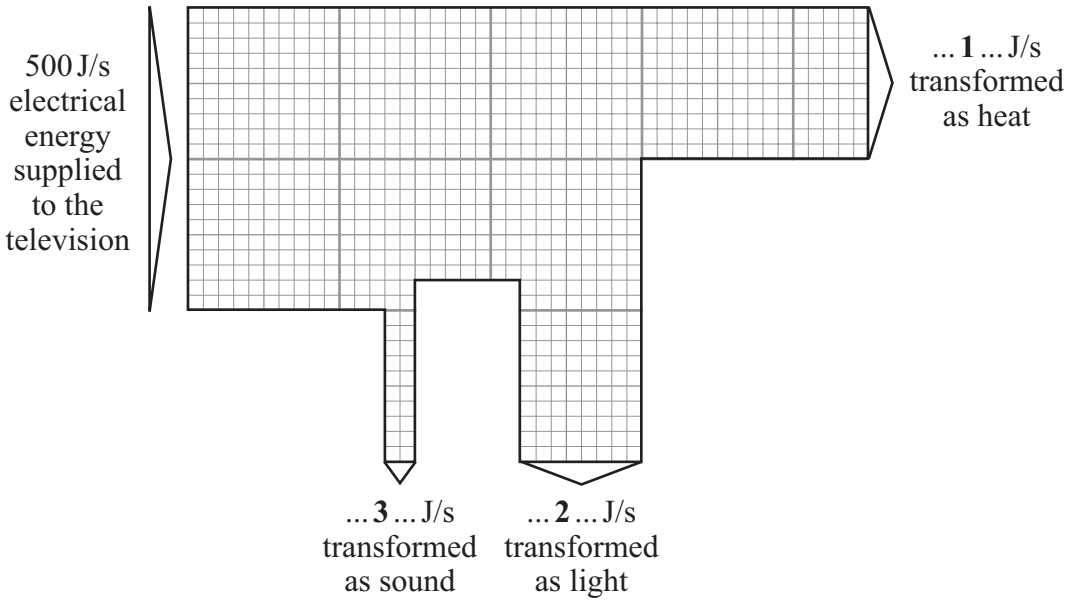
4.1.2.2 Efficiency

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

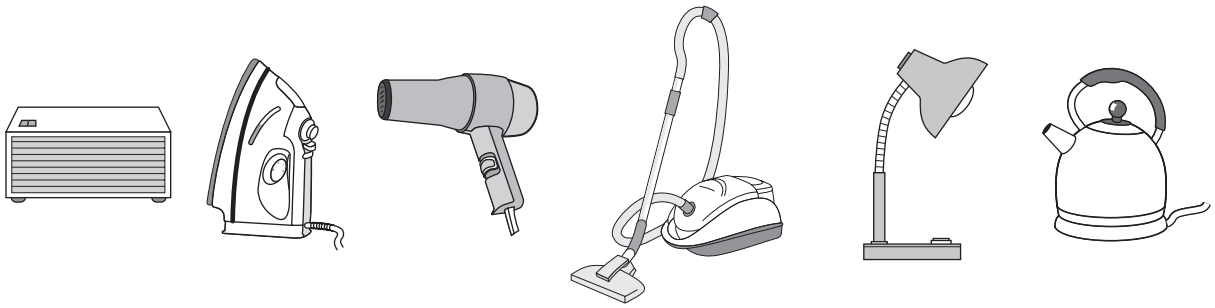
4.1.2.2 Efficiency

Question 31

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)

4.1.2.2 Efficiency

Question 31 · 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

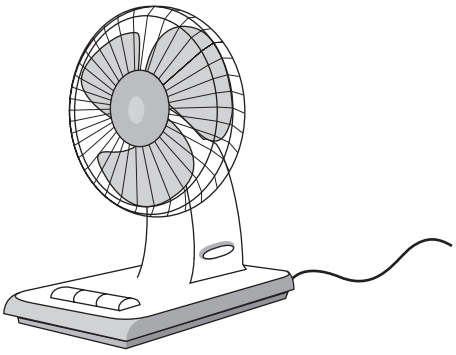
4.1.2.2 Efficiency

Question 32

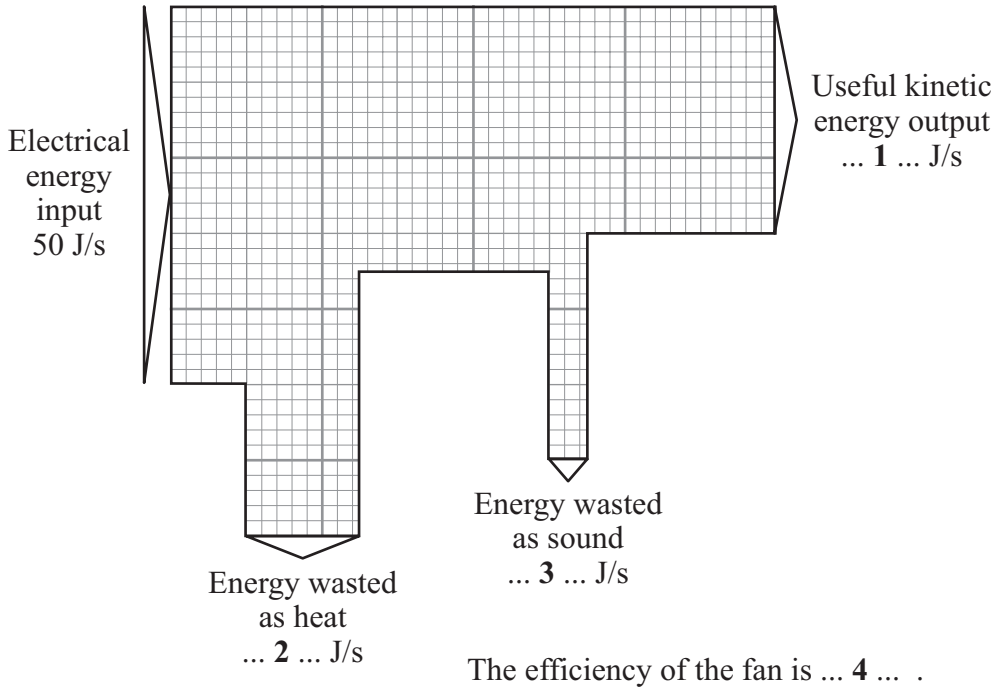
November 2008 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows an electric fan.



The Sankey diagram gives the energy transformations for the fan.



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

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

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

A 0.6

B 5

C 15

D 30

4.1.2.2 Efficiency

Question 33

November 2008 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

This is part of a report in a newspaper.

Tidal Barrage will power Britain

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

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

1 burning fossil fuels releases harmful gases into the atmosphere.

2 tidal power is less expensive than fossil fuels.

3 tidal power is more efficient than fossil fuels.

4 we have no fossil fuels left.

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

Tidal power stations . . .

1 are a predictable source of energy.

2 endanger wildlife and destroy habitats.

3 create jobs.

4 release no harmful gases in the atmosphere.

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

The turbines are connected to a . . .

1 boiler.

2 generator.

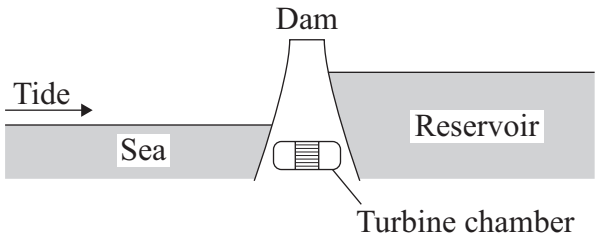
3 pump.

4 transformer.

4.1.2.2 Efficiency

Question 33 · continued

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



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

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

1 from kinetic to gravitational potential to electrical.

2 from gravitational potential to kinetic to electrical.

3 from chemical to kinetic to electrical.

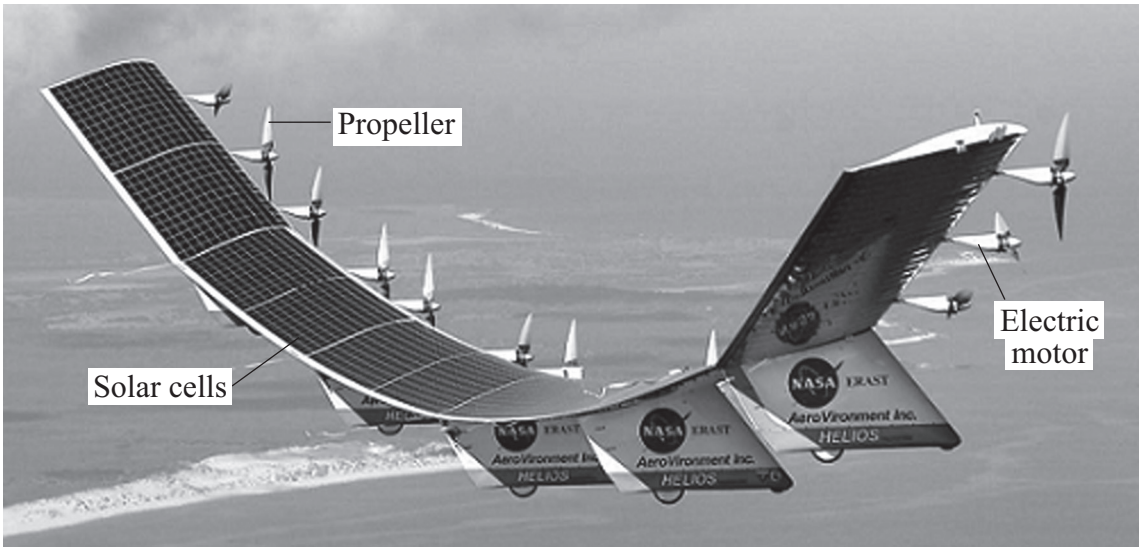
4 from kinetic to heat to electrical.

4.1.2.2 Efficiency

Question 34

January 2009 | PHY1F | Original Q3 | Legacy

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



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

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

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

..... energy.

(2 marks)

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

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

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

4.1.2.2 Efficiency

Question 34 · continued

for mark

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

.....

(1 mark)

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

.....

.....

(1 mark)

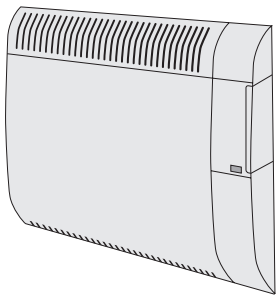
8

4.1.2.2 Efficiency

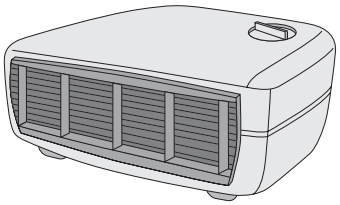
Question 35

January 2009 | PHY1F | Original Q7 | Legacy

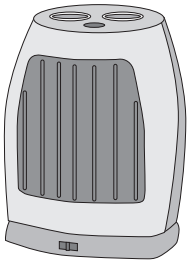
7 The pictures show three different types of electric heater.



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



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



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

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

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

energy transferred = power × time

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kilowatt-hours

(2 marks)

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

.....

(1 mark)

4.1.2.2 Efficiency

Question 35 · continued

for mark

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

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

oil-filled panel heater .....

.....

fan heater .....

.....

ceramic heater .....

.....

(3 marks)

6

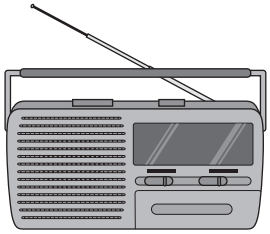
4.1.2.2 Efficiency

Question 36

March 2009 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

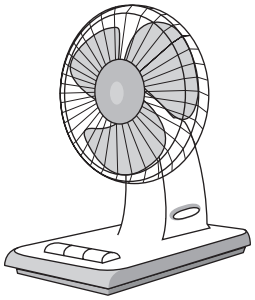
This question is about useful energy transformations in domestic appliances.



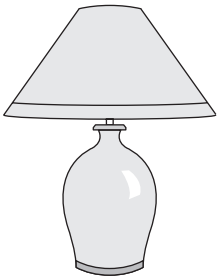
A
Radio



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

4.1.2.2 Efficiency

Question 37

March 2009 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

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

6A A car engine transfers kinetic energy.

The kinetic energy is transformed from . . .

1 chemical energy.

2 electrical energy.

3 light energy.

4 sound energy.

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

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

1 has a higher top speed.

2 has a lower top speed.

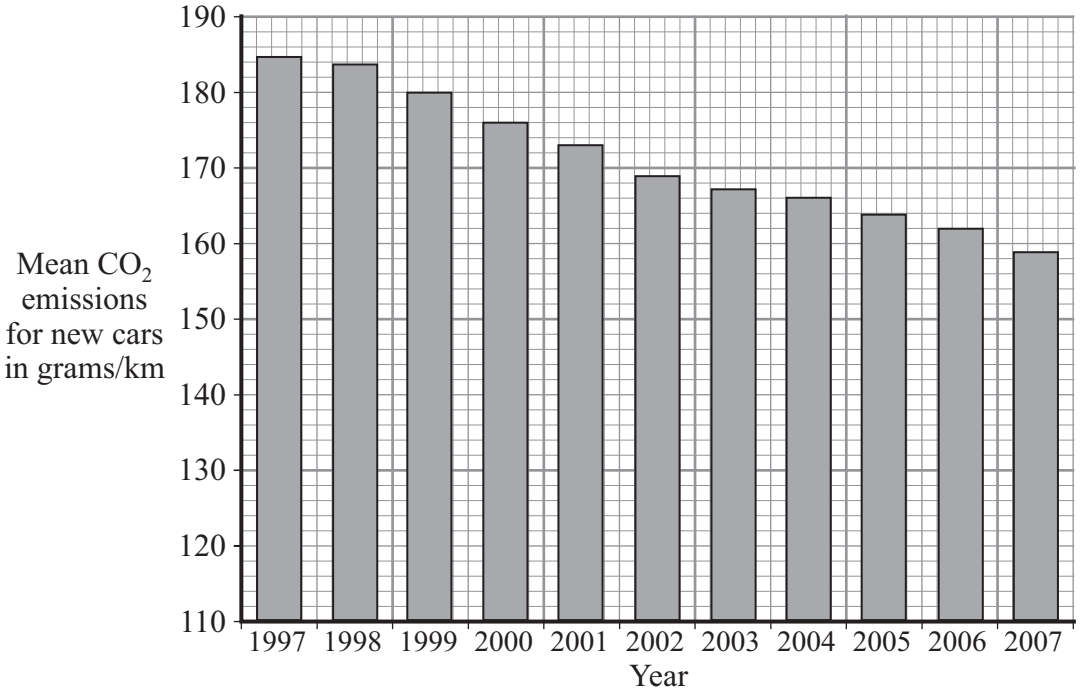
3 uses less petrol.

4 uses more petrol.

4.1.2.2 Efficiency

Question 37 · continued

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



6C The display is called a . . .

1 bar chart.

2 line graph.

3 pie chart.

4 scattergram.

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

1 steadily increased.

2 steadily decreased.

3 decreased and then increased.

4 stayed the same.

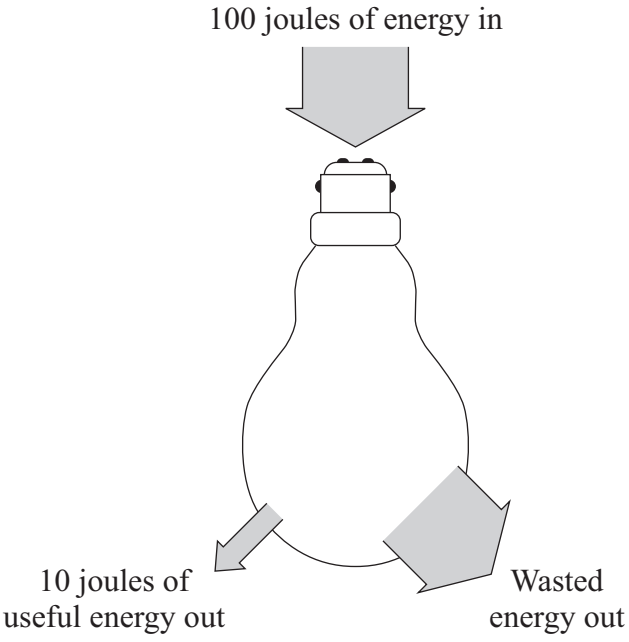
4.1.2.2 Efficiency

Question 38

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

4.1.2.2 Efficiency

Question 38 · continued

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

4.1.2.2 Efficiency

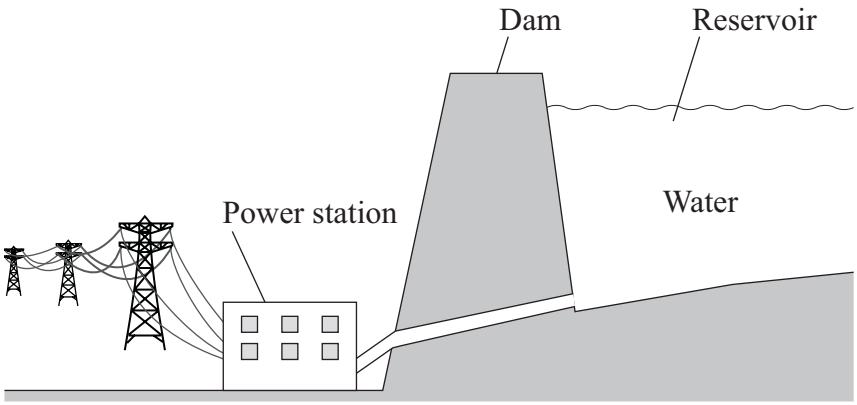
Question 39

June 2009 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

Useful energy can be obtained from falling water.

The diagram shows one way of doing this.



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

A electrical

B gravitational potential

C heat (thermal energy)

D kinetic

Large amounts of . . . **1** . . . energy are stored in the water in the reservoir.

Water flowing down from this reservoir has . . . **2** . . . energy which can turn a turbine.

The turbine can power a generator which produces useful . . . **3** . . . energy.

Some energy is wasted in the power station as . . . **4** . . . .

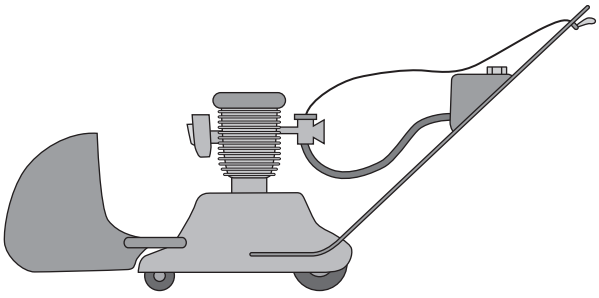
4.1.2.2 Efficiency

Question 40

June 2009 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The diagram shows a petrol-driven lawn mower.



7A The useful energy transformation is . . .

1 chemical energy to kinetic energy.

2 heat (thermal energy) to kinetic energy.

3 kinetic energy to chemical energy.

4 sound energy to heat (thermal energy).

7B The wasted energy is . . .

1 elastic potential.

2 heat only.

3 heat and sound.

4 sound only.

7C All wasted energy will eventually . . .

1 be destroyed.

2 be transferred to the surroundings.

3 cause the machine to overheat.

4 no longer exist anywhere.

4.1.2.2 Efficiency

7D Another lawn mower is said to be more efficient than this one.

This is because . . .

1 it cuts the grass more quickly.

2 it leaves fewer loose grass clippings.

3 it cuts the grass shorter.

4 it uses less petrol.

Turn over for the next question

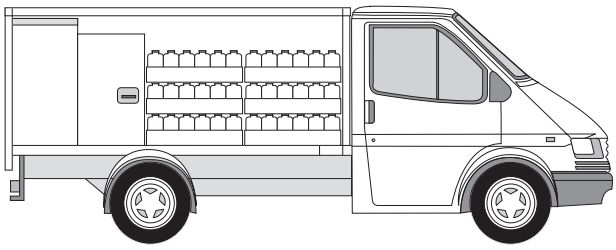
4.1.2.2 Efficiency

Question 41

June 2009 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The diagram shows an electrically powered milk float.



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

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

1 electrical energy to kinetic energy.

2 kinetic energy to chemical energy.

3 chemical energy to electrical energy.

4 kinetic energy to electrical energy.

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

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

The energy transferred to the batteries is . . .

1 0.3 kWh

2 3.3 kWh

3 7.5 kWh

4 75 kWh

4.1.2.2 Efficiency

Question 41 · continued

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

What is the efficiency of the motor?

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

1 0.4

2 2.5

3 2400

4 5600

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

This is because . . .

1 the batteries store energy.

2 it produces no harmful waste gases.

3 the batteries can be recharged many times.

4 the top speed is only 20 km/h.

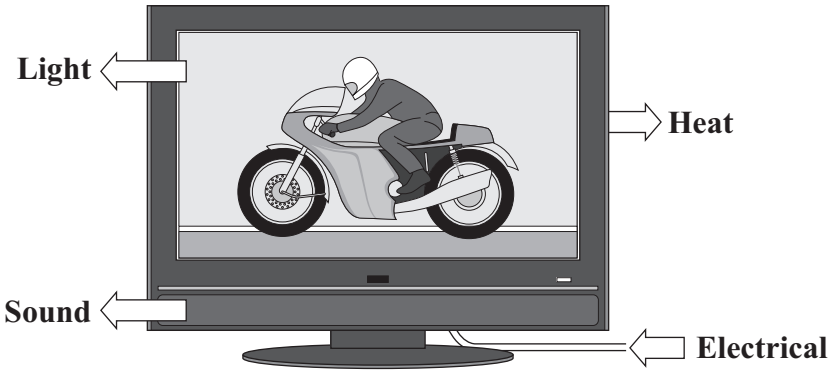
END OF TEST

4.1.2.2 Efficiency

Question 42

June 2009 | PHY1F | Original Q1 | Legacy

1 The diagram shows the energy transformations produced by a TV.



1 (a) Use words from the diagram to complete the following sentence.

The TV is designed to transform ..... energy into light and ..... energy.

(2 marks)

1 (b) Which **one** of the following statements is **false**?

Put a tick (✓) in the box next to the **false** statement.

The energy transformed by the TV makes the surroundings warmer. ☐

The energy transformed by the TV becomes spread out. ☐

The energy transformed by the TV will be destroyed. ☐

(1 mark)

4.1.2.2 Efficiency

Question 42 · continued

for mark

1 (c) Two different makes of television, **A** and **B**, transform energy at the same rate. Television **A** wastes less energy than television **B**.

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

Television **A** has

a higher efficiency than
the same efficiency as
a lower efficiency than

television **B**.

(1 mark)

4

Turn over for the next question

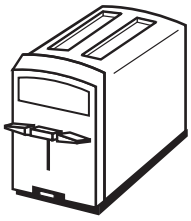
4.1.2.2 Efficiency

Question 43

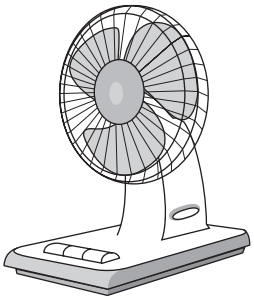
November 2009 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

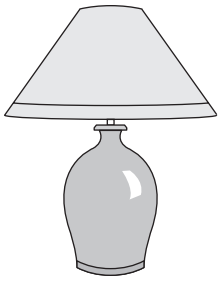
The diagrams show four electrical appliances.



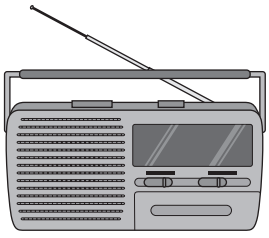
A
Toaster



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

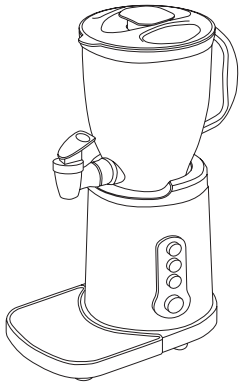
4.1.2.2 Efficiency

Question 44

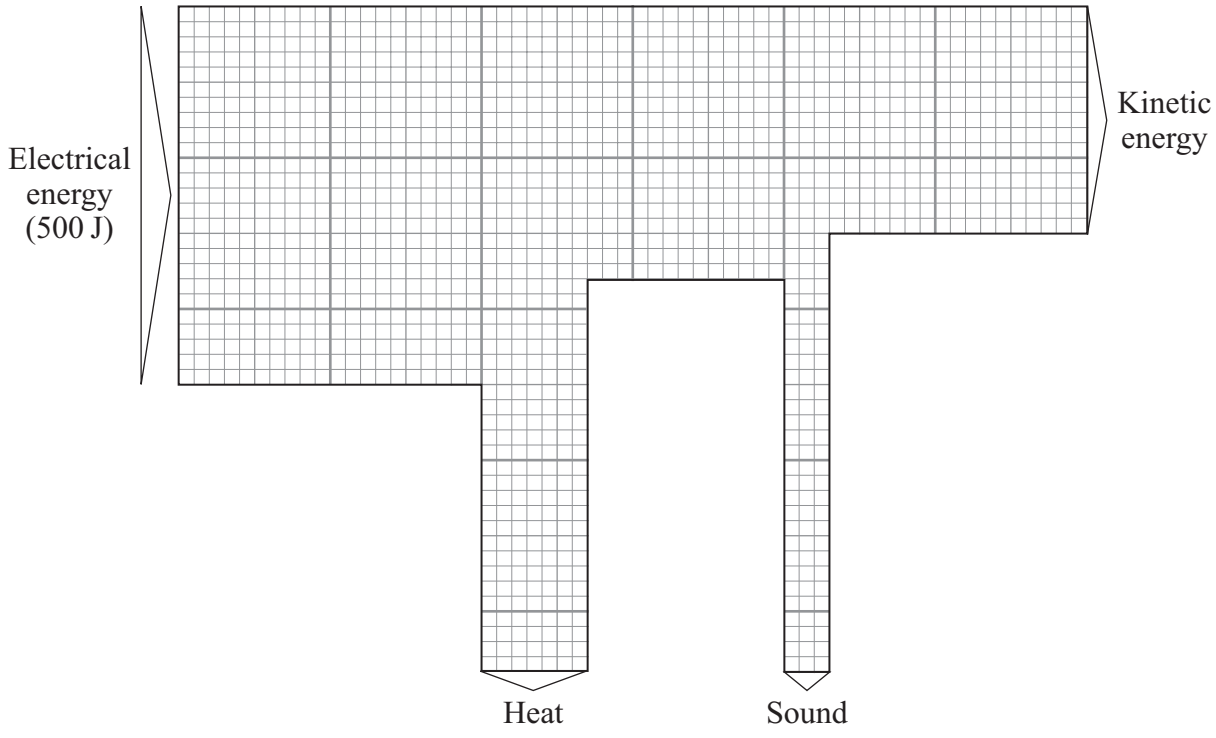
November 2009 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a smoothie maker.



The Sankey diagram shows the energy transfers that take place each second in this smoothie maker.



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

4.1.2.2 Efficiency

Question 44 · continued

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

A 0.6

B 140

C 200

D 300

The kinetic energy produced each second is . . . **1** . . . J.

The heat produced each second is . . . **2** . . . J.

The total energy wasted each second is . . . **3** . . . J.

The efficiency of the smoothie maker is . . . **4** . . . .

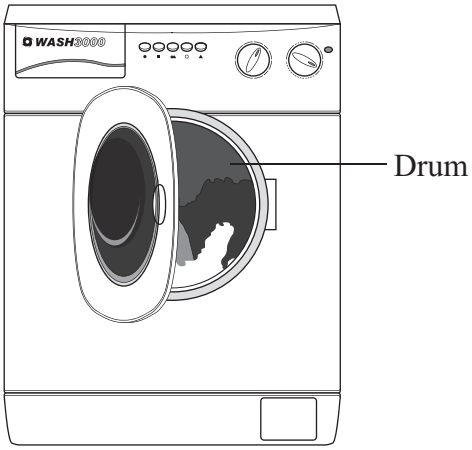
Turn over for the next question

4.1.2.2 Efficiency

Question 45

January 2010 | PHY1F | Original Q7 | Legacy

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?

.....

.....

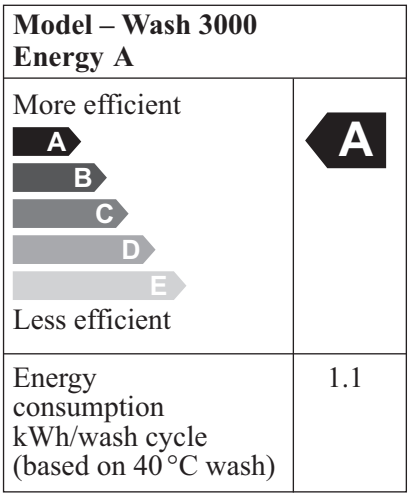
(1 mark)

4.1.2.2 Efficiency

Question 45 · 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)

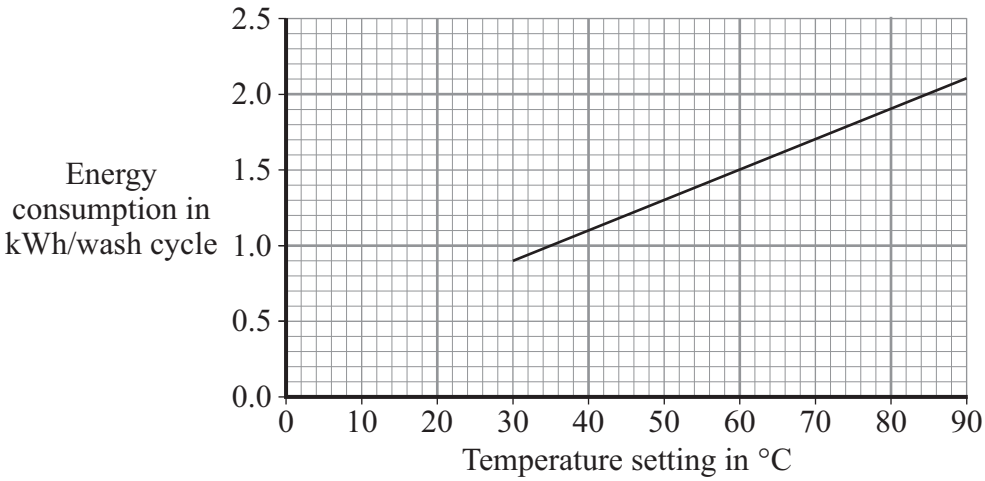
Question 7 continues on the next page

4.1.2.2 Efficiency

Question 45 · 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

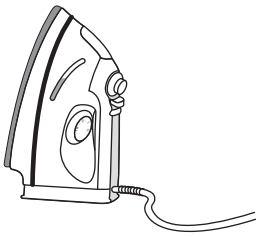
4.1.2.2 Efficiency

Question 46

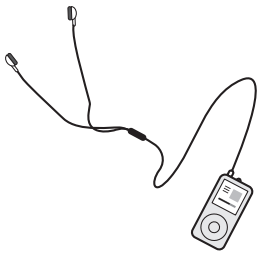
March 2010 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

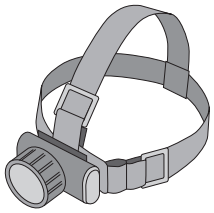
These devices transform electrical energy into other useful forms of energy.



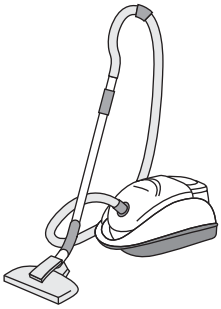
1
Iron



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

4.1.2.2 Efficiency

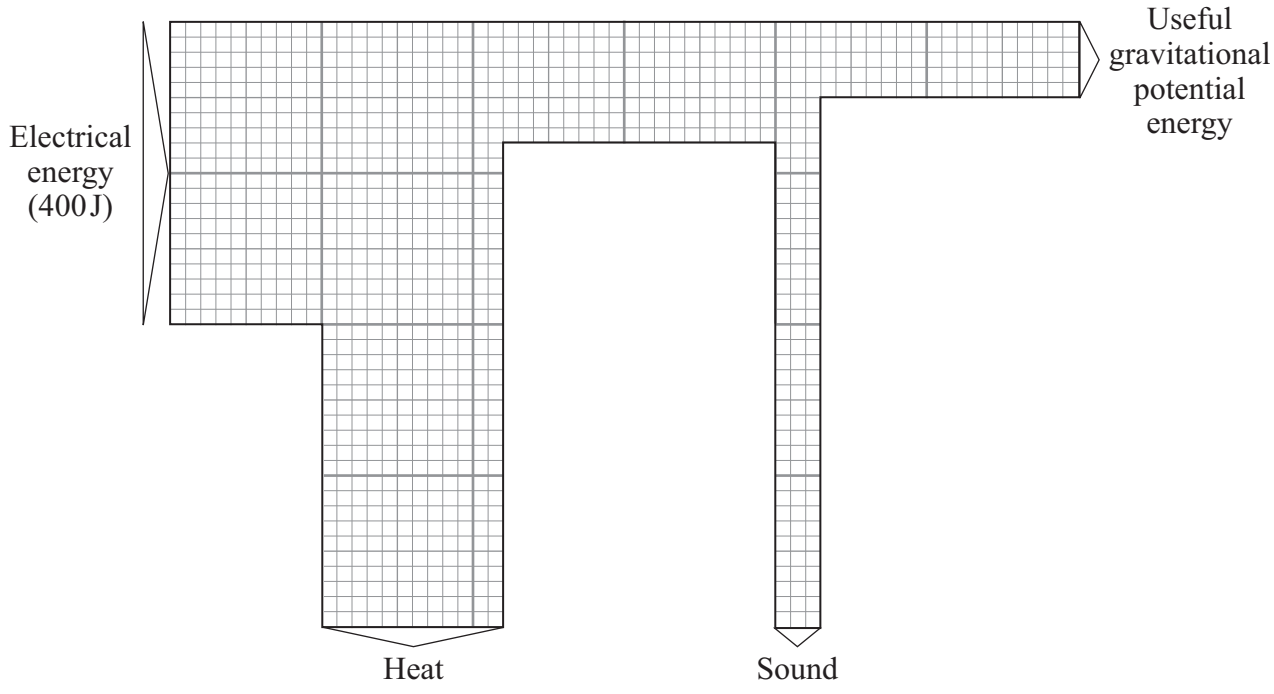
Question 47

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** . . . .

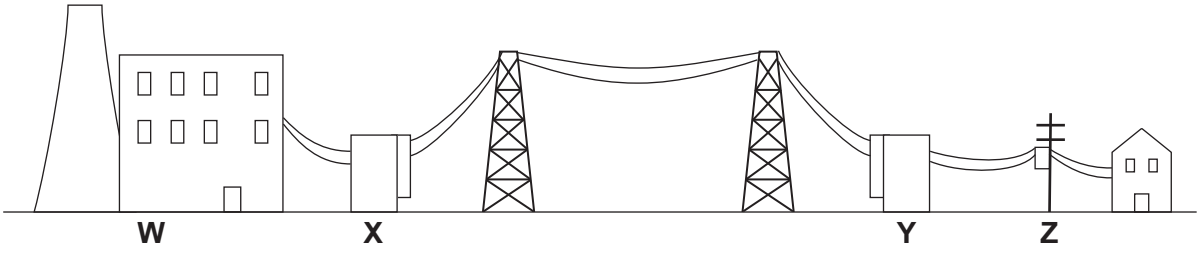
4.1.2.2 Efficiency

Question 48

June 2010 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

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



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

1 **W**

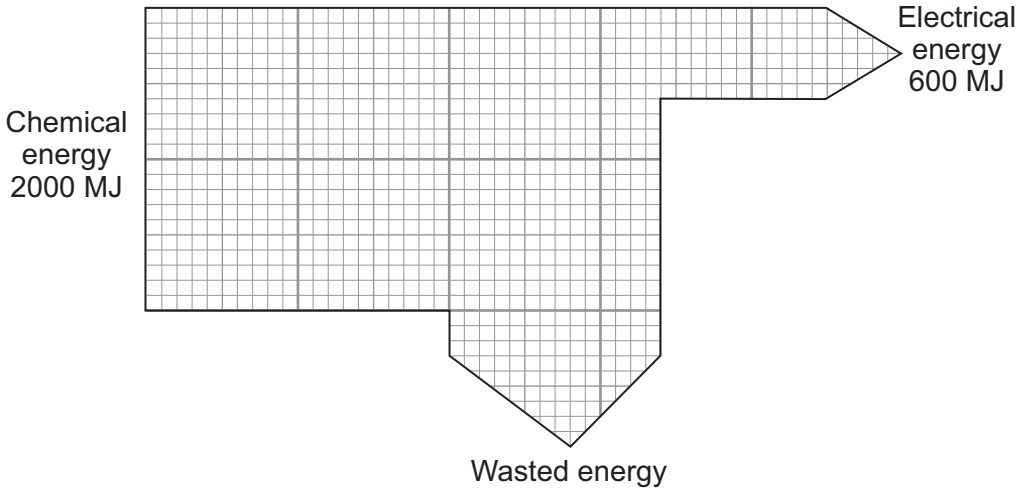
2 **X**

3 **Y**

4 **Z**

Fuel is burned in this power station.

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



7B How much energy is wasted?

1 30 MJ

2 600 MJ

3 1400 MJ

4 2600 MJ

4.1.2.2 Efficiency

Question 48 · continued

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

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

What is the efficiency of this power station?

1 0.30

2 0.33

3 0.60

4 0.70

7D What happens to the energy that is wasted?

1 It is transferred into useful energy.

2 It warms up the surroundings.

3 It is recycled.

4 It is stored until needed.

4.1.2.2 Efficiency

Question 49

June 2010 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

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

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

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

This means that they . . .

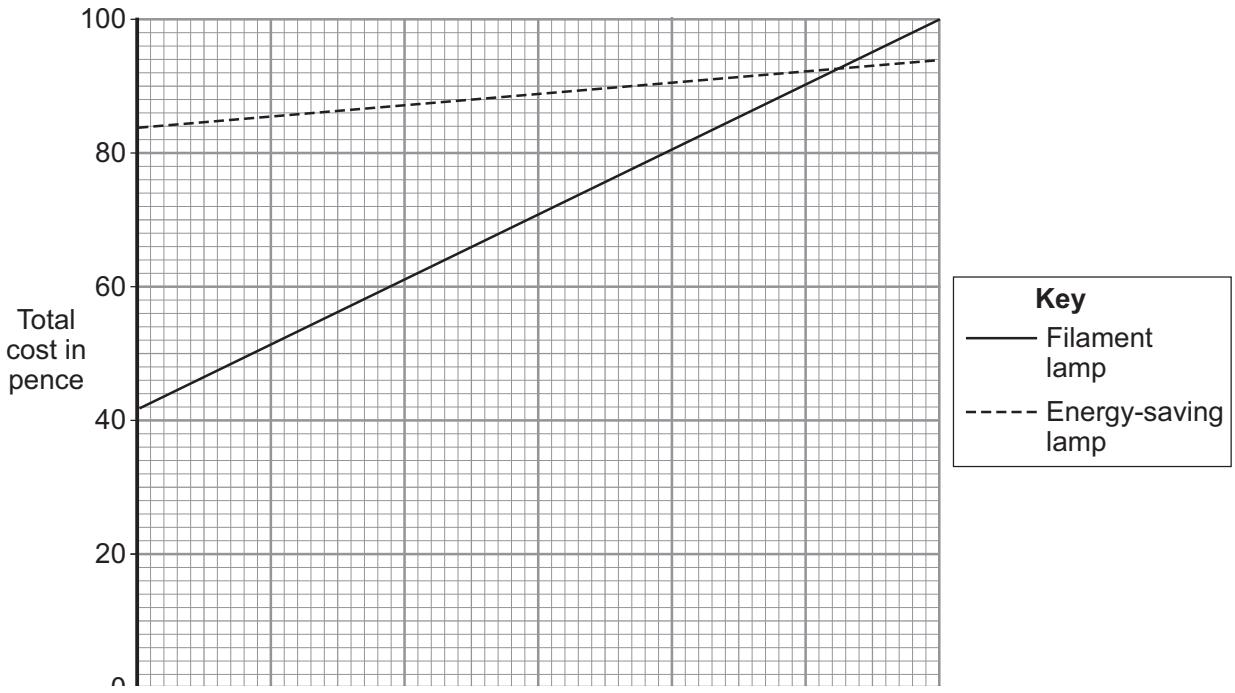
1 cost less.

2 do not last as long.

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

4 reach full brightness straight away.

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



4.1.2.2 Efficiency

Question 49 · continued

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

1 half as much.

2 twice as much.

3 the same.

4 four times as much.

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

1 86 hours of use.

2 93 hours of use.

3 103 hours of use.

4 105 hours of use.

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

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

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

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

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

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

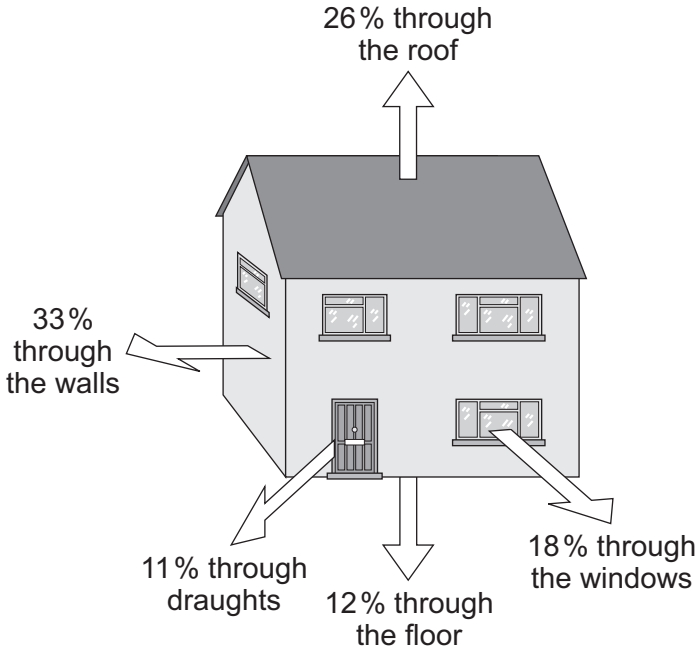
END OF TEST

4.1.2.2 Efficiency

Question 50

June 2010 | PHY1F | Original Q4 | Legacy

4 The diagram shows where heat is lost from a house that is **not** insulated.



4 (a) (i) Through which part of the house is most heat lost?

.....

(1 mark)

4 (a) (ii) How can the heat loss through the windows be reduced?

.....

.....

(1 mark)

4.1.2.2 Efficiency

Question 50 · continued

4 (b) A homeowner wants to reduce her energy bills and make her home more energy efficient. The table shows five ways this could be done. The table also shows how much money each way would save the homeowner each year.

	Cost	Money saved each year
Installing loft insulation	£175	£60
Fitting draught-proofing	£45	£20
Installing cavity wall insulation	£300	£80
Adding a hot water tank jacket	£15	£20
Using energy efficient light bulbs	£60	£30

4 (b) (i) Which **one** of the five ways of reducing energy bills would reduce the yearly energy bill the most?

.....

(1 mark)

4 (b) (ii) This year the homeowner has only got £60 to spend to improve the energy efficiency of her home.

Use the information in the table to explain what the homeowner should spend this money on.

.....

.....

.....

.....

(2 marks)

5

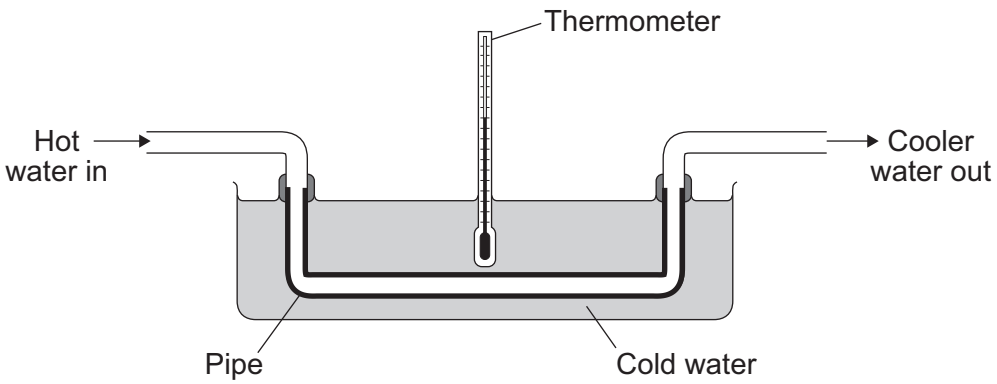
4.1.2.2 Efficiency

Question 51

June 2010 | PHY1F | Original Q6 | Legacy

6 Heat exchangers are devices that are used to transfer heat from one place to another.

The diagram shows a simple heat exchanger used by a student in an investigation. Heat is transferred from the hot water inside the pipe to the cold water outside the pipe.



6 (a) By which process is heat transferred from the hot water inside the pipe to the cold water outside the pipe?

.....

(1 mark)

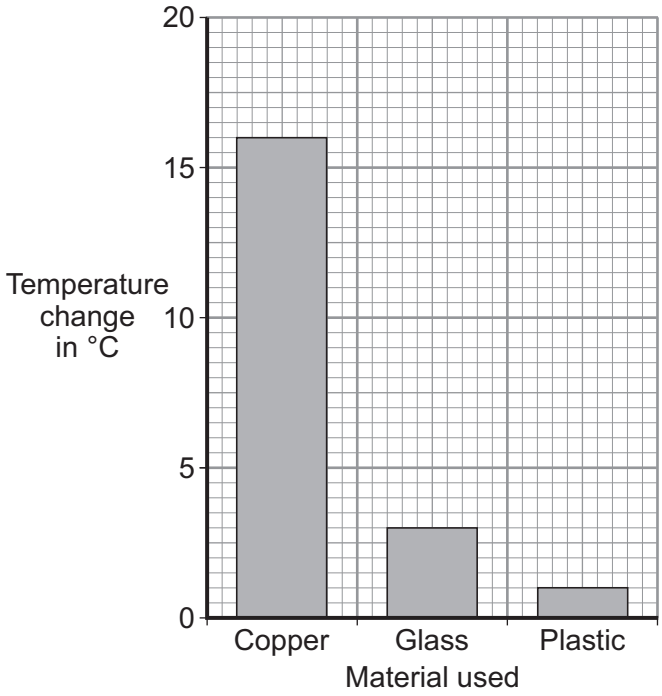
6 (b) The student wanted to find out if the efficiency of a heat exchanger depends on the material used to make the pipe. The student tested three different materials. For each material, the rate of flow of hot water through the pipe was kept the same.

The results obtained by the student are recorded in the table and displayed in the bar chart.

Material	Temperature of the cold water at the start in °C	Temperature of the cold water after 10 minutes in °C
Copper	20	36
Glass	20	23
Plastic	20	21

4.1.2.2 Efficiency

Question 51 · continued



6 (b) (i) The rate of flow of hot water through the pipe was one of the control variables in the investigation.

Give **one** other control variable in the investigation.

.....

(1 mark)

6 (b) (ii) Why did the student draw a bar chart rather than a line graph?

.....

.....

(1 mark)

6 (b) (iii) Which **one** of the three materials made the best heat exchanger?

.....

Give a reason for your answer.

.....

.....

.....

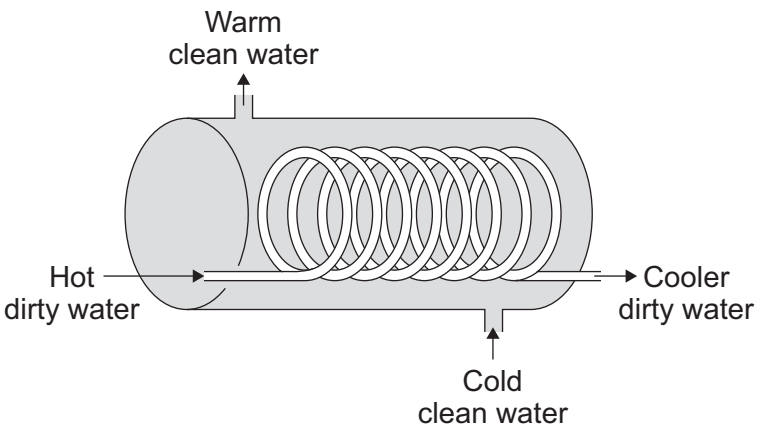
(2 marks)

Question 6 continues on the next page

4.1.2.2 Efficiency

Question 51 · continued

6 (c) The student finds a picture of a heat exchanger used in an industrial laundry.
The heat exchanger uses hot, dirty water to warm cold, clean water.



Why does this heat exchanger transfer heat faster than the heat exchanger used by the student in the investigation?

.....

.....

(1 mark)

6

Turn to page 18 for Question 7

4.1.2.2 Efficiency

Question 52

November 2010 | PHY1AP | Original Q3 | Legacy

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** . . . .

4.1.2.2 Efficiency

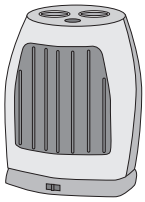
Question 53

November 2010 | PHY1AP | Original Q6 | Legacy

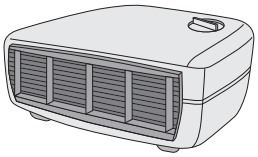
QUESTION SIX

The pictures show four different types of electric heater.

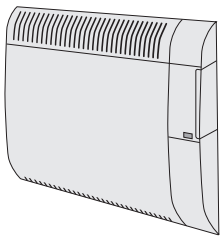
1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out



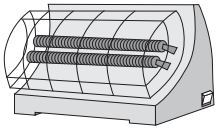
3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



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



2 kW radiant heater
- 2 heat settings



6A Which heater is the most powerful?

1 the ceramic heater

2 the fan heater

3 the oil-filled panel heater

4 the radiant heater

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

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

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

1 0.75

2 3.0

3 7.0

4 12.0

4.1.2.2 Efficiency

Question 53 · continued

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

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

Electricity costs 14p per kWh

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

1 £0.14

2 £1.40

3 £14.00

4 £140.00

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

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

2 The fan heater has a power indicator light.

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

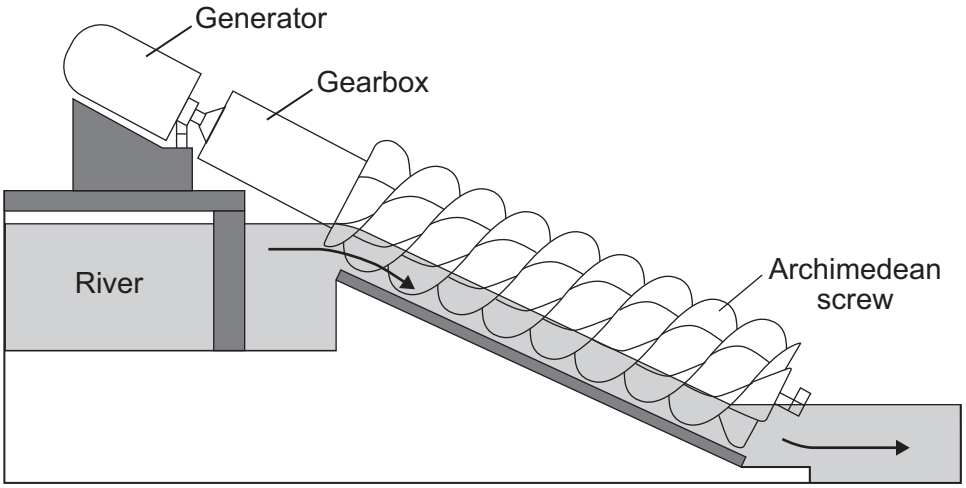
4 The fan heater has more than one heat setting.

4.1.2.2 Efficiency

Question 54

January 2011 | PHY1F | Original Q5 | Legacy

5 The diagram shows a small-scale, *micro-hydroelectricity* generator which uses the energy of falling river water to generate electricity. The water causes a device, called an Archimedean screw, to rotate.
The Archimedean screw is linked to the generator by a gearbox.



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

The gravitational potential energy of the falling water is transformed

into the | chemical / electrical / kinetic | energy of the Archimedean screw.

(1 mark)

4.1.2.2 Efficiency

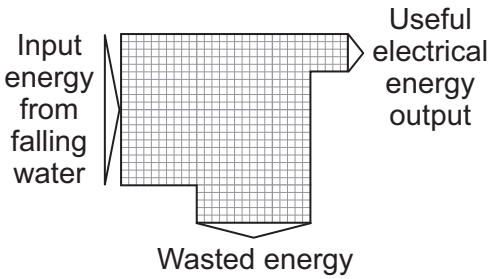
Question 54 · continued

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

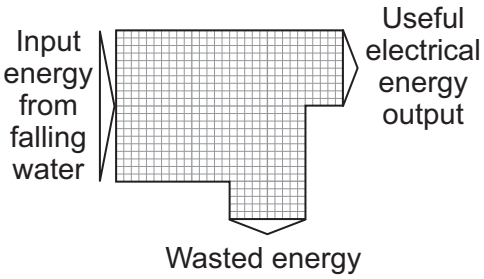
Which **one** of the following Sankey diagrams, **X**, **Y** or **Z**, shows the energy transformations produced by this generator?

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

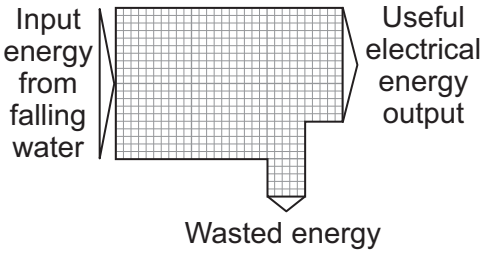
Sankey diagram **X**



Sankey diagram **Y**



Sankey diagram **Z**



Sankey diagram ☐

(1 mark)

Question 5 continues on the next page

4.1.2.2 Efficiency

Question 54 · continued

5 (c) A micro-hydroelectric system generates about 60 kW of electricity, enough for 50 homes. A conventional large-scale hydroelectric power station may generate more than 5 000 000 kW of electricity.

5 (c) (i) Give **one** advantage of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system.

.....

.....

(1 mark)

5 (c) (ii) Which **one** of the following statements gives a **disadvantage** of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system?

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

Energy is wasted as heat and sound. ☐

Large areas of land are flooded. ☐

A constant flow of water is needed. ☐

(1 mark)

5 (d) The electricity generated by the micro-hydroelectric system is transferred directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to homes anywhere in the country through a system of cables and transformers.

5 (d) (i) What name is given to the system of cables and transformers used to transfer electricity to homes anywhere in the country?

.....

(1 mark)

5 (d) (ii) Using short cables to transfer electricity to local homes is much more efficient than using very long cables to transfer electricity to homes anywhere in the country.

Why?

.....

.....

(1 mark)

4.1.2.2 Efficiency

Question 54 · continued

5 (e) Nepal is a mountainous country with over 6000 rivers. In Nepal, 9000 kW of electricity are generated using micro-hydroelectric generators.

Suggest **one** reason why in the UK much less electricity is generated using micro-hydroelectric generators, than in Nepal.

.....

.....

(1 mark)

7

Turn over for the next question

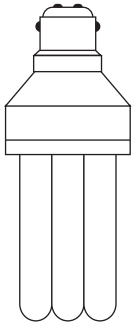
4.1.2.2 Efficiency

Question 55

March 2011 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a compact fluorescent lamp (CFL).



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

A economical

B efficient

C environmental

D ethical

Compared with a filament lamp, a CFL transforms less electrical energy to produce the same amount of light energy each second. This makes the CFL more . . . **1** . . . .

Over time, CFLs cost less to buy and use, making them more . . . **2** . . . than filament lamps.

CFLs contain mercury and their disposal causes . . . **3** . . . problems.

Society must decide whether or not it is . . . **4** . . . to use CFLs even if there is a possible hazard to health.

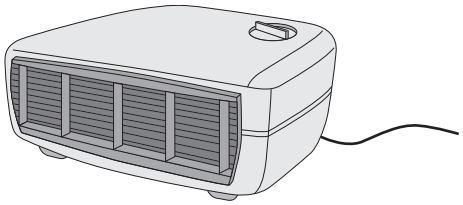
4.1.2.2 Efficiency

Question 56

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.

4.1.2.2 Efficiency

Question 56 · continued

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

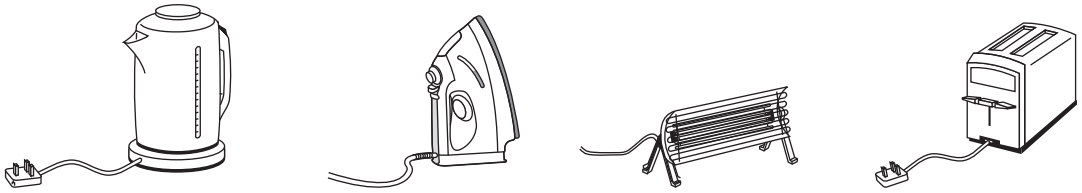
4.1.2.2 Efficiency

Question 57

June 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

The diagrams show four electrical heating devices.



2 kW
Kettle

500 W
Iron

1 kW
Fire

0.5 kW
Toaster

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

1 the kettle and the iron

2 the iron and the toaster

3 the toaster and the fire

4 the fire and the kettle

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

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

How much energy does the kettle transfer?

1 1 kWh

2 4 kWh

3 1000 kWh

4 4000 kWh

4.1.2.2 Efficiency

Question 57 · continued

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

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

Electricity costs 14 p per kWh

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

1 7 p

2 14 p

3 28 p

4 56 p

7D The kettle casing is made of plastic.

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

1 plastic is an electrical insulator.

2 plastic is a thermal insulator.

3 plastic has a higher density than metal.

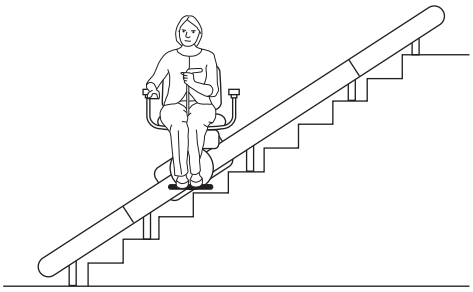
4 plastic is cheaper than metal.

4.1.2.2 Efficiency

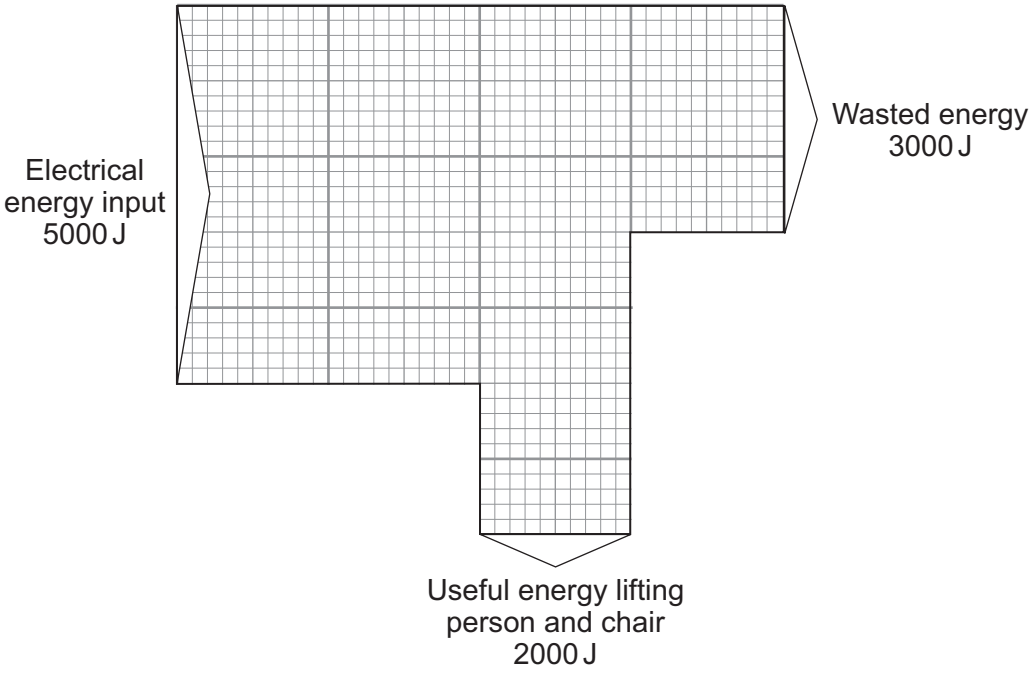
Question 58

June 2011 | PHY1F | Original Q6 | Legacy

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



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



6 (a) Complete the following sentence.

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

(1 mark)

4.1.2.2 Efficiency

Question 58 · continued

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

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

3

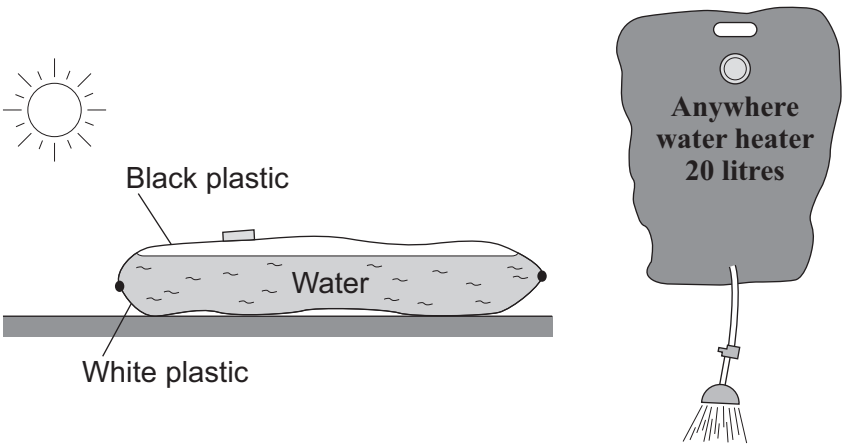
Turn over for the next question

4.1.2.2 Efficiency

Question 59

June 2011 | PHY1F | Original Q7 | Legacy

7 The diagram shows a simple type of portable shower. The water container is a strong plastic bag that is black on one side and white on the other. To warm the water, the bag is placed on the ground in direct sunlight, with the black side facing the Sun.



7 (a) (i) Name the process by which heat is transferred from the Sun to the outside of the bag.

.....

(1 mark)

7 (a) (ii) Explain why the black side of the bag and not the white side should face the Sun.

.....

.....

.....

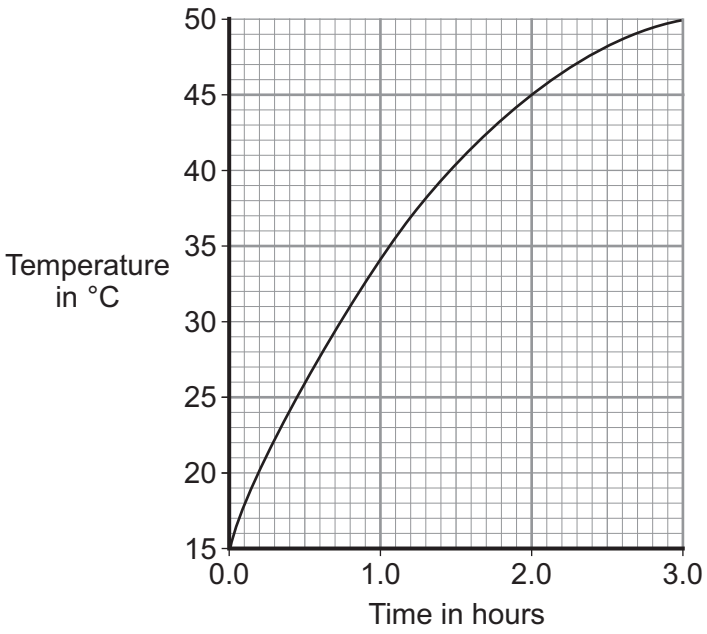
.....

(2 marks)

4.1.2.2 Efficiency

Question 59 · continued

7 (b) The graph shows how the temperature of the water inside a full bag increases after the bag is placed outside on a sunny day.



7 (b) (i) How long does it take for the water to reach 37 °C?

.....

(1 mark)

7 (b) (ii) Describe how the temperature of the water changes during the three hours.

.....

.....

(1 mark)

7 (c) A different manufacturer makes the same type of portable shower but uses a bag with a larger surface area. The bag is made from the same coloured plastics and holds the same amount of water.

7 (c) (i) To compare the efficiency of the two bags at heating water, several variables need to be controlled.

Name **two** variables that need to be controlled.

1 .....

2 .....

(2 marks)

7 (c) (ii) The second bag has a larger surface area.
Draw a line on the graph to show how the temperature of the water inside the second bag would change over the first hour.
Assume that the two bags are tested in exactly the same way.

(1 mark)

8

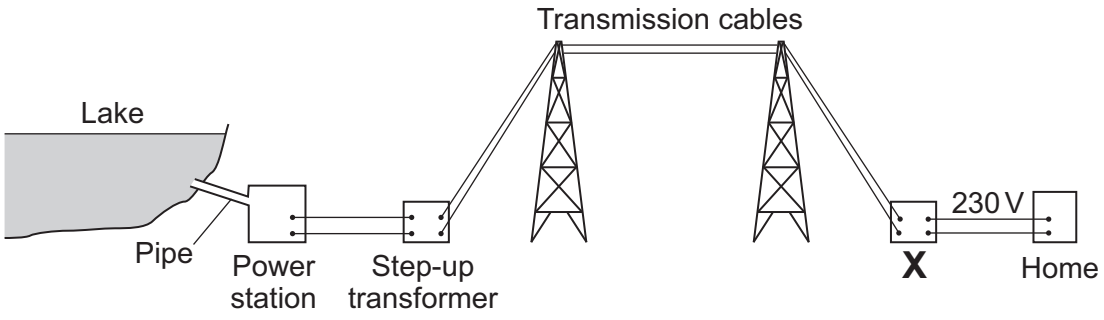
4.1.2.2 Efficiency

Question 60

November 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

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



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

1 current.

2 energy.

3 power.

4 voltage.

7B Using a step-up transformer . . .

1 makes the transmission cables warmer.

2 makes the electricity move faster.

3 reduces the energy loss in the transmission cables.

4 reduces the risk of electrocution.

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

Device **X** is a . . .

1 boiler.

2 generator.

3 step-down transformer.

4 thermal circuit breaker.

4.1.2.2 Efficiency

Question 60 · continued

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

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

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

The efficiency of the power station is . . .

1 0.2

2 0.4

3 0.6

4 1.7

Turn over for the next question

4.1.2.2 Efficiency

Question 61

November 2011 | PHY1AP | Original Q8 | Legacy

QUESTION EIGHT

A particular model of car has a choice of four different engines.

The fuel consumption and the carbon dioxide emissions were measured for each engine.

The table gives some data about the four engines, **P**, **Q**, **R** and **S**.

Car engine	Engine size in litres	Power in kilowatts (kW)	Fuel consumption in litres per 100 kilometres	Carbon dioxide (CO_2) emission in grams per kilometre
P	1.2	45	5.8	138
Q	1.2	52	5.8	138
R	1.4	60	6.3	150
S	1.6	78	6.9	164

8A Based on this data, which engine is the **least** fuel-efficient?

1 **P**

2 **Q**

3 **R**

4 **S**

8B To make a fair comparison of fuel consumption, the four engines should have been tested . . .

1 with different fuels.

2 at the same speed.

3 over different distances.

4 on the same day of the week.

4.1.2.2 Efficiency

Question 61 · continued

8C The tests were carried out under strict conditions. The conditions were set by an independent team of engineers.

This made sure that the results were . . .

1 biased in favour of the government.

2 biased in favour of the manufacturer.

3 biased in favour of the motorist.

4 unbiased.

8D In Britain, people who buy cars with low carbon dioxide emissions pay less road tax to the government.

This is because the government is concerned about . . .

1 economic issues.

2 environmental issues.

3 ethical issues.

4 social issues.

4.1.2.2 Efficiency

Question 62

June 2012 | PH1FP | Original Q7 | Legacy

7 A wood burning stove is used to heat a room.



The fire in the stove uses wood as a fuel. The fire heats the matt black metal case of the stove.

7 (a) The air next to the stove is warmed by infrared radiation.

How does the design of the stove help to improve the rate of energy transfer by infrared radiation?

.....

.....

.....

.....

(2 marks)

4.1.2.2 Efficiency

Question 62 · continued

June 2012 | PH1FP | Original Q7 | Legacy

7 (b) Burning 1 kg of wood transfers 15 MJ of energy to the stove. The stove then transfers 13.5 MJ of energy to the room.

Calculate the efficiency of the stove.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

Efficiency = ...

(2 marks)

7 (c) Some of the energy from the burning wood is wasted as the hot gases leave the chimney and warm the air outside the house.

Name **one** other way energy is wasted by the stove.

.....

(1 mark)

7 (d) Some people heat their homes using electric heaters. Other people heat their homes using a wood burning stove.

Give **two** environmental advantages of using a wood burning stove to heat a home rather than heaters that use electricity generated from fossil fuels.

1 .....

.....

2 .....

.....

(2 marks)

Question 7 continues on the next page

4.1.2.2 Efficiency

Question 62 · continued

7 (e) The metal case of the stove gets hot when the fire is lit.

Here is some information about the stove.

Mass of metal case	100 kg
Starting temperature of metal case	20 °C
Final temperature of metal case	70 °C
Specific heat capacity of metal case	510 J/kg °C

Calculate the energy required to raise the temperature of the metal case to 70 °C.

Use the correct equation from the Physics Equations Sheet.

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

.....

.....

.....

.....

Energy required = ...

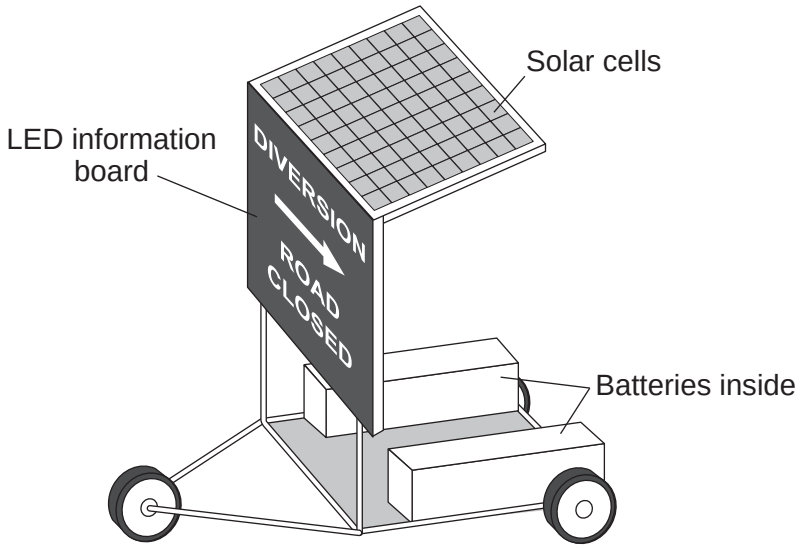
(3 marks)

10

4.1.2.2 Efficiency

Question 63

2 The picture shows a temporary road traffic information board.



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

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

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

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

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

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

(3 marks)

4.1.2.2 Efficiency

Question 63 · continued

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

Calculate the efficiency of the solar cells.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Efficiency = ...

(2 marks)

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

Tick (✓) **one** box.

Solar cells will charge the batteries day and night. ☐

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

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

(1 mark)

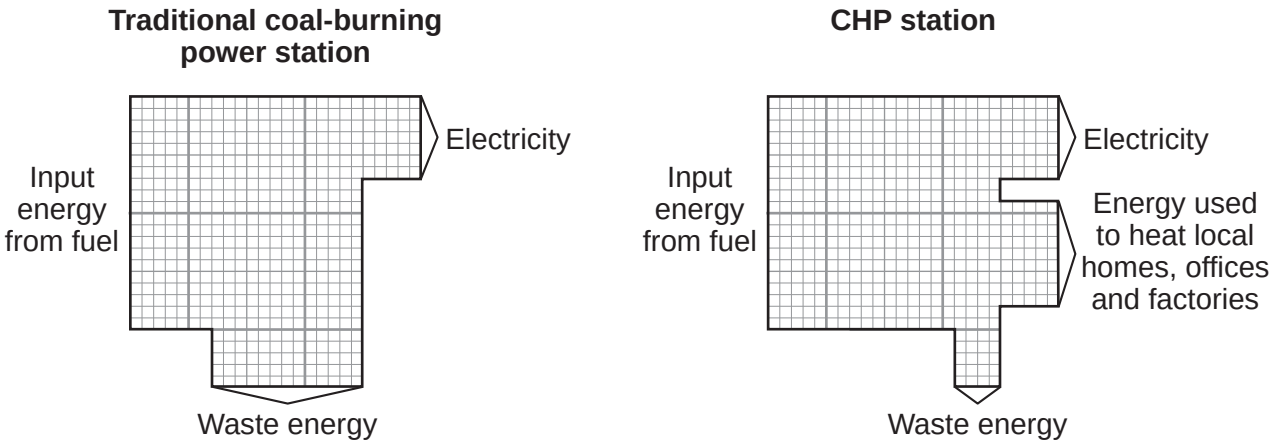
6

4.1.2.2 Efficiency

Question 64

June 2013 | PH1FP | Original Q7 | Legacy

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



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

.....

.....

(1 mark)

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

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Efficiency = ...

(2 marks)

4.1.2.2 Efficiency

Question 64 · continued

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

.....

.....

.....

.....

(2 marks)

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

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

Tick (✓) **one** box.

A system of cables and pylons. ☐

A system of cables and transformers. ☐

A system of cables, transformers and power stations. ☐

(1 mark)

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

Give **one** reason why.

.....

.....

(1 mark)

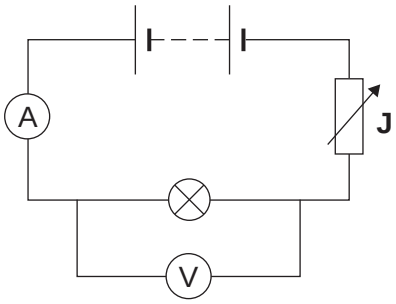
7

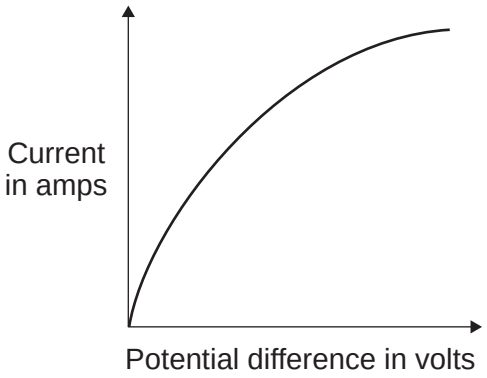
4.1.2.2 Efficiency

Question 65

June 2013 | PH2FP | Original Q8 | Legacy

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





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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Power = ...

(3 marks)

4.1.2.2 Efficiency

Question 65 · continued

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

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

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

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

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

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6 marks)

11

4.1.2.2 Efficiency

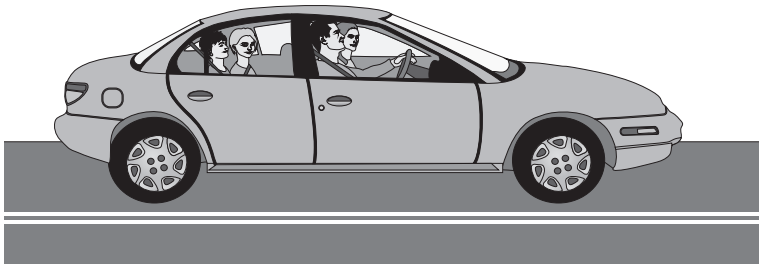
Question 66

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]

.....

.....

4.1.2.2 Efficiency

Question 66 · 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

4.1.2.2 Efficiency

Question 67

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]

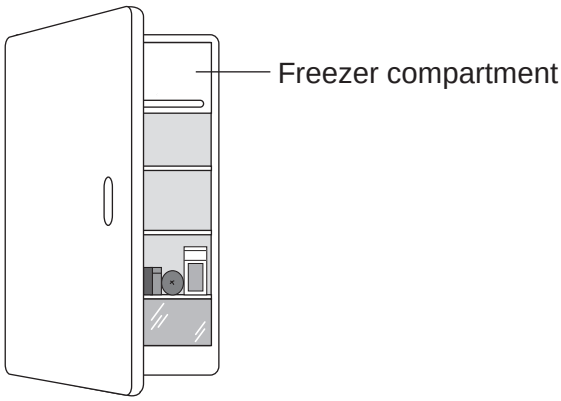
gas	liquid	solid

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 ..... .

4.1.2.2 Efficiency

Question 67 · 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

4.1.2.2 Efficiency

Question 68

June 2015 | PH1FP | Original Q2 | Legacy

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

Figure 3



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

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

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

[3 marks]

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

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

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

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

Question 2 continues on the next page

4.1.2.2 Efficiency

Question 68 · continued

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

Calculate the efficiency of the leaf blower.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

.....

Efficiency = ...

5

4.1.2.2 Efficiency

Question 69

June 2015 | PH1FP | Original Q7 | Legacy

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

A householder wants to reduce her energy bills. She collected information about a number of ways of reducing energy used. The information is shown in **Table 1**.

Table 1

Ways of reducing energy used	Cost to buy and install in £	Money saved per year in £
Install an energy-efficient boiler	2 000	320
Insulate the loft	400	200
Install double-glazed windows	12 000	120
Install cavity wall insulation	415	145

Use the information in **Table 1** to compare the different ways of reducing the energy used. Your answer should include some calculations.

[6 marks]

.....

.....

.....

.....

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.....

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.....

.....

4.1.2.2 Efficiency

Question 69 · continued

Extra space .....

.....

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.....

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.....

.....

7 (b) Increasing the amount of insulation in a house affects the total U-value of the house.

7 (b) (i) What is meant by the term 'U-value'?

[1 mark]

.....

.....

.....

7 (b) (ii) How is the U-value affected by increasing the amount of insulation?

[1 mark]

.....

8

4.1.2.2 Efficiency

Question 70

June 2016 | PH1FP | Original Q1 | Legacy

1 Different energy sources are used to generate electricity.

1 (a) Use words from the box to match the correct energy source to each of the descriptions given in **Table 1**.

[3 marks]

biofuel	coal	geothermal	nuclear	waves

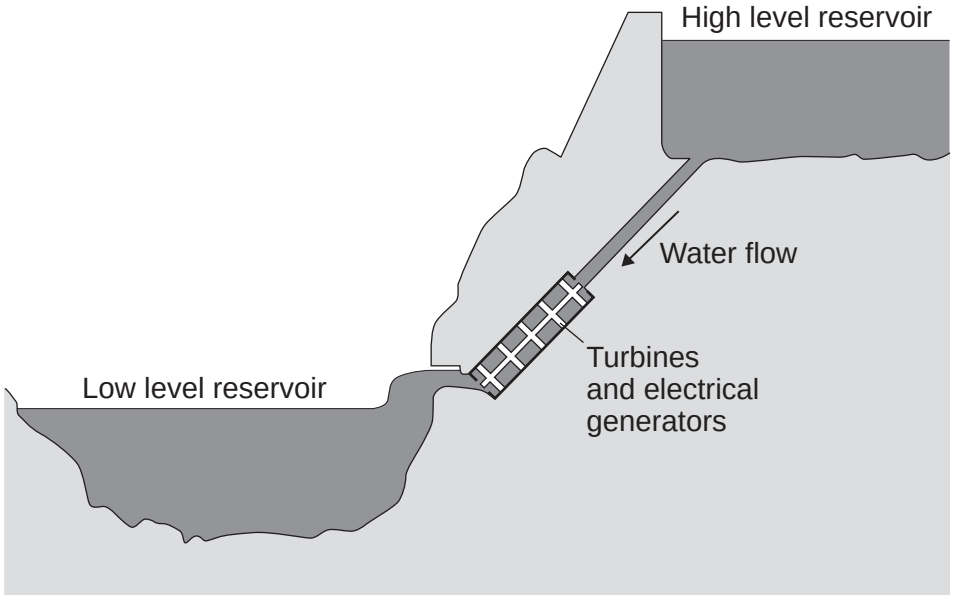
Table 1

Description	Energy source
Energy from the Earth's core is used to heat water.	
Fission of uranium nuclei is used to heat water.	
Gases from rotting plant material are burned to heat water.	

1 (b) Energy can be stored in a pumped storage power station.

Figure 1 shows a pumped storage power station.

Figure 1



4.1.2.2 Efficiency

Question 70 · continued

When electricity is needed, the water in the high level reservoir is allowed to flow to the low level reservoir. The flowing water generates electricity.

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

[3 marks]

electrical	**gravitational potential**	**kinetic**	**nuclear**	**sound**

The water in the high level reservoir stores _____ energy.

The flowing water has _____ energy.

The water turns the turbine which is connected to the generator.

The generator produces some _____, this is wasted energy.

1 (c) The total power input to a pumped storage power station is 600 MW.

The useful power output is 540 MW.

1 (c) (i) Calculate the efficiency of this pumped storage power station.
Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Efficiency = _____

1 (c) (ii) Calculate how much power is wasted by the pumped storage power station.

[1 mark]

_____

Power = _____ MW

1 (c) (iii) How is the temperature of the surroundings affected by the energy wasted by the pumped storage power station?

[1 mark]

_____

10

4.1.2.2 Efficiency

Question 71

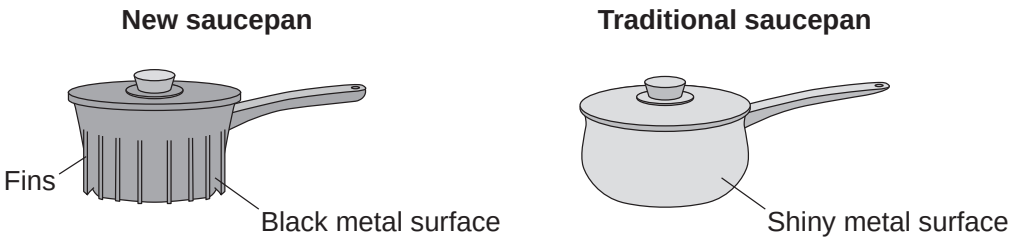
June 2016 | PH1FP | Original Q8 | Legacy

8 (a) Heating food in a saucepan over a gas flame is inefficient.
Suggest why.

[2 marks]

8 (b) A new saucepan has been designed that heats up food much faster than a traditional saucepan. **Figure 13** shows the two saucepans.

Figure 13



Describe how the features of the new saucepan cause the food to heat up faster than when the food is heated in the traditional saucepan.

[2 marks]

Fins

Black metal surface

8 (c) State the relationship between the temperature of the saucepan and the rate at which the saucepan emits infrared radiation.

[1 mark]

5

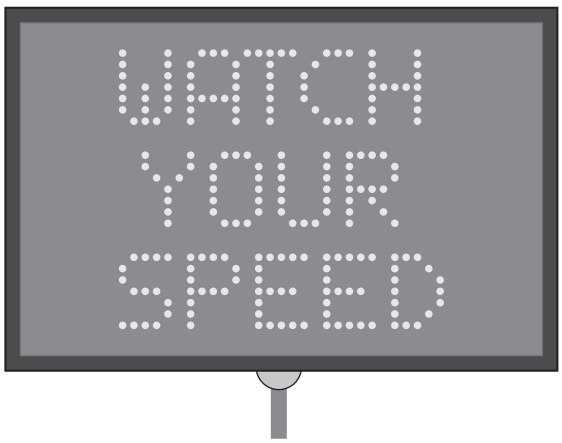
4.1.2.2 Efficiency

Question 72

June 2017 | PH1FP | Original Q2 | Legacy

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

Figure 2

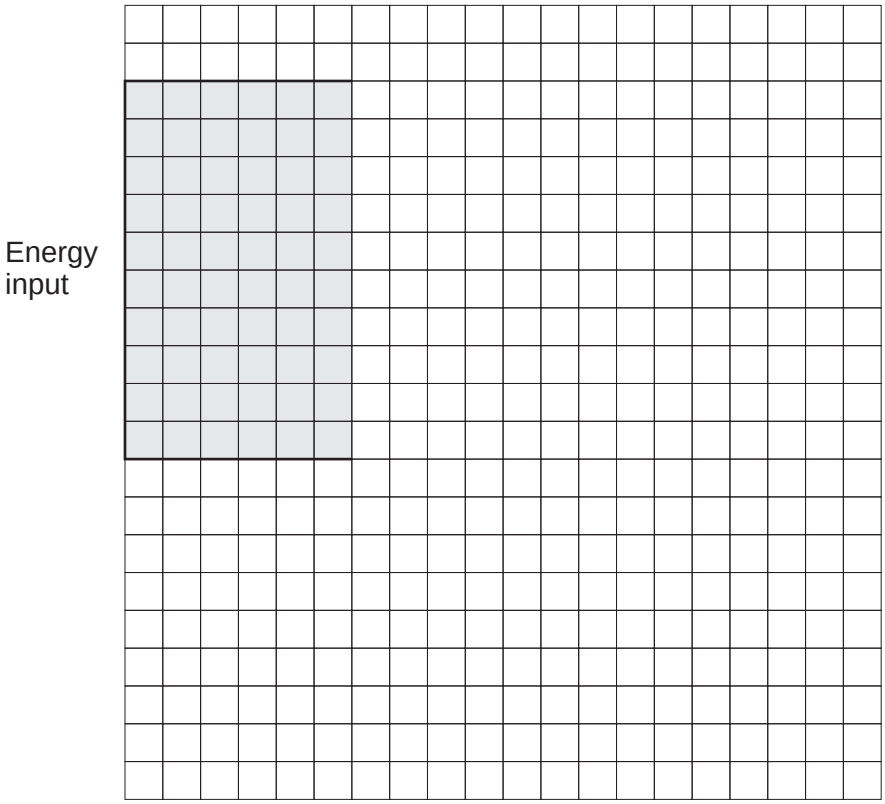


2 (a) The road sign is powered by an electrical generator which has an efficiency of 40%.

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

[2 marks]

Figure 3



4.1.2.2 Efficiency

Question 72 · continued

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

Tick (✓) **one** box.

[1 mark]

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

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

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

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

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ J

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

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

[2 marks]

1 _____

2 _____

7

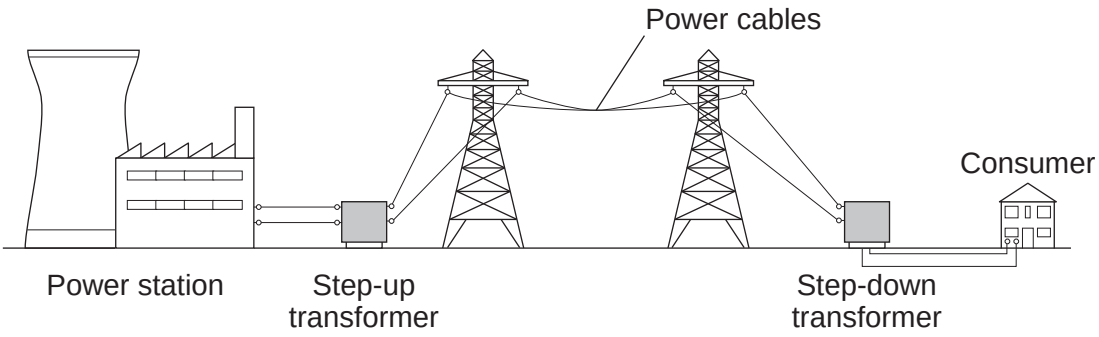
4.1.2.2 Efficiency

Question 73

June 2017 | PH1FP | Original Q4 | Legacy

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

Figure 7



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

[1 mark]

Tick (✓) **one** box.

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

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

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

[1 mark]

4.1.2.2 Efficiency

Question 73 · continued

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

Each word can be used once or not at all.

[3 marks]

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

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

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

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

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

The cost of 1 kWh is 15 pence.

Calculate the cost of the electricity used that month.

[2 marks]

_____

_____

_____

Cost = _____ pence

7

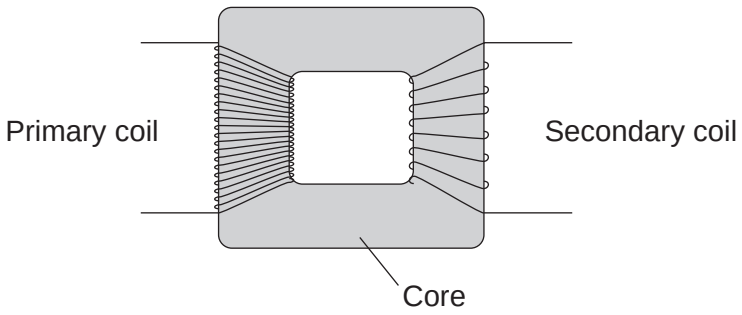
4.1.2.2 Efficiency

Question 74

June 2017 | PH3FP | Original Q2 | Legacy

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

Figure 3



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

[1 mark]

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

The potential difference across the secondary coil is _____

the potential difference across the primary coil.

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

[1 mark]

_____

_____

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

[1 mark]

_____

4.1.2.2 Efficiency

Question 74 · continued

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

[1 mark]

Tick (✓) **one** box.

The mass of the core increases. ☐

A potential difference is induced across the secondary coil. ☐

The temperature of the core decreases. ☐

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

What is the frequency of the mains electricity supply?

[1 mark]

Tick (✓) **one** box.

25 hertz ☐

50 hertz ☐

100 hertz ☐

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

State the power output of the transformer.

[1 mark]

_____

6

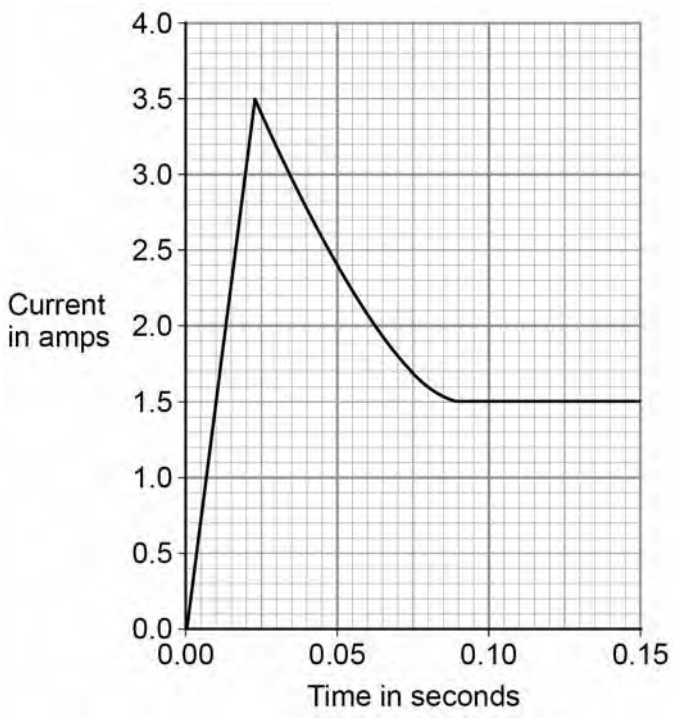
4.1.2.2 Efficiency

Question 75

June 2018 | 8463/1F | Original Q2

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

Figure 2



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

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

Tick **one** box.

[1 mark]

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

4.1.2.2 Efficiency

Question 75 · continued

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

[1 mark]

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

Calculate the power of the lamp.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

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

What does this statement mean?

Tick **one** box.

[1 mark]

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

5

4.1.2.2 Efficiency

Question 76

June 2019 | 8463/1F | Original Q9

0 9 Light bulbs are labelled with a power input.

0 9 . 1 What does power input mean?

[1 mark]

Tick (✓) **one** box.

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

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

[1 mark]

_____

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

The mains potential difference is 230 V

Calculate the current in the light bulb.

[3 marks]

_____

_____

_____

Current = _____ A

4.1.2.2 Efficiency

Question 76 · continued

Table 3 shows information about three different light bulbs.

Table 3

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

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

[1 mark]

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

[3 marks]

X = _____ W

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

Suggest why.

[2 marks]

1

4.1.2.2 Efficiency

Question 77

November 2020 | 8463/1F | Original Q9

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

Figure 13

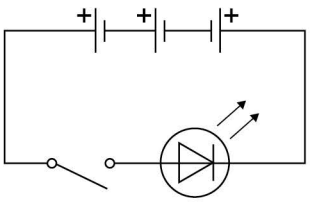


0 9 . 1 The torch contains one LED, one switch and three cells.

Which diagram shows the correct circuit for the torch?

[1 mark]

Tick (✓) **one** box.



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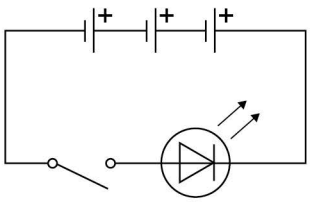
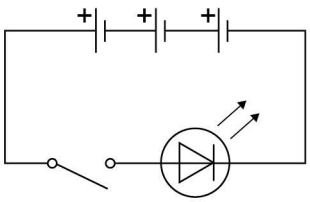


☐



☐

4.1.2.2 Efficiency

Question 77 · continued

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

[1 mark]

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

The current in the LED was 50 mA.

Calculate the total charge flow through the cells.

[3 marks]

Total charge flow = _____ C

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

Explain why the torch did not work.

[2 marks]

Question 9 continues on the next page

4.1.2.2 Efficiency

Question 77 · continued

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

[1 mark]

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

The efficiency of the LED was 0.75

Calculate the useful power output of the LED.

[3 marks]

Useful power output = _____ W

11

4.1.2.2 Efficiency

Question 78

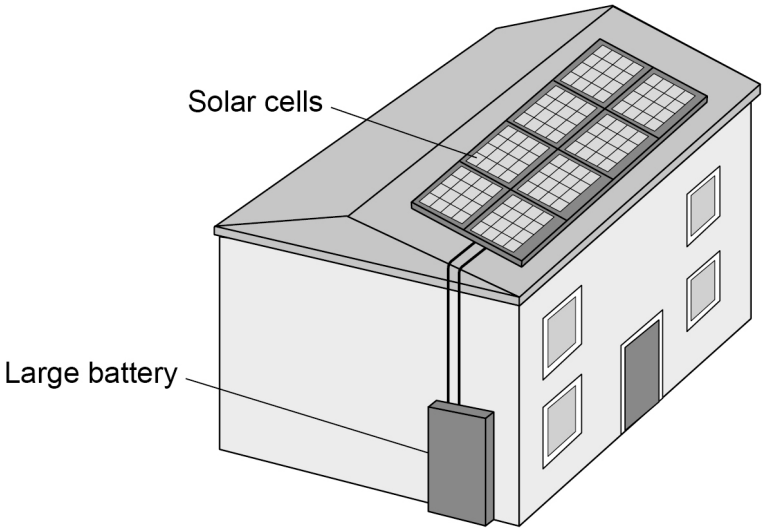
November 2021 | 8463/1F | Original Q6

0 6 **Figure 10** shows a house with a solar power system.

The solar cells generate electricity.

When the electricity generated by the solar cells is not needed, the energy is stored in a large battery.

Figure 10



0 6 . 1 The solar cells on the roof of the house always face in the same direction.

Explain **one** disadvantage caused by the solar cells only facing in one direction.

[2 marks]

4.1.2.2 Efficiency

Question 78 · continued

0 6 . 2 The mean current from the solar cells to the battery is 3.5 A.

Calculate the charge flow from the solar cells to the battery in 3600 seconds.

Use the equation:

charge flow = current × time

[2 marks]

Charge flow = _____ C

0 6 . 3 Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

0 6 . 4 At one time in the day, the total power input to the solar cells was 7500 W.

The efficiency of the solar cells was 0.16

Calculate the useful power output of the solar cells.

[3 marks]

Useful power output = _____ W

Question 6 continues on the next page

4.1.2.2 Efficiency

Question 78 · continued

0 6 . 5 The wasted energy that is **not** usefully transferred by the solar cells is dissipated.

What happens to energy that has been dissipated?

[1 mark]

Tick (✓) **one** box.

The energy becomes less useful. ☐

The energy is destroyed. ☐

The energy is used to generate electricity. ☐

0 6 . 6 Why is it unlikely that all the UK's electricity needs could be met by solar power systems?

[1 mark]

Tick (✓) **one** box.

A very large area would need to be covered with solar cells. ☐

Solar power is a non-renewable energy resource. ☐

The efficiency of solar cells is too high. ☐

10

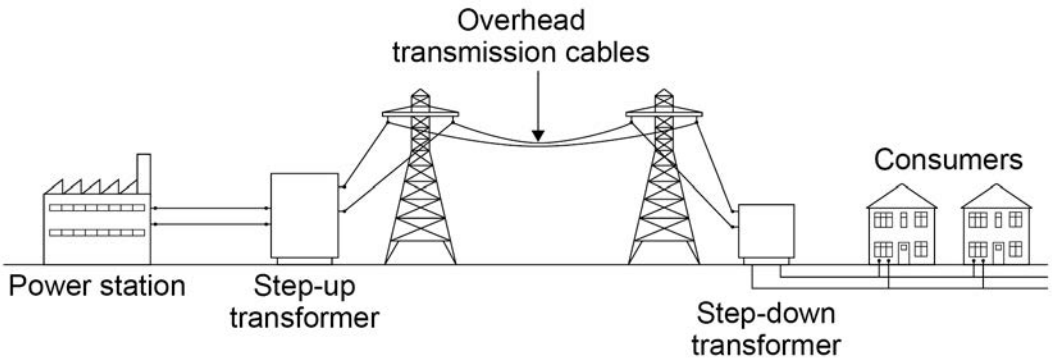
4.1.2.2 Efficiency

Question 79

June 2022 | 8463/1F | Original Q7

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

Figure 8



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

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

[2 marks]

Tick (✓) **one** box in **each** row.

Table 2

Energy resource	Renewable	Non-renewable
biofuel		
coal		
nuclear		
tides		

Question 7 continues on the next page

4.1.2.2 Efficiency

Question 79 · continued

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

Complete the sentences.

Choose answers from the box.

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

[4 marks]

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

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

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

The step-down transformer decreases the _____ .

4.1.2.2 Efficiency

Question 79 · continued

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

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

[1 mark]

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

The battery supplies a current of 130 000 A.

Calculate the charge flow from the battery in 5 minutes.

Choose the unit from the box.

[4 marks]

coulombs	newtons	watts

Charge flow = _____ Unit _____

11

4.1.2.2 Efficiency

Question 80

June 2022 | 8463/1F | Original Q9

0 9 **Figure 13** shows a large wind farm off the coast of the UK.

Figure 13



The mean power output of the wind farm is 696 MW, which is enough power for 580 000 homes.

0 9 . 1 Calculate the mean power needed for 1 home.

Give your answer in watts.

[2 marks]

Mean power needed for 1 home = _____ W

4.1.2.2 Efficiency

Question 80 · continued

0 9 . 2 On one day the demand for electricity in the UK was 34 000 MW.

Suggest **two** reasons why wind power was not able to meet this demand.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

0 9 . 3 Some of the energy from the wind used to rotate a wind turbine is wasted.

An engineer oils the mechanical parts of a wind turbine.

Explain how oiling would affect the efficiency of the wind turbine.

[3 marks]

_____

_____

_____

_____

_____

0 9 . 4 In most homes in the UK there are many different electrical devices.

Explain why people should be encouraged to use energy efficient electrical devices.

[2 marks]

_____

_____

_____

_____

_____

9

4.1.2.2 Efficiency

Question 81

June 2022 | 8463/1F | Original Q11

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

Figure 15 shows someone walking on the pavement tiles.

Figure 15



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

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

[1 mark]

Tick (✓) **one** box.

$P = \frac{V}{I}$ ☐

$P = V \times I$ ☐

$I = P \times V$ ☐

$V = I^2 \times P$ ☐

4.1.2.2 Efficiency

Question 81 · continued

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

4.1.2.2 Efficiency

Question 81 · continued

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

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

[1 mark]

Tick (✓) **one** box.

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

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

Efficiency = useful power output × total power input ☐

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

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

The efficiency of the LED light is 0.85

Calculate the useful power output of the LED light.

[3 marks]

Useful power output = _____ W

8

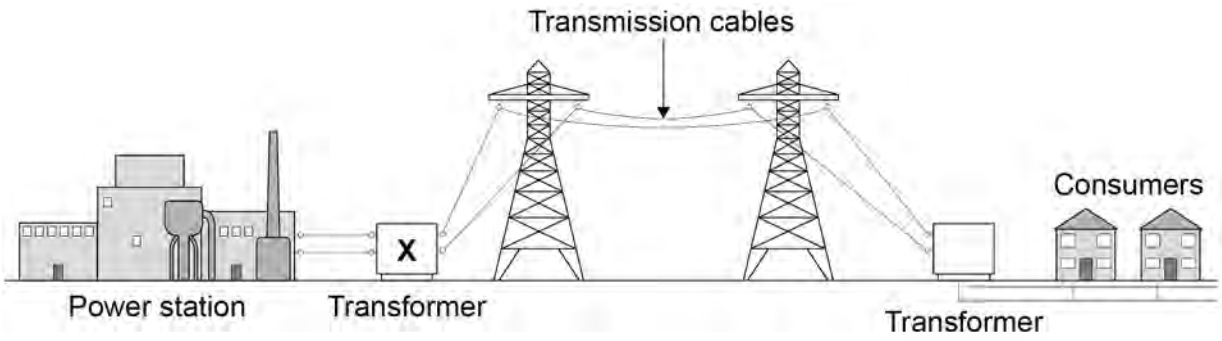
4.1.2.2 Efficiency

Question 82

June 2023 | 8463/1F | Original Q8

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

Figure 11



0 8 . 1 Complete the sentences.

[2 marks]

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

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

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

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

[1 mark]

Tick (✓) **one** box.

$P = \frac{I}{R}$ ☐

$P = \frac{I}{R^2}$ ☐

$P = I^2 R$ ☐

$P = IR$ ☐

4.1.2.2 Efficiency

Question 82 · continued

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

The current in the cable is 2000 A.

Calculate the resistance of the cable.

[3 marks]

Resistance = _____ Ω

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

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

[1 mark]

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

The National Grid has an efficiency of 0.992

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

[3 marks]

Useful energy output = _____ GJ

10

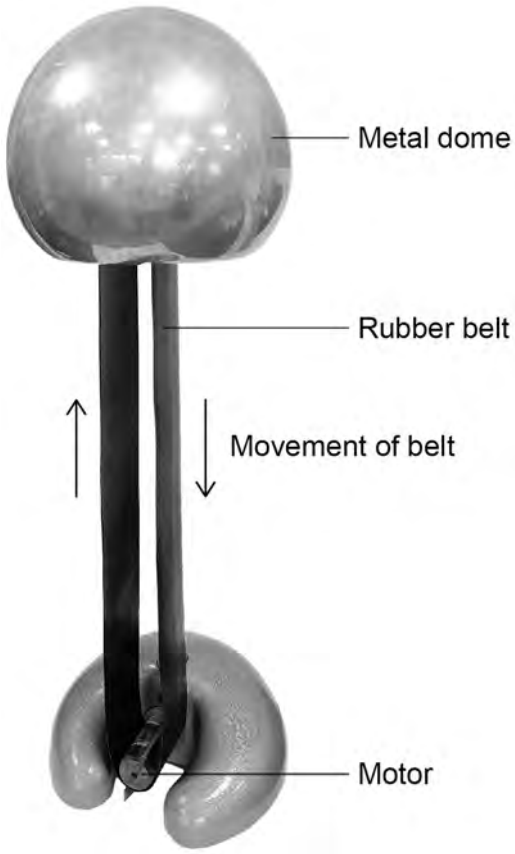
4.1.2.2 Efficiency

Question 83

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.

4.1.2.2 Efficiency

Question 83 · 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

4.1.2.2 Efficiency

Question 83 · continued

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

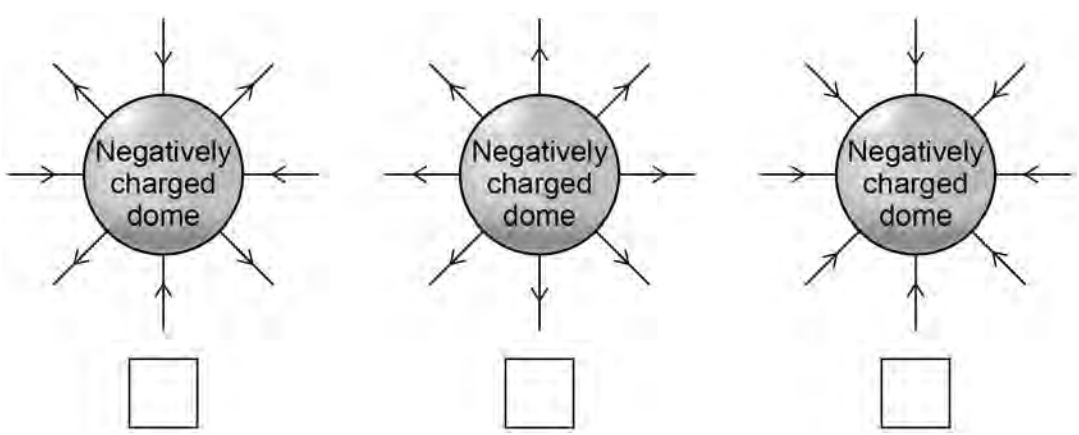
attraction	**gravity**	**repulsion**

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.

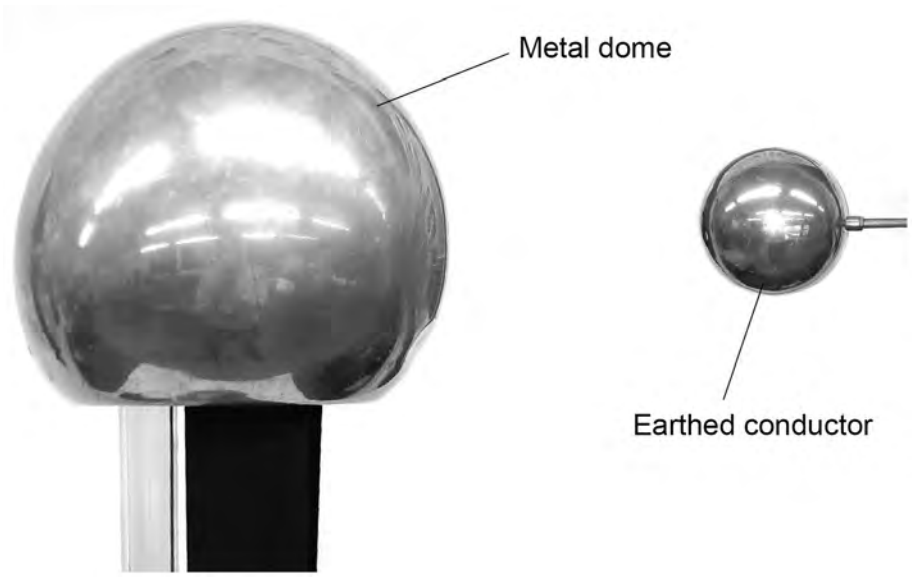


4.1.2.2 Efficiency

Question 83 · 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 83 · 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 ☐

4.1.2.2 Efficiency

Question 83 · 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

4.1.2.2 Efficiency

Question 84

June 2025 | 8463/1F | Original Q5

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

Figure 8



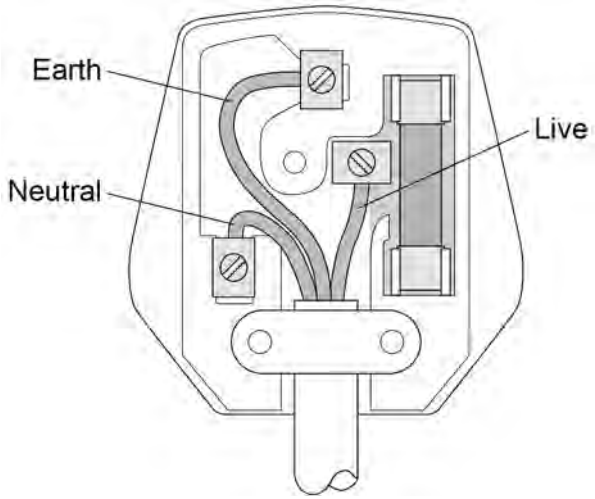
4.1.2.2 Efficiency

Question 84 · continued

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

Figure 9 shows the inside of the plug.

Figure 9



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

[3 marks]

Choose answers from the box.

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

Earth wire _____

Live wire _____

Neutral wire _____

Question 5 continues on the next page

4.1.2.2 Efficiency

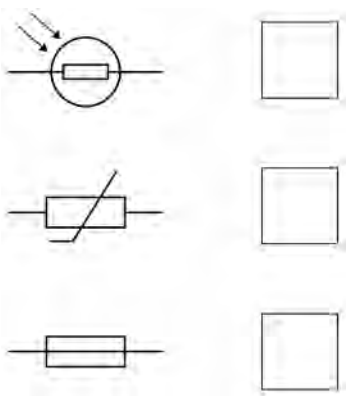
Question 84 · continued

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

What is the circuit symbol for a fuse?

[1 mark]

Tick (✓) **one** box.



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

The power of the heating element is 2420 W.

The current in the heating element is 11.0 A.

Calculate the potential difference across the heating element.

Use the equation:

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

[2 marks]

Potential difference = _____ V

4.1.2.2 Efficiency

Question 84 · continued

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

The current in the heating element is 11.0 A.

Calculate the resistance of the heating element.

Use the equation:

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

[2 marks]

Resistance = _____ Ω

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

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

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

[2 marks]

Tick (✓) **two** boxes.

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

10

4.1.2.2 Efficiency

Question 85

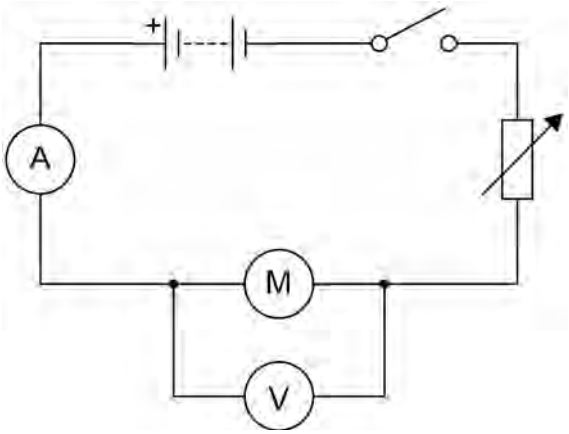
June 2025 | 8463/1F | Original Q7

0 7 A student built a circuit to investigate how the efficiency of a motor varies with the speed of the motor.

The symbol for a motor is 

Figure 12 shows the circuit.

Figure 12



The student used the motor to lift a mass through a height of 1.0 m.

0 7 . 1 The motor took 12 seconds to lift the mass.

The charge flow through the circuit was 6.0 C.

Calculate the current in the circuit.

Use the equation:

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

[2 marks]

Current = _____ A

4.1.2.2 Efficiency

Question 85 · continued

0 7 . 2 The potential difference across the motor was 8.0 V.

The charge flow through the motor was 6.0 C.

Calculate the energy transferred to the motor.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

Question 7 continues on the next page

4.1.2.2 Efficiency

Question 85 · continued

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

0 7 . 3 Which equation links efficiency, total input energy transfer and useful output energy transfer?

[1 mark]

Tick (✓) **one** box.

efficiency = useful output energy transfer × total input energy transfer ☐

efficiency = $\frac{\text{total input energy transfer}}{\text{useful output energy transfer}}$ ☐

efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$ ☐

0 7 . 4 The efficiency of the motor was 0.70

The useful output energy transfer of the motor was 1.96 J.

Calculate the total input energy transfer to the motor.

[3 marks]

Total input energy transfer = _____ J

4.1.2.2 Efficiency

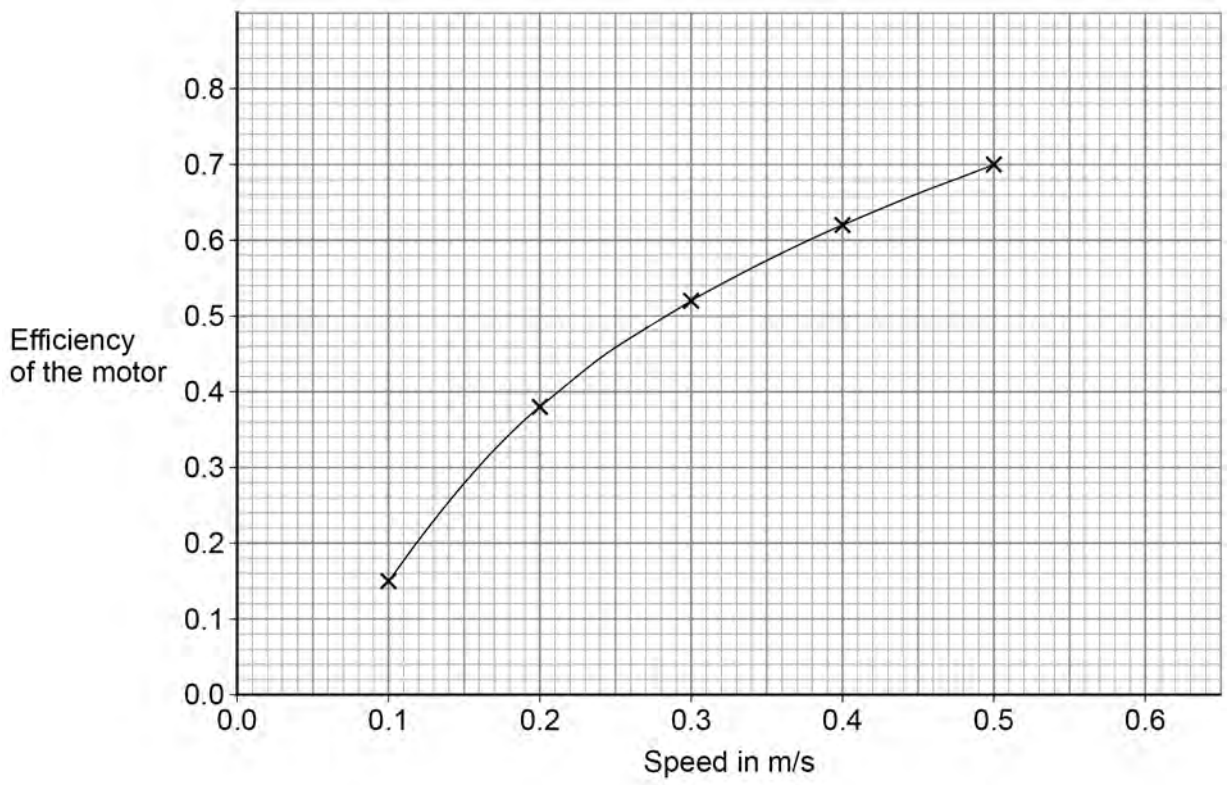
Question 85 · continued

The student adjusted the speed at which the mass was lifted.

For each speed, the student determined the efficiency of the motor.

Figure 13 shows the results.

Figure 13



0 7 . 5 Use **Figure 13** to predict the efficiency of the motor when the speed is 0.6 m/s.

[1 mark]

Efficiency = _____

0 7 . 6 How does **Figure 13** show that the efficiency of the motor is **not** directly proportional to the speed?

[1 mark]

_____

_____

_____

10