AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.1.1

Energy stores and systems

Past-paper questions

Tier	**Foundation**
Question groups	**134**
Available paper years	**2003–2025**

Using this booklet

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

Name: _____ **Date:** _____

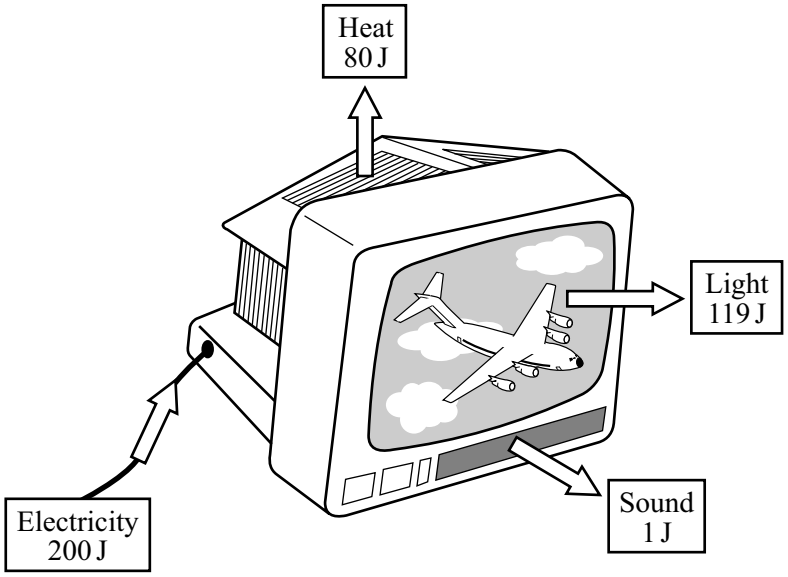
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.1.1.1 Energy stores and systems

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)

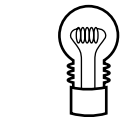
4.1.1.1 Energy stores and systems

Question 01 · continued

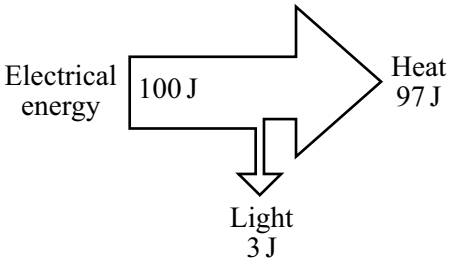
/

MARGIN BLANK

(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.

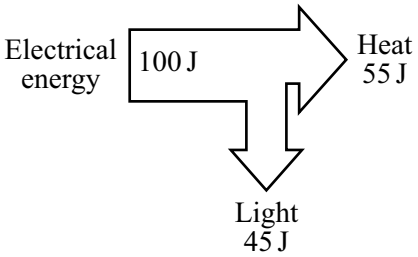


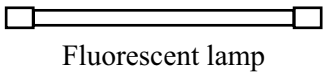
Filament lamp



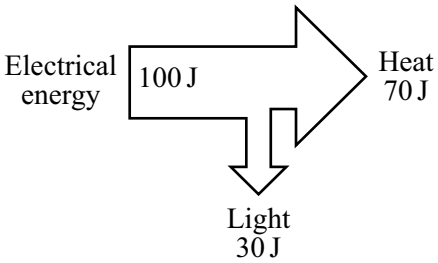


Street lamp





Fluorescent lamp



Which type of lamp is the most efficient?

.....

Give a reason for your choice.

.....

.....

(2 marks)

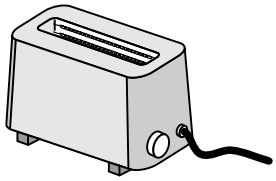
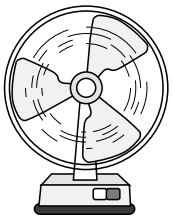
6

4.1.1.1 Energy stores and systems

Question 02

June 2003 | 3451F | Original Q7 | Legacy

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

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

(3 marks)

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

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

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

.....

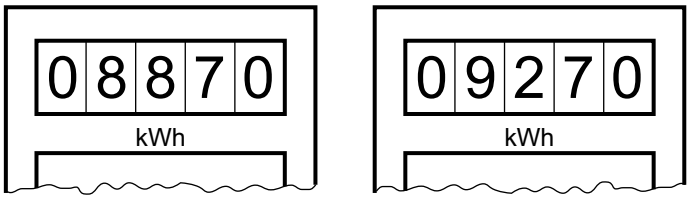
(1 mark)

4.1.1.1 Energy stores and systems

Question 02 · continued

MARGIN BLANK

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



April July

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

.....

.....

Number of Units = ...

(1 mark)

(ii) One Unit costs 6p.

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

total cost = number of Units × cost per Unit

.....

.....

Cost = ...

(2 marks)

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

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

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

.....

.....

Energy transferred = ...kWh

(2 marks)

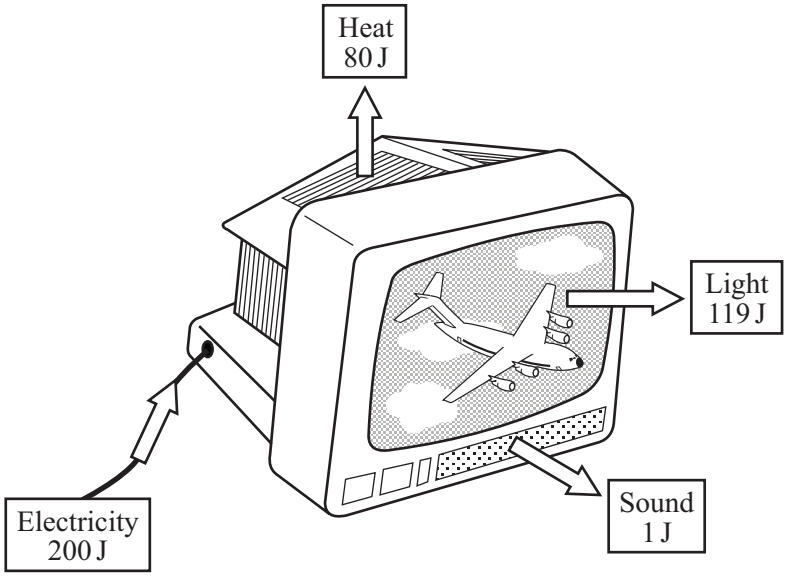
9

4.1.1.1 Energy stores and systems

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)

4.1.1.1 Energy stores and systems

Question 03 · continued

June 2003 | 3462F3 | Original Q4 | Legacy

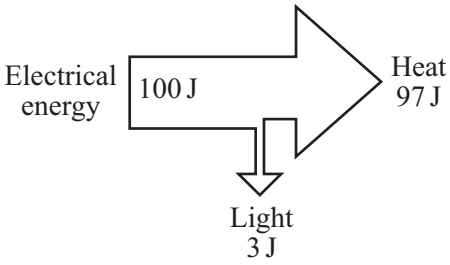
/

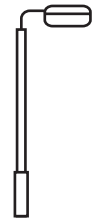
MARGIN BLANK

(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.

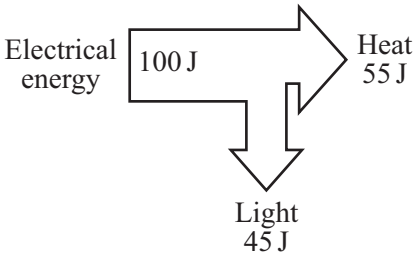


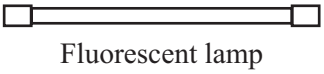
Filament lamp



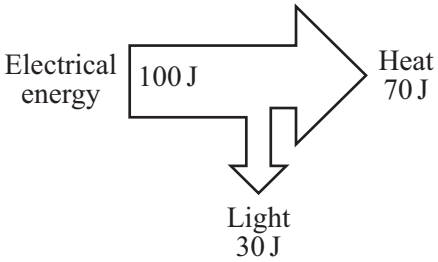


Street lamp





Fluorescent lamp



Which type of lamp is the most efficient?

.....

Give a reason for your choice.

.....

.....

(2 marks)

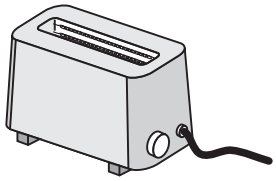
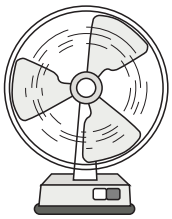
6

4.1.1.1 Energy stores and systems

Question 04

June 2003 | 3462F3 | Original Q7 | Legacy

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

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

(3 marks)

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

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

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

.....

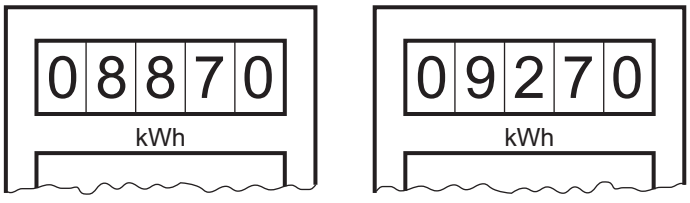
(1 mark)

4.1.1.1 Energy stores and systems

Question 04 · continued

MARGIN BLANK

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



April July

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

.....

.....

Number of Units = ...
(1 mark)

(ii) One Unit costs 6p.

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

total cost = number of Units × cost per Unit

.....

.....

Cost = ...
(2 marks)

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

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

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

.....

.....

Energy transferred = ...kWh
(2 marks)

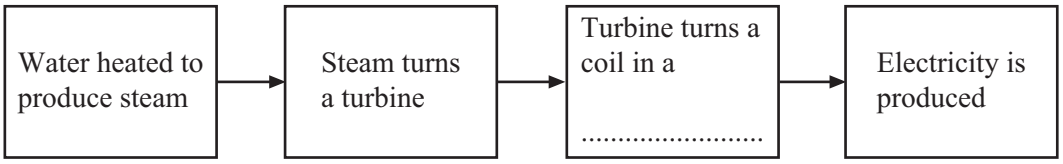
9

4.1.1.1 Energy stores and systems

Question 05

June 2004 | 3451F | Original Q3 | Legacy

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



(1 mark)

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

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

.....

(1 mark)

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

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

.....

.....

efficiency = ...

(2 marks)

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

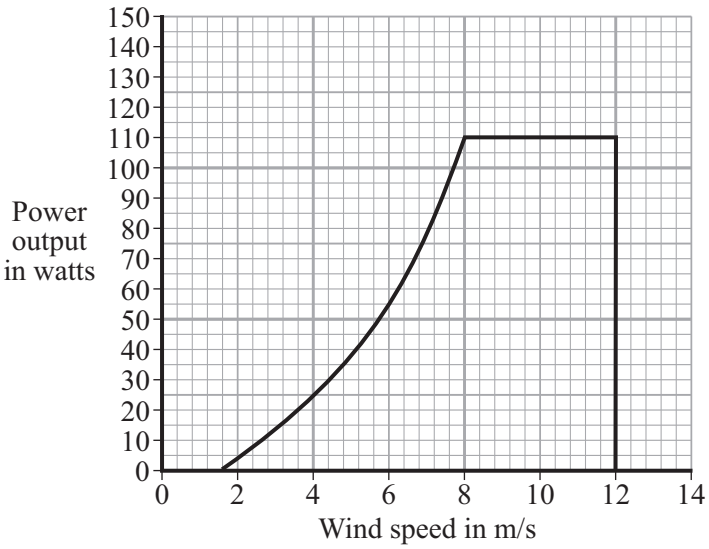
List A **Energy resource**	**List B** **Environmental problem that may be caused**
Wind	Destroys the habitat of wading birds in river estuaries
Tides	Produces a lot of noise
Falling water (hydroelectricity)	Produces the gas sulphur dioxide
	Floods land used for farming or forestry

4.1.1.1 Energy stores and systems

Question 05 · continued

MARGIN BLANK

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



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

..... watts
(1 mark)

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

At what wind speed does the generator stop working?

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

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

.....

.....
(1 mark)

10

4.1.1.1 Energy stores and systems

Question 06

June 2004 | 3451F | Original Q11 | Legacy

11 The diagram represents the electromagnetic spectrum.

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

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

(i) to sterilise surgical instruments;

.....

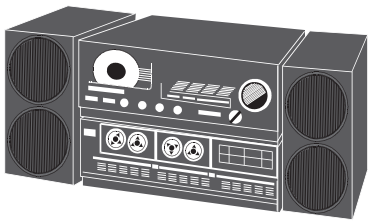
(1 mark)

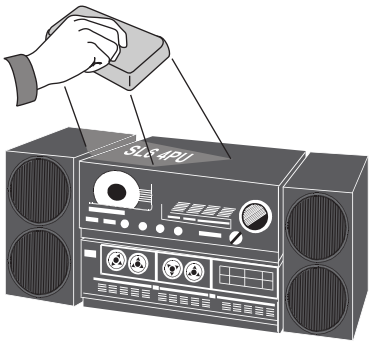
(ii) to send a signal to a TV from a remote control.

.....

(1 mark)

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





Explain what happens to make the ink visible.

.....

.....

.....

.....

(2 marks)

4.1.1.1 Energy stores and systems

Question 06 · continued

MARGIN BLANK

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

.....

.....

.....

.....

(2 marks)

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

Voltage	230 V
Microwave power	0.65 kW
Grill power	1.15 kW

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

..... and .....

(1 mark)

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

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

energy transferred = power × time

.....

.....

.....

energy transferred =.....kWh

(2 marks)

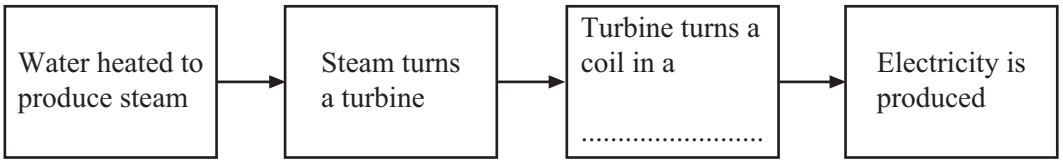
9

4.1.1.1 Energy stores and systems

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.

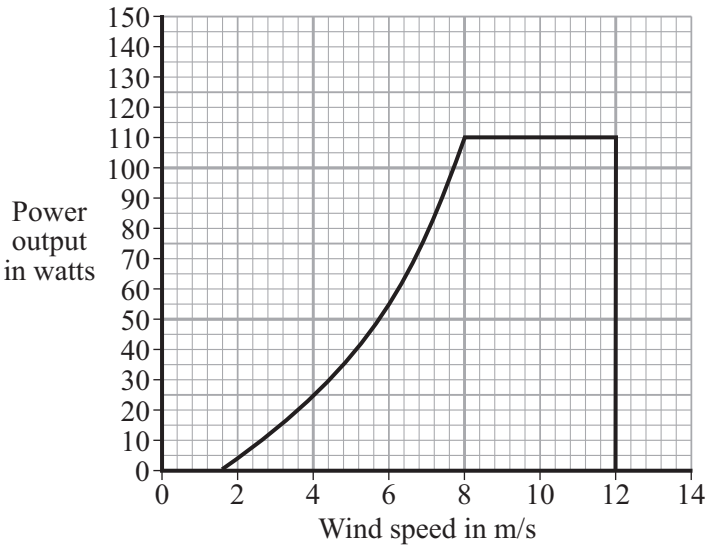
List A **Energy resource**	**List B** **Environmental problem that may be caused**
Wind	Destroys the habitat of wading birds in river estuaries
Tides	Produces a lot of noise
Falling water (hydroelectricity)	Produces the gas sulphur dioxide
	Floods land used for farming or forestry

4.1.1.1 Energy stores and systems

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

4.1.1.1 Energy stores and systems

Question 08

June 2004 | 3462F3 | Original Q9 | Legacy

9 The diagram represents the electromagnetic spectrum.

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

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

(i) to sterilise surgical instruments;

.....

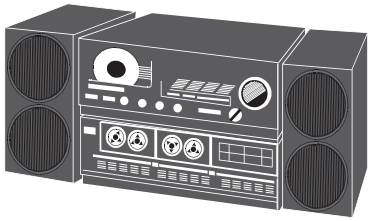
(1 mark)

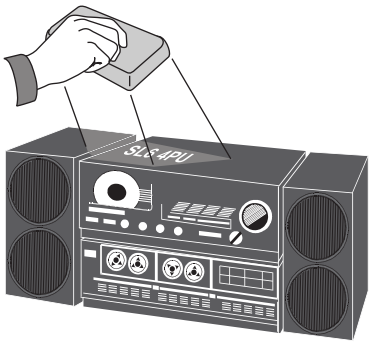
(ii) to send a signal to a TV from a remote control.

.....

(1 mark)

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





Explain what happens to make the ink visible.

.....

.....

.....

.....

(2 marks)

4.1.1.1 Energy stores and systems

Question 08 · continued

MARGIN
BLANK

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

.....

.....

.....

.....

(2 marks)

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

Voltage	230 V
Microwave power	0.65 kW
Grill power	1.15 kW

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

..... and .....

(1 mark)

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

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

energy transferred = power × time

.....

.....

.....

energy transferred =.....kWh

(2 marks)

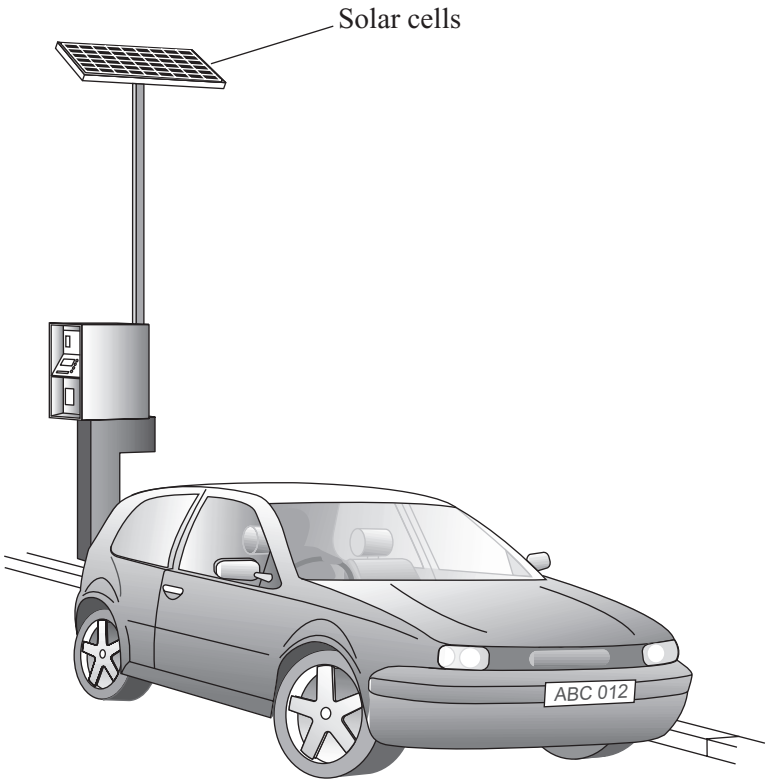
9

4.1.1.1 Energy stores and systems

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)

4.1.1.1 Energy stores and systems

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.

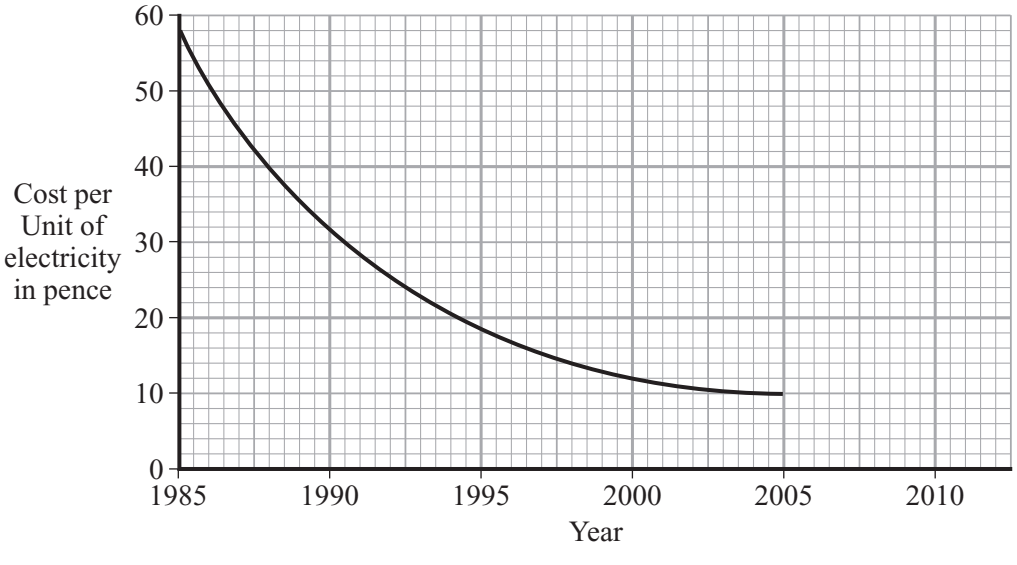
Solar cells give a constant supply of electricity. ☐

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)

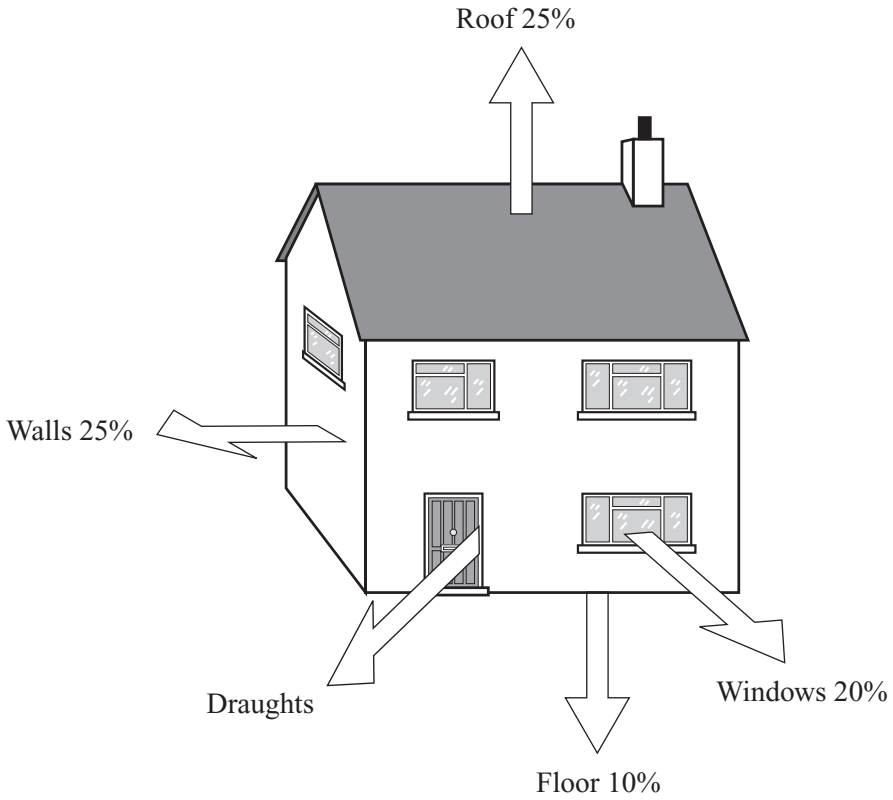
6

4.1.1.1 Energy stores and systems

Question 10

June 2005 | 3451 | Original Q13 | Legacy

13 (a) The diagram shows the ways in which heat energy can be transferred from an old house.



(i) Calculate the percentage of energy transferred by draughts.

.....

% energy transferred by draughts = ...

(1 mark)

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

conduction	**convection**	**radiation**

Draughts transfer heat energy by..... .

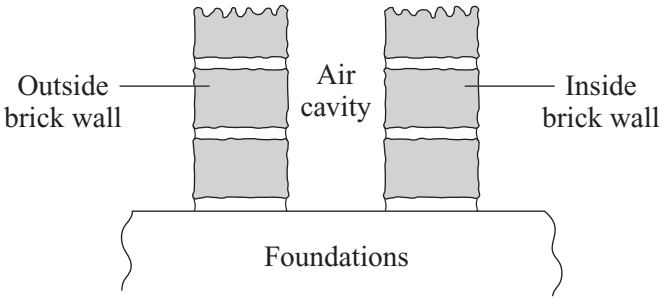
(1 mark)

(iii) State **one** way of reducing the heat transfer by draughts.

.....

(1 mark)

(b) The diagram shows a section through the walls of a house built in 1930.



Explain how the air cavity between the two walls reduces the heat transfer from the house.

.....

.....

.....

.....

(2 marks)

(c) The table shows the installation costs and yearly savings on energy bills for different methods of insulating a house.

Method of insulation	Installation cost in £	Yearly saving on energy bills in £
Double glazing	4000	65
Loft insulation	240	60
Cavity wall insulation	600	80

(i) Give **one** reason why loft insulation is often fitted to an old house before double glazing or cavity wall insulation.

.....

.....

(1 mark)

(ii) The time it takes for the saving on energy bills to equal the cost of installing the insulation is called the pay-back time.

Calculate the pay-back time for loft insulation.

.....

Pay-back time = ... years

(1 mark)

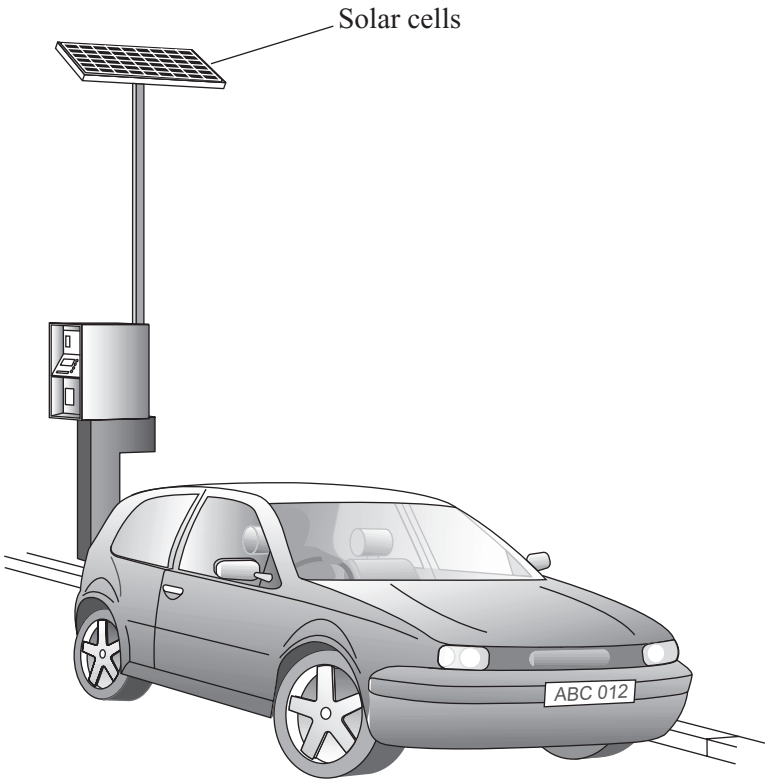
7

4.1.1.1 Energy stores and systems

Question 11

June 2005 | 3462 | Original Q4 | Legacy

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



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

Each word may be used once or not at all.

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

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

(1 mark)

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

(1 mark)

4.1.1.1 Energy stores and systems

Question 11 · continued

/

MARGIN BLANK

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

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

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

.....

.....

Efficiency = ...

(2 marks)

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

Tick (✓) the box next to your choice.

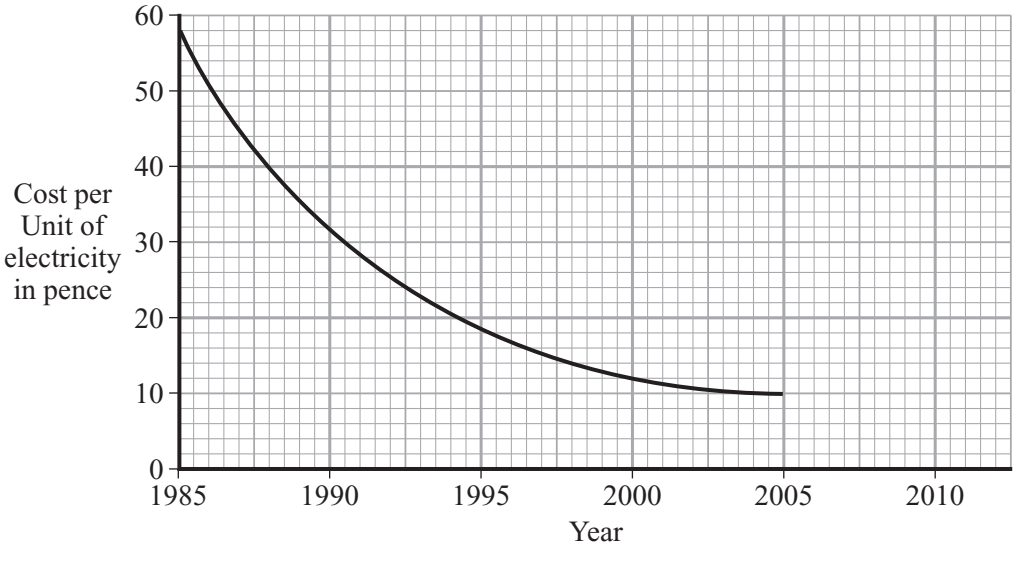
Solar cells give a constant supply of electricity. ☐

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

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

(1 mark)

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



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

.....

(1 mark)

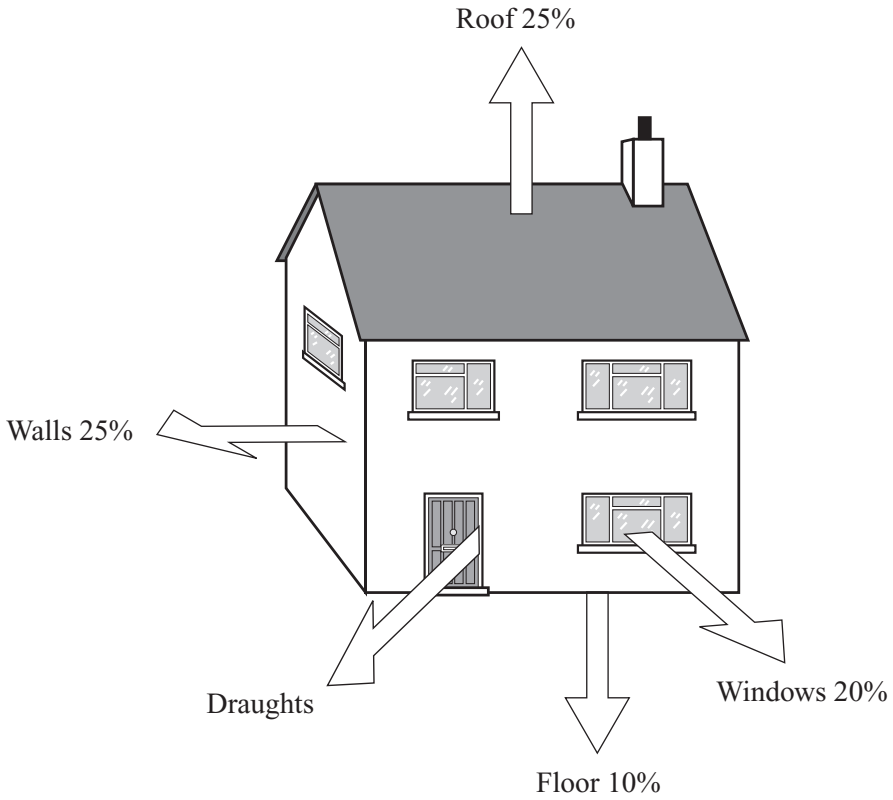
6

4.1.1.1 Energy stores and systems

Question 12

June 2005 | 3462 | Original Q11 | Legacy

11 (a) The diagram shows the ways in which heat energy can be transferred from an old house.



(i) Calculate the percentage of energy transferred by draughts.

.....

% energy transferred by draughts = ...

(1 mark)

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

conduction	**convection**	**radiation**

Draughts transfer heat energy by..... .

(1 mark)

(iii) State **one** way of reducing the heat transfer by draughts.

.....

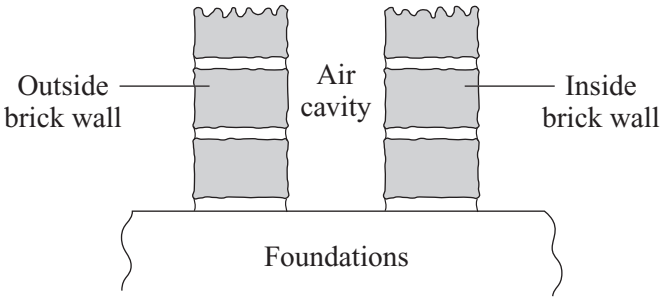
(1 mark)

4.1.1.1 Energy stores and systems

Question 12 · continued

MARGIN BLANK

(b) The diagram shows a section through the walls of a house built in 1930.



Explain how the air cavity between the two walls reduces the heat transfer from the house.

.....

.....

.....

.....

(2 marks)

(c) The table shows the installation costs and yearly savings on energy bills for different methods of insulating a house.

Method of insulation	Installation cost in £	Yearly saving on energy bills in £
Double glazing	4000	65
Loft insulation	240	60
Cavity wall insulation	600	80

(i) Give **one** reason why loft insulation is often fitted to an old house before double glazing or cavity wall insulation.

.....

.....

(1 mark)

(ii) The time it takes for the saving on energy bills to equal the cost of installing the insulation is called the pay-back time.

Calculate the pay-back time for loft insulation.

.....

Pay-back time = ... years

(1 mark)

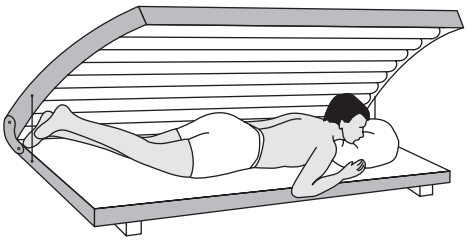
7

4.1.1.1 Energy stores and systems

Question 13

June 2006 | 3451 | Original Q2 | Legacy

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



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

Draw a ring around your answer.

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

(1 mark)

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

.....

.....

(1 mark)

Question 13 · continued

BLANK

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

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

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

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

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

The sunbed transfers 1.8 joules of energy every second. ☐

(1 mark)

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

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

Show clearly how you work out your answer.

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

.....

.....

Energy transferred = ... kWh

(2 marks)

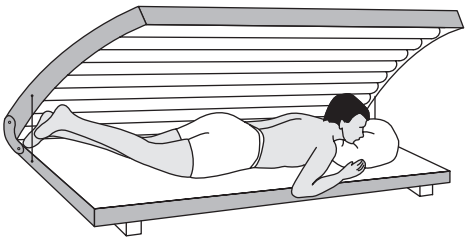
5

4.1.1.1 Energy stores and systems

Question 14

June 2006 | 3462 | Original Q2 | Legacy

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



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

Draw a ring around your answer.

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

(1 mark)

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

.....

.....

(1 mark)

Question 14 · continued

BLANK

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

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

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

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

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

The sunbed transfers 1.8 joules of energy every second. ☐

(1 mark)

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

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

Show clearly how you work out your answer.

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

.....

.....

Energy transferred = ... kWh

(2 marks)

5

4.1.1.1 Energy stores and systems

Question 15

November 2006 | PHY1A | Original Q7 | Legacy

QUESTION SEVEN

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



7A One model has a sticker which reads:

More efficient than any other washing machine at this price

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

1 cost less to run.

2 use less electrical energy.

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

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

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

1 being easier to recycle in the future.

2 having less impact on the environment.

3 using less water.

4.1.1.1 Energy stores and systems

Question 15 · continued

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

2400 watts is equal to . . .

1 0.24 kW

2 2.40 kW

3 24 kW

4 240 kW

7D

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

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

1 2.4

2 40

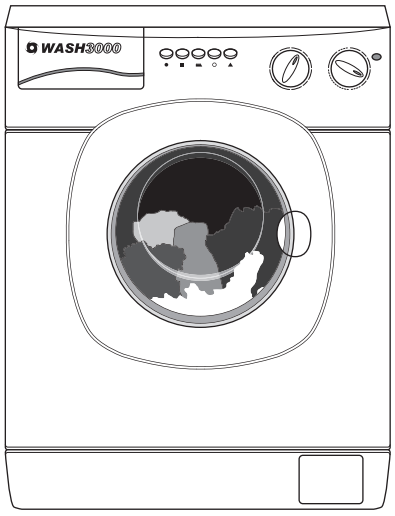
3 144

4 144 000

4.1.1.1 Energy stores and systems

Question 16

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



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

kinetic	**light**	**sound**

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

..... energy.

(1 mark)

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

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

4.1.1.1 Energy stores and systems

Question 16 · continued

BLANK

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

energy transferred = power × time

.....

.....

Energy transferred = ... kWh

(2 marks)

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

.....

.....

(1 mark)

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

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

.....

.....

(1 mark)

5

4.1.1.1 Energy stores and systems

Question 17

March 2007 | PHY1A | Original Q4 | Legacy

QUESTION FOUR

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

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

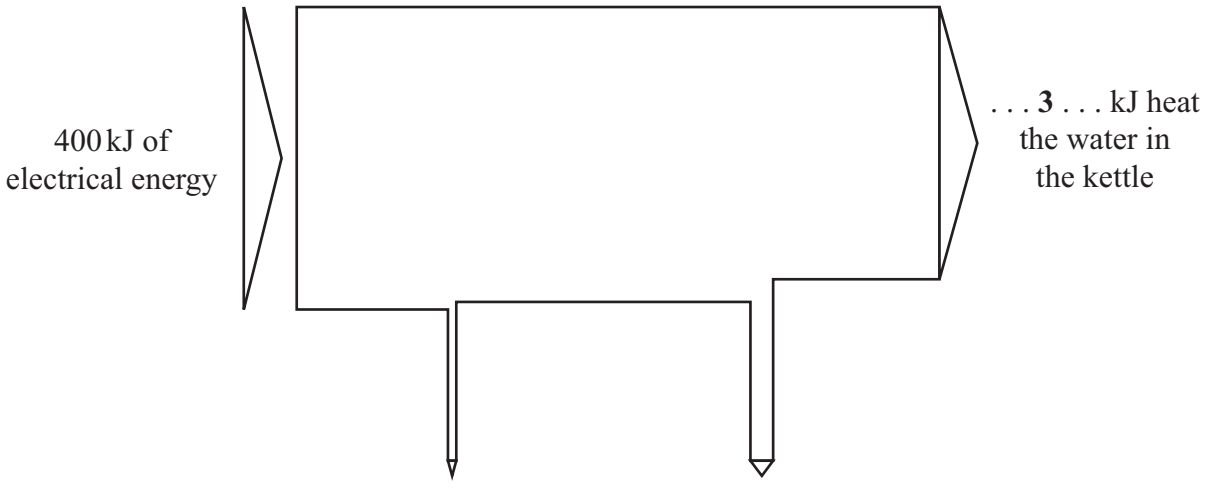
Match numbers, **A**, **B**, **C** and **D**, with the spaces **1–4**.

A 0.9

B 10

C 30

D 360



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

4.1.1.1 Energy stores and systems

Question 18

June 2007 | PHY1A | Original Q4 | Legacy

QUESTION FOUR

The Sankey diagram shows energy transfers in a petrol engine.

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

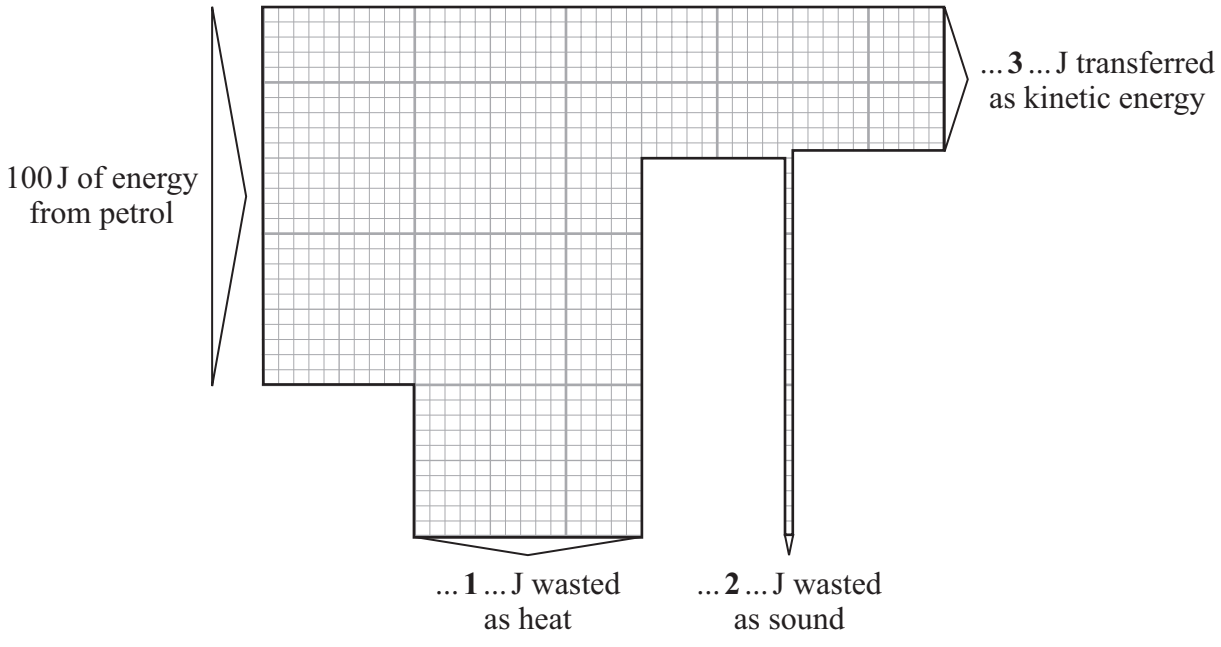
Match numbers, **A**, **B**, **C** and **D**, with the spaces **1–4** on the diagram.

A 0.38

B 2

C 38

D 60



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

4.1.1.1 Energy stores and systems

Question 19

June 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

Convection currents are formed when liquids are heated.

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

A decreases

B increases

C is unchanged

D rises

When liquids are heated, the particles gain kinetic energy.

The space between the particles in the liquid . . . **1** . . . so the density of the liquid . . . **2** . . . .

The warm liquid . . . **3** . . . .

The total mass of the liquid . . . **4** . . . .

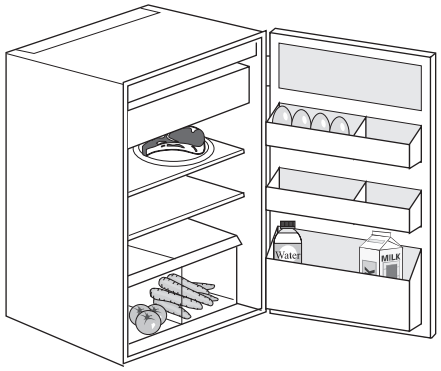
4.1.1.1 Energy stores and systems

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

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.

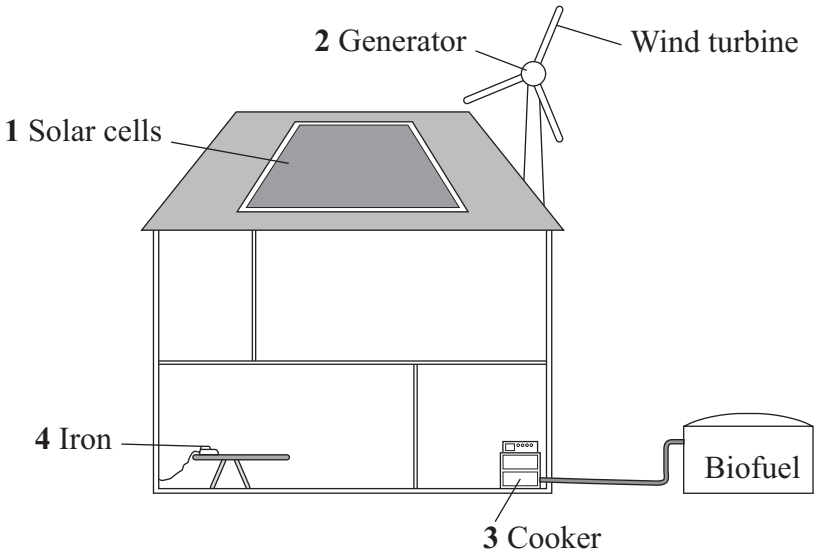
4.1.1.1 Energy stores and systems

Question 21

November 2007 | PHY1A | Original Q1 | Legacy

QUESTION ONE

The diagram shows an eco-friendly house.



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

A chemical energy to heat

B electrical energy to heat

C light energy to electrical energy

D kinetic energy to electrical energy

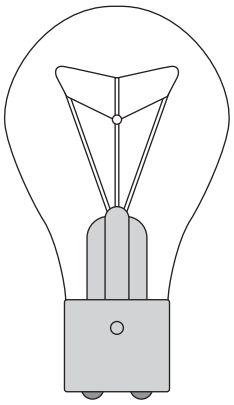
4.1.1.1 Energy stores and systems

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

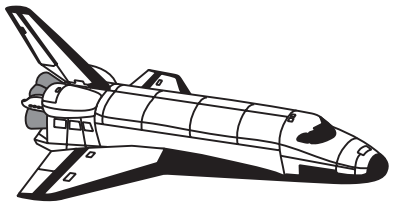
4.1.1.1 Energy stores and systems

Question 23

November 2007 | PHY1A | Original Q6 | Legacy

QUESTION SIX

The diagram shows the space shuttle returning to Earth. As it moves towards Earth, it moves faster.



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

A gravitational potential energy

B kinetic energy

C light energy

D thermal energy

As the shuttle moves towards Earth, it loses . . . **1** . . . .

When the shuttle moves faster, it gains . . . **2** . . . .

When the shuttle enters the Earth's atmosphere, there is a lot of friction. This makes the tiles covering the shuttle glow red. As a result, the shuttle gives off a lot of . . . **3** . . . and a little . . . **4** . . . .

4.1.1.1 Energy stores and systems

Question 24

January 2008 | PHY1F | Original Q1 | Legacy

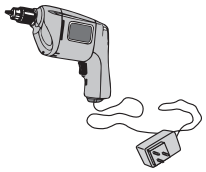
1 (a) Each letter **A**, **B**, **C**, **D** and **E** represents an energy transformation.

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

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

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

Drill



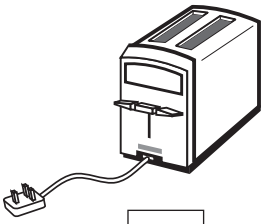
☐

MP3 player



☐

Toaster



☐

(3 marks)

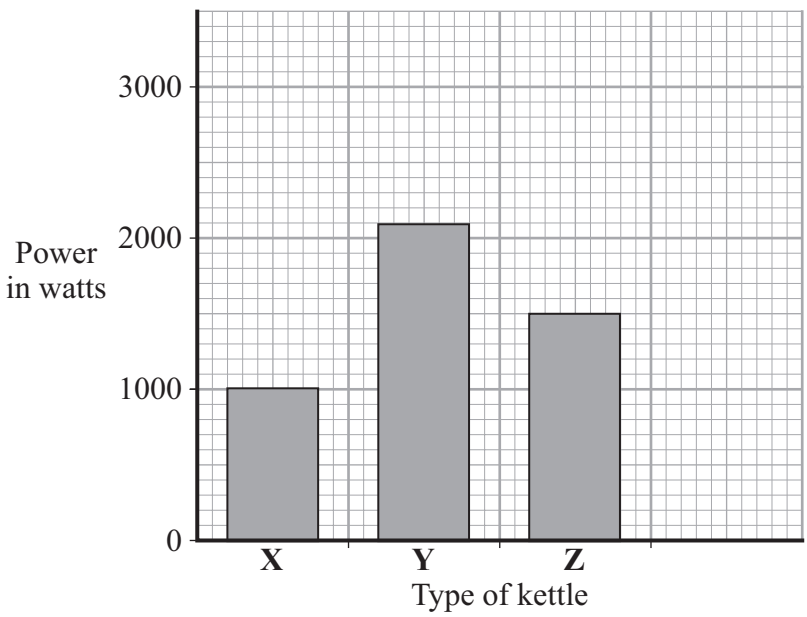
Question 1 continues on the next page

4.1.1.1 Energy stores and systems

Question 24 · continued

BLANK

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



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

.....

(1 mark)

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

Which kettle costs the most to use?

.....

(1 mark)

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

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

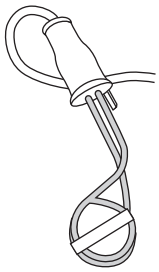
4.1.1.1 Energy stores and systems

Question 24 · continued

BLANK

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





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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

8

4.1.1.1 Energy stores and systems

Question 25

January 2008 | PHY1F | Original Q5 | Legacy

5 (a) Water waves are a renewable energy source.

The government wants more electricity to be generated from renewable energy sources. Some people do not think this is a good idea.

What reasons could a government scientist give to show people that using more renewable energy sources is a good idea?

.....

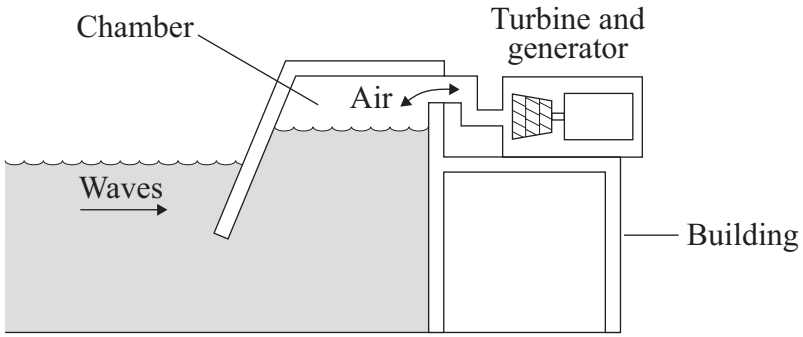
.....

.....

.....

(2 marks)

(b) The diagram shows a wave-powered generator. The generator transforms kinetic energy from the waves to electrical energy.



The following sentences describe how the wave generator works. The sentences are in the wrong order.

R Waves push air up and down a chamber inside the building.
S The turbine turns the generator.
T The generator transforms kinetic energy to electrical energy.
U The air rushes through a turbine making it spin.
V Strong waves move towards the wave-powered generator.

Arrange these sentences in the correct order. Start with letter **V**.

V → ☐ → ☐ → ☐ → ☐

(3 marks)

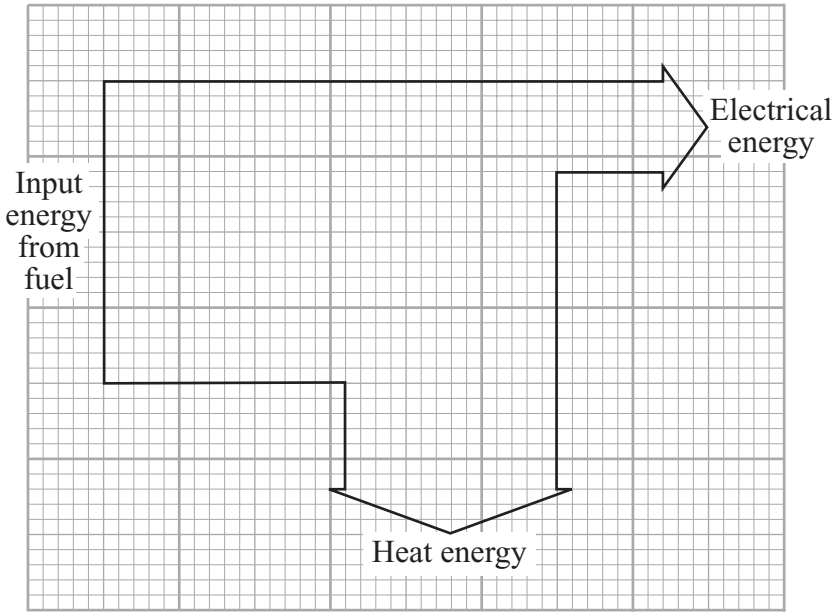
5

4.1.1.1 Energy stores and systems

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

4.1.1.1 Energy stores and systems

Question 26 · continued

BLANK

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

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

What is meant by a device being *efficient*?

.....

.....

(1 mark)

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

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

.....

.....

.....

.....

(2 marks)

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

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

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

.....

.....

(1 mark)

4.1.1.1 Energy stores and systems

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)

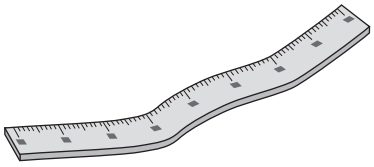
12

4.1.1.1 Energy stores and systems

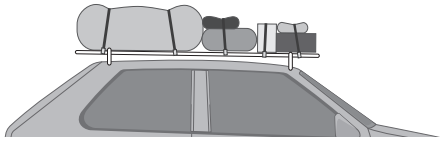
Question 27

January 2008 | PHY2F | Original Q1 | Legacy

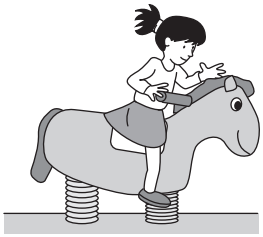
1 (a) The pictures show four objects. Each object has had its shape changed.



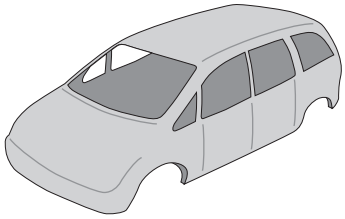
Bent metal ruler
A



Stretched bungee cords
B



Springs on a playground ride
C



Moulded plastic model car body
D

Which of the objects are storing elastic potential energy?

.....

Explain the reason for your choice or choices.

.....

.....

.....

.....

.....

.....

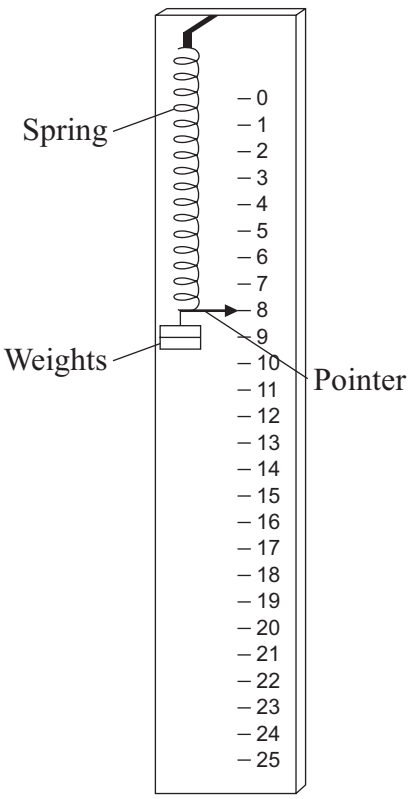
(3 marks)

Question 1 continues on the next page

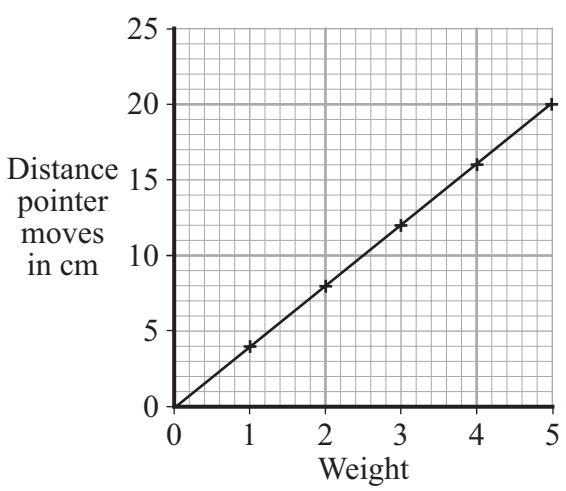
Question 27 · continued

BLANK

(b) A student makes a simple spring balance. To make a scale, the student uses a range of weights. Each weight is put onto the spring and the position of the pointer marked.



The graph below shows how increasing the weight made the pointer move further.



4.1.1.1 Energy stores and systems

Question 27 · continued

BLANK

(i) Which **one** of the following is the unit of weight?

Draw a ring around your answer.

joule **kilogram** **newton** **watt**

(1 mark)

(ii) What range of weights did the student use?

.....

(1 mark)

(iii) How far does the pointer move when 4 units of weight are on the spring?

.....

(1 mark)

(iv) The student ties a stone to the spring. The spring stretches 10 cm.

What is the weight of the stone?

.....

(1 mark)

7

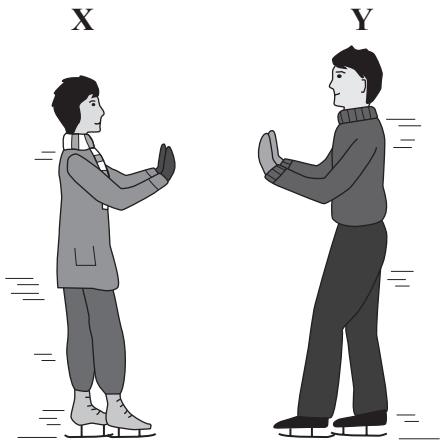
4.1.1.1 Energy stores and systems

Question 28

January 2008 | PHY2F | Original Q2 | Legacy

2 The picture shows two children, **X** and **Y**, skating towards each other at an ice rink.

The children collide with each other, fall over and stop.



(a) Before the collision the children had different amounts of kinetic energy.

(i) What are the **two** factors that determine the kinetic energy of the children?

1 .....

2 .....

(2 marks)

(ii) What was the total kinetic energy of the children after they had fallen over and stopped?

.....

(1 mark)

4.1.1.1 Energy stores and systems

Question 28 · continued

BLANK

(b) The total momentum of the children before and after the collision is zero.

(i) Use the equation in the box and the data given in the diagram to calculate the momentum of child **Y** before the collision.

momentum = mass × velocity

Show clearly how you work out your answer.

.....

.....

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

(ii) Complete the following sentence using one of the words in the box.

conserved	**decreased**	**increased**

The total momentum of the two children was ..... .
(1 mark)

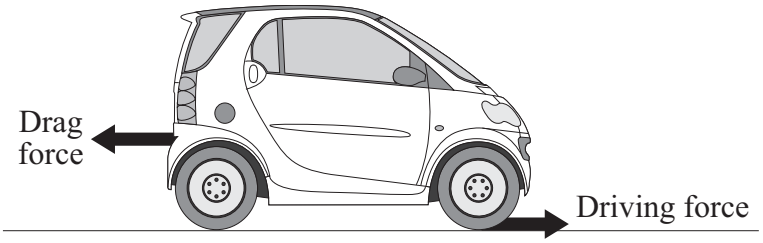
6

4.1.1.1 Energy stores and systems

Question 29

January 2008 | PHY2F | Original Q3 | Legacy

3 The diagram shows the horizontal forces acting on a car travelling along a straight road.



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

(i) When the driving force equals the drag force, the speed of the car is

decreasing
constant
increasing

.

(1 mark)

(ii) Putting the brakes on transforms the car's kinetic energy mainly into

heat
light
sound

.

(1 mark)

4.1.1.1 Energy stores and systems

Question 29 · continued

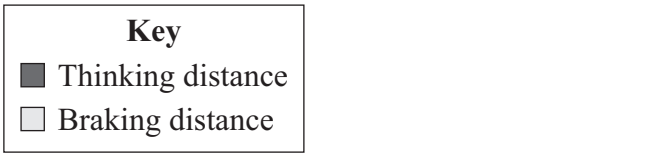
BLANK

(b) The charts, **A**, **B** and **C** give the thinking distance and the braking distance for a car driven under different conditions.

(i) Draw straight lines to match each chart to the correct conditions.

Draw only **three** lines.

Conditions	Charts
Speed = 22 m/s driver wide awake	A
Speed = 13 m/s driver wide awake	B
Speed = 13 m/s driver very tired	C







Key
Thinking distance
Braking distance

(2 marks)

(ii) The three charts above all apply to dry road conditions.

How would the braking distances be different if the road were wet?

.....

.....

(1 mark)

5

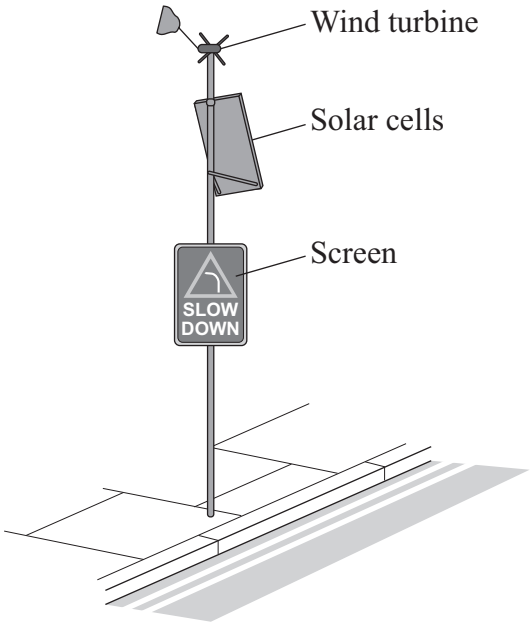
4.1.1.1 Energy stores and systems

Question 30

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** . . . .

4.1.1.1 Energy stores and systems

Question 31

March 2008 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

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

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



At the start of the day

At the end of the day

Each kilowatt-hour of electricity costs 11 p.

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

A 10

B 44

C 56

D 2000

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

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

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

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

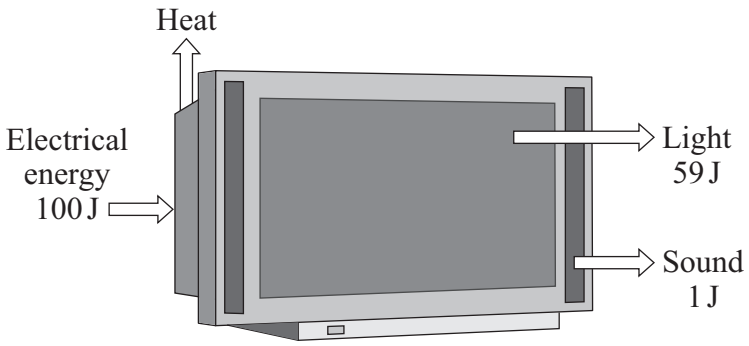
4.1.1.1 Energy stores and systems

Question 32

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

4.1.1.1 Energy stores and systems

Question 32 · 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.

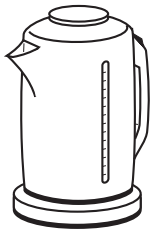
4.1.1.1 Energy stores and systems

Question 33

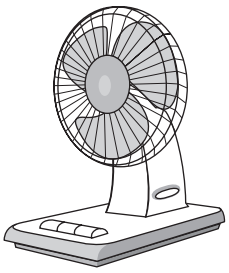
June 2008 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

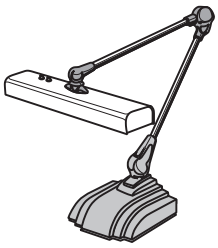
These devices transform electrical energy into other useful forms of energy.



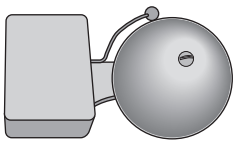
1
Kettle



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

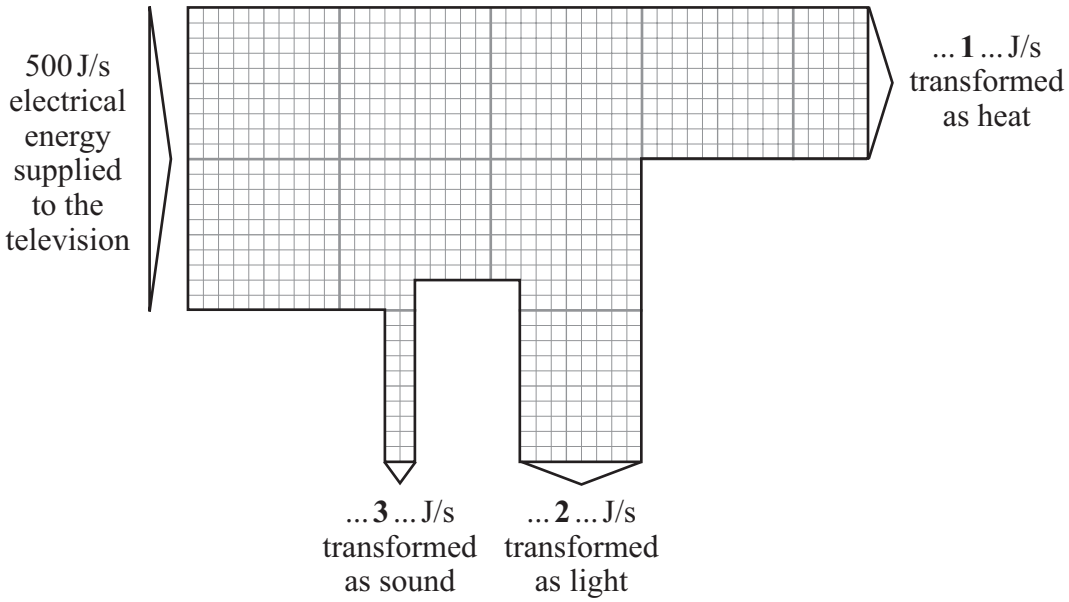
4.1.1.1 Energy stores and systems

Question 34

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

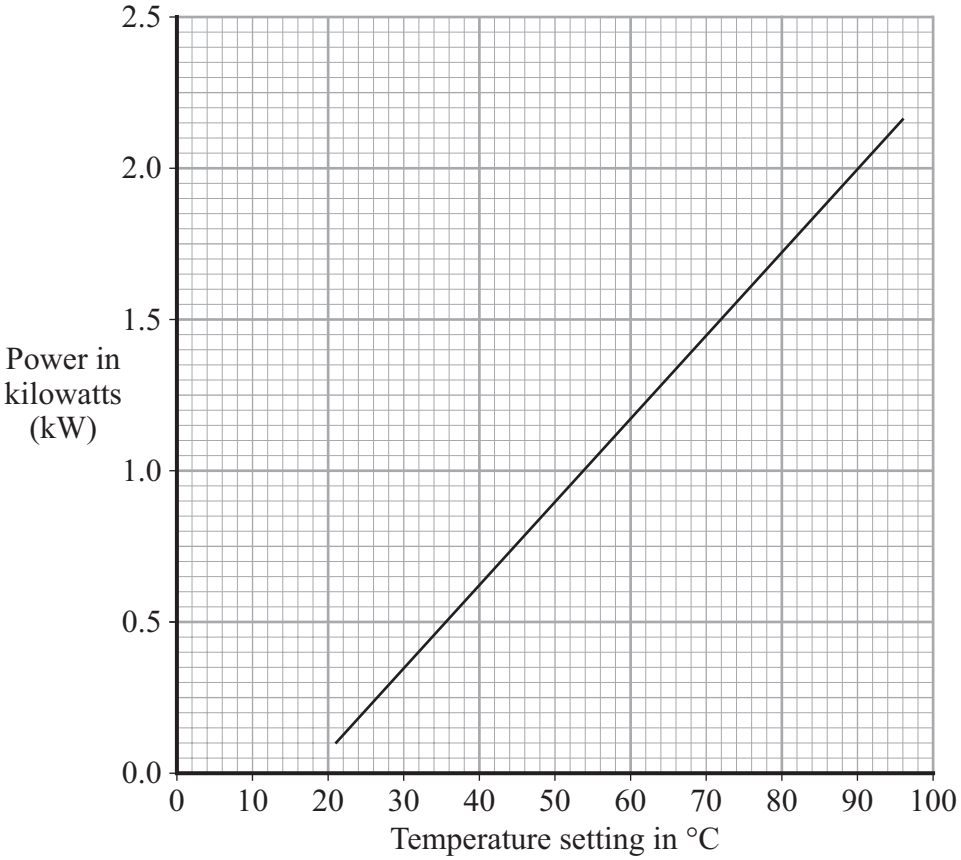
4.1.1.1 Energy stores and systems

Question 35

June 2008 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

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



7A What relationship does the graph show?

1 As the temperature setting increases, the power increases.

2 As the temperature setting increases, the power decreases.

3 As the temperature setting decreases, the power increases.

4 There is no relationship.

Question 35 · continued

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

1 1.90 kW

2 1.95 kW

3 2.00 kW

4 2.10 kW

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

1 70 °C

2 71 °C

3 72 °C

4 75 °C

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

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

How many kilowatt-hours of energy will it use?

1 0.50

2 0.75

3 3.00

4 3.50

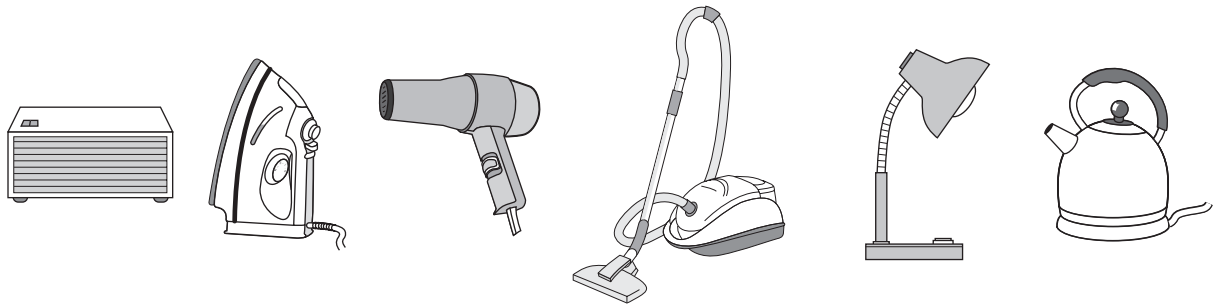
4.1.1.1 Energy stores and systems

Question 36

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)

4.1.1.1 Energy stores and systems

Question 36 · 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

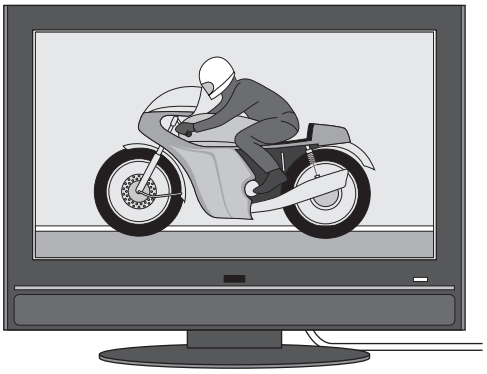
4.1.1.1 Energy stores and systems

Question 37

November 2008 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

The drawing shows a television set.



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

A electrical

B heat

C light

D sound

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

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

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

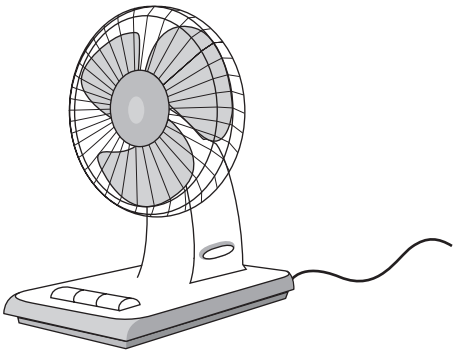
4.1.1.1 Energy stores and systems

Question 38

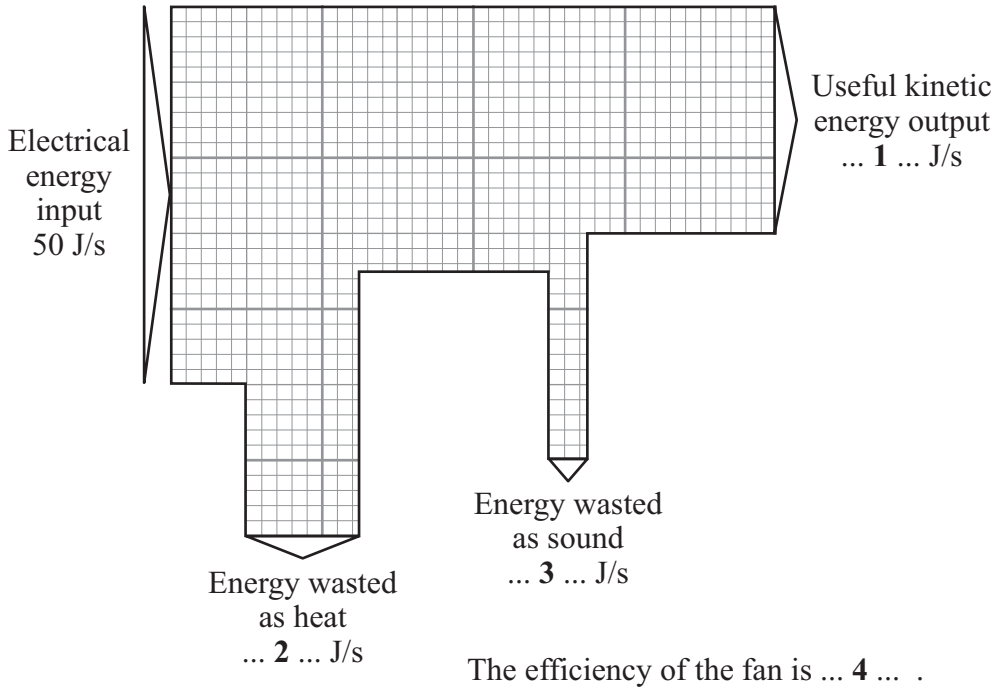
November 2008 | PHY1AP | Original Q5 | Legacy

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

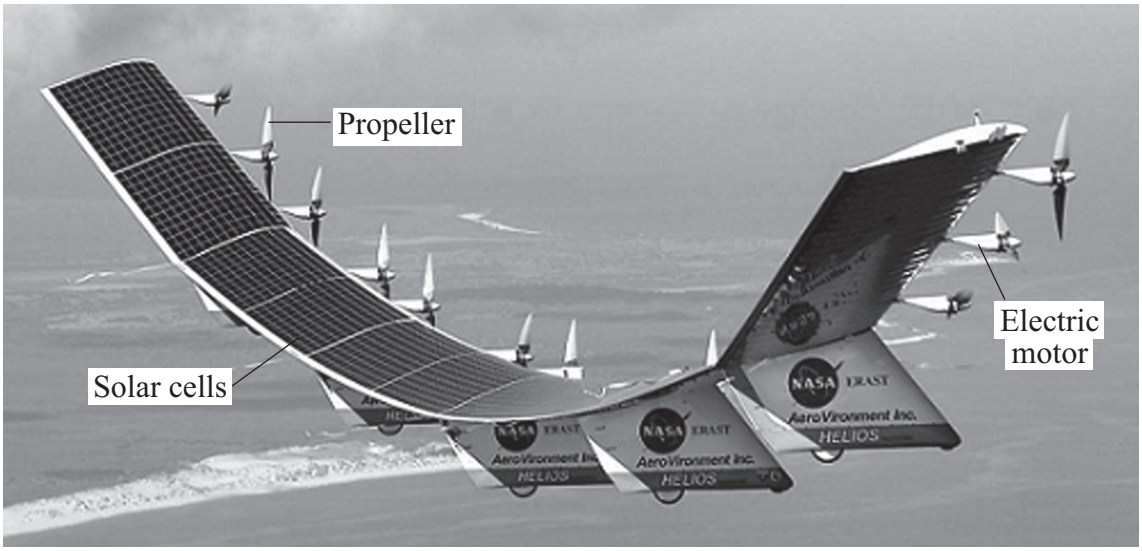
D 30

4.1.1.1 Energy stores and systems

Question 39

January 2009 | PHY1F | Original Q3 | Legacy

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



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

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

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

..... energy.

(2 marks)

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

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

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

4.1.1.1 Energy stores and systems

Question 39 · continued

for mark

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

.....

(1 mark)

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

.....

.....

(1 mark)

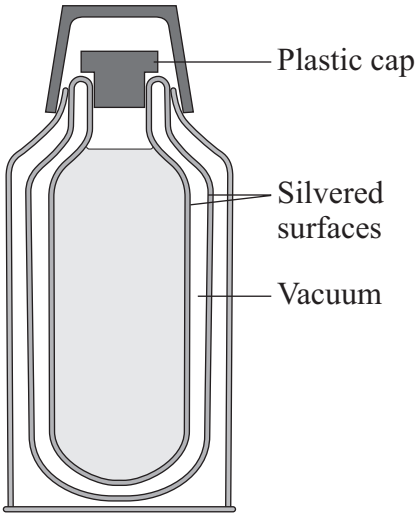
8

4.1.1.1 Energy stores and systems

Question 40

January 2009 | PHY1F | Original Q6 | Legacy

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



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

The first row has been done for you.

Feature	Conduction	Convection	Radiation
vacuum	✓	✓	
silvered surfaces			
plastic cap			

(2 marks)

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

.....

.....

.....

.....

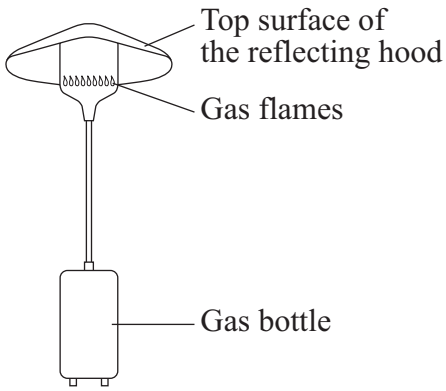
(2 marks)

4.1.1.1 Energy stores and systems

Question 40 · continued

for mark

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



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

.....

.....

.....

(2 marks)

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

Draw and label a Sankey diagram for the patio heater.

(2 marks)

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

.....

.....

(1 mark)

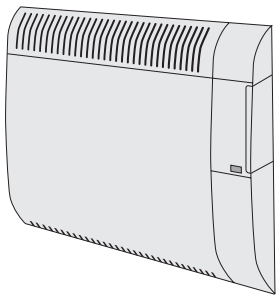
9

4.1.1.1 Energy stores and systems

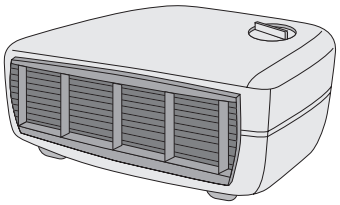
Question 41

January 2009 | PHY1F | Original Q7 | Legacy

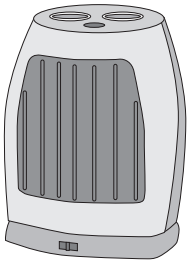
7 The pictures show three different types of electric heater.



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



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



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

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

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

energy transferred = power × time

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kilowatt-hours

(2 marks)

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

.....

(1 mark)

4.1.1.1 Energy stores and systems

Question 41 · continued

for mark

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

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

oil-filled panel heater .....

.....

fan heater .....

.....

ceramic heater .....

.....

(3 marks)

6

4.1.1.1 Energy stores and systems

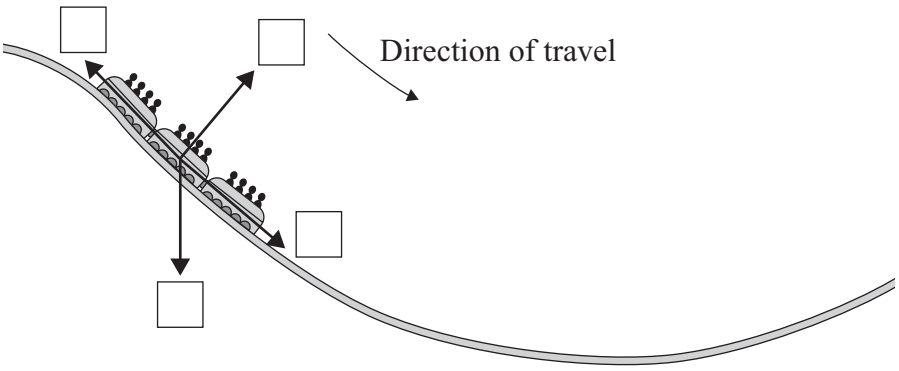
Question 42

January 2009 | PHY2F | Original Q7 | Legacy

7 The diagram shows the passenger train on part of a rollercoaster ride.

7 (a) Which arrow shows the direction of the resultant force acting on the passenger train?

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



(1 mark)

7 (b) At the bottom of the slope, the passengers in the train all have the same speed but they each have a different kinetic energy.

Why is the kinetic energy of each passenger different?

.....

.....

(1 mark)

7 (c) For part of the ride, the maximum gravitational field strength acting on the passengers seems 3 times bigger than normal.

Normal gravitational field strength = 10 N/kg

7 (c) (i) Calculate the maximum gravitational field strength that seems to act on the passengers during the ride.

.....

.....

Maximum gravitational field strength = ... N/kg

(1 mark)

4.1.1.1 Energy stores and systems

Question 42 · continued

for mark

7 (c) (ii) One of the passengers has a mass of 80 kg.

Use the equation in the box to calculate the maximum weight this passenger seems to have during the ride.

weight = mass × gravitational field strength

Show clearly how you work out your answer.

.....

.....

Maximum weight = ... N
(2 marks)

5

Turn over for the next question

4.1.1.1 Energy stores and systems

Question 43

March 2009 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

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

6A A car engine transfers kinetic energy.

The kinetic energy is transformed from . . .

1 chemical energy.

2 electrical energy.

3 light energy.

4 sound energy.

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

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

1 has a higher top speed.

2 has a lower top speed.

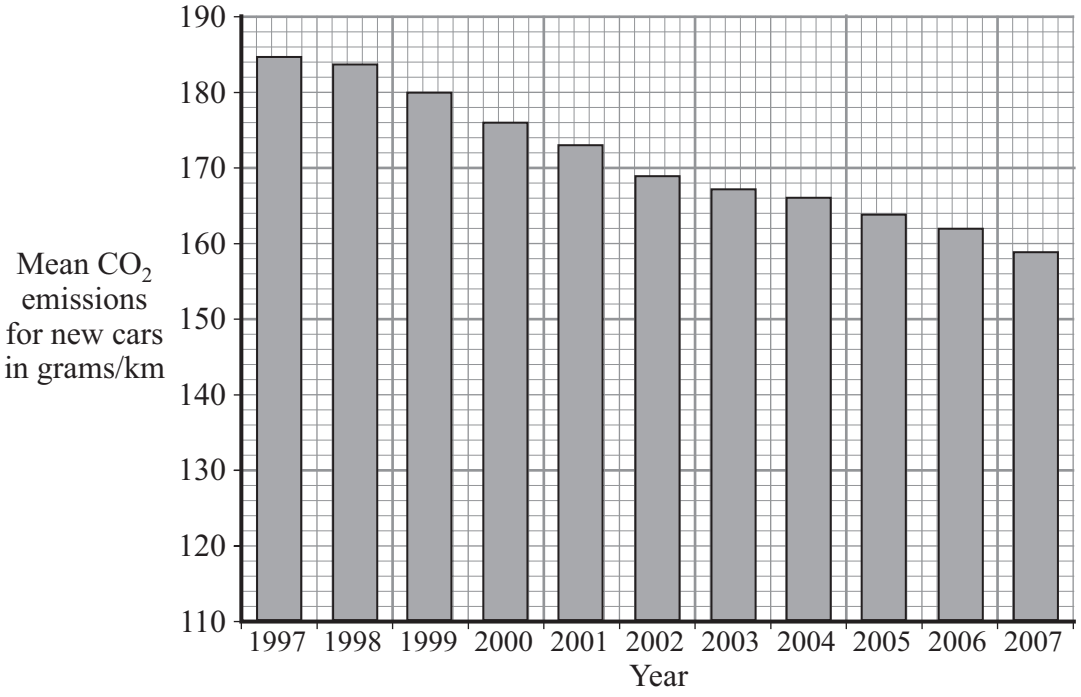
3 uses less petrol.

4 uses more petrol.

4.1.1.1 Energy stores and systems

Question 43 · continued

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



6C The display is called a . . .

1 bar chart.

2 line graph.

3 pie chart.

4 scattergram.

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

1 steadily increased.

2 steadily decreased.

3 decreased and then increased.

4 stayed the same.

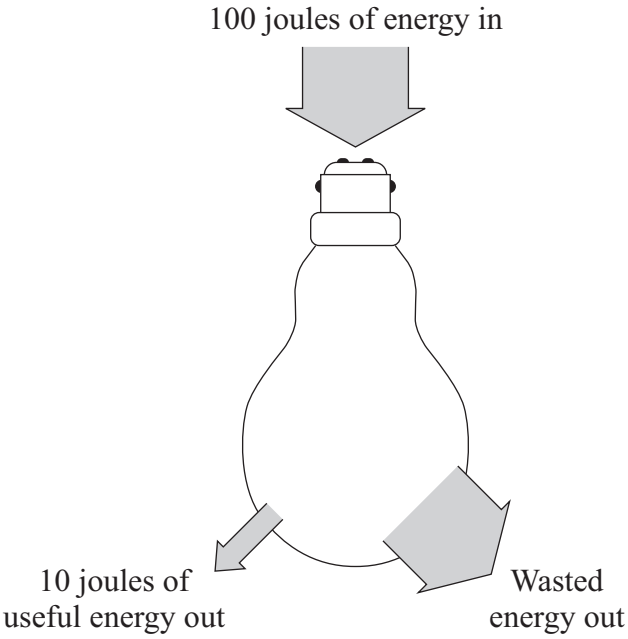
4.1.1.1 Energy stores and systems

Question 44

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

4.1.1.1 Energy stores and systems

Question 44 · 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

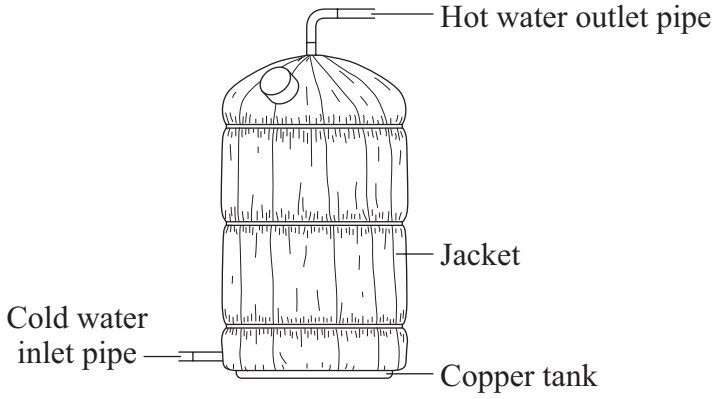
4.1.1.1 Energy stores and systems

Question 45

March 2009 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

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



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

Trapped air reduces heat loss by . . .

1 conduction only.

2 conduction and radiation.

3 conduction and convection.

4 conduction, convection and radiation.

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

This is because dark matt surfaces are . . .

1 good conductors.

2 poor conductors.

3 good radiators.

4 poor radiators.

4.1.1.1 Energy stores and systems

Question 45 · continued

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

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

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

1 0.5

2 18

3 500

4 18 000

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

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

How much was the bill?

1 £200

2 £600

3 £20 000

4 £60 000

END OF TEST

4.1.1.1 Energy stores and systems

Question 46

June 2009 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

This question is about useful electrical devices.

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

A fan

B lamp

C oven

D radio

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

4.1.1.1 Energy stores and systems

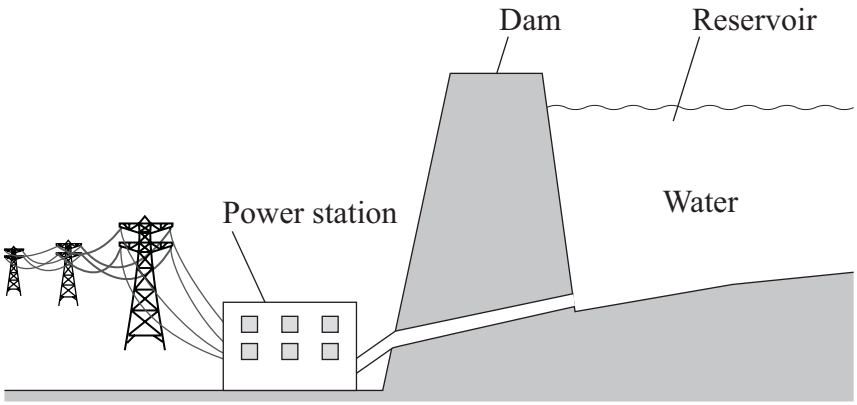
Question 47

June 2009 | PHY1AP | Original Q4 | Legacy

QUESTION FOUR

Useful energy can be obtained from falling water.

The diagram shows one way of doing this.



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

A electrical

B gravitational potential

C heat (thermal energy)

D kinetic

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

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

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

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

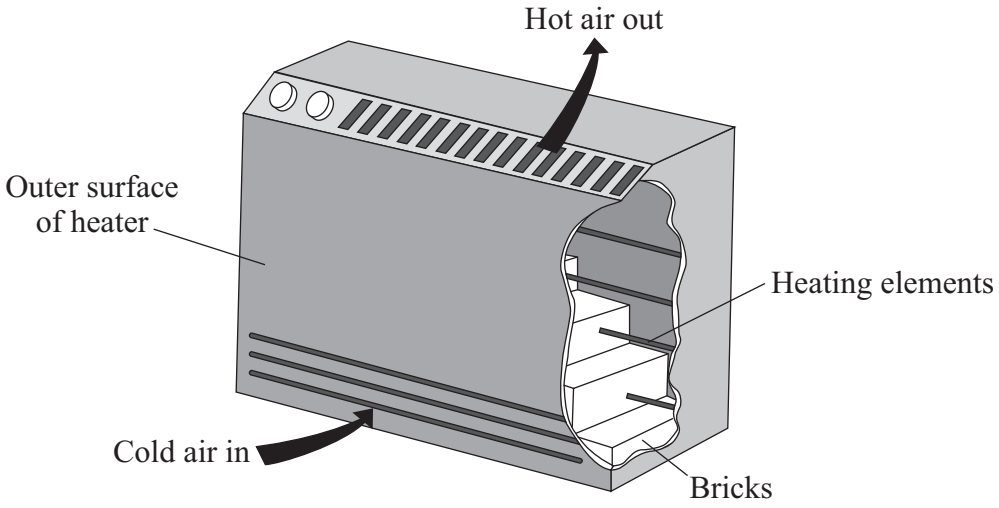
4.1.1.1 Energy stores and systems

Question 48

June 2009 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

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



6A The bricks warm up because they . . .

1 absorb heat.

2 insulate heat.

3 radiate heat.

4 reflect heat.

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

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

1 conduction from the bricks

2 conduction from the outside surface of the heater

3 convection currents in the air

4 radiation from the outside surface of the heater

Question 48 · continued

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

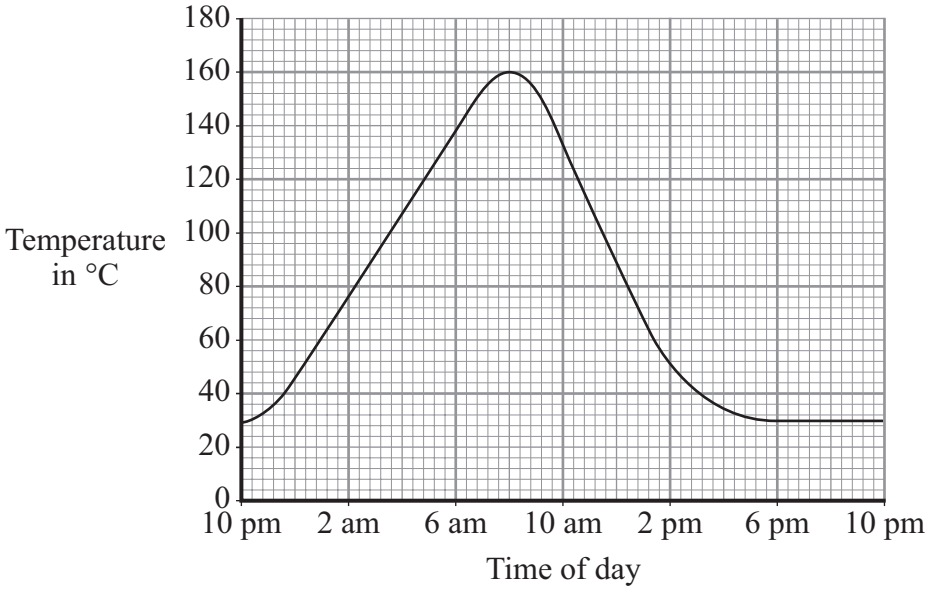
1 dark, matt

2 dark, shiny

3 light, shiny

4 light, matt

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



At what time did the bricks reach their highest temperature?

1 8 am

2 10 am

3 6 pm

4 10 pm

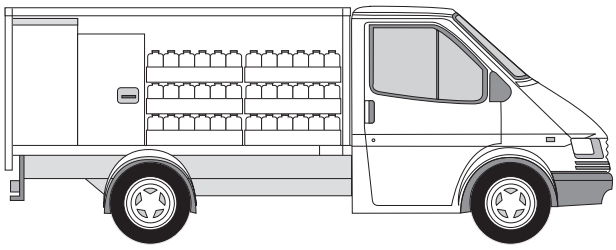
4.1.1.1 Energy stores and systems

Question 49

June 2009 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The diagram shows an electrically powered milk float.



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

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

1 electrical energy to kinetic energy.

2 kinetic energy to chemical energy.

3 chemical energy to electrical energy.

4 kinetic energy to electrical energy.

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

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

The energy transferred to the batteries is . . .

1 0.3 kWh

2 3.3 kWh

3 7.5 kWh

4 75 kWh

4.1.1.1 Energy stores and systems

Question 49 · continued

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

What is the efficiency of the motor?

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

1 0.4

2 2.5

3 2400

4 5600

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

This is because . . .

1 the batteries store energy.

2 it produces no harmful waste gases.

3 the batteries can be recharged many times.

4 the top speed is only 20 km/h.

END OF TEST

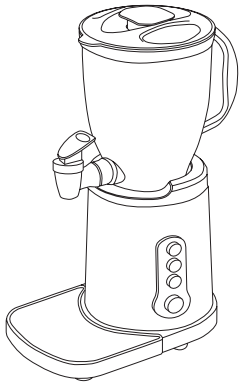
4.1.1.1 Energy stores and systems

Question 50

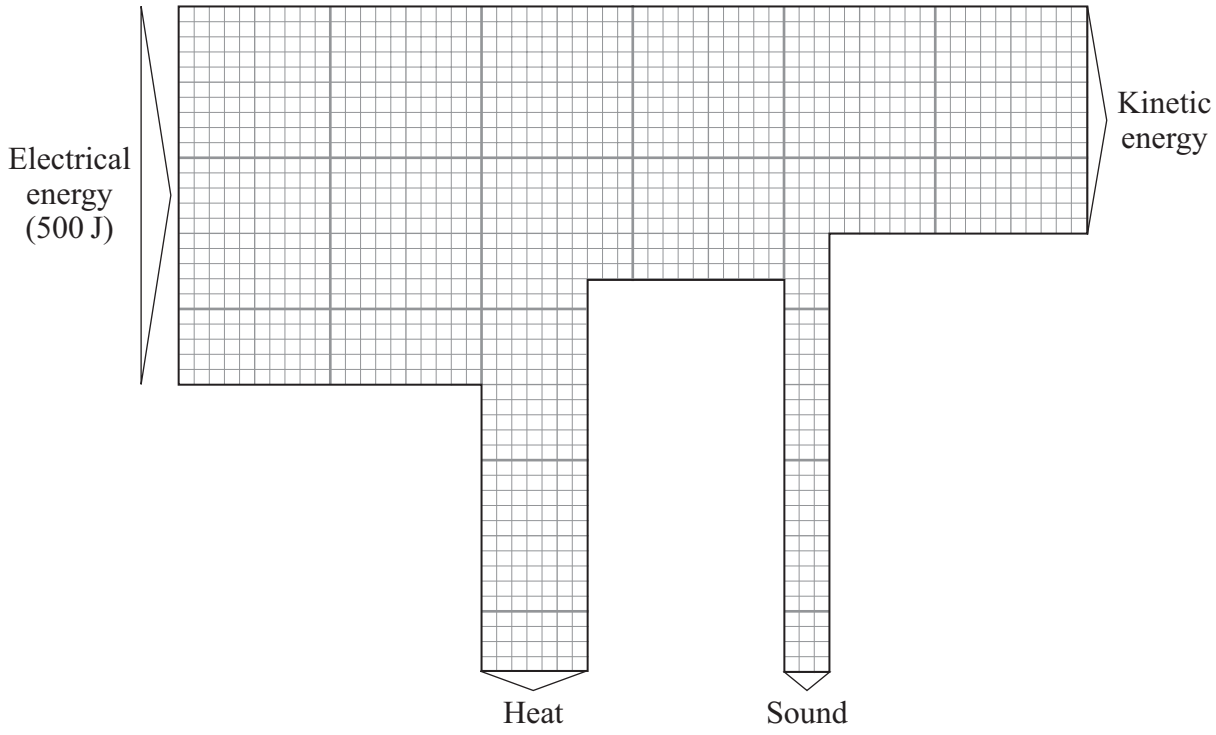
November 2009 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a smoothie maker.



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



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

4.1.1.1 Energy stores and systems

Question 50 · 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

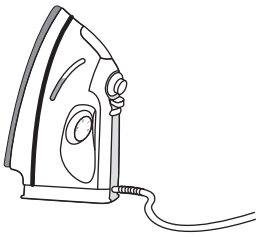
4.1.1.1 Energy stores and systems

Question 51

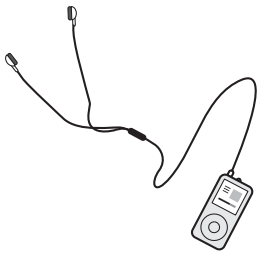
March 2010 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

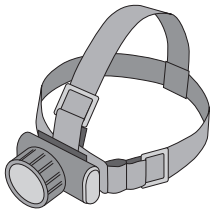
These devices transform electrical energy into other useful forms of energy.



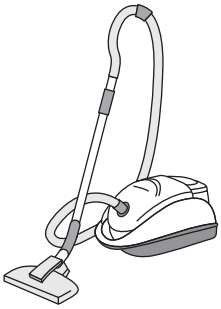
1
Iron



2
MP3 player



3
Head torch



4
Vacuum cleaner

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

A heat (thermal energy)

B light

C movement (kinetic energy)

D sound

4.1.1.1 Energy stores and systems

Question 52

March 2010 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

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

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

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

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

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

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

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

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

4.1.1.1 Energy stores and systems

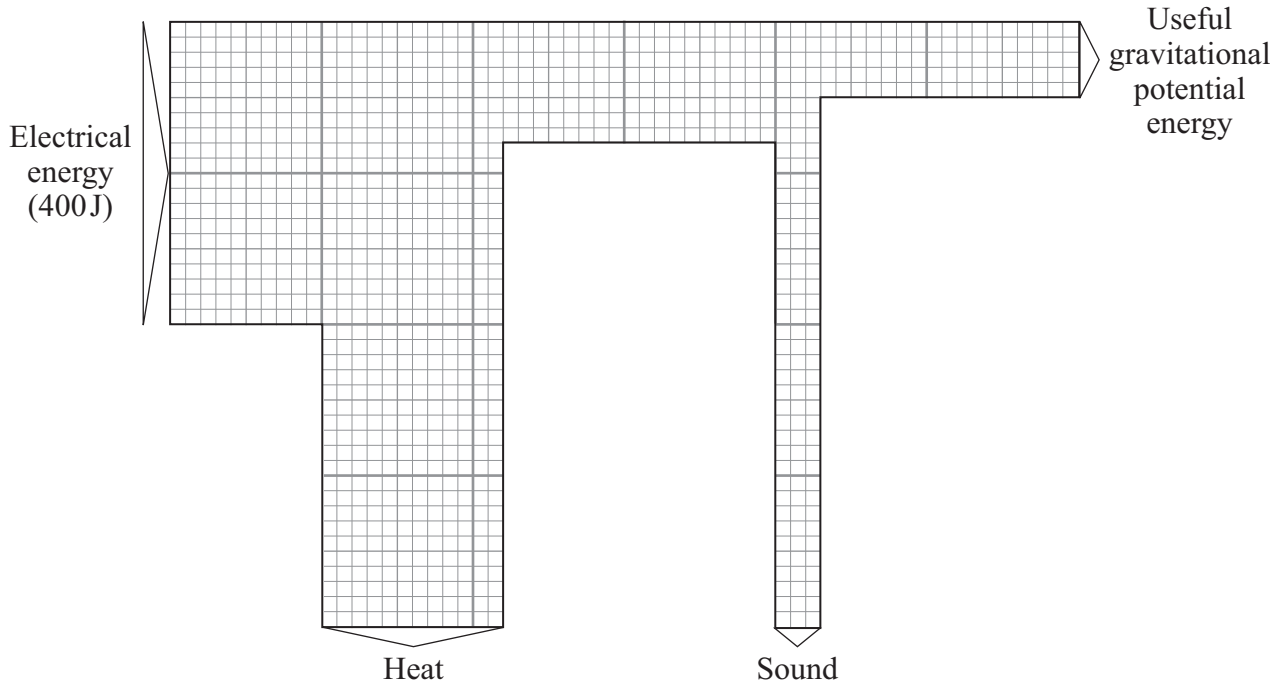
Question 53

March 2010 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

An electric motor is used to lift a weight.

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



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

A 0.25

B 60

C 100

D 240

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

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

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

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

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

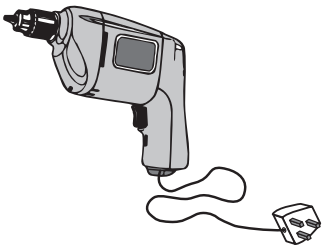
4.1.1.1 Energy stores and systems

Question 54

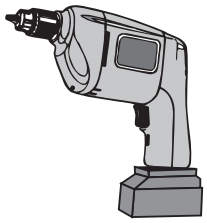
June 2010 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

The diagrams show a mains electric drill and a cordless electric drill. The cordless drill has a rechargeable battery.



Mains electric drill



Cordless electric drill

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

A chemical energy

B electrical energy

C heat (thermal energy)

D kinetic energy

Drills are designed to produce . . . **1** . . . .

The drills also produce . . . **2** . . . and sound energy which are wasted.

Both drills use . . . **3** . . . to make their motors work.

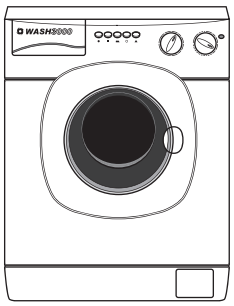
The cordless drill has a battery that stores . . . **4** . . . .

4.1.1.1 Energy stores and systems

Question 55

June 2010 | PHY1AP | Original Q6 | Legacy

QUESTION SIX



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

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

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

1 chemical energy.

2 kinetic energy.

3 light energy.

4 sound energy.

4.1.1.1 Energy stores and systems

Question 55 · continued

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

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

1 3.6 kWh

2 3.2 kWh

3 0.8 kWh

4 0.4 kWh

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

1 The HOT cycle has the lowest average power.

2 The HOT cycle takes the shortest time to run.

3 More energy is transferred during the HOT cycle.

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

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

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

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

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

1 £1.20

2 12 p

3 1.2 p

4 0.12 p

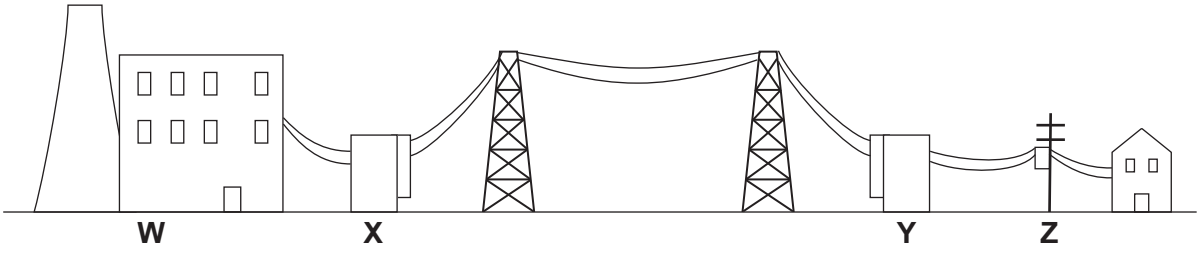
4.1.1.1 Energy stores and systems

Question 56

June 2010 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

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



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

1 **W**

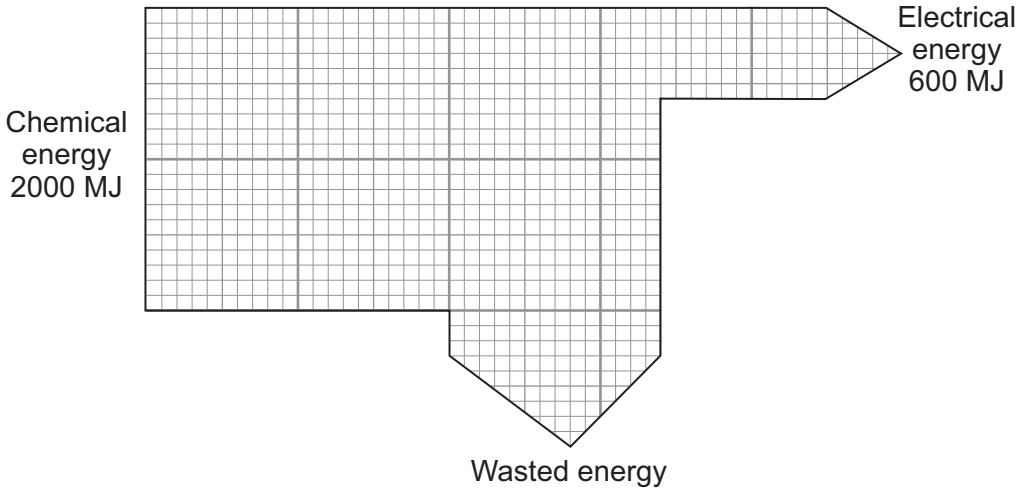
2 **X**

3 **Y**

4 **Z**

Fuel is burned in this power station.

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



7B How much energy is wasted?

1 30 MJ

2 600 MJ

3 1400 MJ

4 2600 MJ

4.1.1.1 Energy stores and systems

Question 56 · continued

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

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

What is the efficiency of this power station?

1 0.30

2 0.33

3 0.60

4 0.70

7D What happens to the energy that is wasted?

1 It is transferred into useful energy.

2 It warms up the surroundings.

3 It is recycled.

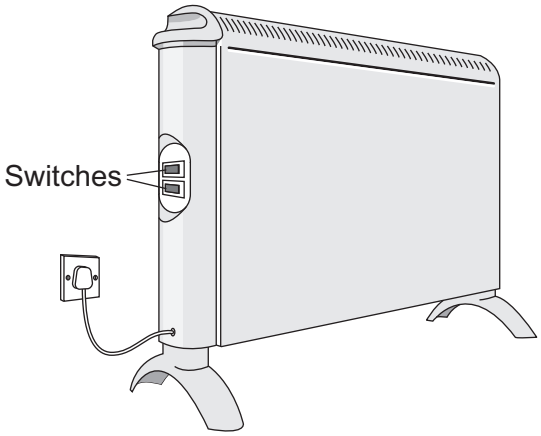
4 It is stored until needed.

4.1.1.1 Energy stores and systems

Question 57

June 2010 | PHY1F | Original Q3 | Legacy

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



Setting	Power in kW
Low	0.5
Medium	1.5
High	

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

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

.....

Power = ... kW

(1 mark)

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

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

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

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

4.1.1.1 Energy stores and systems

Question 57 · continued

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

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

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

Show clearly how you work out your answer.

.....

.....

Total cost = ... pence

(2 marks)

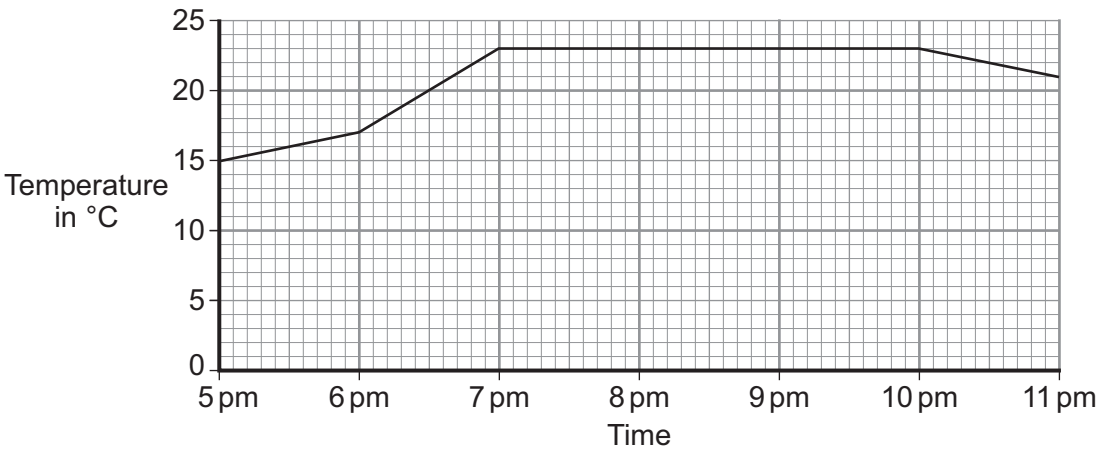
Question 3 continues on the next page

4.1.1.1 Energy stores and systems

Question 57 · continued

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

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



The heater was first used on the medium setting.

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

.....

Give a reason for your answer.

.....

.....

.....

(2 marks)

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

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

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

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

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

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

(1 mark)

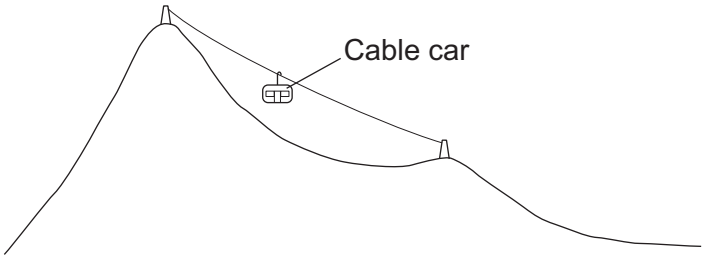
8

4.1.1.1 Energy stores and systems

Question 58

June 2010 | PHY2F | Original Q6 | Legacy

6 (a) The diagram shows a cable car used to take skiers to the top of a mountain.



6 (a) (i) The total mass of the cable car and skiers is 7500 kg.

Use the equation in the box to calculate the weight of the cable car and skiers.

weight = mass × gravitational field strength

gravitational field strength = 10 N/kg

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

.....

.....

Weight = ...

(3 marks)

4.1.1.1 Energy stores and systems

Question 58 · continued

6 (a) (ii) The cable car moves at a constant speed. It lifts skiers through a vertical height of 800 metres in 7 minutes.

Use the following equation to calculate the work done to lift the cable car and skiers.

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

Show clearly how you work out your answer.

.....

.....

Work done = ... J

(2 marks)

6 (b) The diagram shows a skier who is accelerating down a steep ski slope.



6 (b) (i) Draw an arrow on the diagram to show the direction of the resultant force acting on the skier.

(1 mark)

6 (b) (ii) How and why does the kinetic energy of the skier change?

.....

.....

.....

.....

(2 marks)

Question 6 continues on the next page

4.1.1.1 Energy stores and systems

Question 58 · continued

6 (c) Last year, 18 000 skiers suffered a head injury. It is thought that nearly 8000 of these injuries could have been avoided if the skier had been wearing a helmet. However, at present, there are no laws to make skiers wear helmets.

Suggest why skiers should be made aware of the benefits of wearing a helmet.

.....

.....

(1 mark)

9

4.1.1.1 Energy stores and systems

Question 59

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** . . . .

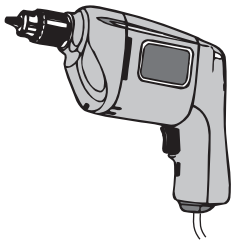
4.1.1.1 Energy stores and systems

Question 60

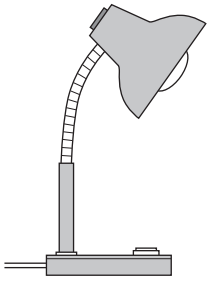
November 2010 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

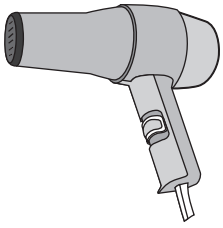
The diagrams show four electrical devices. The Sankey diagrams show the energy transformations involved in the four electrical devices.



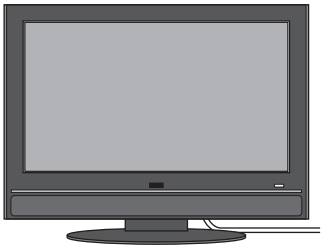
A
Electric drill



B
Desk lamp



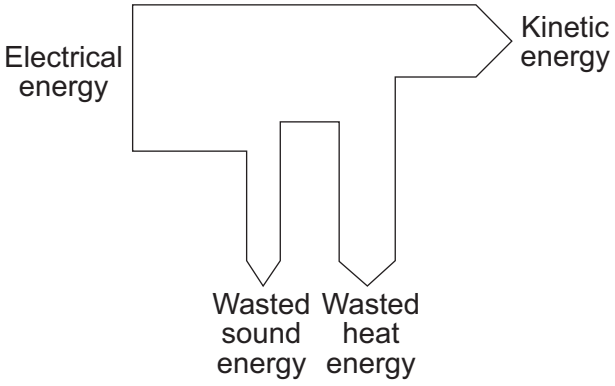
C
Hair dryer



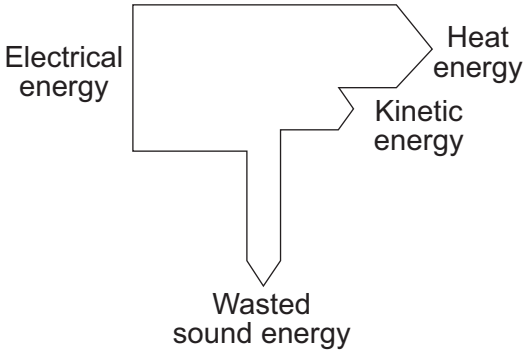
D
Television

Match devices, **A**, **B**, **C** and **D**, with the Sankey diagrams **1**–**4**.

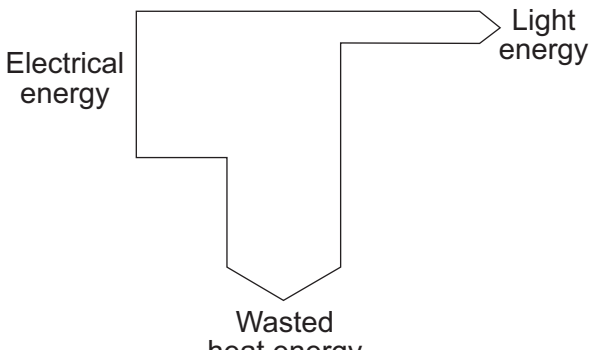
1



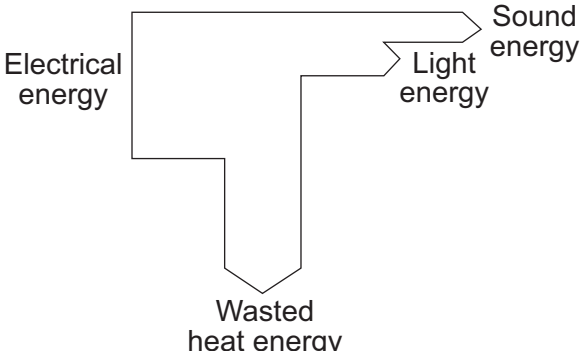
2



3



4



4.1.1.1 Energy stores and systems

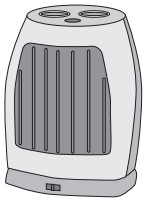
Question 61

November 2010 | PHY1AP | Original Q6 | Legacy

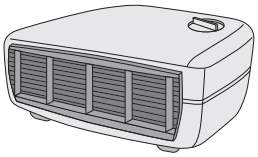
QUESTION SIX

The pictures show four different types of electric heater.

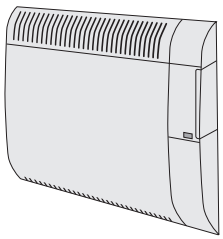
1800 W ceramic heater
- 2 heat settings
- 8 hour timer
- Power indicator light
- Safety overheat cut-out



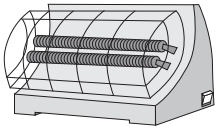
3 kW fan heater
- 2 heat settings
- Power indicator light
- Cool air fan setting



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



2 kW radiant heater
- 2 heat settings



6A Which heater is the most powerful?

1 the ceramic heater

2 the fan heater

3 the oil-filled panel heater

4 the radiant heater

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

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

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

1 0.75

2 3.0

3 7.0

4 12.0

4.1.1.1 Energy stores and systems

Question 61 · continued

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

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

Electricity costs 14p per kWh

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

1 £0.14

2 £1.40

3 £14.00

4 £140.00

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

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

2 The fan heater has a power indicator light.

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

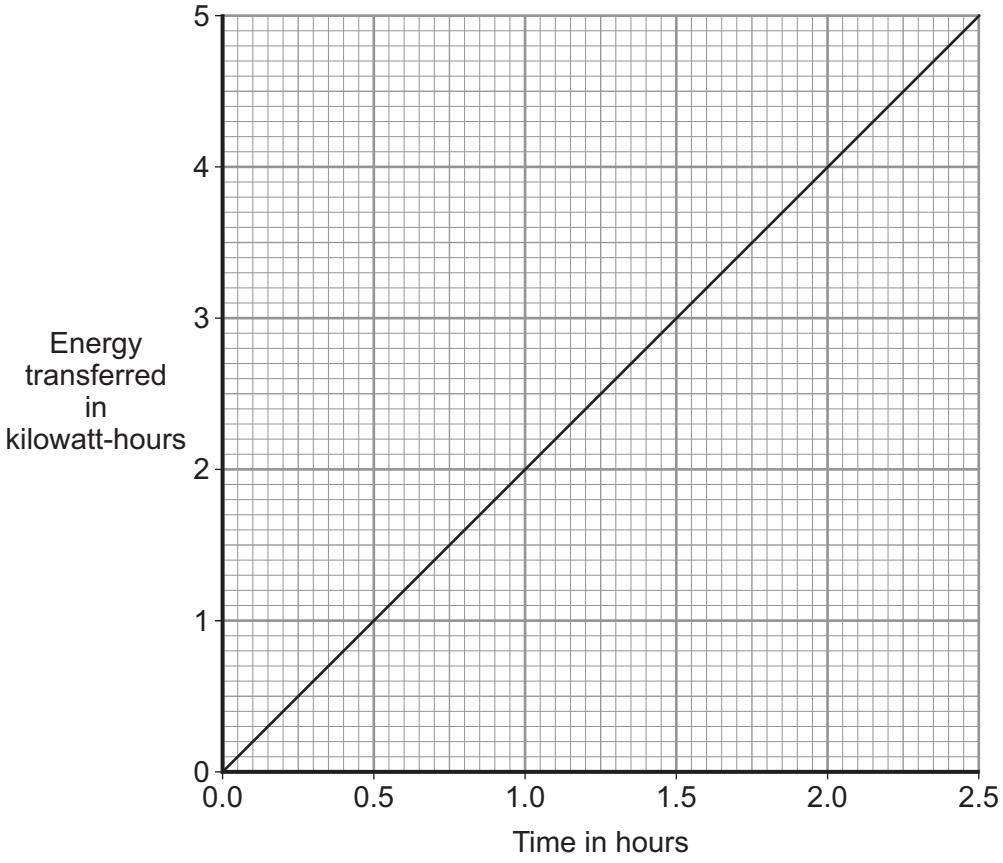
4 The fan heater has more than one heat setting.

4.1.1.1 Energy stores and systems

Question 62

January 2011 | PHY1F | Original Q2 | Legacy

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



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

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

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

Show clearly how you work out your answer.

.....

.....

Cost = ... p

(2 marks)

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

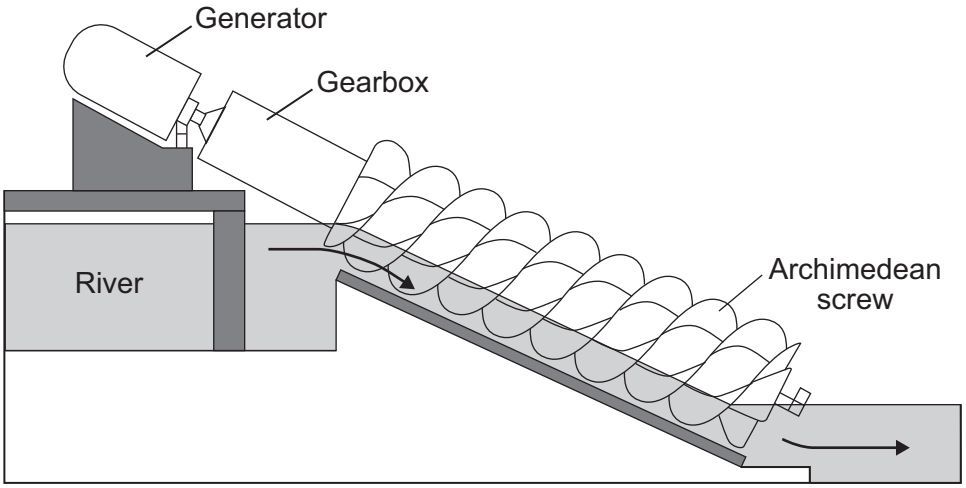
(1 mark)

3

4.1.1.1 Energy stores and systems

Question 63

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



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

The gravitational potential energy of the falling water is transformed

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

(1 mark)

4.1.1.1 Energy stores and systems

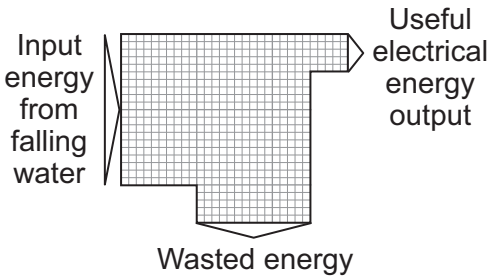
Question 63 · continued

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

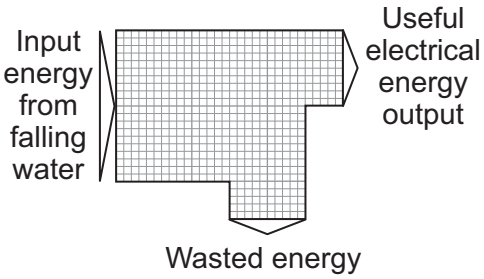
Which **one** of the following Sankey diagrams, **X**, **Y** or **Z**, shows the energy transformations produced by this generator?

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

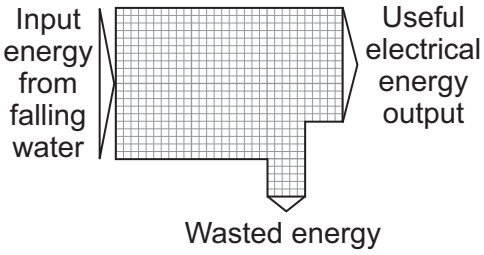
Sankey diagram **X**



Sankey diagram **Y**



Sankey diagram **Z**



Sankey diagram ☐

(1 mark)

Question 5 continues on the next page

Question 63 · continued

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

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

.....

.....

(1 mark)

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

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

Energy is wasted as heat and sound. ☐

Large areas of land are flooded. ☐

A constant flow of water is needed. ☐

(1 mark)

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

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

.....

(1 mark)

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

Why?

.....

.....

(1 mark)

4.1.1.1 Energy stores and systems

Question 63 · continued

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

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

.....

.....

(1 mark)

7

Turn over for the next question

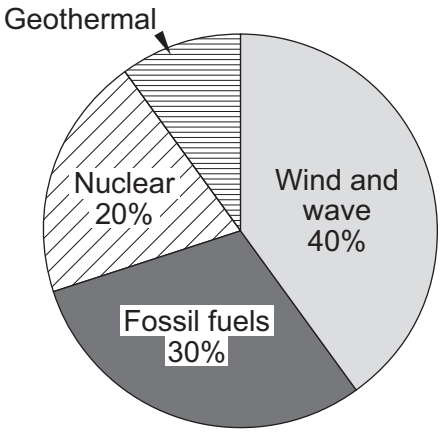
4.1.1.1 Energy stores and systems

Question 64

June 2011 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The pie chart shows how a country's electricity demands are met using different energy sources.



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

A 10 %

B 20 %

C 40 %

D 50 %

The percentage of electricity generated from non-renewable sources is . . . **1** . . . .

The percentage of electricity generated from geothermal sources is . . . **2** . . . .

The percentage of electricity generated using a source that produces radioactive waste is . . . **3** . . . .

The percentage of electricity generated using the kinetic energy of the source directly is . . . **4** . . . .

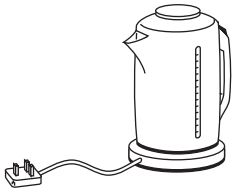
4.1.1.1 Energy stores and systems

Question 65

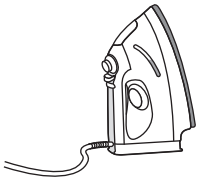
June 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

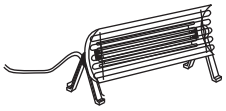
The diagrams show four electrical heating devices.



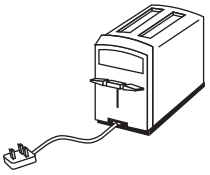
2 kW
Kettle



500 W
Iron



1 kW
Fire



0.5 kW
Toaster

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

1 the kettle and the iron

2 the iron and the toaster

3 the toaster and the fire

4 the fire and the kettle

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

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

How much energy does the kettle transfer?

1 1 kWh

2 4 kWh

3 1000 kWh

4 4000 kWh

4.1.1.1 Energy stores and systems

Question 65 · continued

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

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

Electricity costs 14 p per kWh

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

1 7 p

2 14 p

3 28 p

4 56 p

7D The kettle casing is made of plastic.

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

1 plastic is an electrical insulator.

2 plastic is a thermal insulator.

3 plastic has a higher density than metal.

4 plastic is cheaper than metal.

4.1.1.1 Energy stores and systems

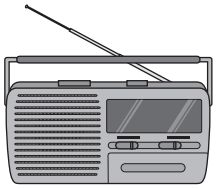
Question 66

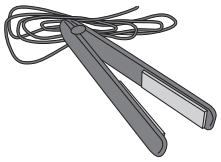
June 2011 | PHY1F | Original Q5 | Legacy

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


Kettle


Toaster


Radio


Hair straighteners

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

.....

Give a reason for your answer.

.....

.....

(2 marks)

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

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

Each appliance is switched on for 5 minutes.

Which appliance transforms the most energy?

.....

(1 mark)

4.1.1.1 Energy stores and systems

Question 66 · continued

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

Electricity costs 15 p per kilowatt-hour.

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

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

Show clearly how you work out your answer.

.....

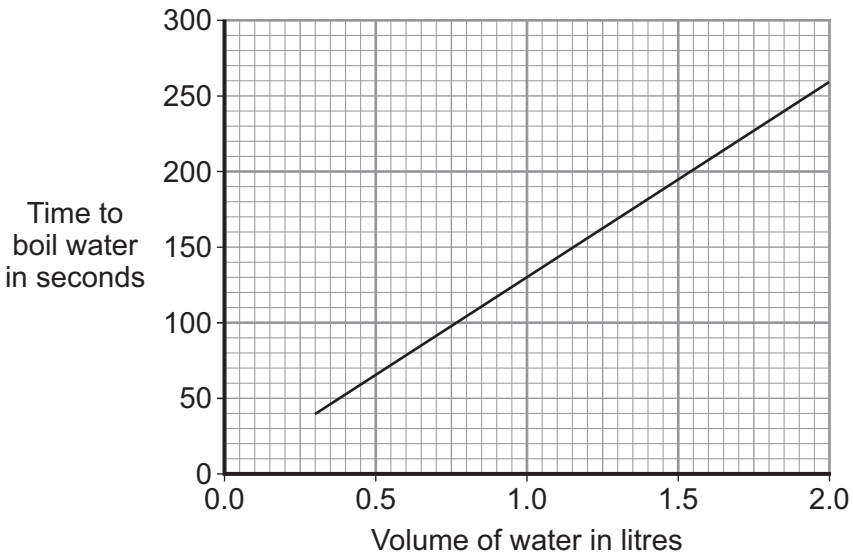
.....

Total cost = ... pence
(2 marks)

Question 5 continues on the next page

Question 66 · continued

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



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

Explain how the householder is wasting money.

.....

.....

.....

.....

.....

.....

(3 marks)

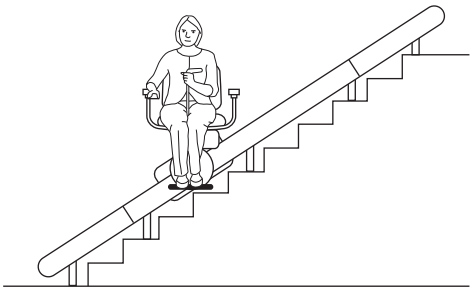
8

4.1.1.1 Energy stores and systems

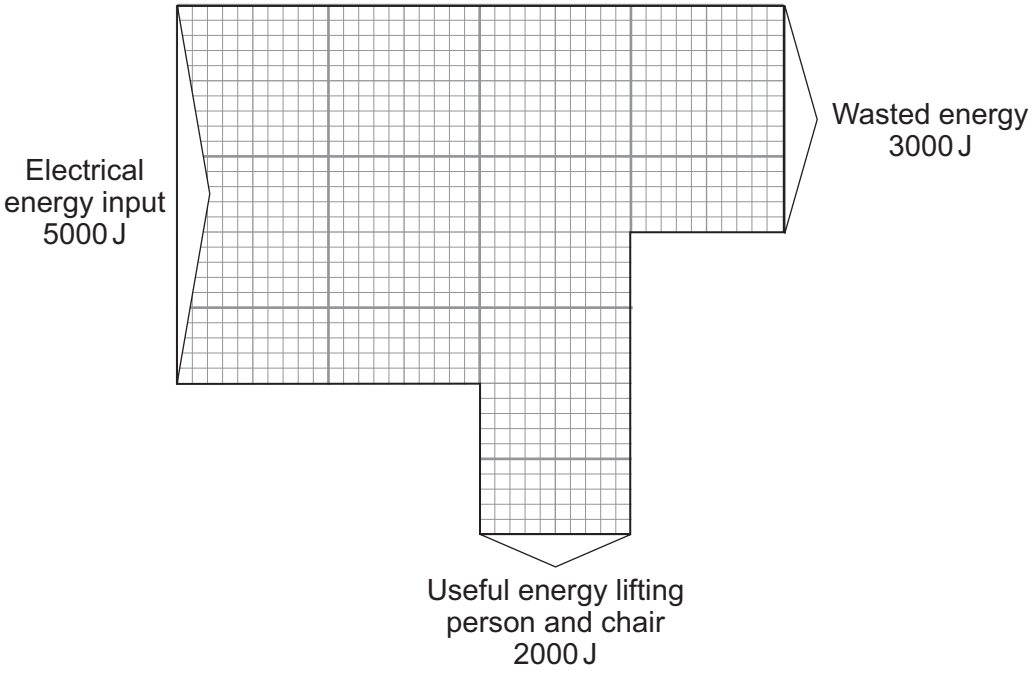
Question 67

June 2011 | PHY1F | Original Q6 | Legacy

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



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



6 (a) Complete the following sentence.

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

(1 mark)

4.1.1.1 Energy stores and systems

Question 67 · continued

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

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

Show clearly how you work out your answer.

.....

.....

Efficiency = ...

(2 marks)

3

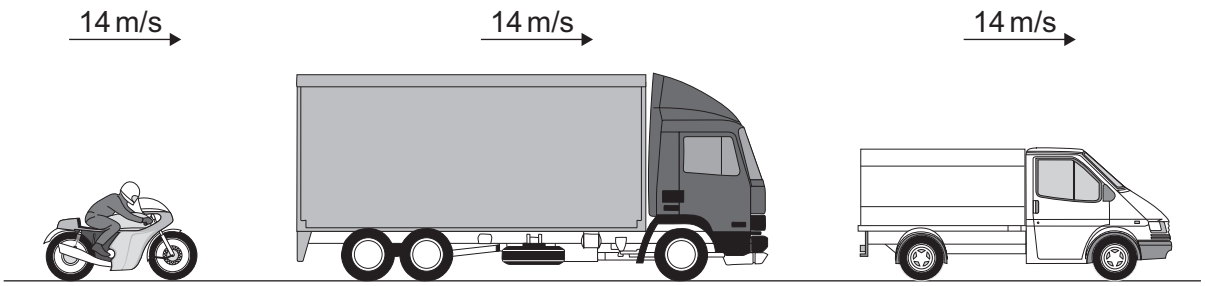
Turn over for the next question

4.1.1.1 Energy stores and systems

Question 68

June 2011 | PHY2F | Original Q3 | Legacy

3 (a) (i) The diagram shows three vehicles travelling along a straight road at 14 m/s.



Motorbike
Mass = 175 kg

Lorry
Mass = 10 000 kg

Van
Mass = 3000 kg

Which vehicle has the greatest momentum?

.....

Give the reason for your answer.

.....

.....

.....

(2 marks)

3 (a) (ii) Use the equation in the box to calculate the momentum of the motorbike when it travels at 14 m/s.

momentum = mass × velocity

Show clearly how you work out your answer.

.....

.....

Momentum = ...kg m/s

(2 marks)

4.1.1.1 Energy stores and systems

Question 68 · continued

3 (b) The motorbike follows the lorry for a short time, and then accelerates to overtake both the lorry and van.

3 (b) (i) Complete the following sentence by drawing a ring around the correct line in the box.

When the motorbike starts to overtake, the kinetic energy

of the motorbike

decreases.
stays the same.
increases.

(1 mark)

3 (b) (ii) Give a reason for your answer to part (b)(i).

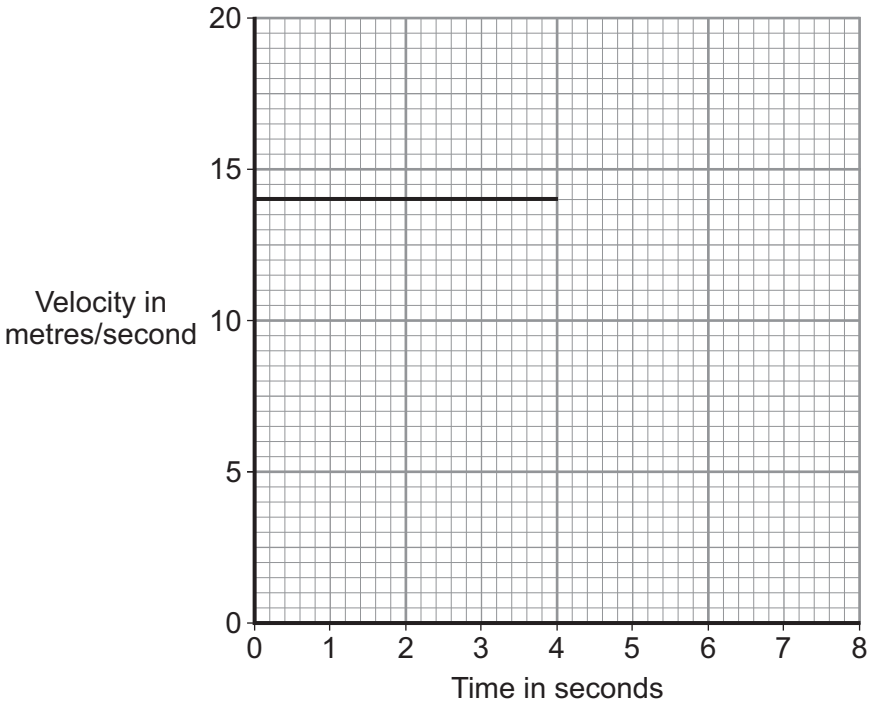
.....

.....

(1 mark)

3 (b) (iii) The graph shows the velocity of the motorbike up to the time when it starts to accelerate. The motorbike accelerates constantly, going from a speed of 14 m/s to a speed of 20 m/s in a time of 2 seconds. The motorbike then stays at 20 m/s.

Complete the graph to show the motion of the motorbike over the next 4 seconds.



(3 marks)

9

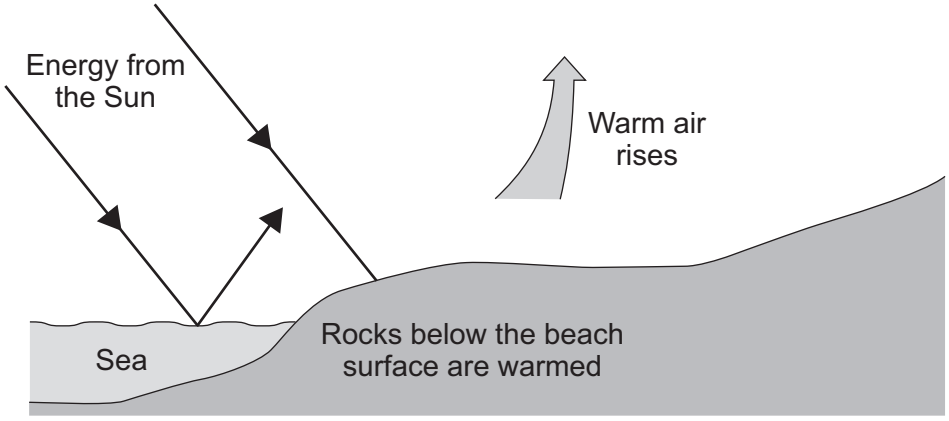
4.1.1.1 Energy stores and systems

Question 69

November 2011 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

The diagram shows some energy transfers at a warm sunny beach.



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

A conduction

B convection

C radiation

D reflection

Energy from the Sun is transferred through space by . . . **1** . . . .

Rocks below the beach surface are warmed up by . . . **2** . . . .

Warm air rises from the beach by . . . **3** . . . .

Energy, not absorbed by the sea, leaves the surface of the sea by . . . **4** . . . .

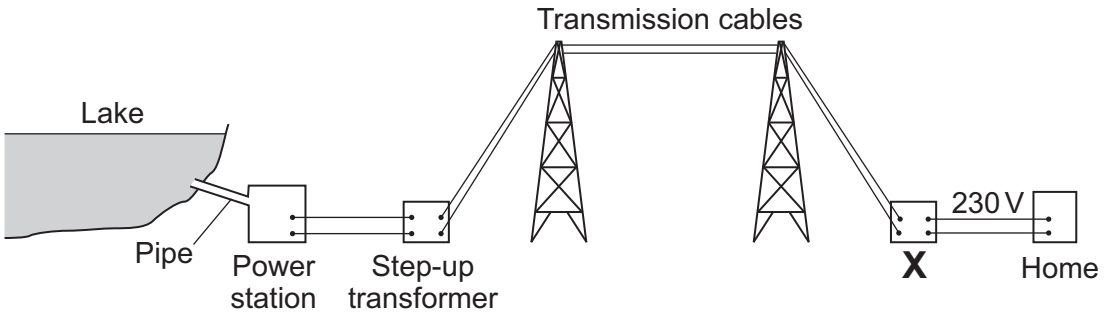
4.1.1.1 Energy stores and systems

Question 70

November 2011 | PHY1AP | Original Q7 | Legacy

QUESTION SEVEN

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



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

1 current.

2 energy.

3 power.

4 voltage.

7B Using a step-up transformer . . .

1 makes the transmission cables warmer.

2 makes the electricity move faster.

3 reduces the energy loss in the transmission cables.

4 reduces the risk of electrocution.

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

Device **X** is a . . .

1 boiler.

2 generator.

3 step-down transformer.

4 thermal circuit breaker.

4.1.1.1 Energy stores and systems

Question 70 · continued

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

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

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

The efficiency of the power station is . . .

1 0.2

2 0.4

3 0.6

4 1.7

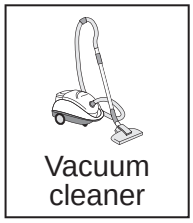
Turn over for the next question

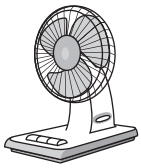
4.1.1.1 Energy stores and systems

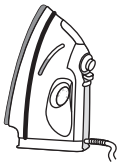
Question 71

June 2012 | PH1FP | Original Q1 | Legacy

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

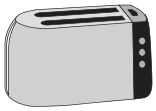

Vacuum cleaner


Fan


Iron


Drill


Washing machine


Toaster


Television

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

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

Draw a ring around each correct appliance.

(3 marks)

4.1.1.1 Energy stores and systems

Question 71 · continued

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

Tick (✓) **two** boxes.

Appliances only transfer part of the energy usefully. ☐

The energy transferred by appliances will be destroyed. ☐

The energy transferred by appliances makes the surroundings warmer. ☐

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

(2 marks)

5

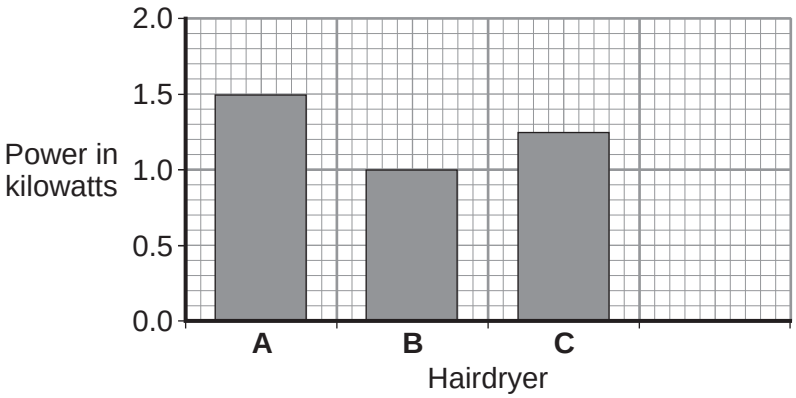
Turn over for the next question

4.1.1.1 Energy stores and systems

Question 72

June 2012 | PH1FP | Original Q4 | Legacy

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



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

Write the correct answer in the box. ☐

(1 mark)

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

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

(1 mark)

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

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

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Energy transferred = ... kWh

(2 marks)

4.1.1.1 Energy stores and systems

Question 72 · continued

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

Calculate the cost of using the hairdryer for 2 hours.

Show clearly how you work out your answer.

.....

.....

Cost = ... pence
(2 marks)

6

Turn over for the next question

4.1.1.1 Energy stores and systems

Question 73

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)

4.1.1.1 Energy stores and systems

Question 73 · continued

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

4.1.1.1 Energy stores and systems

Question 73 · 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

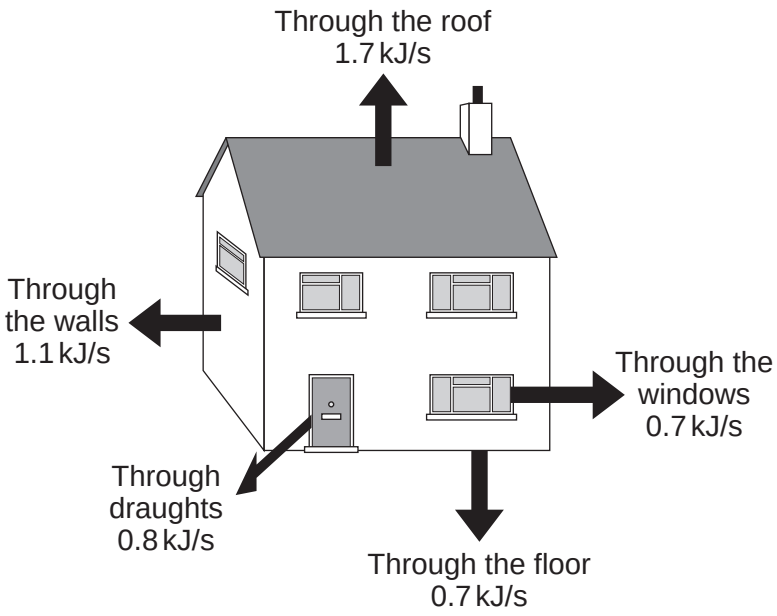
4.1.1.1 Energy stores and systems

Question 74

January 2013 | PH1FP | Original Q9 | Legacy

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

Diagram 1



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

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

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

.....

Power of the heating system = ... kW

(1 mark)

4.1.1.1 Energy stores and systems

Question 74 · continued

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

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

Use the correct equation from the Physics Equations Sheet.

.....

.....

Energy transferred each day = ... kWh

(2 marks)

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

Calculate the cost of heating the house for one day.

.....

Cost = ...

(1 mark)

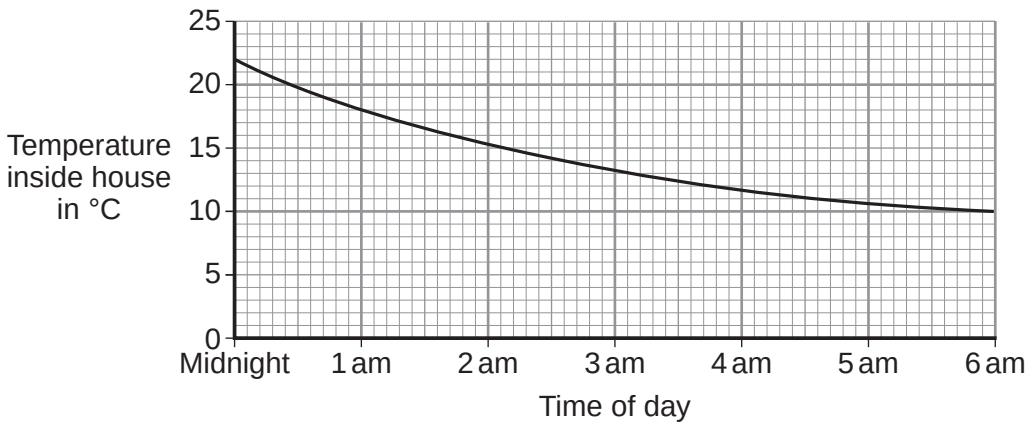
Question 9 continues on the next page

4.1.1.1 Energy stores and systems

Question 74 · continued

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

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



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

Between midnight and 6 am the rate of energy transfer from

the house

decreases.
decreases then stays constant.
increases.

Give the reason for your answer.

.....

.....

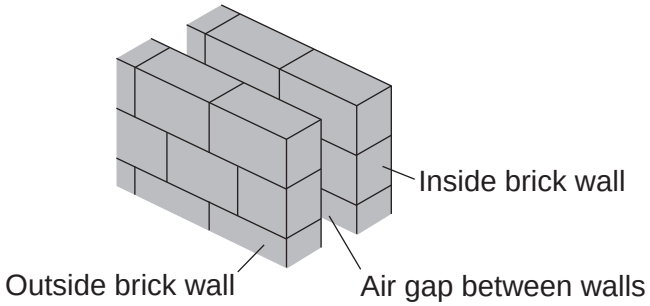
(2 marks)

4.1.1.1 Energy stores and systems

Question 74 · continued

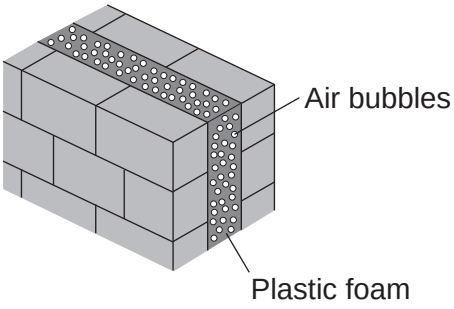
9 (b) **Diagram 2** shows how the walls of the house are constructed.
Diagram 3 shows how the insulation of the house could be improved by filling the air gap between the two brick walls with plastic foam.

Diagram 2



U-value of the wall = 0.7

Diagram 3



U-value of the wall = 0.3

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

Explain why.

.....

.....

.....

.....

(2 marks)

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

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

.....

.....

(1 mark)

Question 9 continues on the next page

4.1.1.1 Energy stores and systems

Question 74 · continued

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

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

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

.....

.....

.....

.....

.....

(2 marks)

11

4.1.1.1 Energy stores and systems

Question 75

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

230 V	**2760 W**
50 Hz	

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

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

.....

(1 mark)

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

.....

(1 mark)

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

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

Use the correct equation from the Physics Equations Sheet.

Choose the unit from the list below.

amps **volts** **watts**

.....

.....

.....

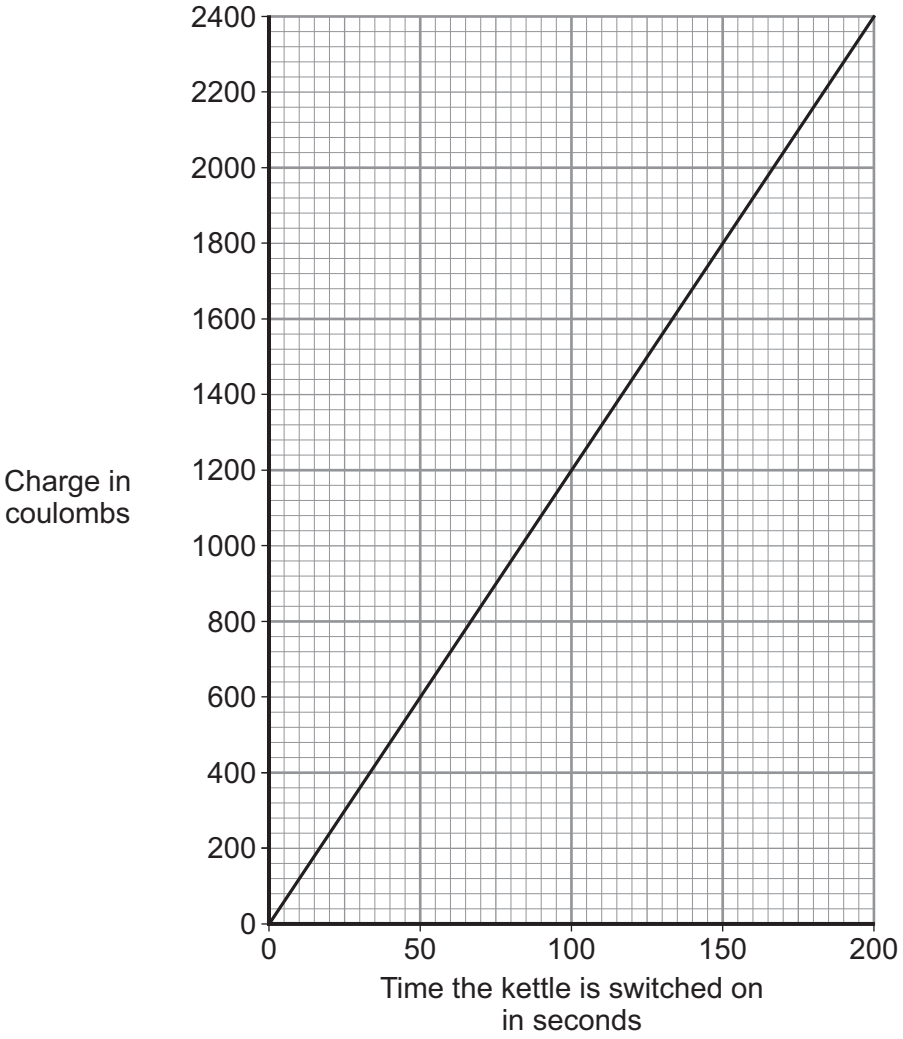
Current = ...

(3 marks)

4.1.1.1 Energy stores and systems

Question 75 · continued

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



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

.....

.....

(2 marks)

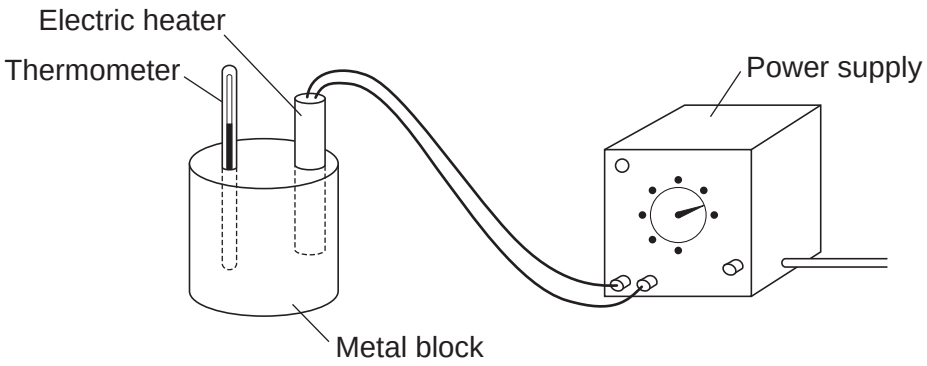
7

4.1.1.1 Energy stores and systems

Question 76

June 2013 | PH1FP | Original Q6 | Legacy

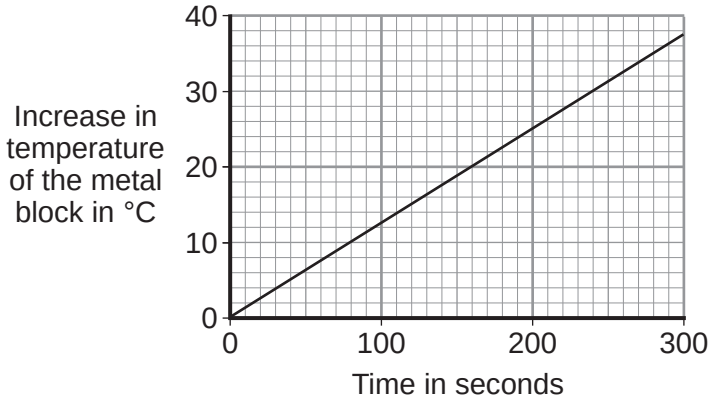
6 (a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.



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

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

Graph A



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

.....

.....

.....

.....

(2 marks)

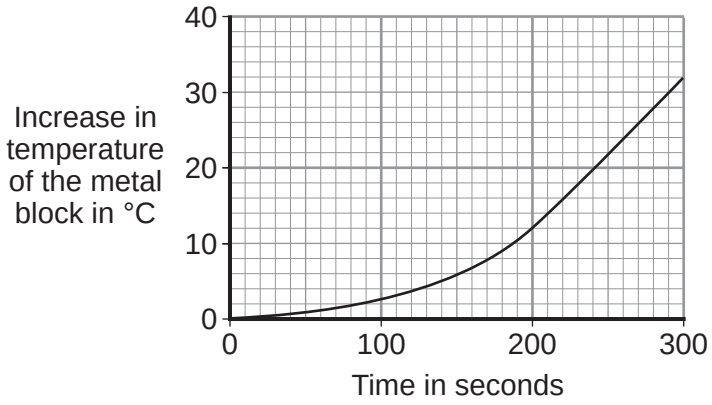
4.1.1.1 Energy stores and systems

Question 76 · continued

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

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

Graph B



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

Suggest **one** reason why.

.....

.....

(1 mark)

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

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

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Energy transferred = ... J

(2 marks)

Question 6 continues on the next page

Question 76 · continued

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

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

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

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

Draw a ring around the correct answer.

aluminium **iron** **lead**

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

.....

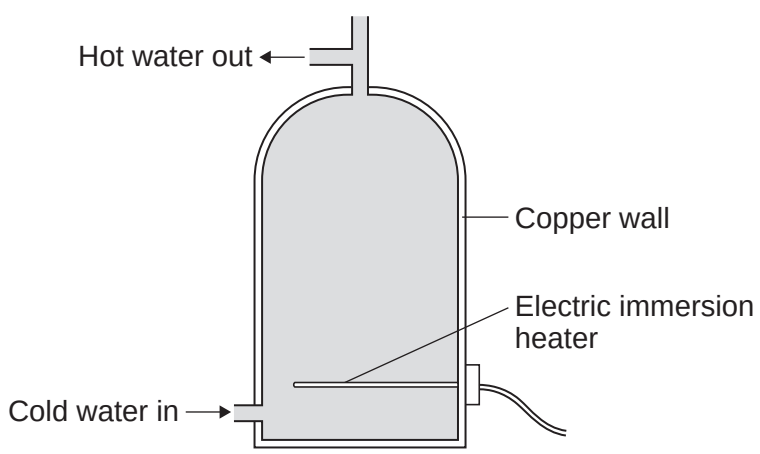
.....

.....

.....

(2 marks)

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



4.1.1.1 Energy stores and systems

Question 76 · continued

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

Energy is transferred through the water by

conduction.
convection.
evaporation.

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

conduction.
convection.
evaporation.

(2 marks)

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

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

Calculate the pay-back time for the insulating jacket.

.....

.....

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

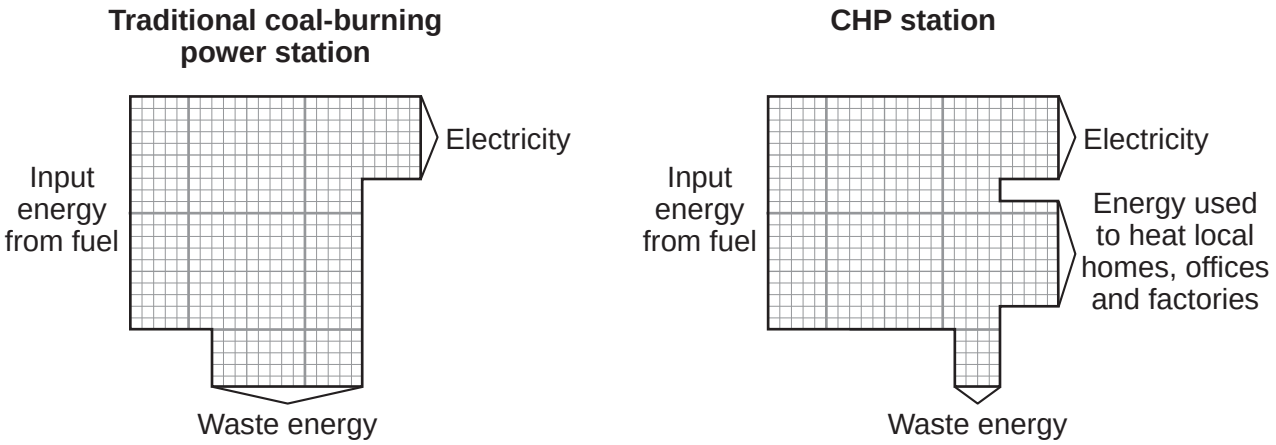
11

4.1.1.1 Energy stores and systems

Question 77

June 2013 | PH1FP | Original Q7 | Legacy

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



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

.....

.....

(1 mark)

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

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Efficiency = ...

(2 marks)

4.1.1.1 Energy stores and systems

Question 77 · continued

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

.....

.....

.....

.....

(2 marks)

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

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

Tick (✓) **one** box.

A system of cables and pylons. ☐

A system of cables and transformers. ☐

A system of cables, transformers and power stations. ☐

(1 mark)

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

Give **one** reason why.

.....

.....

(1 mark)

7

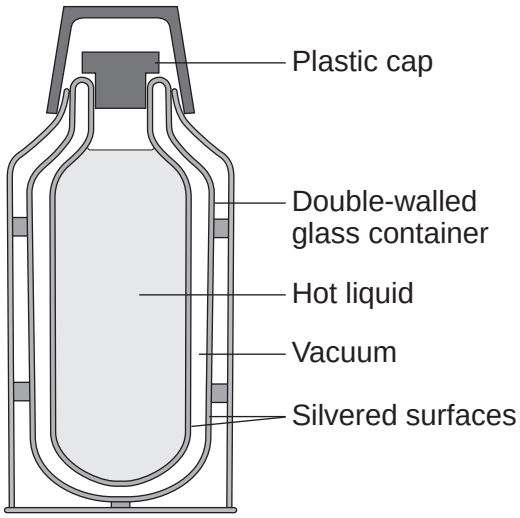
4.1.1.1 Energy stores and systems

Question 78

June 2013 | PH1FP | Original Q9 | Legacy

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

The diagram shows the structure of a vacuum flask.



A vacuum flask is designed to reduce the rate of energy transfer by heating processes.

Describe how the design of a vacuum flask keeps the liquid inside hot.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

4.1.1.1 Energy stores and systems

Question 78 · continued

.....

.....

.....

.....

(6 marks)

9 (b) Arctic foxes live in a very cold environment.



Arctic foxes have small ears.

How does the size of the ears help to keep the fox warm in a cold environment?

.....

.....

.....

.....

.....

(2 marks)

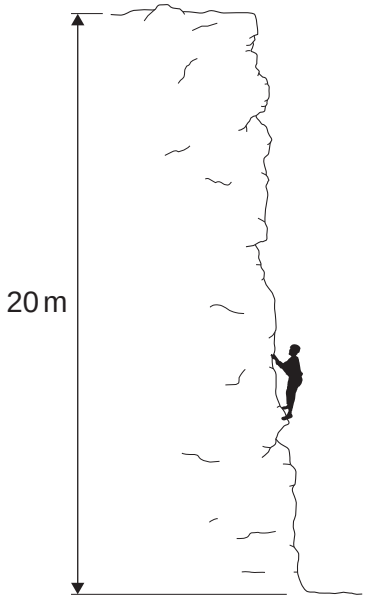
8

4.1.1.1 Energy stores and systems

Question 79

June 2013 | PH2FP | Original Q4 | Legacy

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



4 (a) Complete the sentence.

When the climber moves up the cliff, the climber

gains gravitational ..... energy.

(1 mark)

4 (b) The climber weighs 660 N.

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

Use the correct equation from the Physics Equations Sheet.

.....

.....

Work done = ... J

(2 marks)

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

Calculate the power of the climber during the climb.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Power = ... W

(2 marks)

5

4.1.1.1 Energy stores and systems

Question 80

June 2014 | PH1FP | Original Q5 | Legacy

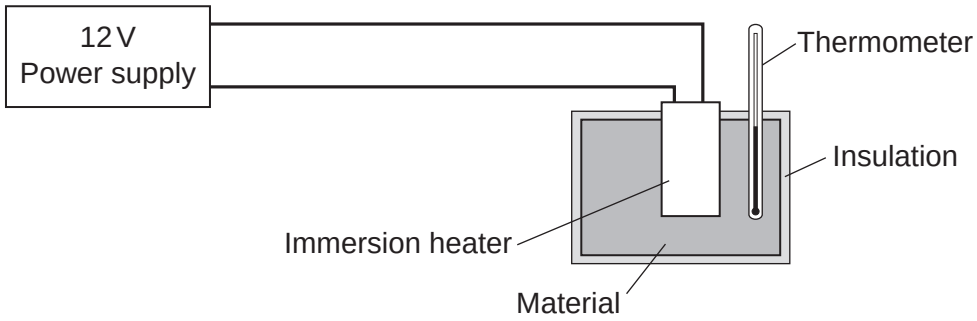
5 A student used the apparatus in **Figure 5** to compare the energy needed to heat blocks of different materials.

Each block had the same mass.

Each block had holes for the thermometer and the immersion heater.

Each block had a starting temperature of 20 °C.

Figure 5



The student measured the time taken to increase the temperature of each material by 5 °C.

5 (a) (i) State **two** variables the student controlled.

[2 marks]

1 .....

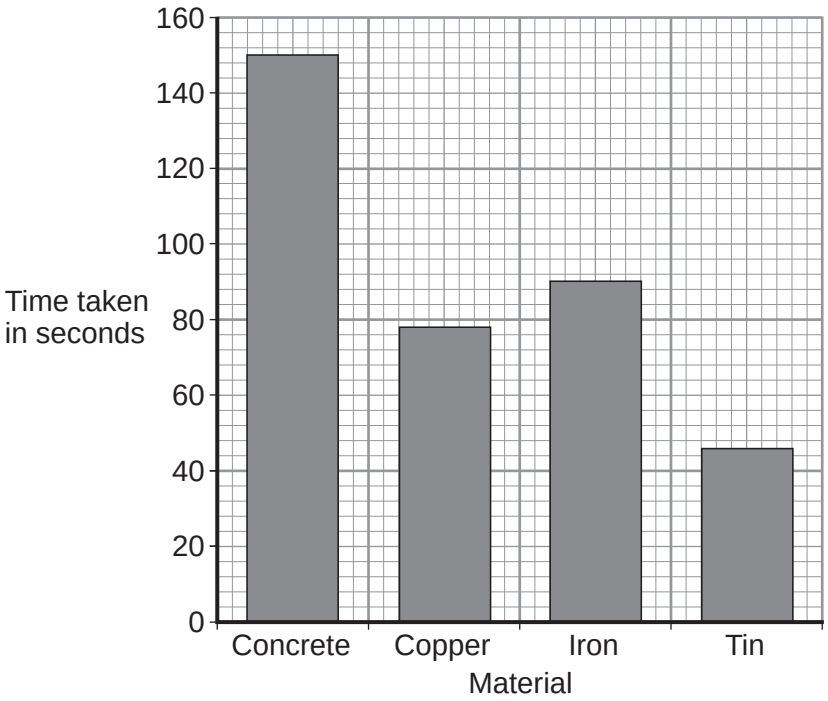
2 .....

4.1.1.1 Energy stores and systems

Question 80 · continued

Figure 6 shows the student's results.

Figure 6



5 (a) (ii) Why was a bar chart drawn rather than a line graph?

[1 mark]

.....

.....

5 (a) (iii) Which material was supplied with the most energy?

.....

Give the reason for your answer.

[2 marks]

.....

.....

Question 5 continues on the next page

4.1.1.1 Energy stores and systems

Question 80 · continued

5 (a) (iv) The iron block had a mass of 2 kg.

Calculate the energy transferred by the heater to increase the temperature of the iron block by 5 °C.

Use the correct equation from the Physics Equations Sheet.

The specific heat capacity of iron is 450 J/kg °C.

[2 marks]

.....

.....

.....

Energy transferred = ... J

4.1.1.1 Energy stores and systems

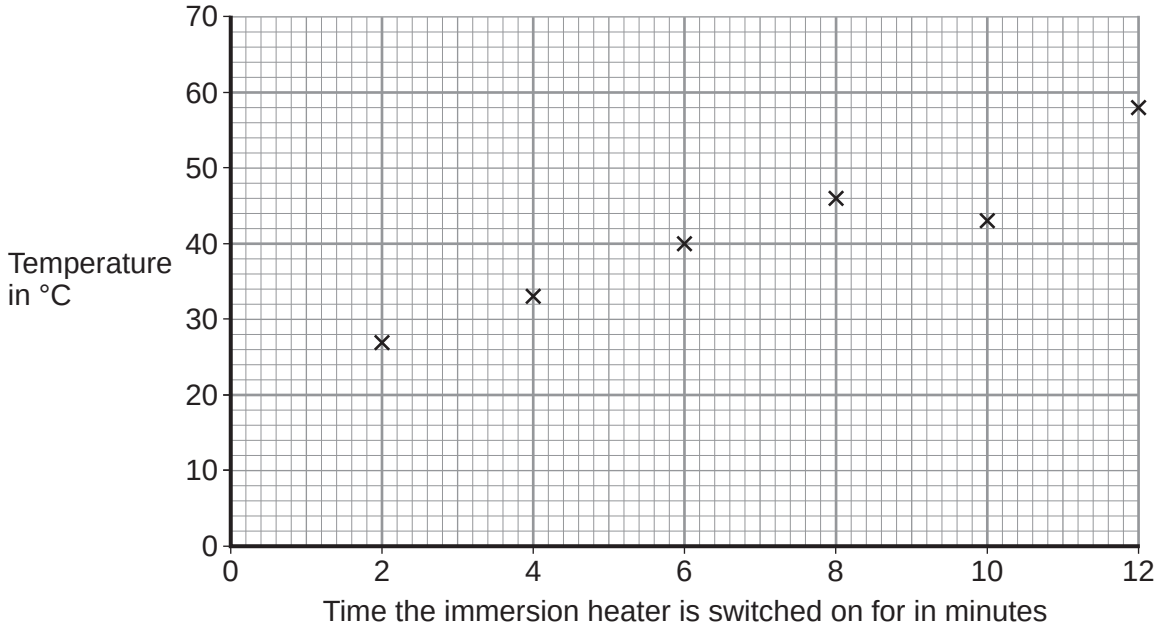
Question 80 · continued

5 (b) The student used the same apparatus to heat a 1 kg block of aluminium.

He recorded the temperature of the block as it was heated from room temperature.

The results are shown in **Figure 7.**

Figure 7



5 (b) (i) One of the student's results is anomalous.

Draw a ring around the anomalous result.

[1 mark]

5 (b) (ii) Draw the line of best fit for the points plotted in **Figure 7**.

[1 mark]

5 (b) (iii) What was the temperature of the room?

[1 mark]

Temperature = ... °C

5 (b) (iv) What was the interval of the time values used by the student?

[1 mark]

Interval = ... minutes

11

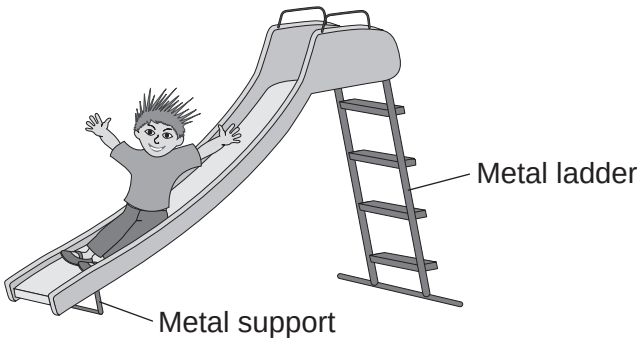
4.1.1.1 Energy stores and systems

Question 81

June 2014 | PH2FP | Original Q7 | Legacy

7 **Figure 12** shows a slide in a children's playground.

Figure 12



7 (a) A child of mass 18 kilograms goes down the slide.

The vertical distance from the top to the bottom of the slide is 2.5 metres.

Calculate the decrease in gravitational potential energy of the child sliding from the top to the bottom of the slide.

Gravitational field strength = 10 N/kg

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Decrease in gravitational potential energy = ... J

4.1.1.1 Energy stores and systems

Question 81 · continued

7 (b) The slide is made of plastic.

7 (b) (i) The child becomes electrically charged when he goes down the slide.

Explain why.

[2 marks]

.....

.....

.....

.....

7 (b) (ii) Going down the slide causes the child's hair to stand on end.

What conclusion about the electrical charge on the child's hair can be made from this observation?

[2 marks]

.....

.....

Give a reason for your answer.

.....

.....

7 (b) (iii) Why would the child **not** become electrically charged if the slide was made from metal?

[1 mark]

.....

.....

7

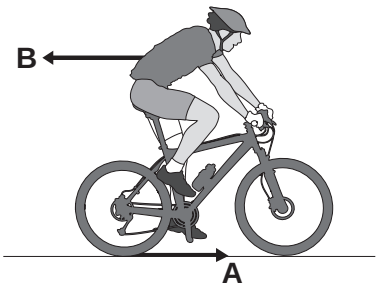
4.1.1.1 Energy stores and systems

Question 82

June 2014 | PH2FP | Original Q8 | Legacy

8 (a) **Figure 13** shows the horizontal forces acting on a moving bicycle and cyclist.

Figure 13



8 (a) (i) What causes force **A**?

Draw a ring around the correct answer.

[1 mark]

friction **gravity** **weight**

8 (a) (ii) What causes force **B**?

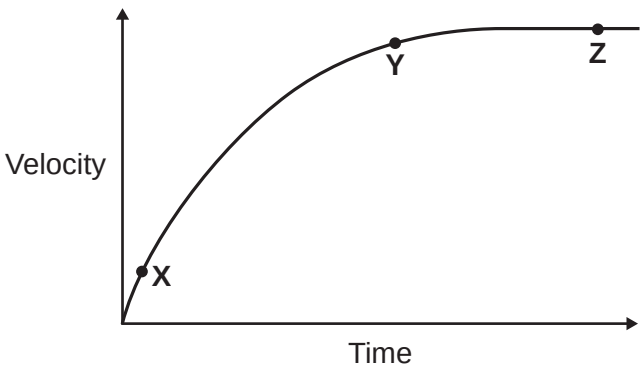
[1 mark]

.....

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

Figure 14 shows how the velocity of the cyclist changes during the first part of a journey along a straight and level road. During this part of the journey the force applied by the cyclist to the bicycle pedals is constant.

Figure 14



4.1.1.1 Energy stores and systems

Question 82 · continued

Describe how **and** explain, in terms of the forces **A** and **B**, why the velocity of the cyclist changes:

- between the points **X** and **Y**
- and between the points **Y** and **Z**, marked on the graph in **Figure 14**.

[6 marks]

Extra space .....

Question 8 continues on the next page

4.1.1.1 Energy stores and systems

Question 82 · continued

8 (b) (i) The cyclist used the brakes to slow down and stop the bicycle.

A constant braking force of 140 N stopped the bicycle in a distance of 24 m.

Calculate the work done by the braking force to stop the bicycle. Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

.....

.....

.....

Work done = ...

8 (b) (ii) Complete the following sentences.

[2 marks]

When the brakes are used, the bicycle slows down. The kinetic energy of the bicycle ..... .

At the same time, the ..... of the brakes increases.

13

4.1.1.1 Energy stores and systems

Question 83

June 2015 | PH1FP | Original Q2 | Legacy

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

Figure 3



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

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

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

[3 marks]

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

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

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

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

Question 2 continues on the next page

4.1.1.1 Energy stores and systems

Question 83 · continued

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

Calculate the efficiency of the leaf blower.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

.....

Efficiency = ...

5

4.1.1.1 Energy stores and systems

Question 84

June 2015 | PH1FP | Original Q3 | Legacy

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

Figure 4



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

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

[1 mark]

Tick (✓) **one** box.

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

Question 3 continues on the next page

Question 84 · continued

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

[1 mark]

Tick (✓) **one** box.

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

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

Figure 5



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

[1 mark]

conductors	insulators	radiators

The oven gloves are good ..... .

4.1.1.1 Energy stores and systems

Question 84 · continued

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

[1 mark]

Tick (✓) **one** box.

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

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

[2 marks]

1 .....

2 .....

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

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

[1 mark]

.....

.....

7

4.1.1.1 Energy stores and systems

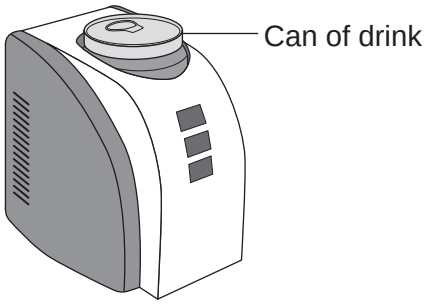
Question 85

June 2015 | PH1FP | Original Q4 | Legacy

4 A 'can-chiller' is used to make a can of drink colder.

Figure 6 shows a can-chiller.

Figure 6



4 (a) The can-chiller decreases the temperature of the liquid in the can by 15 °C.
The mass of liquid is 0.33 kg.
The specific heat capacity of the liquid is 4200 J/kg °C.

Calculate the energy transferred from the liquid as it cools.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Energy = ... J

4 (b) Complete the following sentence.

[1 mark]

The specific heat capacity of a substance is the amount of energy required to change the ..... of one kilogram of the substance by one degree Celsius.

4.1.1.1 Energy stores and systems

Question 85 · continued

4 (c) To calculate the specific heat capacity of a material, the mass of the material needs to be measured.

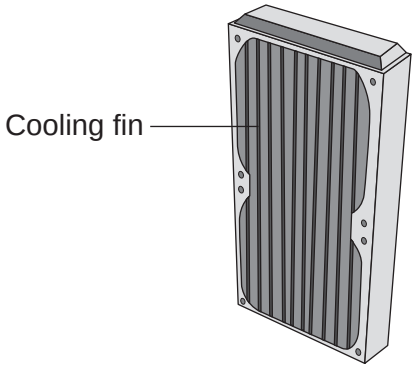
State the name of a measuring instrument used to measure mass.

[1 mark]

.....

4 (d) The back of the can-chiller has cooling fins, as shown in **Figure 7**.

Figure 7



The cooling fins increase the rate of energy transfer from the can-chiller to the surroundings.

Complete the following sentences.

[2 marks]

The cooling fins are a ..... colour because that makes them good emitters of infrared radiation.

The large surface area of the cooling fins allows the air around the can-chiller to gain energy quickly and rise, transferring energy by ..... .

Question 4 continues on the next page

4.1.1.1 Energy stores and systems

Question 85 · continued

4 (e) (i) The energy input to the can-chiller is the same as the energy output. This shows that energy is conserved.

Complete the following sentence.

[1 mark]

Energy can be transferred usefully, stored or dissipated, but cannot be

..... or destroyed.

4 (e) (ii) The temperature of the can of drink decreases while it is in the can-chiller.

What happens to the temperature of the air around the cooling fins?

[1 mark]

.....

8

4.1.1.1 Energy stores and systems

Question 86

June 2015 | PH2FP | Original Q3 | Legacy

3 (a) When a force is applied to a spring, the spring extends by 0.12 m. The spring has a spring constant of 25 N/m.

Calculate the force applied to the spring.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

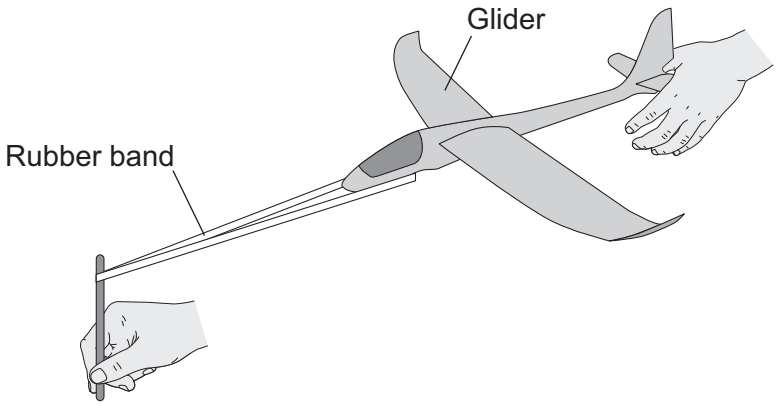
.....

.....

Force = ... N

3 (b) **Figure 2** shows a toy glider. To launch the glider into the air, the rubber band and glider are pulled back and then the glider is released.

Figure 2



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

[2 marks]

chemical	**elastic potential**	**kinetic**	**thermal**

When the glider is released, the ..... energy stored in the rubber band decreases and the glider gains ..... energy.

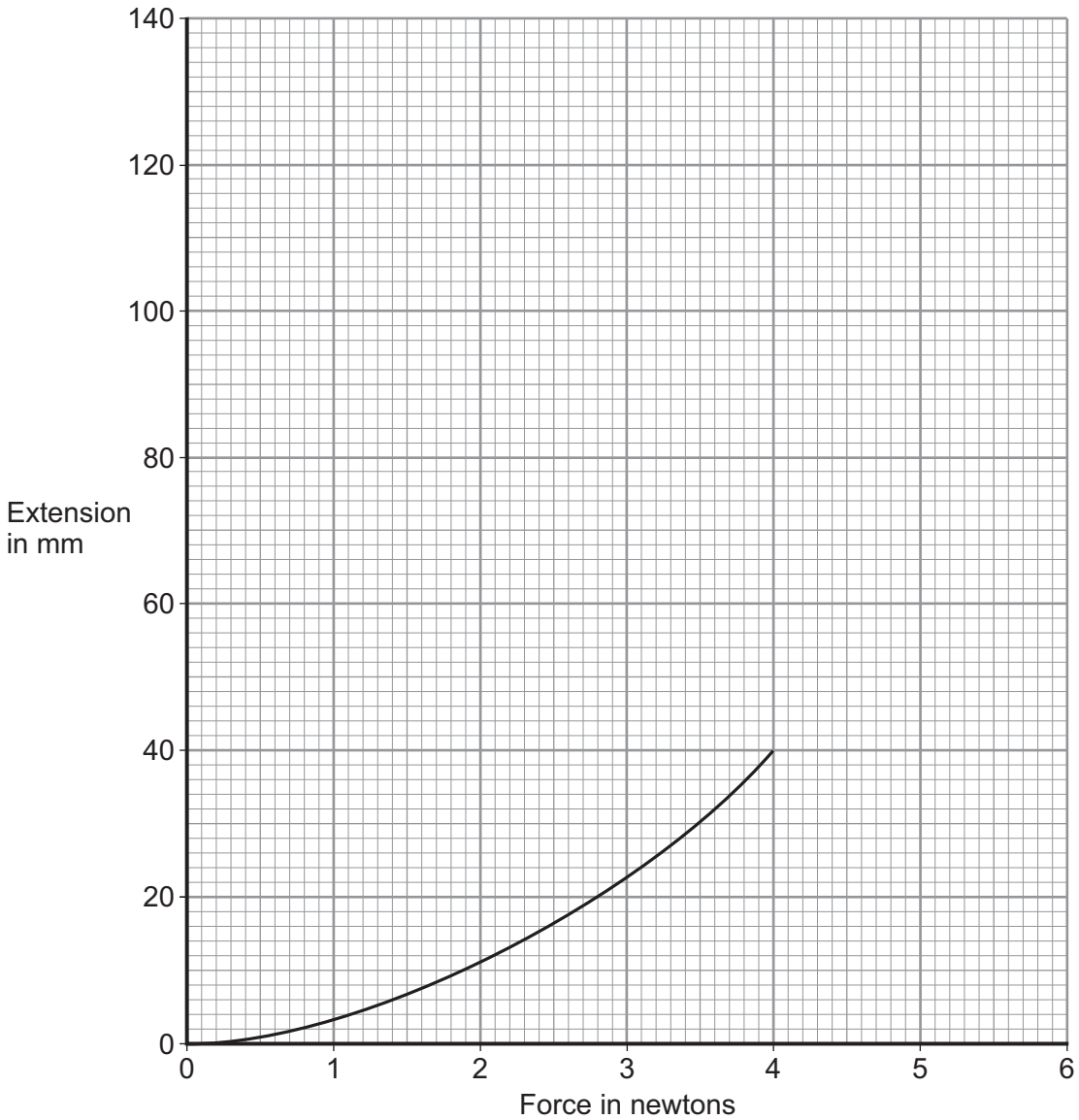
Question 3 continues on the next page

4.1.1.1 Energy stores and systems

Question 86 · continued

3 (b) (ii) **Figure 3** shows how the extension of the rubber band varies with the force applied to the rubber band.

Figure 3



What can you conclude, from **Figure 3**, would happen to the extension of the rubber band if the force applied to the rubber band was increased to 6 N?

The rubber band does **not** break.

[2 marks]

.....

.....

.....

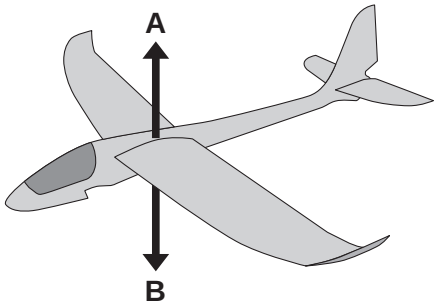
.....

4.1.1.1 Energy stores and systems

Question 86 · continued

3 (c) **Figure 4** shows the vertical forces, **A** and **B**, acting on the glider when it is flying.

Figure 4



3 (c) (i) What name is given to the force labelled **B**?

[1 mark]

Draw a ring around the correct answer.

drag **friction** **weight**

3 (c) (ii) Which **one** of the following describes the downward speed of the glider when force **B** is greater than force **A**?

[1 mark]

Tick (✓) **one** box.

Downward speed increases ☐

Downward speed is constant ☐

Downward speed decreases ☐

8

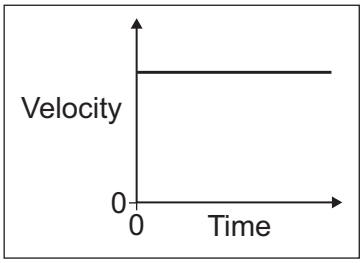
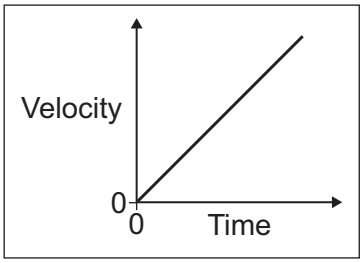
4.1.1.1 Energy stores and systems

Question 87

June 2015 | PH2FP | Original Q5 | Legacy

5 (a) Draw **one** line from each velocity–time graph to the statement describing the motion shown by the graph.

[2 marks]

Velocity–time graph	Motion shown by graph
	Constant acceleration
	Not moving
	Constant deceleration
	Constant velocity

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

[1 mark]

energy	**momentum**	**speed**

The velocity of an object includes both the ..... of the object and the direction the object is moving.

Question 5 continues on the next page

4.1.1.1 Energy stores and systems

Question 87 · continued

5 (c) At the start of a race, a horse accelerates from a velocity of 0 m/s to a velocity of 9 m/s in 4 seconds.

5 (c) (i) Calculate the acceleration of the horse.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

Acceleration = ... m/s^2

5 (c) (ii) When the horse accelerates, what, if anything, happens to the air resistance acting against the horse?

[1 mark]

Tick (✓) **one** box.

The air resistance decreases. ☐

The air resistance is constant. ☐

The air resistance increases. ☐

5 (d) A horse and a pony walk across a field at the same constant speed.

The horse has 4000 joules of kinetic energy.

The pony is **half** the mass of the horse.

What is the kinetic energy of the pony?

[2 marks]

Draw a ring around the correct answer.

2000 J **4000 J** **8000 J**

Give a reason for your answer.

.....

.....

8

4.1.1.1 Energy stores and systems

Question 88

June 2016 | PH1FP | Original Q1 | Legacy

1 Different energy sources are used to generate electricity.

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

[3 marks]

biofuel	coal	geothermal	nuclear	waves

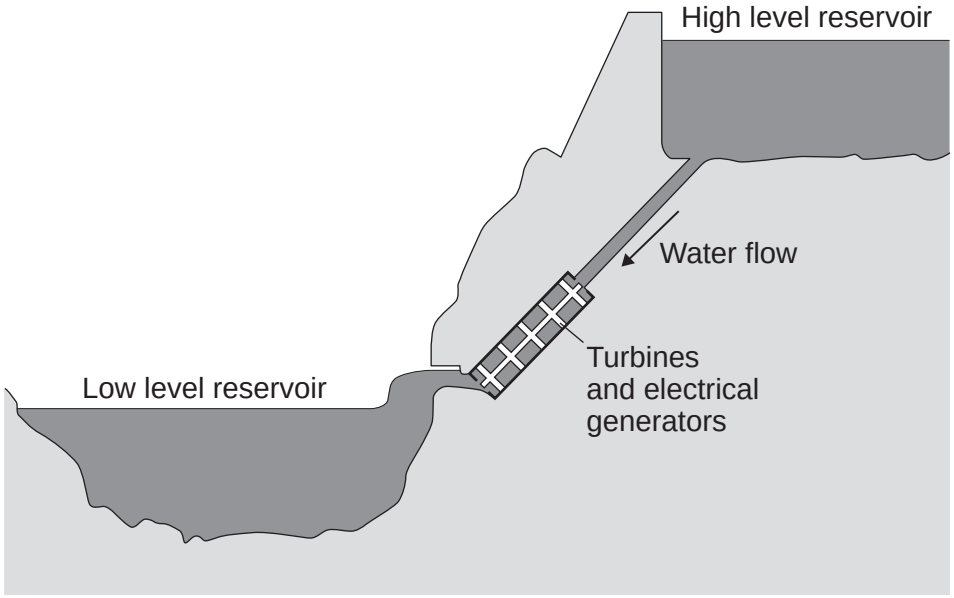
Table 1

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

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

Figure 1 shows a pumped storage power station.

Figure 1



4.1.1.1 Energy stores and systems

Question 88 · continued

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

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

[3 marks]

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

The water in the high level reservoir stores _____ energy.

The flowing water has _____ energy.

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

The generator produces some _____, this is wasted energy.

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

The useful power output is 540 MW.

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

[2 marks]

_____

_____

_____

Efficiency = _____

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

[1 mark]

_____

Power = _____ MW

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

[1 mark]

_____

10

4.1.1.1 Energy stores and systems

Question 89

June 2016 | PH1FP | Original Q2 | Legacy

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

Figure 2



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

Calculate the energy transferred to the surroundings from the water.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Energy = _____ joules

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

[1 mark]

Tick (✓) **one** box.

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

4.1.1.1 Energy stores and systems

Question 89 · continued

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

The energy costs 15 pence per kWh.

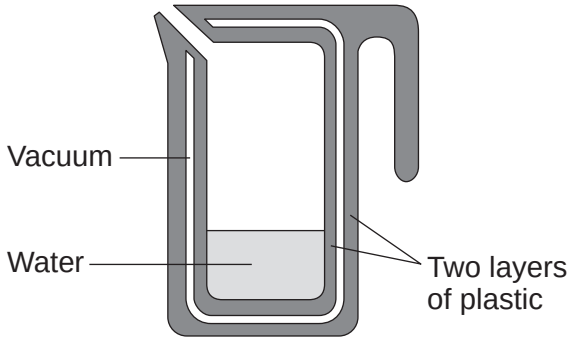
Calculate the cost of using the kettle for one day.

[2 marks]

Cost = _____ pence

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

Figure 3



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

[1 mark]

Tick (✓) **one** box.

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

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

[1 mark]

7

4.1.1.1 Energy stores and systems

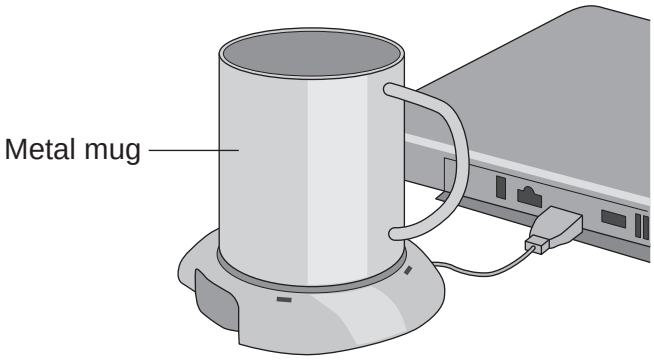
Question 90

June 2016 | PH1FP | Original Q5 | Legacy

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

Figure 9 shows a metal mug on the heater.

Figure 9



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

[1 mark]

Tick (✓) **one** box.

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

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

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

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ joules

4.1.1.1 Energy stores and systems

Question 90 · continued

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

Complete the sentences to explain how.

[3 marks]

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

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

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

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

[3 marks]

Table 2

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

9

4.1.1.1 Energy stores and systems

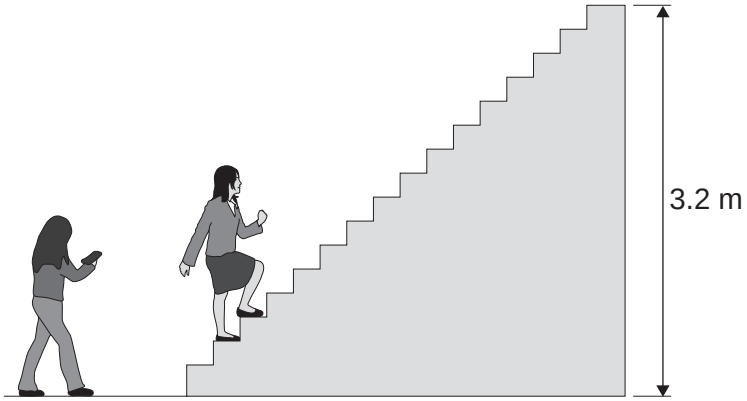
Question 91

June 2016 | PH2FP | Original Q6 | Legacy

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

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

Figure 9



6 (a) Complete the following sentence.

[1 mark]

To run up the stairs the student must do work against

the force of _____ .

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

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

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Power = _____ W

4.1.1.1 Energy stores and systems

Question 91 · continued

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

[1 mark]

Tick (✓) **one** box.

much more than 2240 J ☐

2240 J ☐

much less than 2240 J ☐

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

Table 1

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

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

What variable did the students keep constant?

[1 mark]

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

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

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

[1 mark]

6

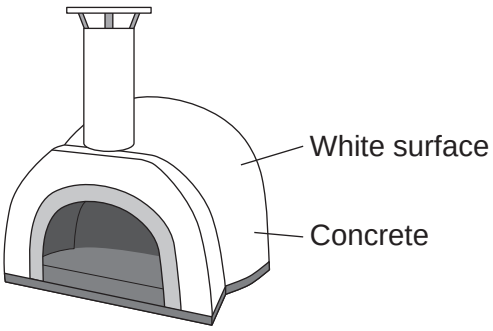
4.1.1.1 Energy stores and systems

Question 92

June 2017 | PH1FP | Original Q1 | Legacy

1 **Figure 1** shows an outdoor pizza oven.

Figure 1



1 (a) The pizza oven is designed to stay hot for a long time.

Use the correct answer from the box to complete each sentence. Each answer may be used once, more than once or not at all.

[2 marks]

conduction	**convection**	**radiation**

The white surface reduces energy transfer by _____ .

The concrete has a low U-value which means energy is transferred

slowly by _____ .

1 (b) The pizza oven is heated by burning wood.

What type of fuel is wood?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
biofuel	
fossil fuel	
non-renewable fuel	

4.1.1.1 Energy stores and systems

Question 92 · continued

1 (c) The concrete used to make the pizza oven has a specific heat capacity of 880 J/kg °C
The mass of the concrete is 250 kg

Calculate the energy transferred to the concrete to increase its temperature by 380 °C

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy transferred = _____ J

5

Turn over for the next question

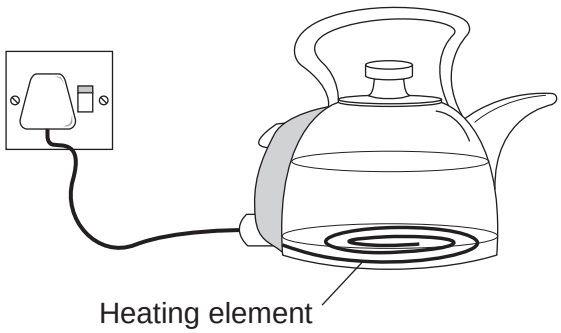
4.1.1.1 Energy stores and systems

Question 93

June 2017 | PH1FP | Original Q5 | Legacy

5 **Figure 8** shows an electric kettle being used to heat some water.

Figure 8



5 (a) Complete the following sentences to describe how the water in the kettle is warmed by convection.

[4 marks]

When the kettle is switched on, the temperature of the water near the heating element increases.

As the temperature of the water increases, the water _____ and

becomes less _____ .

The heated water _____ towards the top of the kettle.

The movement of the water sets up a convection _____ .

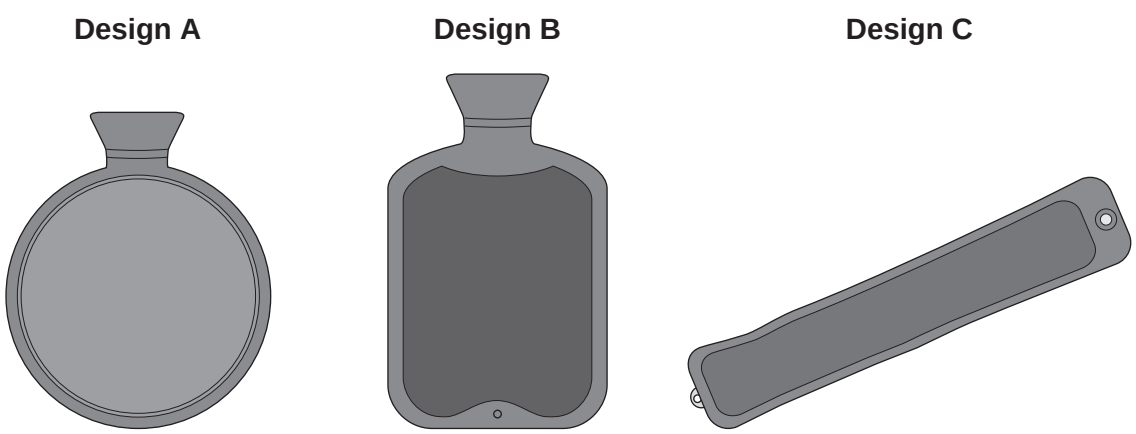
4.1.1.1 Energy stores and systems

Question 93 · continued

5 (b) Three different designs of hot water bottle are each filled with water at 90 °C from the kettle.

Figure 9 shows the three different designs. Each hot water bottle is made from a different material but holds the same amount of water.

Figure 9



State **two** factors that would affect the time it would take the hot water bottles to cool down to room temperature.

[2 marks]

1 _____

2 _____

6

4.1.1.1 Energy stores and systems

Question 94

June 2017 | PH2FP | Original Q2 | Legacy

2 A car driver sees the traffic lights ahead change to red. The driver applies the brakes to stop the car.

The stopping distance of the car is the thinking distance plus the braking distance.

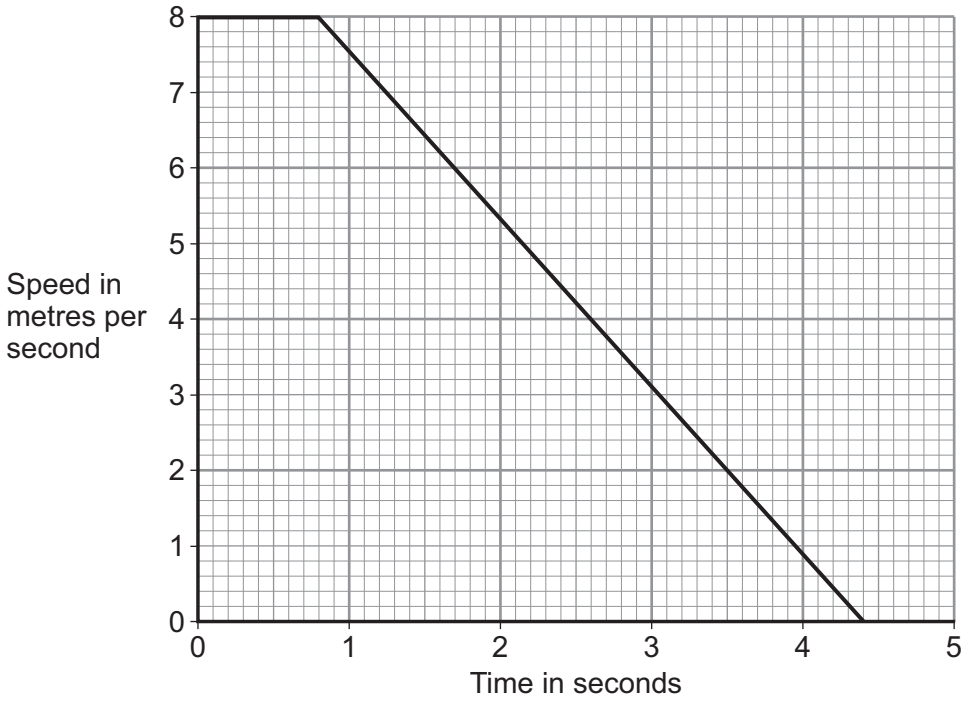
2 (a) Draw **one** line from each distance to the description of that distance.

[2 marks]

Distance	Description
Stopping	The distance the car moves between the brakes being applied and the car stopping.
Braking	The distance the car moves between the driver seeing the red light and the car stopping.
	The distance the car moves between the driver seeing the red light and applying the brakes.

2 (b) **Figure 3** shows how the speed of the car changes from the instant that the driver sees the traffic lights change to red.

Figure 3



4.1.1.1 Energy stores and systems

Question 94 · continued

2 (b) (i) What is the reaction time of the driver?

[1 mark]

Tick (✓) **one** box.

0.8 s ☐ 3.6 s ☐ 4.4 s ☐

2 (b) (ii) Using a mobile phone while driving may increase the reaction time of the driver.

Explain the effect of an increased reaction time on the stopping distance of the car.

[2 marks]

_____

_____

_____

_____

2 (b) (iii) The car has a mass of 750 kg

How is the kinetic energy of the car calculated when the car is travelling at 8 m/s?

[1 mark]

Tick (✓) **one** box.

$\frac{1}{2} \times 750 \times 8$ ☐

$\frac{1}{2} \times 750 \times 8^2$ ☐

$\frac{1}{2} \times 750^2 \times 8^2$ ☐

2 (b) (iv) Use the correct answers from the box to complete the sentence.

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

[2 marks]

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

When the brakes of the car are applied,

the kinetic energy of the car _____ and

the temperature of the brakes _____ .

8

4.1.1.1 Energy stores and systems

Question 95

June 2018 | 8463/1F | Original Q1

0 1 **Figure 1** shows a cyclist riding along a flat road.

Figure 1



0 1 . 1 Complete the sentence.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**gravitational potential**	**kinetic**

As the cyclist accelerates, the _____ energy store in the cyclist's body decreases and the _____ energy of the cyclist increases.

0 1 . 2 The mass of the cyclist is 80 kg. The speed of the cyclist is 12 m/s.

Calculate the kinetic energy of the cyclist.

Use the equation:

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

[2 marks]

_____

_____

_____

_____

Kinetic energy = _____ J

4.1.1.1 Energy stores and systems

Question 95 · continued

0 1 . 3 When the cyclist uses the brakes, the bicycle slows down.

This causes the temperature of the brake pads to increase by 50 °C.
The mass of the brake pads is 0.040 kg.
The specific heat capacity of the material of the brake pads is 480 J/kg °C.

Calculate the change in thermal energy of the brake pads.

Use the equation:

change in thermal energy = mass × specific heat capacity × temperature change

[2 marks]

Change in thermal energy = _____ J

0 1 . 4 How is the internal energy of the particles in the brake pads affected by the increase in temperature?

Tick **one** box.

[1 mark]

- Decreased ☐
- Increased ☐
- Not affected ☐

7

4.1.1.1 Energy stores and systems

Question 96

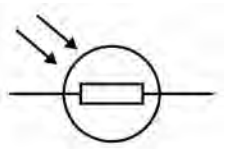
June 2018 | 8463/1F | Original Q7

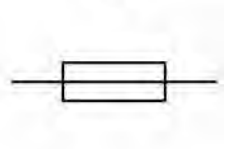
0 7 The plug of an electrical appliance contains a fuse.

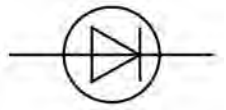
0 7 . 1 What is the correct circuit symbol for a fuse?

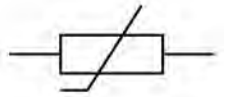
Tick **one** box.

[1 mark]


☐


☐


☐


☐

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

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

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

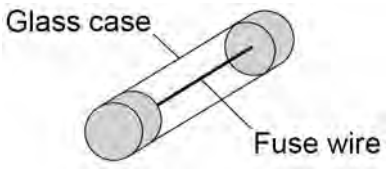
Energy transferred = _____ J

4.1.1.1 Energy stores and systems

Question 96 · continued

Figure 9 shows the structure of a fuse.

Figure 9



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

[1 mark]

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

Calculate the current at which the fuse wire melts.

[3 marks]

Current = _____ A

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

Calculate the energy needed to melt the fuse wire.

Use the Physics Equations Sheet.

[2 marks]

Energy = _____ J

9

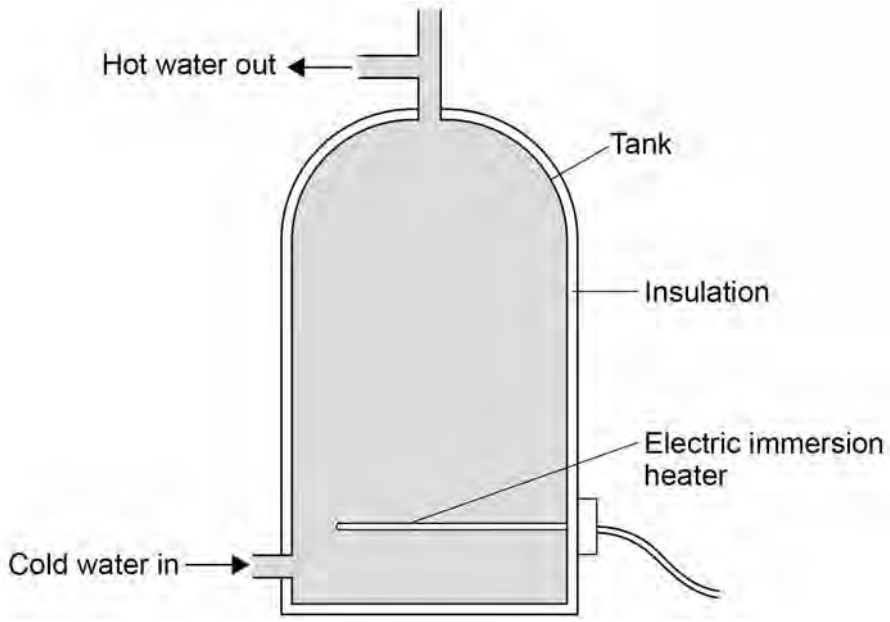
4.1.1.1 Energy stores and systems

Question 97

June 2018 | 8463/1F | Original Q8

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

Figure 10



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

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

Tick **one** box.

[1 mark]

Higher ☐

Lower ☐

The same ☐

4.1.1.1 Energy stores and systems

Question 97 · continued

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

Complete the sentences.

[2 marks]

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

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

Question 8 continues on the next page

Question 97 · continued

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

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

Figure 11

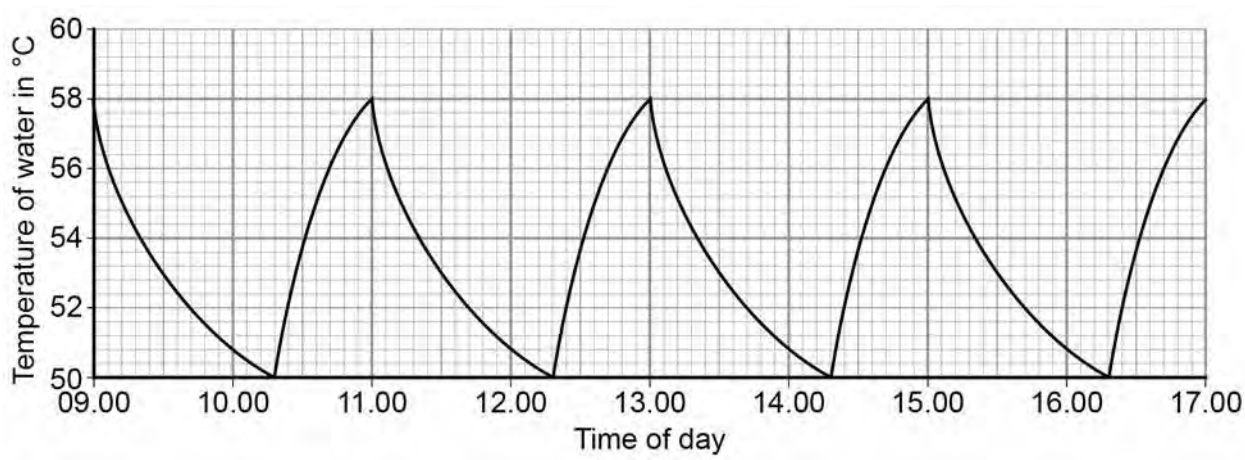
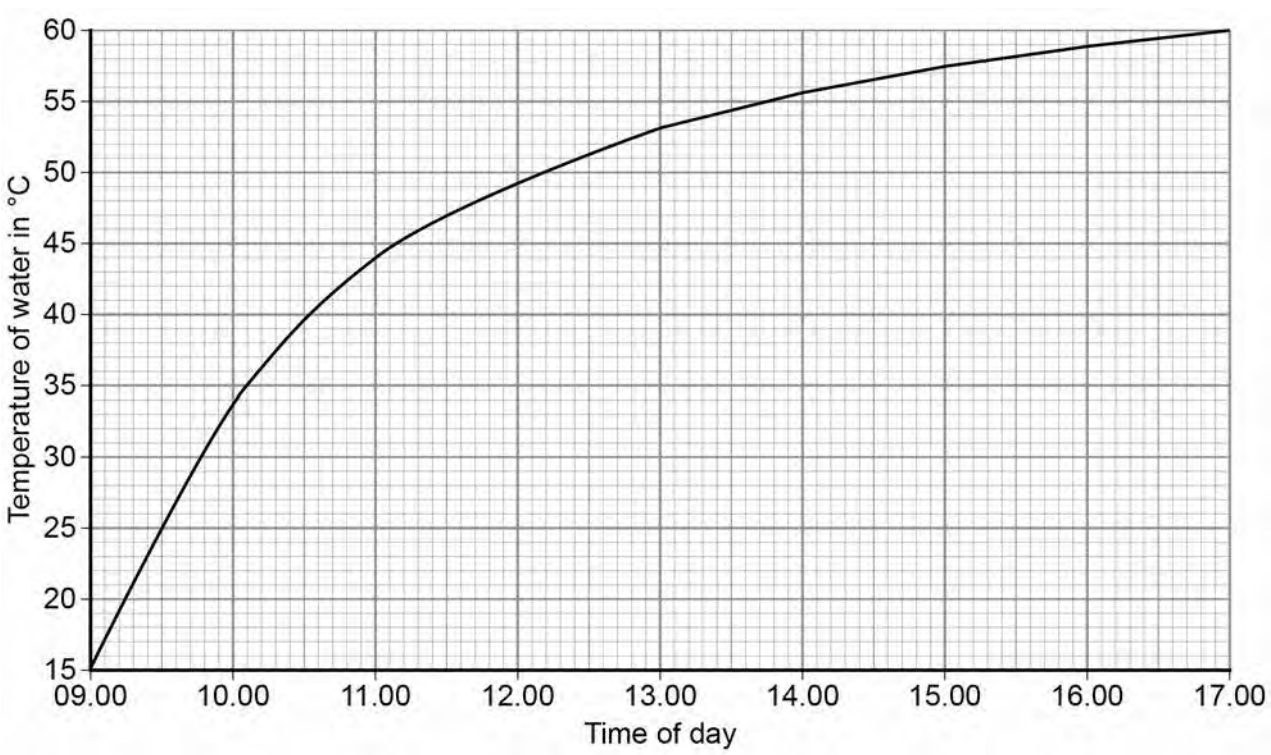


Figure 12



4.1.1.1 Energy stores and systems

Question 97 · continued

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

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

[2 marks]

Advantage of solar panels _____

_____

_____

Disadvantage of solar panels _____

_____

_____

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

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

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

[2 marks]

_____

_____

_____

_____

Proportion of total energy = _____

Question 8 continues on the next page

4.1.1.1 Energy stores and systems

Question 97 · continued

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

[1 mark]

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

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

Give the unit.

[4 marks]

Time = _____ Unit _____

1

4.1.1.1 Energy stores and systems

Question 98

June 2018 | 8463/1F | Original Q9

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

Figure 13



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

Calculate the power output of the motor in the lift.

Use the equation:

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

[2 marks]

Power output = _____ W

4.1.1.1 Energy stores and systems

Question 98 · continued

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

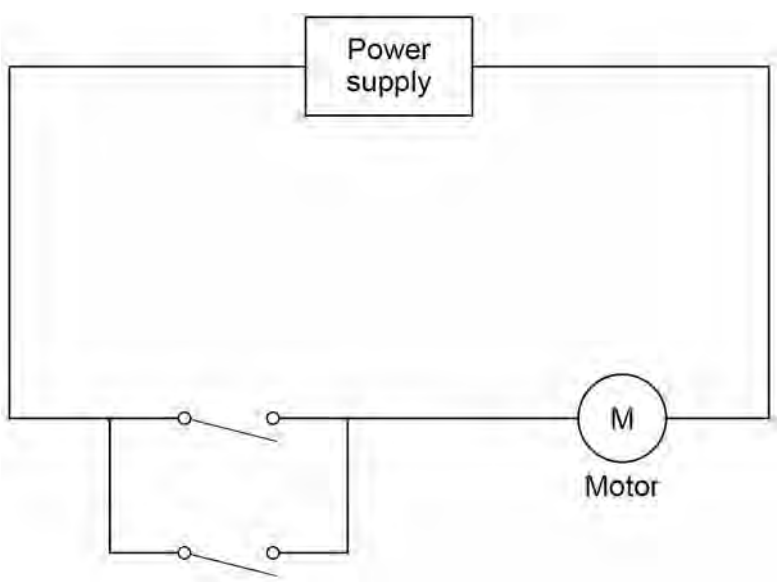
Tick **two** reasons why.

[2 marks]

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

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

Figure 14



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

Explain why.

[2 marks]

4.1.1.1 Energy stores and systems

Question 98 · continued

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

[1 mark]

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

gravitational field strength = 9.8 N/kg

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

Give your answer to 2 significant figures.

[3 marks]

Increase in gravitational potential energy = _____ J

10

4.1.1.1 Energy stores and systems

Question 99

June 2018 | 8463/2F | Original Q10

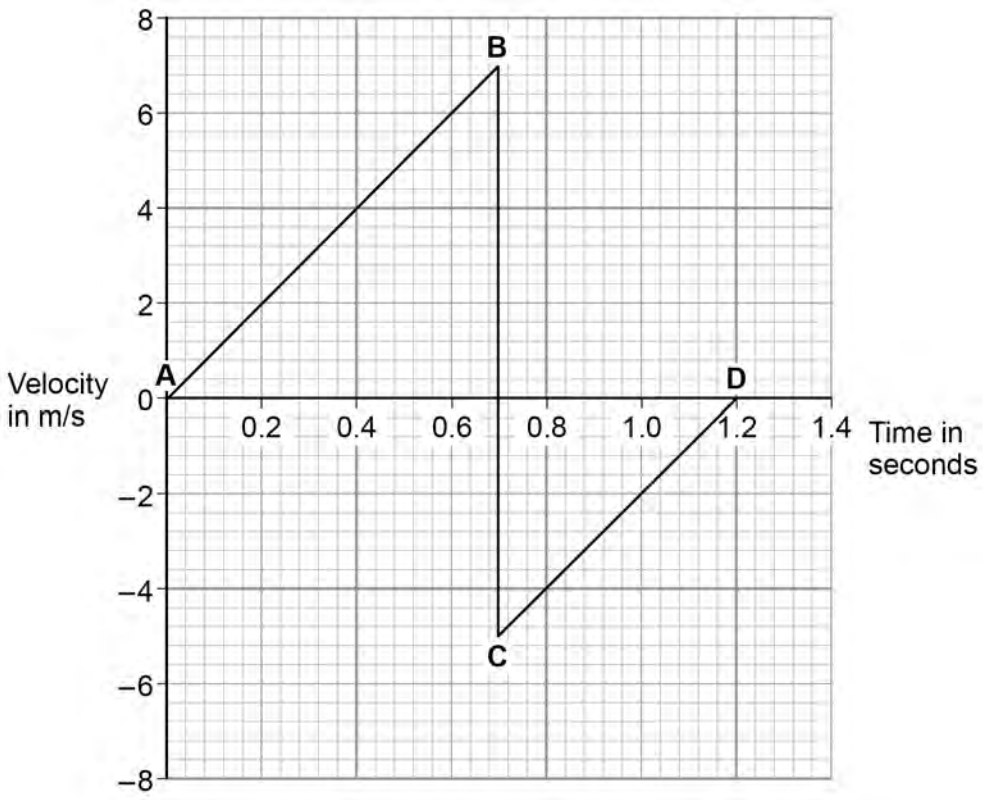
1 0 A child drops a ball.

The ball hits the ground and bounces.

Figure 14 shows the velocity-time graph for the ball from when the ball is dropped until when the ball reaches the top of its first bounce.

Air resistance has been ignored.

Figure 14



1 0 . 1 Describe the motion of the ball between points **A** and **B** on **Figure 14**.

[2 marks]

1 0 . 2 What direction is the ball moving between points **C** and **D** on **Figure 14**?

[1 mark]

4.1.1.1 Energy stores and systems

Question 99 · continued

10.3 The ball and the Earth form a system.

What is meant by 'a system'?

Tick **one** box.

[1 mark]

- A group of objects that interact. ☐
- Objects with big differences in mass. ☐
- Objects with gravitational potential energy. ☐

10.4 When the ball hits the ground, energy is transferred from the ball to the Earth.

Explain how the data in **Figure 14** shows this energy transfer.

[4 marks]

8

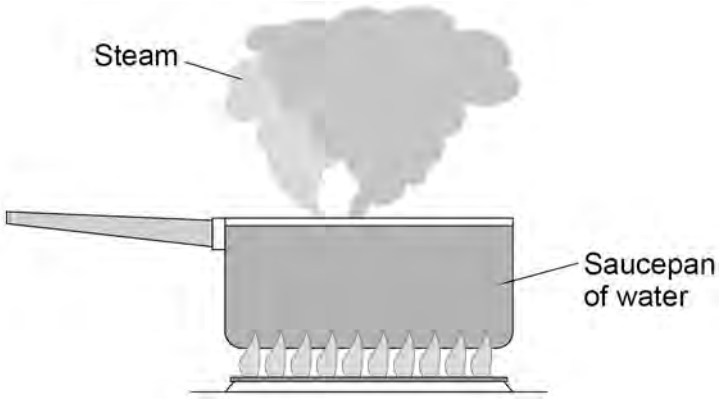
4.1.1.1 Energy stores and systems

Question 100

June 2019 | 8463/1F | Original Q1

0 1 **Figure 1** shows water being heated. Eventually the water changed into steam.

Figure 1



0 1 . 1 Complete the sentences.

Choose answers from the box.

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

[2 marks]

greater than	**less than**	**the same as**

The distance between the particles in steam is _____ the distance between the particles in liquid water.

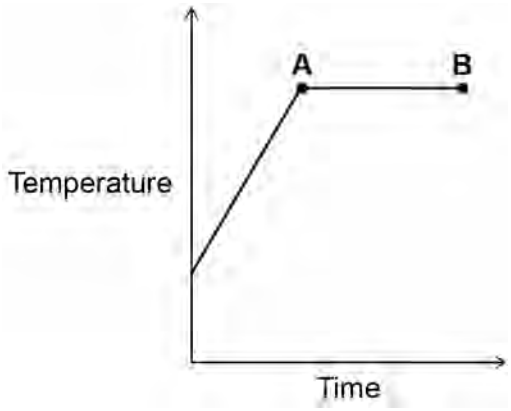
The density of steam is _____ the density of liquid water.

4.1.1.1 Energy stores and systems

Question 100 · continued

Figure 2 shows how the temperature of the water varied with time.

Figure 2



0 1 . 2 What is the name of the process that is taking place between points **A** and **B**?

Give a reason for your answer.

[2 marks]

Process _____

Reason _____

_____

0 1 . 3 A mass of 0.063 kg of water was turned into steam.

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

Calculate the thermal energy transferred to the water to turn it into steam.

Use the equation:

thermal energy for a change of state = mass × specific latent heat

[2 marks]

_____

_____

_____

Energy = _____ J

4.1.1.1 Energy stores and systems

Question 100 · continued

0 1 . 4 The mass of the steam was 0.063 kg

The volume of the steam was 0.105 m^3

Calculate the density of steam.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Choose the unit from the box.

[3 marks]

kg	m^3 / kg	kg / m^3

Density = _____ Unit _____

9

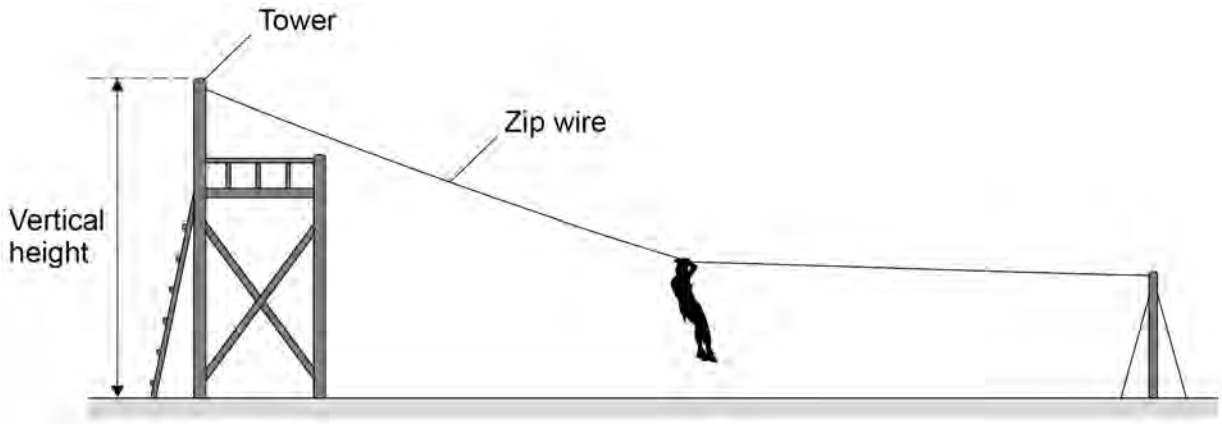
4.1.1.1 Energy stores and systems

Question 101

June 2019 | 8463/1F | Original Q3

0 3 **Figure 4** shows a person sliding down a zip wire.

Figure 4



0 3 . 1 Describe how the vertical height of the tower could be measured accurately.

[2 marks]

0 3 . 2 When using the zip wire, the person moved through a vertical height of 2.0 m

The person has a mass of 45 kg

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the person.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Change in gravitational potential energy = _____ J

4.1.1.1 Energy stores and systems

Question 101 · continued

0 3 . 3 Give **three** factors that affected the kinetic energy of the person as she reached the bottom of the zip wire.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

7

Turn over for the next question

4.1.1.1 Energy stores and systems

Question 102

June 2019 | 8463/1F | Original Q6

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

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

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

Table 2

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

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

[2 marks]

1 _____

_____

2 _____

_____

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

The total mass of the electric car is 1610 kg

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

[2 marks]

_____

_____

_____

_____

Percentage of total mass = _____ %

4.1.1.1 Energy stores and systems

Question 102 · continued

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

Suggest **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

Figure 8 shows an electric car being recharged.

Figure 8



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

[1 mark]

_____

_____

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

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

[3 marks]

_____

_____

_____

_____

Time = _____ s

10

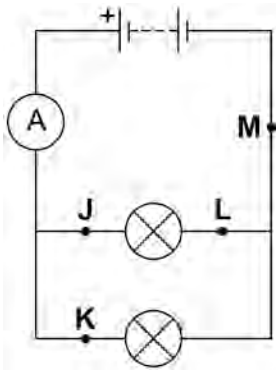
4.1.1.1 Energy stores and systems

Question 103

June 2019 | 8463/1F | Original Q7

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

Figure 9



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

[1 mark]

Tick (✓) **one** box.

J ☐ **K** ☐ **L** ☐ **M** ☐

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

[1 mark]

4.1.1.1 Energy stores and systems

Question 103 · continued

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

Calculate the current in the battery.

Use the equation:

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

[2 marks]

Current = _____ A

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

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

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

Question 7 continues on the next page

4.1.1.1 Energy stores and systems

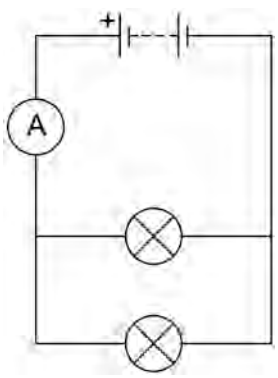
Question 103 · continued

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

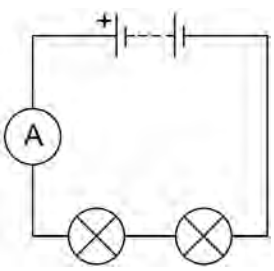
The components used in each circuit were identical.

Figure 10

Circuit X



Circuit Y



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

[1 mark]

Tick (✓) **one** box.

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

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

The readings would be the same. ☐

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

[1 mark]

Tick (✓) **one** box.

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

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

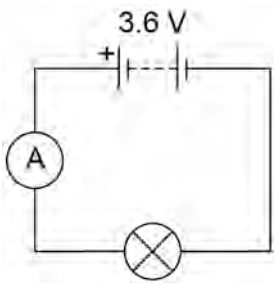
The total resistance is the same. ☐

4.1.1.1 Energy stores and systems

Question 103 · continued

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

Figure 11



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

[1 mark]

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

The current through the lamp is 0.80 A

Calculate the resistance of the lamp.

[3 marks]

Resistance = _____ Ω

12

4.1.1.1 Energy stores and systems

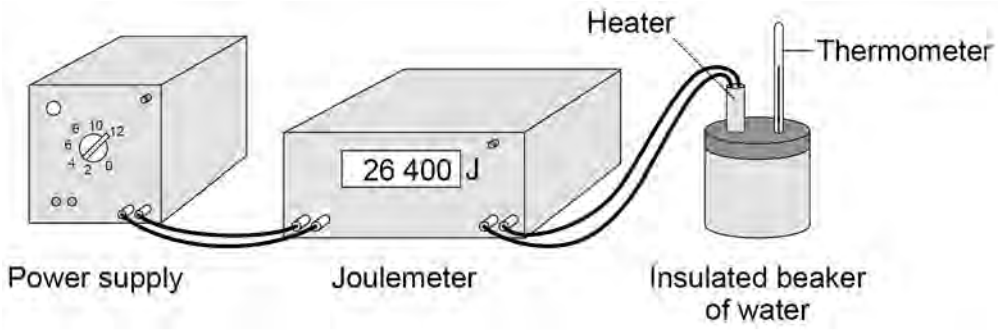
Question 104

June 2019 | 8463/1F | Original Q8

0 8 A student carried out an experiment to determine the specific heat capacity of water.

Figure 12 shows the equipment the student used to heat the water.

Figure 12



0 8 . 1 Why did the student insulate the beaker of water?

[1 mark]

Tick (✓) **one** box.

To increase energy transfer to the surroundings. ☐

To reduce energy transfer to the surroundings. ☐

To stop energy transfer to the surroundings. ☐

0 8 . 2 One hazard in this experiment is the hot water.

Give **one** risk to the student caused by this hazard.

[1 mark]

_____

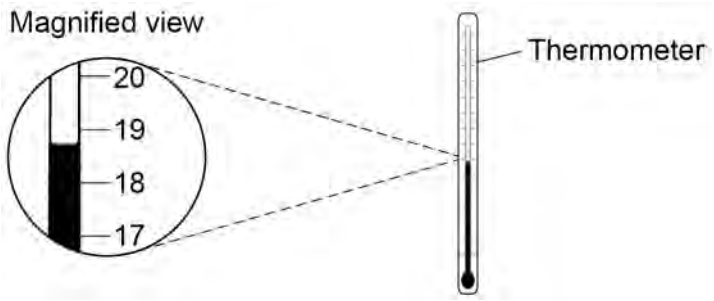
_____

4.1.1.1 Energy stores and systems

Question 104 · continued

0 8 . 3 **Figure 13** shows the thermometer that the student used.

Figure 13



What is the resolution of the thermometer?

[1 mark]

Tick (✓) **one** box.

1 °C ☐

3 °C ☐

19 °C ☐

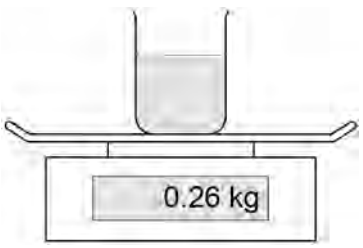
Question 8 continues on the next page

4.1.1.1 Energy stores and systems

Question 104 · continued

0 8 . 4 **Figure 14** shows the beaker of water on a balance.

Figure 14



The mass of the water was 0.20 kg

What was the mass of the beaker?

[1 mark]

Tick (✓) **one** box.

0.06 kg ☐

0.20 kg ☐

0.26 kg ☐

0.46 kg ☐

4.1.1.1 Energy stores and systems

Question 104 · continued

0 8 . 5 The energy transferred to the water was 26 400 J

The mass of water was 0.20 kg

The temperature increase of the water was 30 °C

Calculate the specific heat capacity of water using the data from this experiment.

Use the Physics Equations Sheet.

Choose the unit from the box.

[4 marks]

J/kg	J/kg°C	J/°C

Specific heat capacity = _____ Unit _____

8

4.1.1.1 Energy stores and systems

Question 105

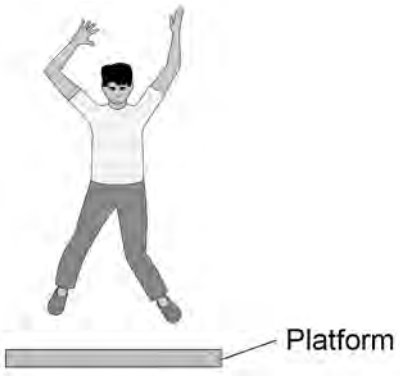
June 2019 | 8463/1F | Original Q11

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

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

Figure 18 shows a volunteer taking part in the experiment.

Figure 18



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

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

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

One volunteer has a muscle power of 41 W/kg

He was in the air for 0.12 s

Calculate his jump height.

[3 marks]

Jump height = _____ m

4.1.1.1 Energy stores and systems

Question 105 · continued

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

[1 mark]

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

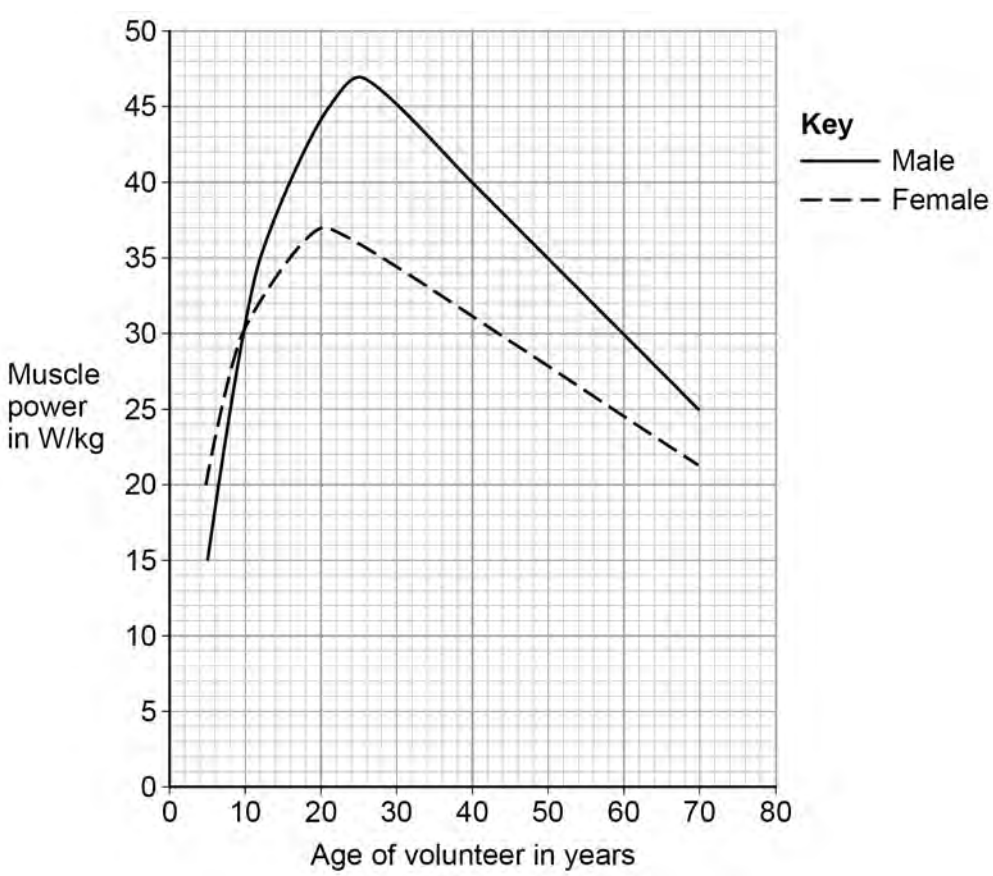
Calculate his mass.

[3 marks]

Mass = _____ kg

Figure 19 shows the scientist's results.

Figure 19



4.1.1.1 Energy stores and systems

Question 105 · continued

June 2019 | 8463/1F | Original Q11

11.4 Compare the muscle power of males with the muscle power of females.

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

[4 marks]

11.5 The muscle power of each volunteer was measured five times.

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

Suggest **one** reason why.

[1 mark]

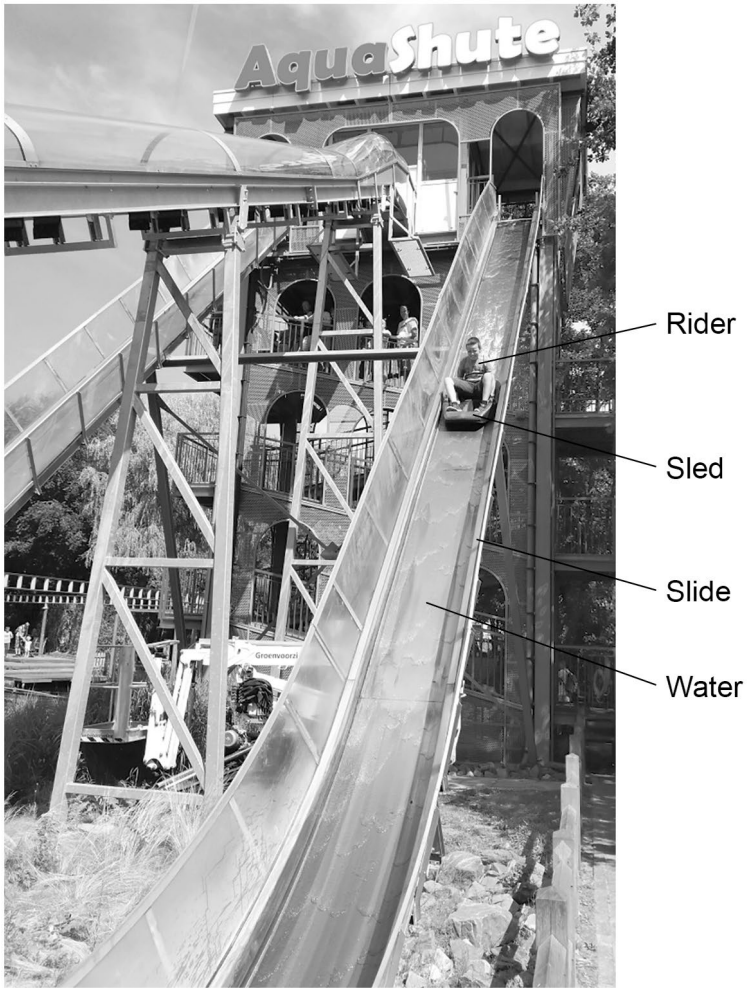
4.1.1.1 Energy stores and systems

Question 106

November 2020 | 8463/1F | Original Q2

0 2 **Figure 4** shows a theme park ride called AquaShute.

Figure 4



0 2 . 1 Riders of the AquaShute sit on a sled and move down a slide.

There is a layer of water between the sled and the slide.

How does the layer of water affect the friction between the sled and the slide?

[1 mark]

Tick (✓) **one** box.

The friction is decreased. ☐

The friction is increased. ☐

The friction is not affected. ☐

4.1.1.1 Energy stores and systems

Question 106 · continued

0 2 . 2 The mass of one rider is 62.5 kg.

The height of the slide is 16.0 m.

gravitational field strength = 9.8 N/kg

Calculate the gravitational potential energy of the rider at the top of the slide.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

0 2 . 3 At the bottom of the slide the speed of the rider is 12 m/s.

The mass of the rider is 62.5 kg.

Calculate the kinetic energy of the rider at the bottom of the slide.

Use the equation:

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

[2 marks]

Kinetic energy = _____ J

Question 2 continues on the next page

4.1.1.1 Energy stores and systems

Question 106 · continued

0 2 . 4 When a rider reaches the bottom of the slide, the sled decelerates and stops.

Give **two** factors that will affect how far the sled will move before it stops.

[2 marks]

1 _____

_____

2 _____

_____

7

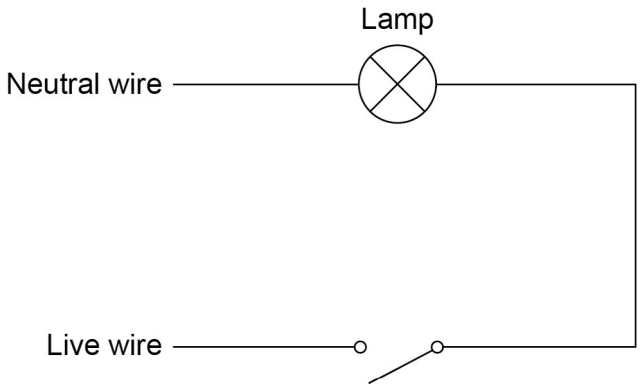
4.1.1.1 Energy stores and systems

Question 107

November 2020 | 8463/1F | Original Q3

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

Figure 5



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

[1 mark]

Tick (✓) **one** box.

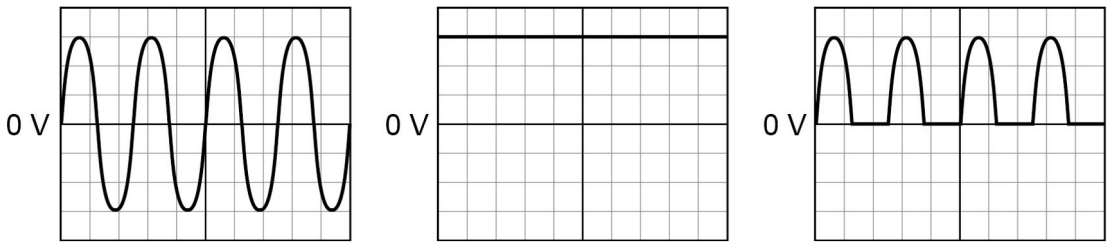
20 Hz ☐ 50 Hz ☐ 60 Hz ☐ 100 Hz ☐

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

Which diagram shows an alternating potential difference?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐

4.1.1.1 Energy stores and systems

Question 107 · continued

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

The current in the lamp is 0.020 A.

Calculate the power output of the lamp.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

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

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

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

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

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

[2 marks]

Hazard _____

Risk _____

8

4.1.1.1 Energy stores and systems

Question 108

November 2020 | 8463/1F | Original Q7

0 7 A student heated water in an electric kettle.

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

Complete the sentence.

Choose answers from the box.

[2 marks]

°C	**J**	**kg**	**s**	**W**

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

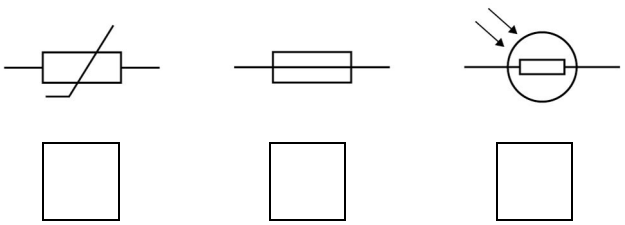
temperature of 1 _____ of the substance by 1 _____.

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

What is the correct symbol for a thermistor?

[1 mark]

Tick (✓) **one** box.



4.1.1.1 Energy stores and systems

Question 108 · continued

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

The current in the heating element is 12 A.

Calculate the power of the heating element.

Use the equation:

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

[2 marks]

Power = _____ W

Question 7 continues on the next page

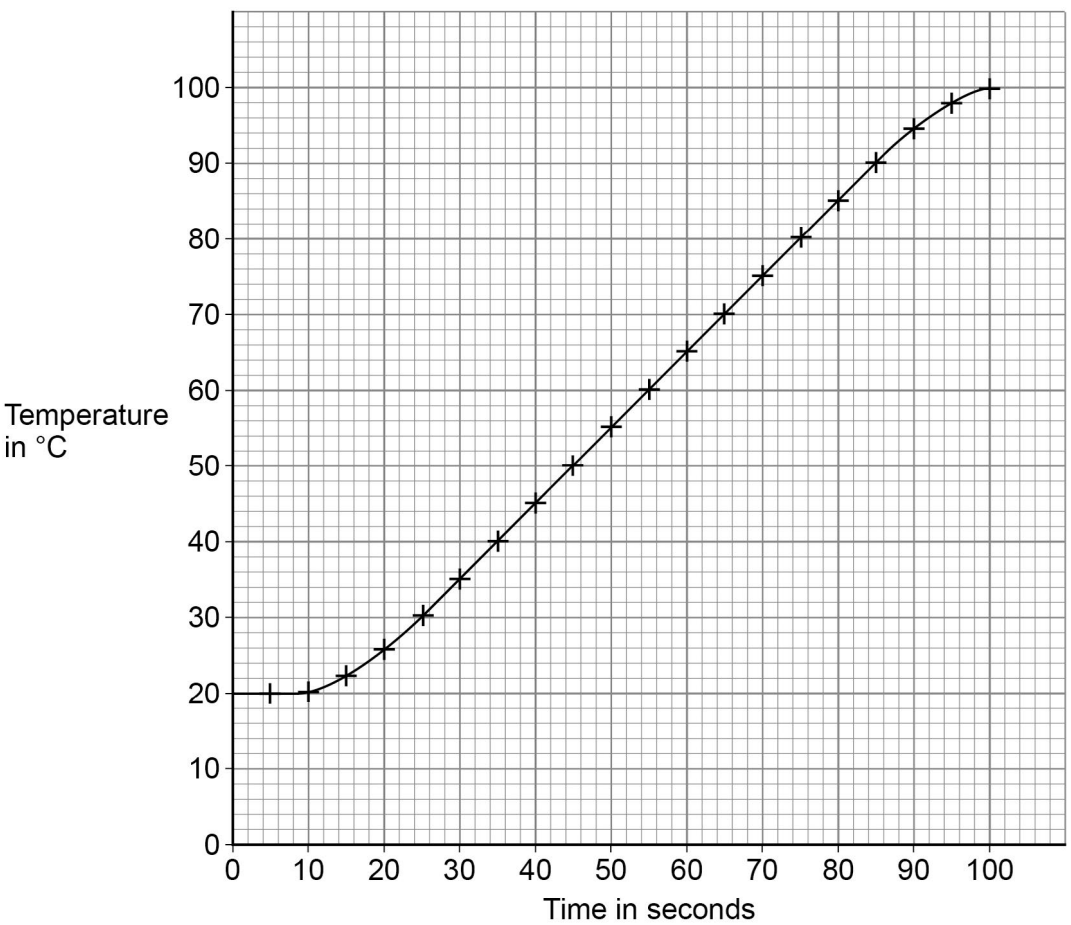
4.1.1.1 Energy stores and systems

Question 108 · continued

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

Figure 10 shows the results of the investigation.

Figure 10



4.1.1.1 Energy stores and systems

Question 108 · continued

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

What is the reason for this?

[1 mark]

Tick (✓) **one** box.

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

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

[6 marks]

Question 7 continues on the next page

4.1.1.1 Energy stores and systems

Question 108 · continued

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

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

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

Calculate the energy transferred to the water.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

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

During this time 5.0 g of water changed to steam.

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

Calculate the energy transferred to change the water to steam.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

18

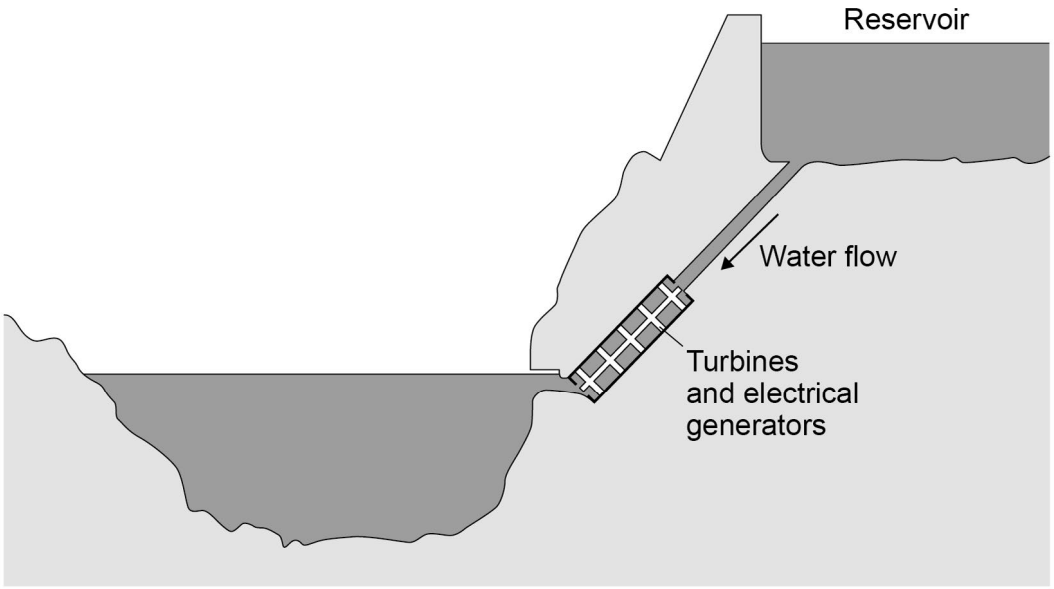
4.1.1.1 Energy stores and systems

Question 109

November 2020 | 8463/1F | Original Q10

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

Figure 14



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

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

[1 mark]

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

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

Calculate the mass of water in the reservoir.

Give your answer in standard form.

[4 marks]

Mass (in standard form) = _____ kg

4.1.1.1 Energy stores and systems

Question 109 · continued

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

[1 mark]

1 0 . 4 The electrical generators can provide 1.5×10^9 W of power for a maximum of 5 hours.

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

[3 marks]

Energy transferred = _____ J

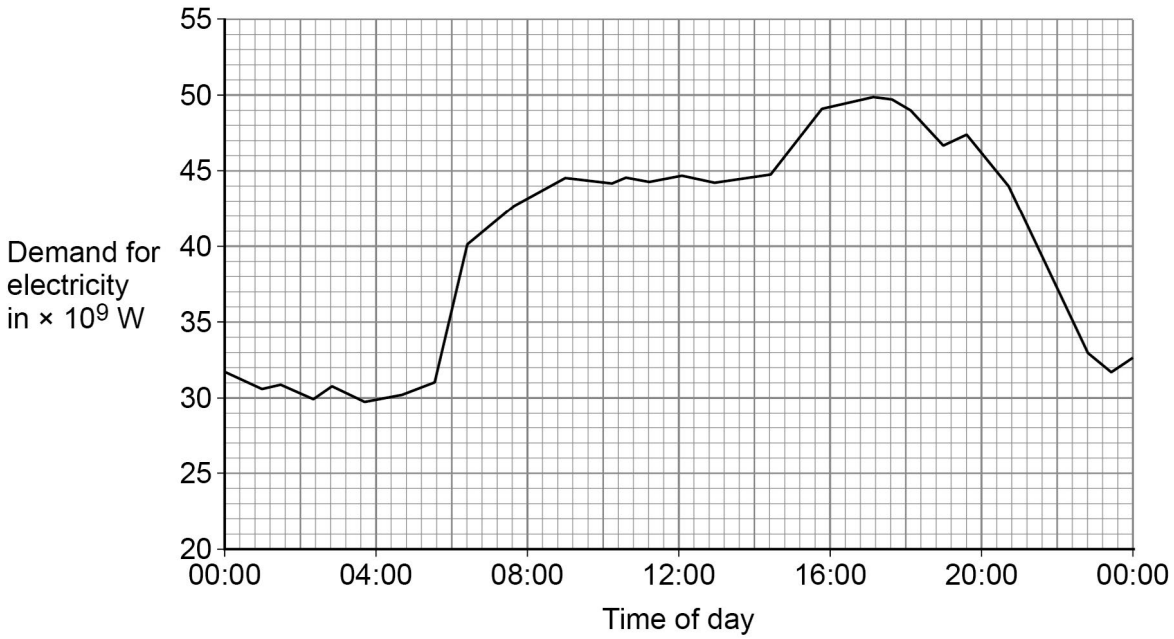
Question 10 continues on the next page

4.1.1.1 Energy stores and systems

Question 109 · continued

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

Figure 15



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

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

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

11

4.1.1.1 Energy stores and systems

Question 110

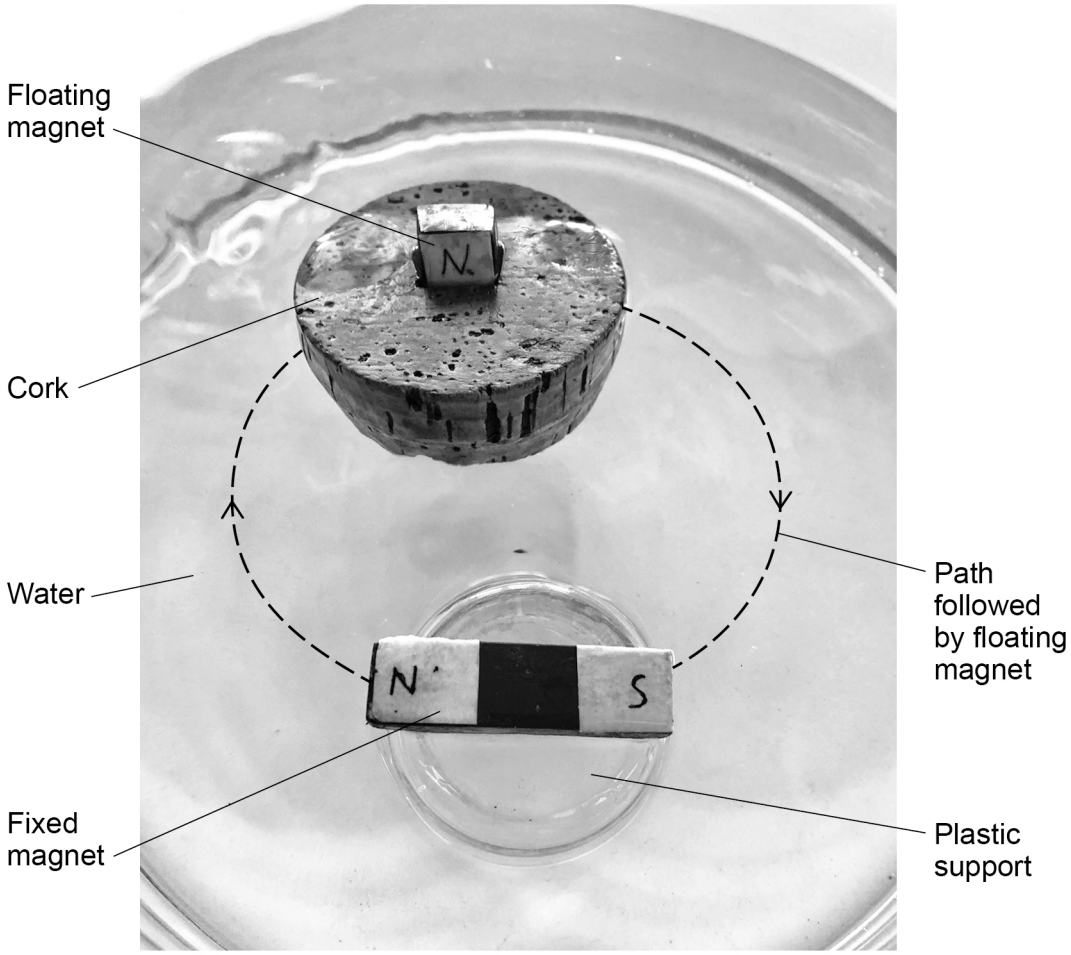
November 2020 | 8463/2F | Original Q5

0 5 A student placed a magnet on top of a plastic support in a bowl of water. This magnet was fixed in position and above the surface of the water.

The student put a second magnet into a piece of cork so that the magnet floated on the water. Only the north pole of the floating magnet was above the surface of the water.

Figure 6 shows the arrangement of the magnets.

Figure 6



0 5 . 1 The floating magnet was placed near to the north pole of the fixed magnet. The floating magnet then moved along the path shown in **Figure 6**.

Explain why.

[2 marks]

4.1.1.1 Energy stores and systems

Question 110 · continued

0 5 . 2 The student replaced the floating magnet with a piece of iron.

What happened to the piece of iron?

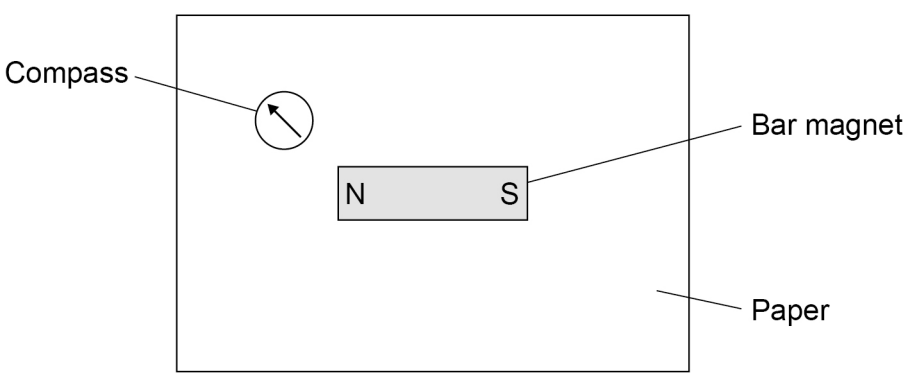
[1 mark]

0 5 . 3 Describe how to use a compass to plot the magnetic field pattern around a bar magnet.

Use **Figure 7** to help you.

[4 marks]

Figure 7

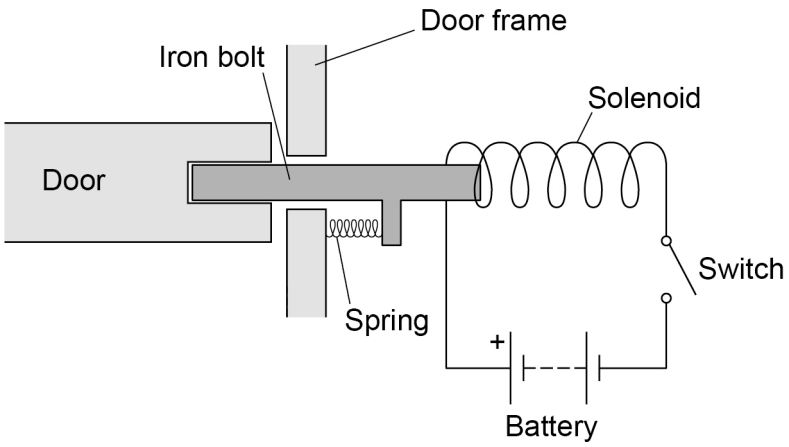


4.1.1.1 Energy stores and systems

Question 110 · continued

Figure 8 shows a diagram of an electromagnetic lock used to secure a door.

Figure 8



0 5 . 4 **Figure 9** shows an incomplete sequence of how the door unlocks.

Figure 9



Write **one** letter in each box to show the correct sequence.

[2 marks]

A The iron bolt moves.

B A magnetic field is created around the solenoid.

C There is a current in the circuit.

Question 5 continues on the next page

4.1.1.1 Energy stores and systems

Question 110 · continued

November 2020 | 8463/2F | Original Q5

0 5 . 5 The electromagnetic lock contains a spring.

When the door is unlocked the extension of the spring is 0.040 m.

spring constant = 200 N/m

Calculate the elastic potential energy of the spring when the door is unlocked.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

11

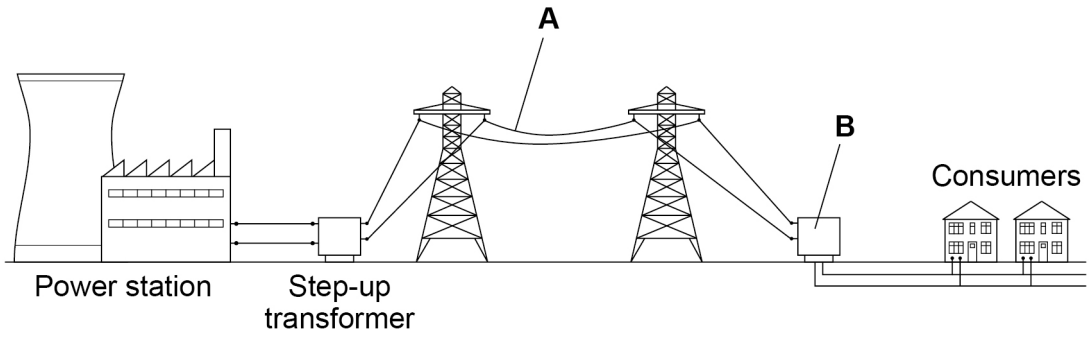
4.1.1.1 Energy stores and systems

Question 111

November 2021 | 8463/1F | Original Q2

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

Figure 2



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

[2 marks]

A _____

B _____

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

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

[1 mark]

Tick (✓) **one** box.

A high potential difference is safer for consumers. ☐

Less thermal energy is transferred to the surroundings. ☐

Power transmission is faster. ☐

4.1.1.1 Energy stores and systems

Question 111 · continued

0 2 . 3 The power station generates electricity at a potential difference of 25 000 V.

The energy transferred by the power station in one second is 500 000 000 J.

Calculate the charge flow from the power station in one second.

Use the equation:

$$\text{charge flow} = \frac{\text{energy}}{\text{potential difference}}$$

[2 marks]

Charge flow in one second = _____ C

Question 2 continues on the next page

4.1.1.1 Energy stores and systems

Question 111 · continued

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

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

Table 1

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

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

Use the equation:

power = potential difference × current

[3 marks]

Total power = _____ W

4.1.1.1 Energy stores and systems

Question 111 · continued

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

Which appliance will transfer the most energy?

Give a reason for your answer.

[2 marks]

Appliance _____

Reason _____

_____

_____

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

There are 32 000 000 seconds in one year.

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

[2 marks]

_____

_____

_____

Average energy transferred = _____ J

12

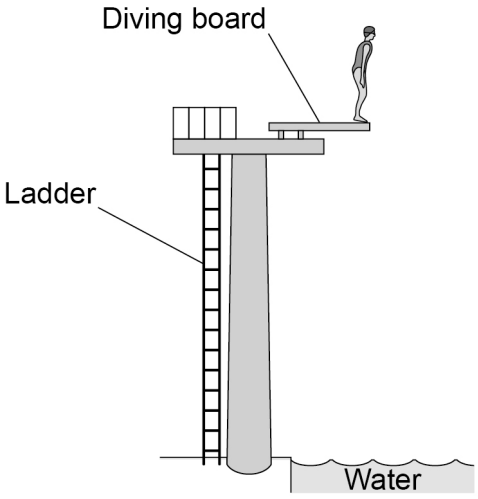
4.1.1.1 Energy stores and systems

Question 112

November 2021 | 8463/1F | Original Q7

0 7 **Figure 11** shows a diver about to dive off a diving board.

Figure 11



0 7 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

elastic potential	**gravitational potential**	**kinetic**	**nuclear**

As the diver falls towards the water there is a decrease in

her _____ energy.

As the diver falls towards the water there is an increase in

her _____ energy.

4.1.1.1 Energy stores and systems

Question 112 · continued

0 7 . 2 Write down the equation which links kinetic energy (E_k), mass (m) and speed (v).

[1 mark]

0 7 . 3 At the instant the diver hits the water, the kinetic energy of the diver is 5040 J.

The speed of the diver is 12 m/s.

Calculate the mass of the diver.

[3 marks]

Mass = _____ kg

0 7 . 4 Most of the kinetic energy of the diver is transferred to the water.

How does this affect the thermal energy of the water?

[1 mark]

Tick (✓) **one** box.

The thermal energy decreases. ☐

The thermal energy stays the same. ☐

The thermal energy increases. ☐

7

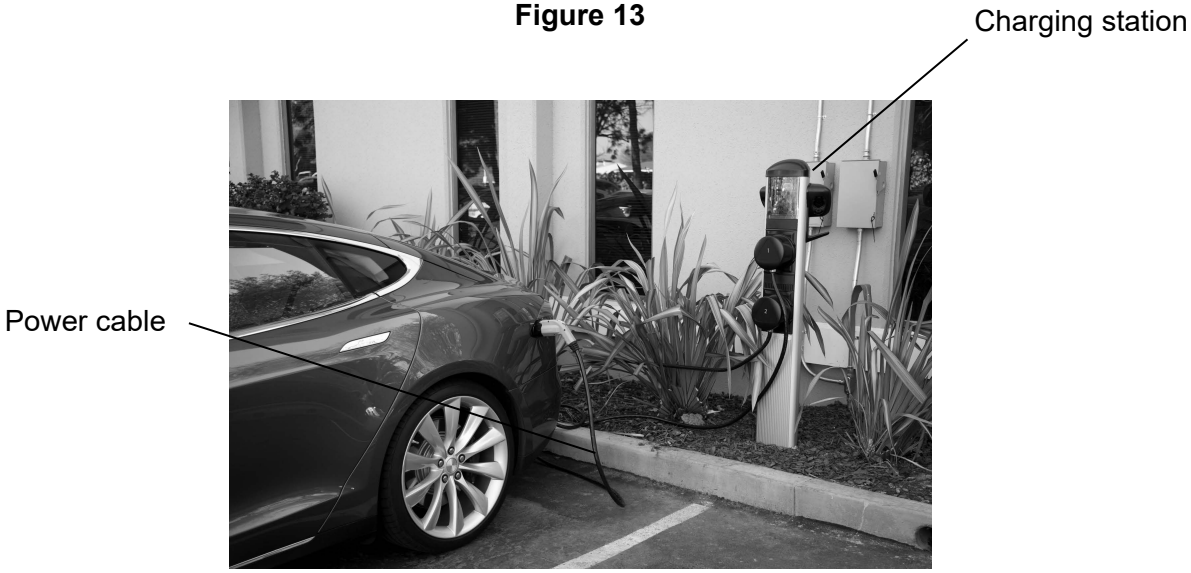
4.1.1.1 Energy stores and systems

Question 113

November 2021 | 8463/1F | Original Q9

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

Figure 13



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

What does 'direct potential difference' mean?

[1 mark]

Question 9 continues on the next page

4.1.1.1 Energy stores and systems

Question 113 · continued

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

[1 mark]

Tick (✓) **one** box.

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

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

energy transferred = power × time ☐

energy transferred = power^2 × time ☐

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

The charging station has a power output of 7200 W.

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

[3 marks]

Time taken = _____ s

4.1.1.1 Energy stores and systems

Question 113 · continued

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

[1 mark]

Tick (✓) **one** box.

$I = V \times R$ ☐

$I = V^2 \times R$ ☐

$R = I \times V$ ☐

$V = I \times R$ ☐

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

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

Calculate the resistance of the motor.

[3 marks]

Resistance = _____ Ω

Question 9 continues on the next page

4.1.1.1 Energy stores and systems

Question 113 · continued

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

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

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

[1 mark]

Tick (✓) **one** box.

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

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

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

10

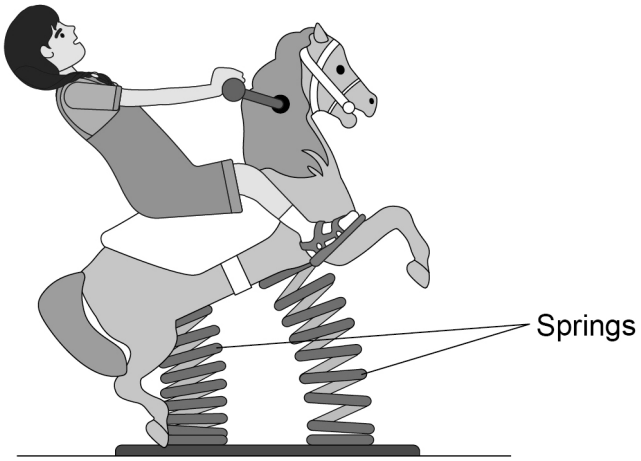
4.1.1.1 Energy stores and systems

Question 114

November 2021 | 8463/2F | Original Q9

0 9 **Figure 20** shows a child on a playground toy.

Figure 20



0 9 . 1 The springs have been elastically deformed.

Explain what is meant by 'elastically deformed'.

[2 marks]

Question 9 continues on the next page

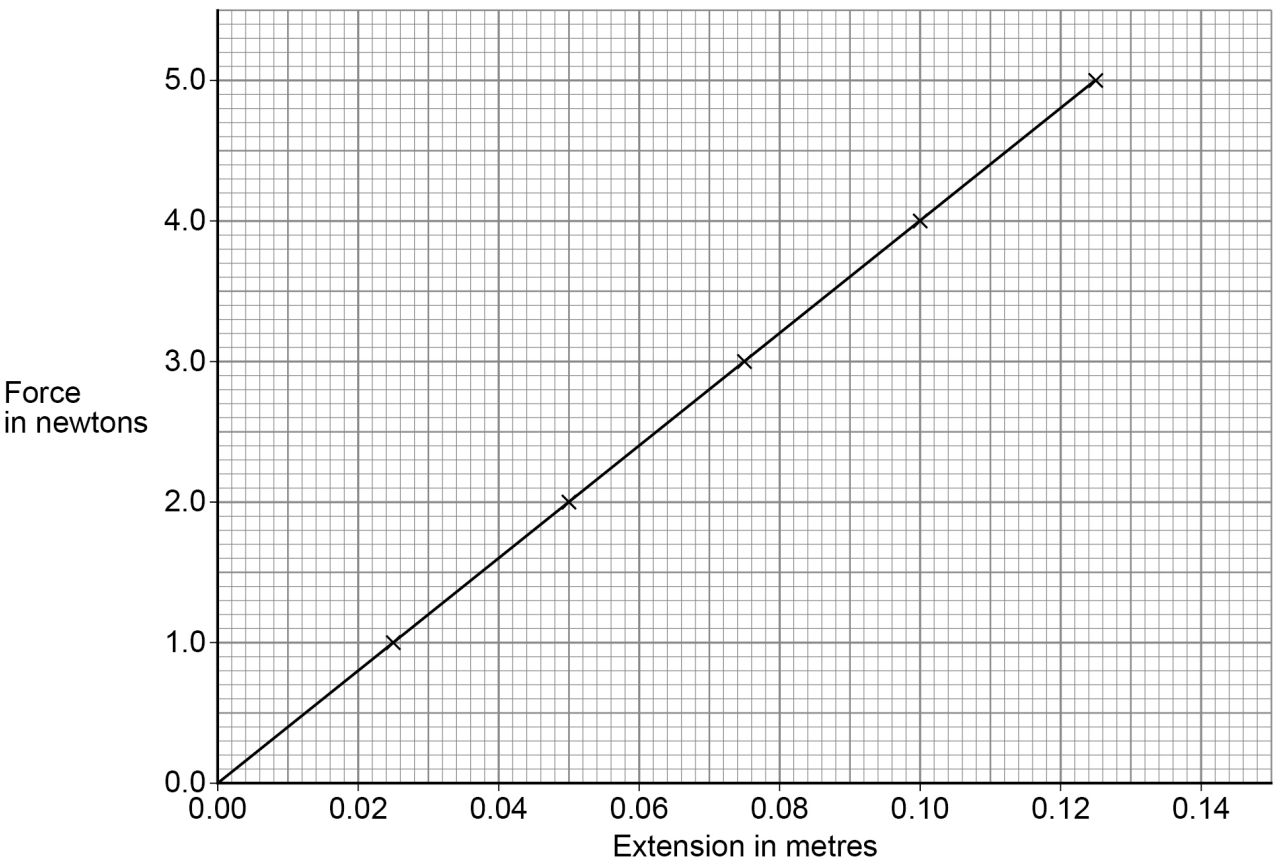
4.1.1.1 Energy stores and systems

Question 114 · continued

A student investigated the relationship between the force applied to a spring and the extension of the spring.

Figure 21 shows the results.

Figure 21



4.1.1.1 Energy stores and systems

Question 114 · continued

0 9 . 2 Describe a method the student could use to obtain the results given in **Figure 21**.

You should include a risk assessment for **one** hazard in the investigation.

Your answer may include a diagram.

[6 marks]

Question 9 continues on the next page

4.1.1.1 Energy stores and systems

Question 114 · continued

0 9 . 3 Which equation links extension (*e*), force (*F*) and spring constant (*k*).

[1 mark]

Tick (✓) **one** box.

force = spring constant × (extension)^2 ☐

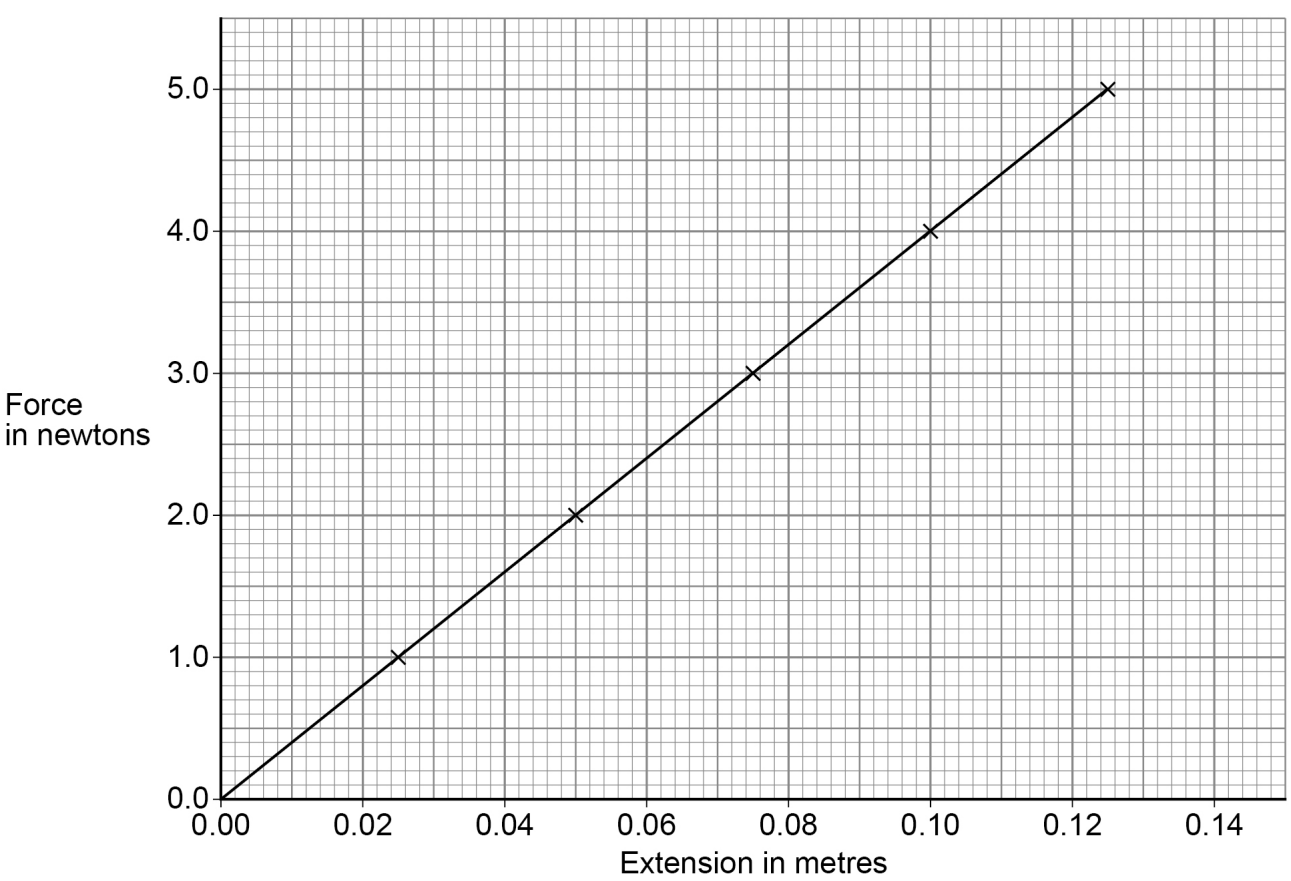
force = spring constant × extension ☐

force = $\frac{\text{extension}}{\text{spring constant}}$ ☐

force = $\frac{\text{spring constant}}{\text{extension}}$ ☐

Figure 21 is repeated below.

Figure 21



4.1.1.1 Energy stores and systems

Question 114 · continued

0 9 . 4 Determine the spring constant of the spring.

Use **Figure 21**.

[3 marks]

Spring constant = _____ N/m

0 9 . 5 The student concluded:

'The extension of the spring is directly proportional to the force applied to the spring.'

Describe how **Figure 21** supports the student's conclusion.

[2 marks]

Question 9 continues on the next page

4.1.1.1 Energy stores and systems

Question 114 · continued

0 9 . 6 The student repeated the investigation using a different spring with a spring constant of 13 N/m.

Calculate the elastic potential energy of the spring when the extension of the spring was 20 cm.

Use the Physics Equations Sheet.

[3 marks]

Elastic potential energy = _____ J

17

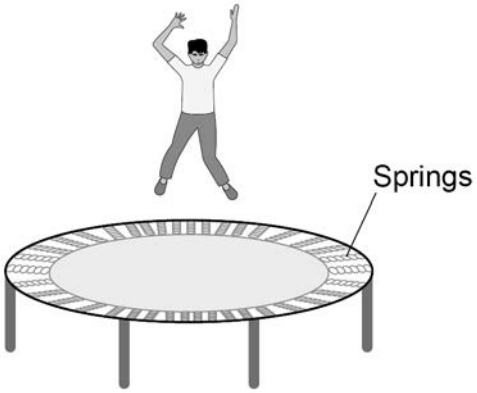
4.1.1.1 Energy stores and systems

Question 115

June 2022 | 8463/1F | Original Q1

0 1 **Figure 1** shows a boy bouncing on a trampoline.

Figure 1



0 1 . 1 The boy falls from the position in **Figure 1** towards the trampoline.

Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**gravitational potential**
kinetic	**nuclear**	

As the boy falls, there is a decrease in his _____ energy.

As the boy falls, there is an increase in his _____ energy.

4.1.1.1 Energy stores and systems

Question 115 · continued

0 1 . 2 As the boy lands on the trampoline, each spring stretches 0.015 m.

spring constant of each spring = 120 000 N/m

Calculate the energy stored by each spring.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

0 1 . 3 There are 40 springs on the trampoline.

Calculate the total energy stored by the 40 springs when each spring is stretched by 0.015 m.

Use your answer from Question **01.2**

[1 mark]

Total energy stored = _____ J

Question 1 continues on the next page

4.1.1.1 Energy stores and systems

Question 115 · continued

0 1 . 4 The kinetic energy of the boy as he lands on the trampoline is 600 J.

The maximum kinetic energy of the boy after he bounces is 45% of his kinetic energy as he lands.

Calculate the maximum kinetic energy of the boy after he bounces.

[2 marks]

Maximum kinetic energy = _____ J

0 1 . 5 Why is the kinetic energy of the boy after he bounces less than his kinetic energy as he lands?

[1 mark]

Tick (✓) **one** box.

- Energy is not conserved. ☐
- Energy is transferred to the surroundings. ☐
- The springs transfer energy to the boy. ☐

8

4.1.1.1 Energy stores and systems

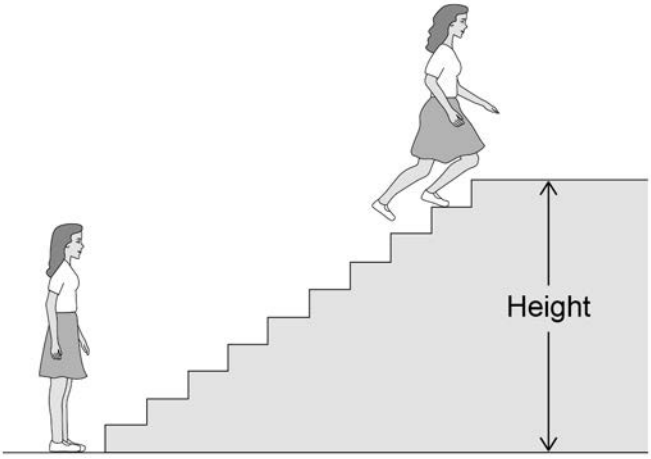
Question 116

June 2022 | 8463/1F | Original Q2

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

Figure 2 shows the stairs.

Figure 2



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

What measuring instrument should she have used?

[1 mark]

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

The mass of the girl was 50 kg.

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the girl.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

4.1.1.1 Energy stores and systems

Question 116 · continued

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

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

Calculate the power of the boy.

Use the equation:

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

[2 marks]

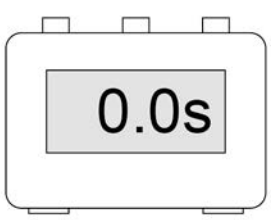
Power = _____ W

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

[1 mark]

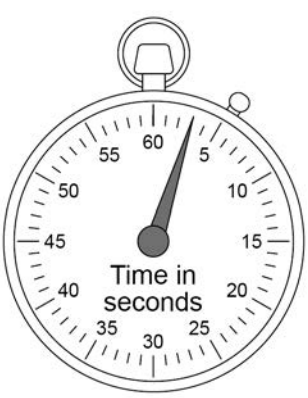
Tick (✓) **one** box.

Stop-clock A



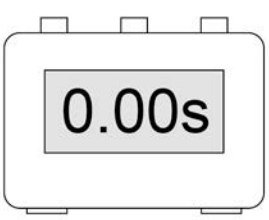
☐

Stop-clock B



☐

Stop-clock C



☐

4.1.1.1 Energy stores and systems

Question 116 · continued

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

The mass of the boy was 70 kg.

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

Use the equation:

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

[2 marks]

Kinetic energy = _____ J

8

4.1.1.1 Energy stores and systems

Question 117

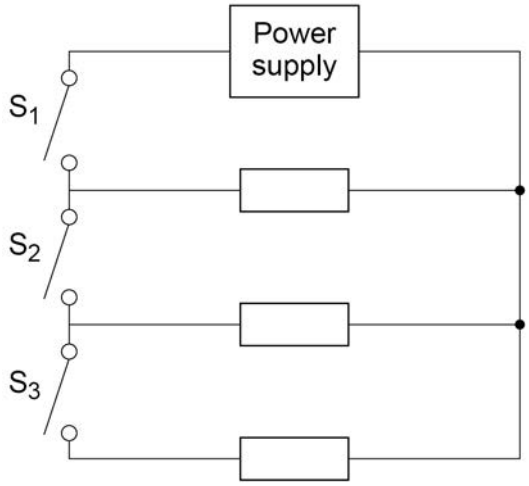
June 2022 | 8463/1F | Original Q6

0 6 A hair dryer contains three heating elements.

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

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

Figure 7



0 6 . 1 Complete the sentence.

[1 mark]

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

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

[1 mark]

Tick (✓) **one** box.

S_1 ☐

S_2 ☐

S_3 ☐

4.1.1.1 Energy stores and systems

Question 117 · continued

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

[1 mark]

Tick (✓) **one** box.

S_1 and S_2 ☐

S_1 and S_3 ☐

S_1, S_2 and S_3 ☐

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

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

[1 mark]

_____

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

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

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

[3 marks]

_____

_____

_____

_____

_____

_____

Time = _____ s

4.1.1.1 Energy stores and systems

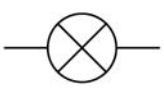
Question 117 · continued

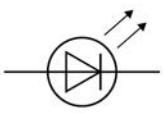
0 6 . 6 The hair dryer has LEDs to indicate the power setting.

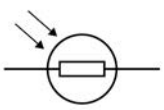
What is the circuit symbol for an LED?

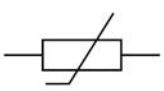
[1 mark]

Tick (✓) **one** box.









8

4.1.1.1 Energy stores and systems

Question 118

June 2022 | 8463/2F | Original Q7

0 7 Sound travels as longitudinal waves.

0 7 . 1 Complete the sentences.

Choose the answers from the box.

[2 marks]

amplitude	frequency	speed	wavelength

The distance between the centre of one compression of a sound wave and the centre of the next compression is called the _____ .

The number of waves passing a point each second is called the _____ .

0 7 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

opposite	perpendicular	parallel

In a longitudinal wave, the oscillations are _____ to the direction of energy transfer.

Question 7 continues on the next page

4.1.1.1 Energy stores and systems

Question 118 · continued

0 7 . 3 A sound wave has a frequency of 8.0 kHz.

Which of the following is the same as 8.0 kHz?

[1 mark]

Tick (✓) **one** box.

0.0080 Hz ☐

8.0 Hz ☐

8000 Hz ☐

800 000 Hz ☐

0 7 . 4 Calculate the period of a sound wave with a frequency of 8.0 kHz.

Use the Physics Equations Sheet.

[2 marks]

Period = _____ s

4.1.1.1 Energy stores and systems

Question 118 · continued

0 7 . 5 Calculate the wavelength of a sound wave with a frequency of 6600 Hz.

speed of sound = 330 m/s

Use the equation:

$$\text{wavelength} = \frac{\text{speed}}{\text{frequency}}$$

Choose the unit from the box.

[3 marks]

kg	m	N

Wavelength = _____ Unit _____

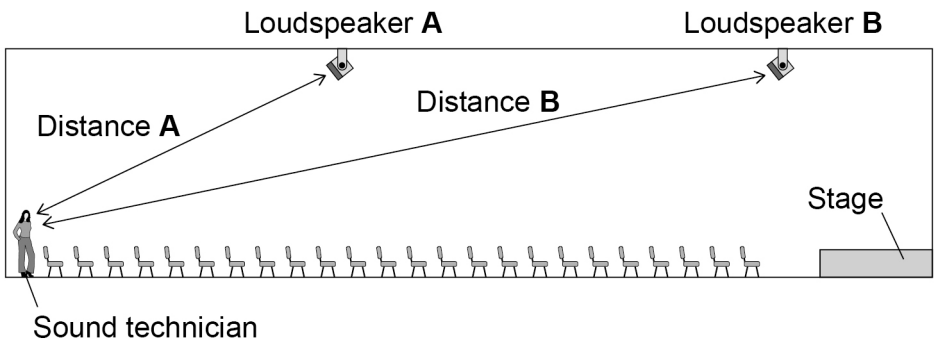
Question 7 continues on the next page

4.1.1.1 Energy stores and systems

Question 118 · continued

Figure 14 shows the arrangement of two loudspeakers at a concert venue.

Figure 14



The loudspeakers in **Figure 14** are tested by playing the same song through both loudspeakers.

A sound technician listens to the song.

Use the Physics Equations Sheet to answer questions **07.6** and **07.7**.

0 7 . 6 Write down the equation which links distance (*s*), speed (*v*) and time (*t*).

[1 mark]

0 7 . 7 Distance **A** on **Figure 14** is 13.2 m.

speed of sound = 330 m/s

Calculate the time taken for the sound to travel from loudspeaker **A** to the technician.

[3 marks]

Time taken = _____ s

4.1.1.1 Energy stores and systems

Question 118 · continued

0 7 . 8 The sound from each loudspeaker travels at the same speed.

For the sound technician to hear the song clearly, the sound from loudspeaker **B** should be emitted slightly before the sound from loudspeaker **A**.

Explain why.

[3 marks]

16

Turn over for the next question

4.1.1.1 Energy stores and systems

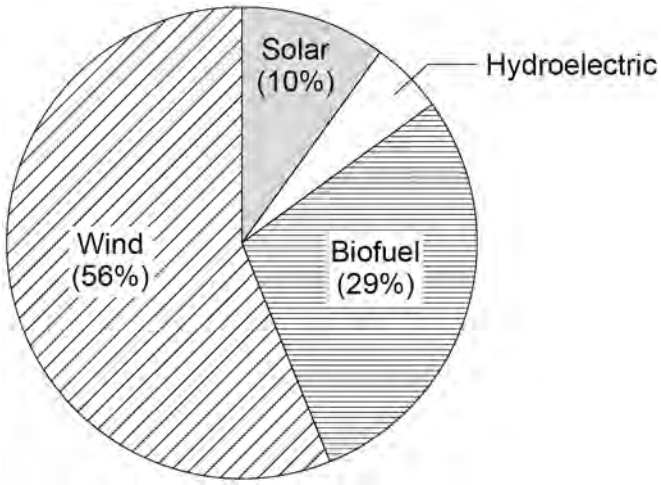
Question 119

June 2023 | 8463/1F | Original Q4

0 4 The UK uses renewable energy resources to generate some of its electricity.

Figure 4 shows the proportion of electricity generated by different renewable energy resources in the UK in 2020.

Figure 4



0 4 . 1 Calculate the percentage of electricity generated using hydroelectric power.

[2 marks]

Percentage = _____ %

4.1.1.1 Energy stores and systems

Question 119 · continued

A remote village in the UK uses a hydroelectric generator to provide electricity.

0 4 . 2 The mass of water that passes through the hydroelectric generator each day is 2 500 000 kg.

The change in vertical height of the water is 15.0 m.

gravitational field strength = 9.8 N/kg

Calculate the decrease in gravitational potential energy of the water.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Decrease in gravitational potential energy = _____ J

Question 4 continues on the next page

4.1.1.1 Energy stores and systems

Question 119 · continued

Use the Physics Equations Sheet to answer questions **04.3** and **04.4**.

0 4 . 3 Write down the equation which links energy (*E*), power (*P*) and time (*t*).

[1 mark]

0 4 . 4 The hydroelectric generator transfers electrical power of 3000 W to the village.

Calculate the energy transferred to the village in 60 minutes.

[3 marks]

Energy transferred = _____ J

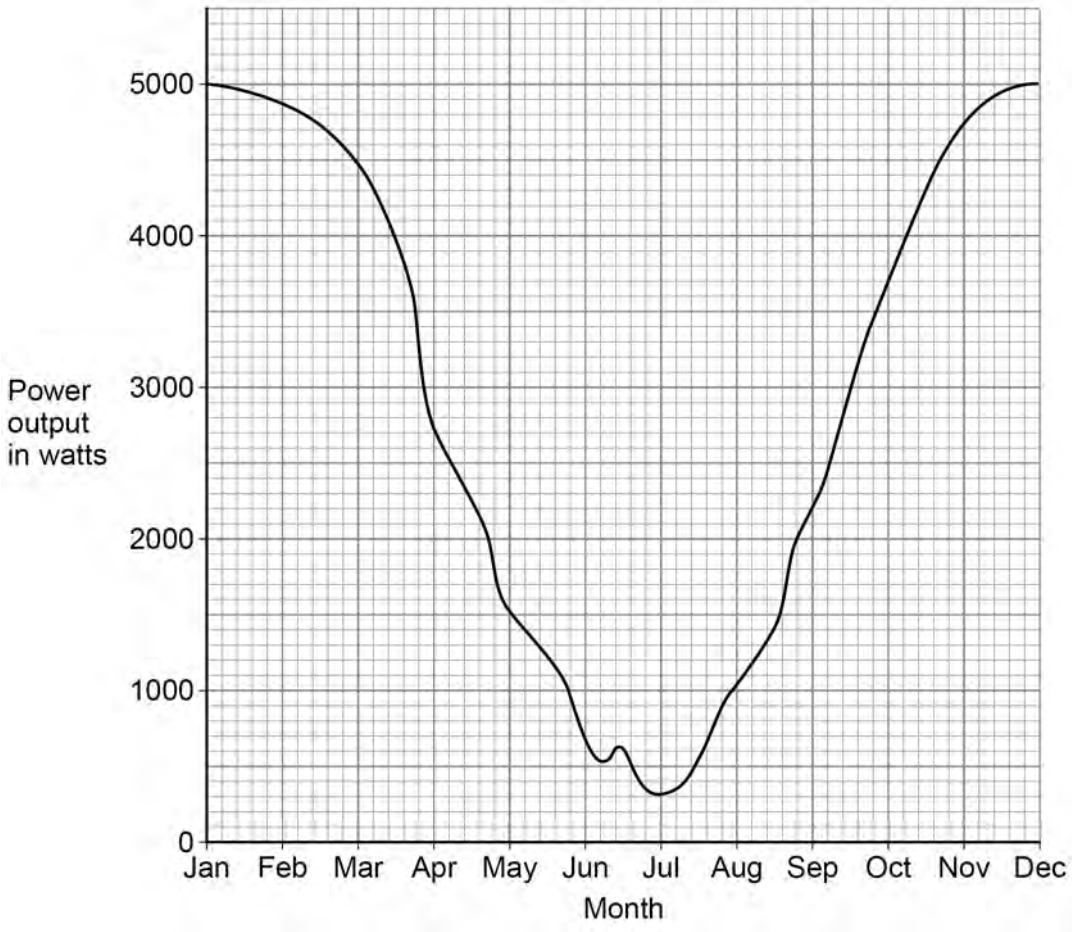
4.1.1.1 Energy stores and systems

Question 119 · continued

0 4 . 5 The hydroelectric generator is turned by falling river water.

Figure 5 shows how the power output of the hydroelectric generator varied during one year.

Figure 5



Explain **one** reason why the power output varied.

[2 marks]

10

4.1.1.1 Energy stores and systems

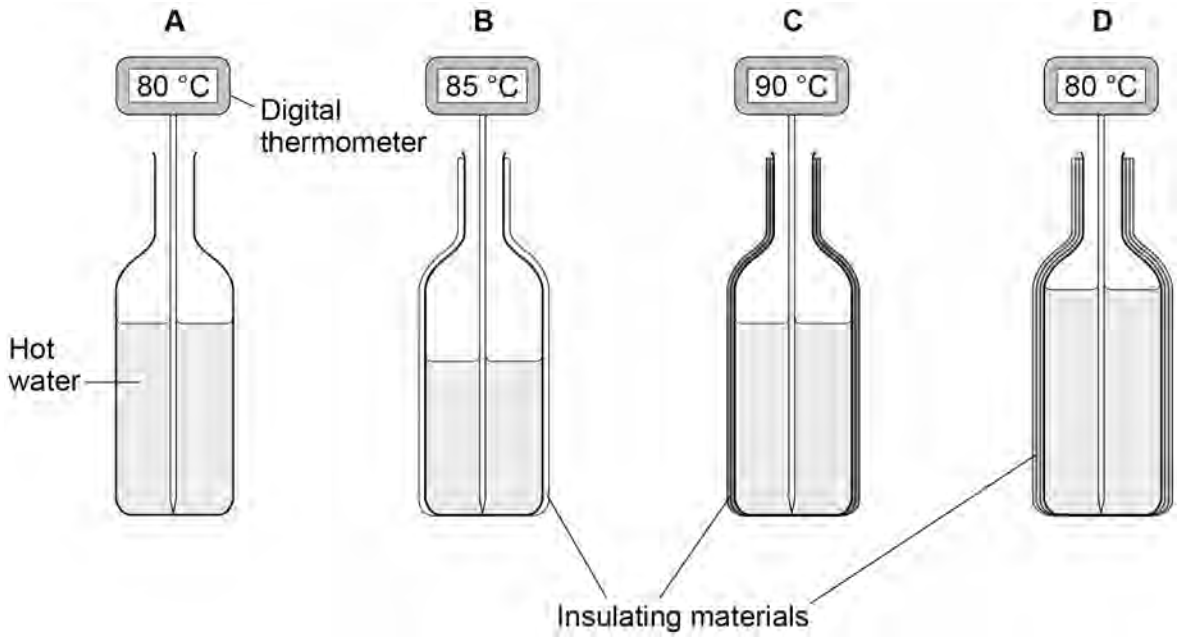
Question 120

June 2023 | 8463/1F | Original Q5

0 5 A student investigated how different insulating materials affect the energy transfer from bottles of very hot water.

Figure 6 shows some of the equipment used.

Figure 6



0 5 . 1 To prevent spillages the student used a funnel to pour very hot water into each bottle.

Why did the student use the funnel?

[1 mark]

Tick (✓) **one** box.

Preventing spillages was a control variable. ☐

To make the investigation valid. ☐

Using the funnel was a safety precaution. ☐

4.1.1.1 Energy stores and systems

Question 120 · continued

0 5 . 2 Why did the student **not** use insulation for bottle **A**?

[1 mark]

Tick (✓) **one** box.

Bottle **A** was the control. ☐

Bottle **A** was the fair test. ☐

Bottle **A** was the independent variable. ☐

Question 5 continues on the next page

4.1.1.1 Energy stores and systems

Question 120 · continued

The student recorded how much the temperature of the water in each bottle changed in five minutes.

0 5 . 3 What equipment could the student use to measure time?

[1 mark]

0 5 . 4 **Table 4** shows the results.

Table 4

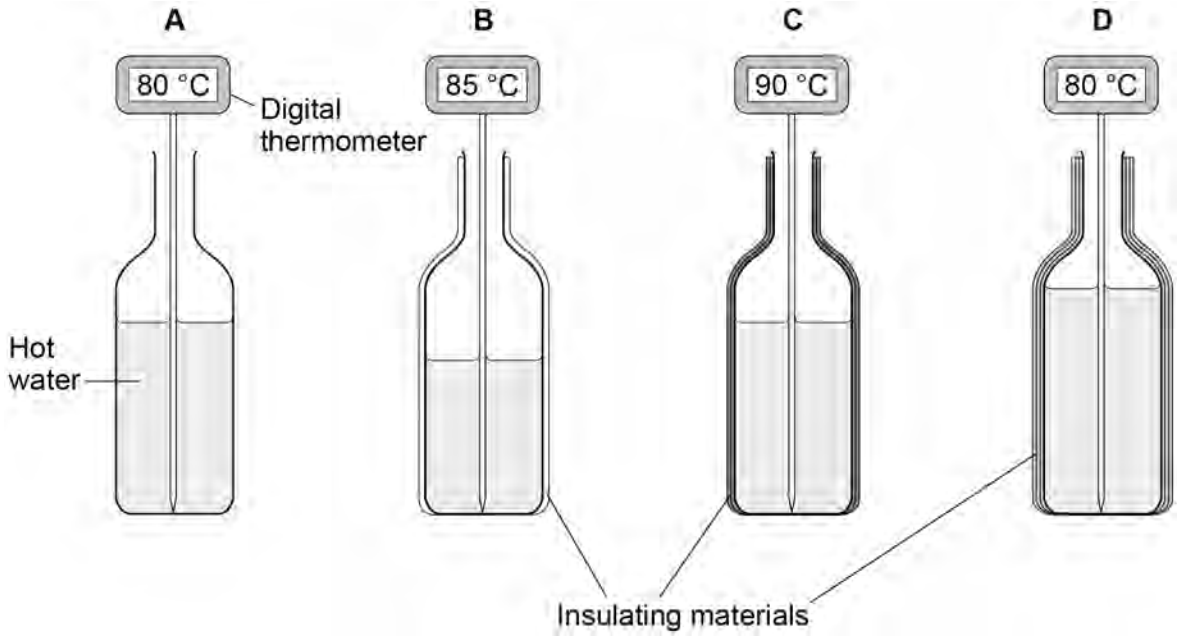
Bottle	Insulation	Start temperature in °C	Final temperature in °C	Temperature change in °C
A	None	80	60	20
B	1 layer of paper	85	70	15
C	2 layers of card	90	75	15
D	3 layers of bubble wrap	80	70	10

4.1.1.1 Energy stores and systems

Question 120 · continued

Figure 6 is repeated below.

Figure 6



The student could **not** make a valid conclusion from the results about how different insulating materials affect the energy transfer.

Explain **two** ways that the student could improve the investigation to be able to make a valid conclusion.

Use **Figure 6** and **Table 4**.

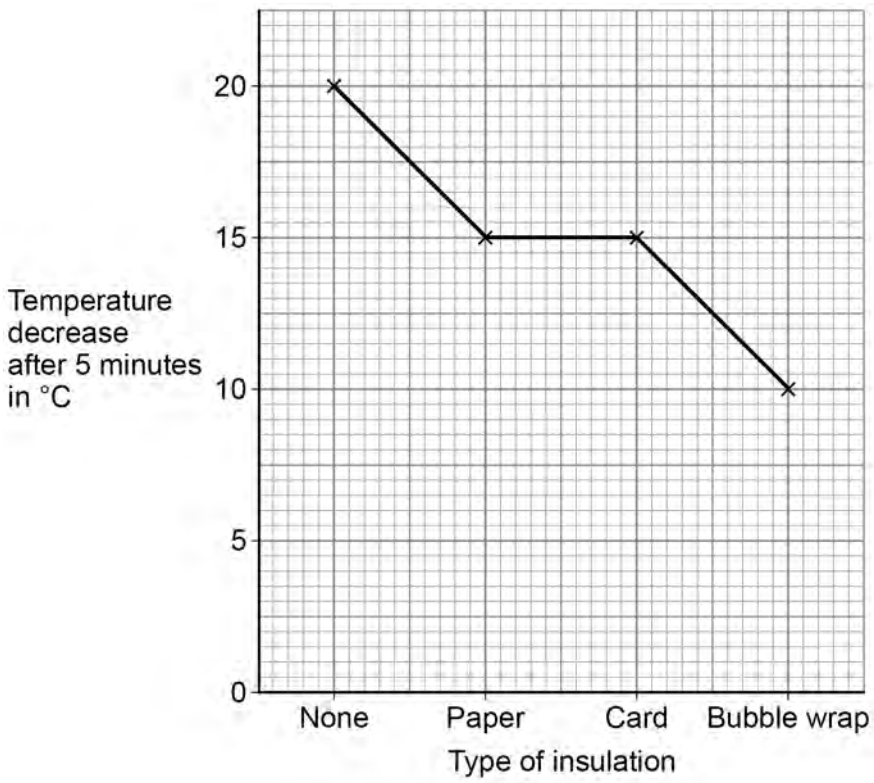
[4 marks]

4.1.1.1 Energy stores and systems

Question 120 · continued

0 5 . 5 **Figure 7** shows the graph plotted by the student.

Figure 7



The student should **not** have plotted a line graph.

What type of graph should the student have plotted?

Give a reason for your answer.

[2 marks]

Type of graph _____

Reason _____

_____

_____

9

4.1.1.1 Energy stores and systems

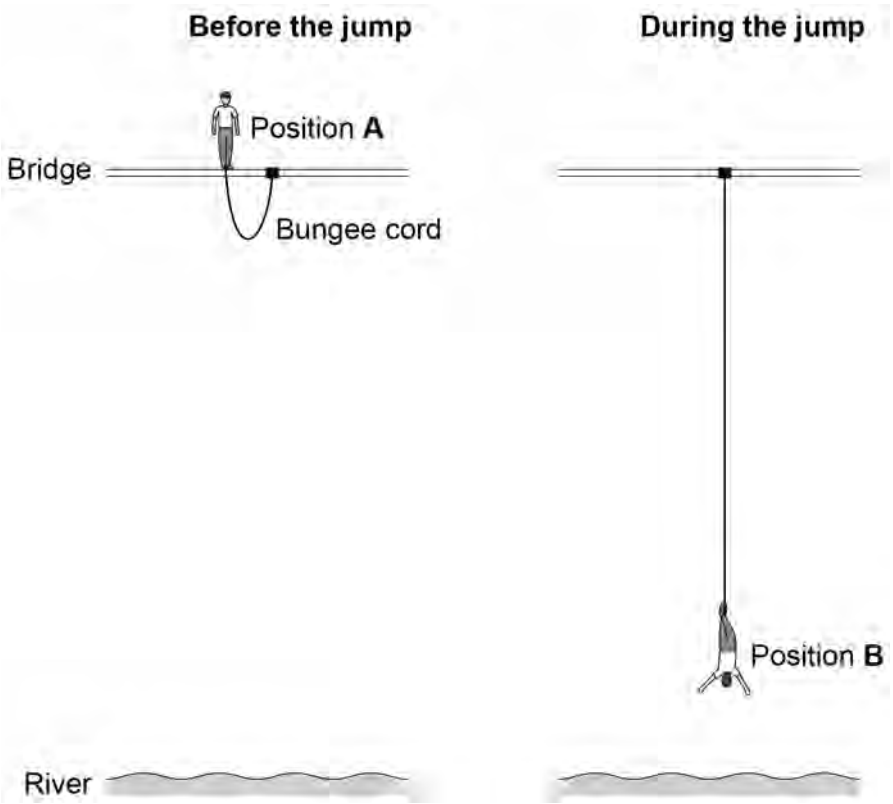
Question 121

June 2023 | 8463/1F | Original Q6

0 6 **Figure 8** shows a student before and during a bungee jump.

The diagram is not to scale.

Figure 8



0 6 . 1 In position **B**, the student is moving towards the river and the bungee cord is stretching.

How do the energy stores in position **B** compare with the energy stores in position **A**?

[3 marks]

Tick (✓) **one** box in **each** row.

Energy store	Less than at A	The same as at A	More than at A
The student's gravitational potential energy			
The student's kinetic energy			
The bungee cord's elastic potential energy			

4.1.1.1 Energy stores and systems

Question 121 · continued

0 6 . 2 The bungee cord behaves like a spring with a spring constant of 78.4 N/m.

At one point in the bungee jump, the extension of the bungee cord is 25 m.

Calculate the elastic potential energy stored by the bungee cord.

Use the equation:

elastic potential energy = 0.5 × spring constant × extension^2

[2 marks]

Elastic potential energy = _____ J

4.1.1.1 Energy stores and systems

Question 121 · continued

Table 5 shows information about different bungee cords.

Table 5

Bungee cord	Spring constant in N/m	Maximum extension before snapping in metres
A	78.4	36
B	82.0	24
C	84.5	12

0 6 . 3 Bungee cord **C** will have a smaller extension than **A** or **B** for any bungee jumper.

Give the reason why.

[1 mark]

0 6 . 4 Which bungee cord would be safest to use for a person with a large weight?

Give a reason for your answer.

[2 marks]

Bungee cord _____

Reason _____

8

4.1.1.1 Energy stores and systems

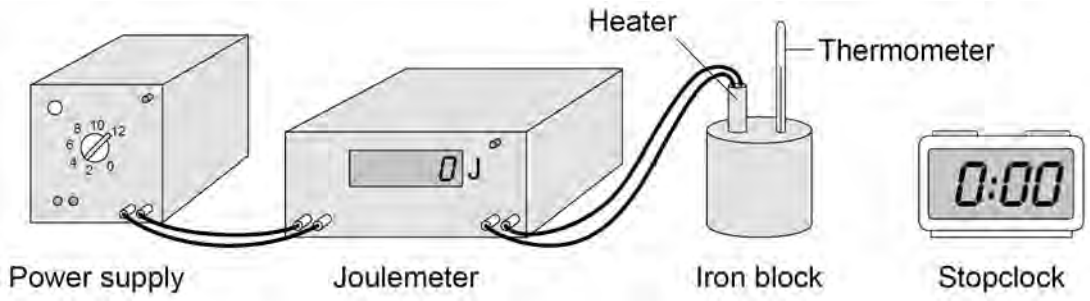
Question 122

June 2023 | 8463/1F | Original Q9

0 9 **Figure 12** shows the equipment a student used to determine the specific heat capacity of iron.

The iron block the student used has two holes, one for the heater and one for the thermometer.

Figure 12



0 9 . 1 Before the power supply was switched on, the thermometer was used to measure the temperature of the iron block.

The student left the thermometer in the iron block for a few minutes before recording the initial temperature.

Suggest why.

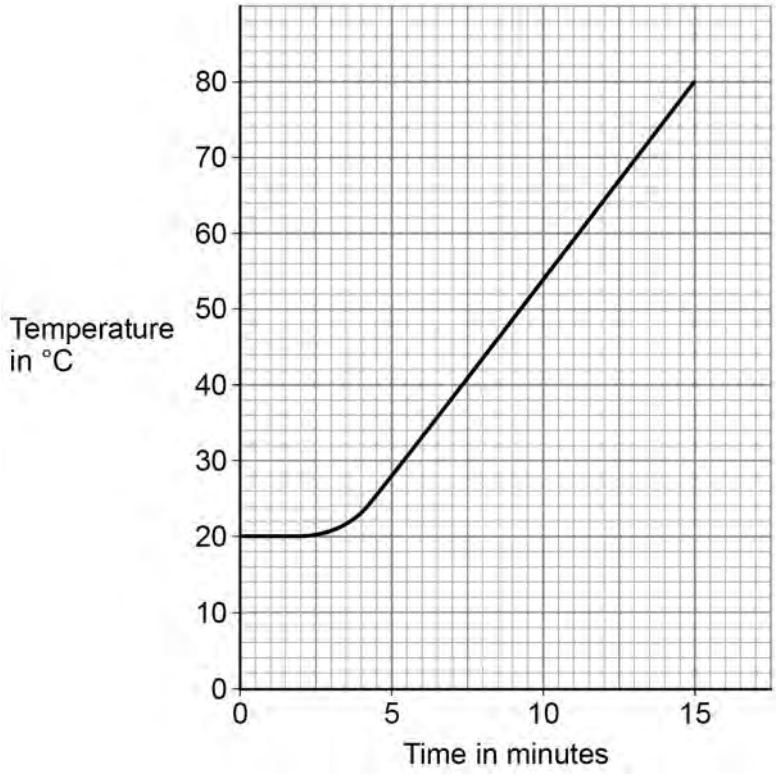
[1 mark]

4.1.1.1 Energy stores and systems

Question 122 · continued

0 9 . 2 **Figure 13** shows how the temperature changed after the power supply was switched on.

Figure 13



The energy transferred to the iron block between 5 and 10 minutes was 26 000 J.

The mass of the iron block was 2.0 kg.

Calculate the specific heat capacity of iron.

Use information from **Figure 13** and the Physics Equations Sheet.

[4 marks]

Specific heat capacity = _____ J/kg °C

4.1.1.1 Energy stores and systems

Question 122 · continued

0 9 . 3 The student repeated the investigation but wrapped insulation around the iron block.

What effect will adding insulation have had on the investigation?

[2 marks]

Tick (✓) **two** boxes.

- The calculated specific heat capacity will be more accurate. ☐
- The iron block will transfer thermal energy to the surroundings at a lower rate. ☐
- The power output of the heater will be lower than expected. ☐
- The temperature of the iron block will increase more slowly than expected. ☐
- The uncertainty in the temperature measurement will be greater. ☐

7

4.1.1.1 Energy stores and systems

Question 123

June 2023 | 8463/2F | Original Q2

0 2 The stopping distance of a car is the braking distance added to the thinking distance.

0 2 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**electrostatic**	**kinetic**
nuclear		**thermal**

A driver applies the brakes to a moving car.

As the car slows down, there is a decrease in the _____ energy of the car.

The work done by friction causes an increase in the _____ energy store of the brakes.

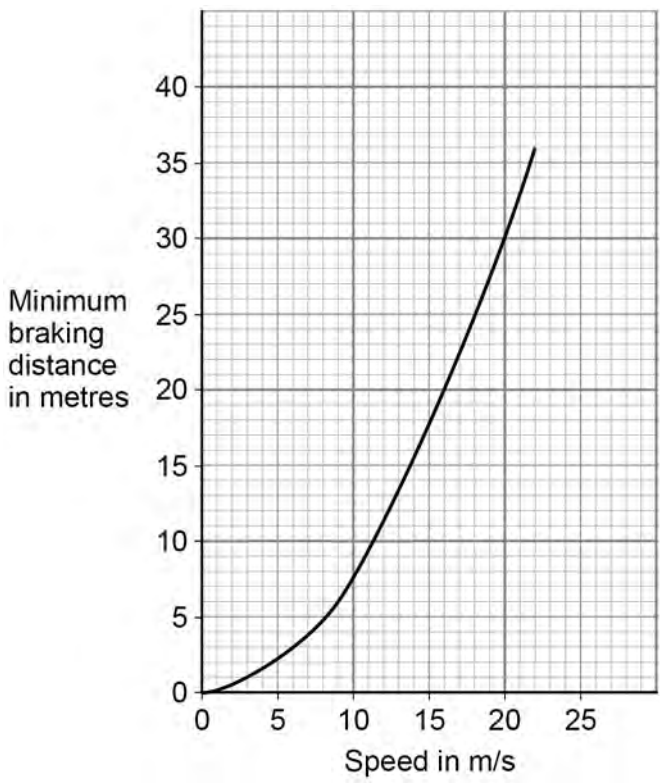
Question 2 continues on the next page

4.1.1.1 Energy stores and systems

Question 123 · continued

0 2 . 2 **Figure 3** shows how the speed of the car affects the minimum braking distance of the car.

Figure 3



Describe the relationship between the speed of the car and the minimum braking distance of the car.

[1 mark]

0 2 . 3 Complete the sentence.

Choose the answer from the box.

[1 mark]

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

When the road becomes icy, the braking distance _____.

4.1.1.1 Energy stores and systems

Question 123 · continued

A car driver applies the brakes to decelerate the car as it approaches a road junction.

The car decelerates at 0.25 m/s^2.

mass of the car = 1600 kg

0 2 . 4 Calculate the time taken for the velocity of the car to decrease from 12.5 m/s to 5.0 m/s.

Use the equation:

$$\text{time taken} = \frac{\text{change in velocity}}{\text{deceleration}}$$

[3 marks]

Time taken = _____ s

0 2 . 5 Calculate the resultant force causing the car to decelerate.

Use the equation:

$$\text{resultant force} = \text{mass} \times \text{deceleration}$$

[2 marks]

Resultant force = _____ N

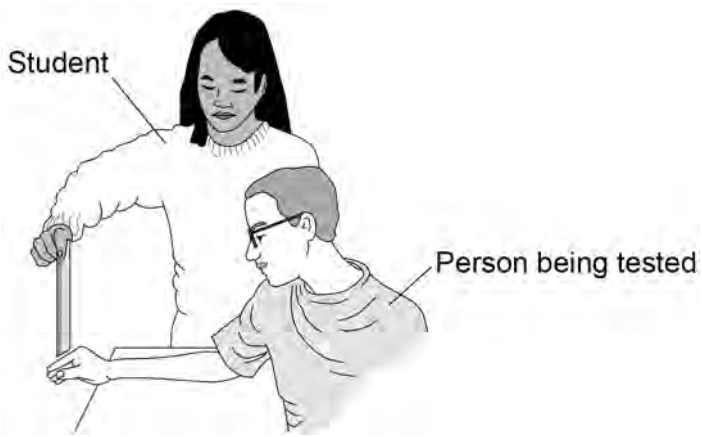
4.1.1.1 Energy stores and systems

Question 123 · continued

Thinking distance is affected by the reaction time of the driver.

Figure 4 shows how a student tested a person's reaction time.

Figure 4



The student held a ruler and then released it.

The person being tested closed his hand to catch the ruler as quickly as possible.

The further the ruler fell the greater the person's reaction time.

0 2 . 6 The student wanted to test the reaction time of the people in her class.

Which of the following could have been a control variable in this investigation?

[1 mark]

Tick (✓) **one** box.

Distance fallen by the ruler before being caught ☐

Initial height of the ruler above the person's hand ☐

Reaction time of the person being tested ☐

4.1.1.1 Energy stores and systems

Question 123 · continued

0 2 . 7 The student tested three people in her class.

The mean distance that the ruler fell before being caught was 18.2 cm.

If all of the people in her class were tested, the mean distance may not be 18.2 cm.

Suggest why.

[1 mark]

0 2 . 8 Describe how this investigation could be changed to find out how listening to music affects reaction time.

[2 marks]

13

4.1.1.1 Energy stores and systems

Question 124

June 2023 | 8463/2F | Original Q9

0 9 Infrared waves are transverse waves.

0 9 . 1 Complete the sentence.

[1 mark]

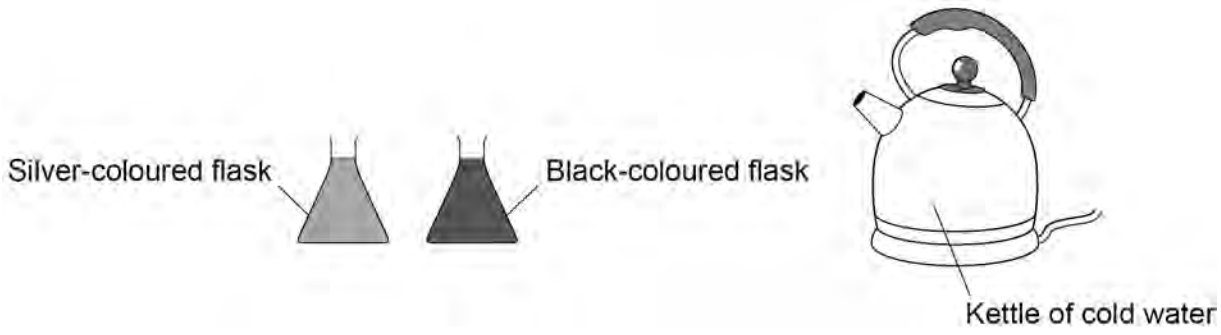
In a transverse wave, the direction of oscillation is _____

to the direction of energy transfer by the wave.

A student investigated how the colour of a surface affects the rate at which the surface emits infrared radiation.

Figure 23 shows some of the equipment used.

Figure 23



4.1.1.1 Energy stores and systems

Question 124 · continued

0 9 . 2 The student wrote the following hypothesis:

‘The black-coloured flask will emit more infrared radiation than the silver-coloured flask during 10 minutes of cooling.’

Describe a method to test this hypothesis.

[6 marks]

Question 9 continues on the next page

4.1.1.1 Energy stores and systems

Question 124 · continued

0 9 . 3 When will the flasks emit infrared radiation at the greatest rate?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

During the 1st minute ☐

During the 5th minute ☐

During the 9th minute ☐

Reason _____

_____

4.1.1.1 Energy stores and systems

Question 124 · continued

Another student investigated the absorption of infrared radiation by different surface colours.

The student filled four hollow metal cubes with cold water.

Each cube was the same size but had a different surface colour.

The cubes were then placed the same distance from an infrared heater.

After 10 minutes, the student measured the temperature increase of the water inside each cube.

0 9 . 4 What was the dependent variable in this investigation?

[1 mark]

0 9 . 5 **Table 2** shows the results.

Table 2

Surface colour of the cube	Temperature increase after 10 minutes in °C
Matt white	3.0
Shiny white	2.0
Matt black	6.5
Shiny black	4.0

Give **two** conclusions that can be made from the results in **Table 2**.

[2 marks]

1

2

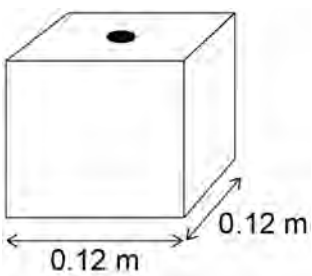
4.1.1.1 Energy stores and systems

Question 124 · continued

Figure 24 shows one of the cubes. The cube is filled with water.

The weight of the water exerts a pressure on the bottom of the cube.

Figure 24



Use the Physics Equations Sheet to answer questions **09.6** and **09.7**.

0 9 . 6 Which equation correctly links area, force and pressure?

[1 mark]

Tick (✓) **one** box.

pressure = force × area^2 ☐

pressure = force × area ☐

pressure = $\frac{\text{force}}{\text{area}}$ ☐

pressure = $\frac{\text{area}}{\text{force}}$ ☐

4.1.1.1 Energy stores and systems

Question 124 · continued

0 9 . 7 The water pressure at the bottom of the cube is 1500 Pa.

Calculate the force of the water on the bottom of the cube.

[4 marks]

Force = _____ N

17

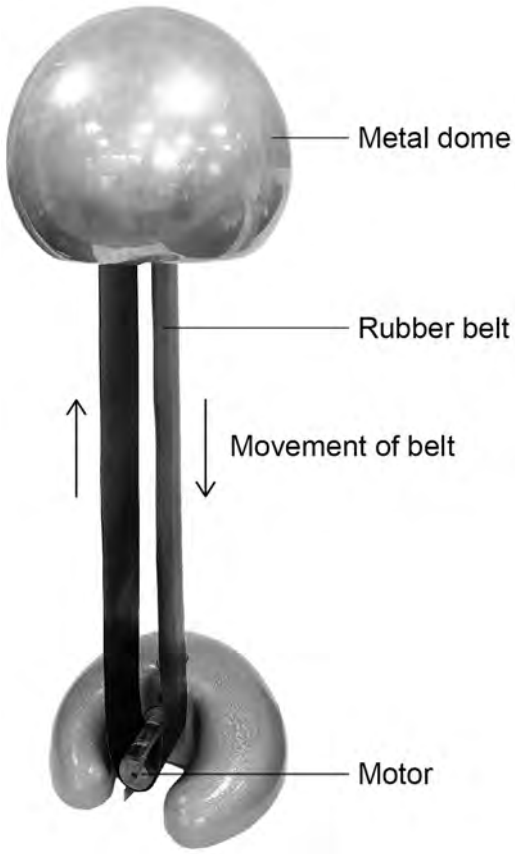
Turn over for the next question

4.1.1.1 Energy stores and systems

Question 125

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.

4.1.1.1 Energy stores and systems

Question 125 · 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

4.1.1.1 Energy stores and systems

Question 125 · continued

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

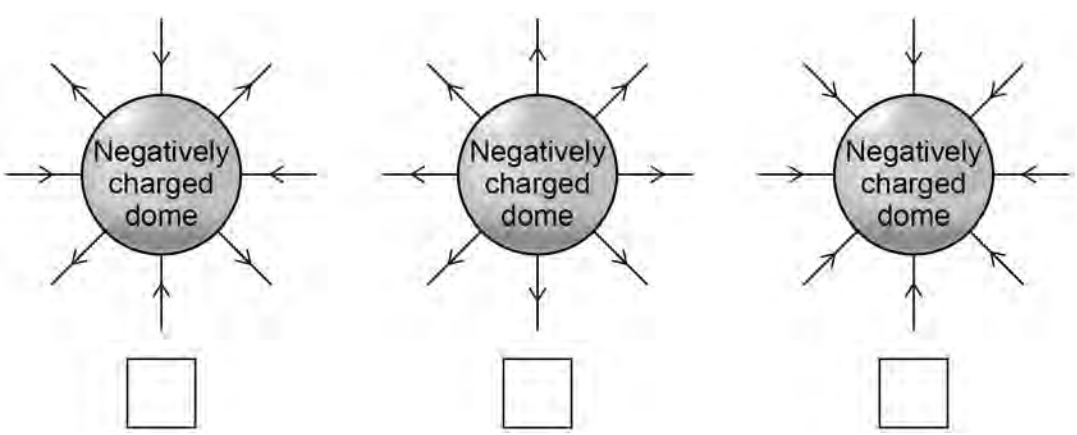
attraction	**gravity**	**repulsion**

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.

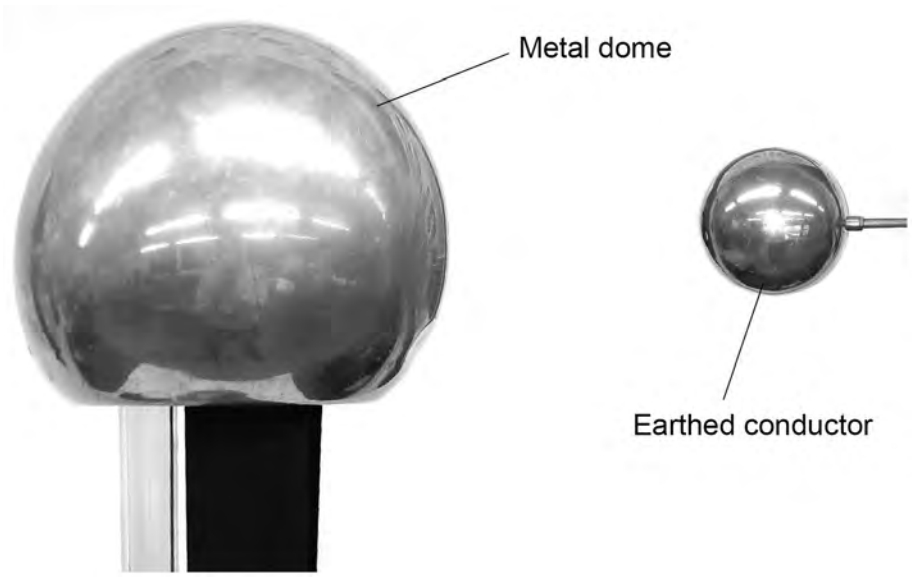


4.1.1.1 Energy stores and systems

Question 125 · 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 125 · 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 ☐

4.1.1.1 Energy stores and systems

Question 125 · 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

4.1.1.1 Energy stores and systems

Question 126

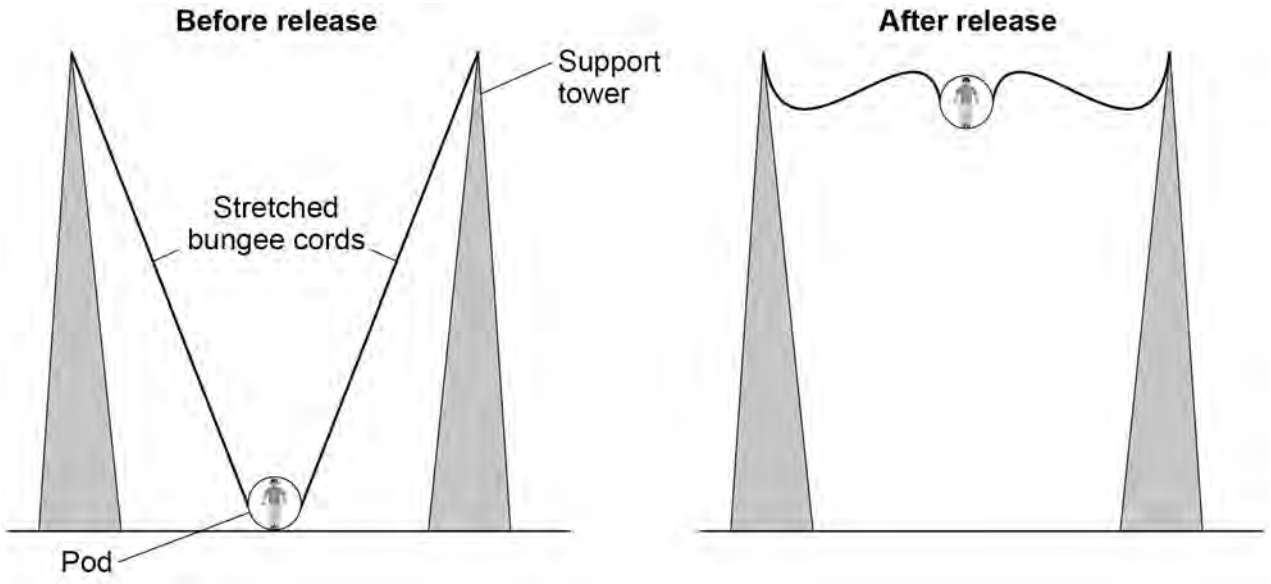
June 2024 | 8463/1F | Original Q3

0 3 In a ride at a theme park, a person is strapped into a pod that is attached to two stretched bungee cords.

The bungee cords behave like springs.

Figure 7 shows a person using the ride.

Figure 7



0 3 . 1 How is the extension of each bungee cord calculated?

[1 mark]

Tick (✓) **one** box.

stretched length + original length ☐

stretched length – original length ☐

stretched length × original length ☐

stretched length ÷ original length ☐

4.1.1.1 Energy stores and systems

Question 126 · continued

0 3 . 2 Before the pod is released, the extension of each bungee cord is 7.5 m.

spring constant of the bungee cord = 800 N/m

Calculate the elastic potential energy stored in each stretched bungee cord.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

0 3 . 3 The maximum speed of the pod is 15 m/s.

The mass of the pod is 240 kg.

Calculate the maximum kinetic energy of the pod.

Use the equation:

kinetic energy = 0.5 × mass × (speed)^2

[2 marks]

Maximum kinetic energy = _____ J

4.1.1.1 Energy stores and systems

Question 126 · continued

Use the Physics Equations Sheet to answer questions **03.4** and **03.5**.

0 3 . 4 Which equation links gravitational field strength (g), gravitational potential energy (E_p), height (h) and mass (m)?

[1 mark]

Tick (✓) **one** box.

$E_p = \frac{m \times g}{h}$ ☐

$E_p = \frac{m}{g \times h}$ ☐

$E_p = m \times g \times h$ ☐

0 3 . 5 The pod has 24 000 J of gravitational potential energy when at its maximum height.

The mass of the pod is 240 kg.

gravitational field strength = 9.8 N/kg

Calculate the maximum height reached by the pod.

[3 marks]

Maximum height = _____ m

Question 3 continues on the next page

4.1.1.1 Energy stores and systems

Question 126 · continued

0 3 . 6 Why is the maximum gravitational potential energy of the pod less than the initial elastic potential energy of the bungee cords?

[2 marks]

Tick (✓) **two** boxes.

- Energy is created. ☐
- Energy is destroyed. ☐
- Energy is transferred to the surroundings. ☐
- Work is done against air resistance. ☐
- Work is done by the force of gravity. ☐
- Work is done by the person in the pod. ☐

11

4.1.1.1 Energy stores and systems

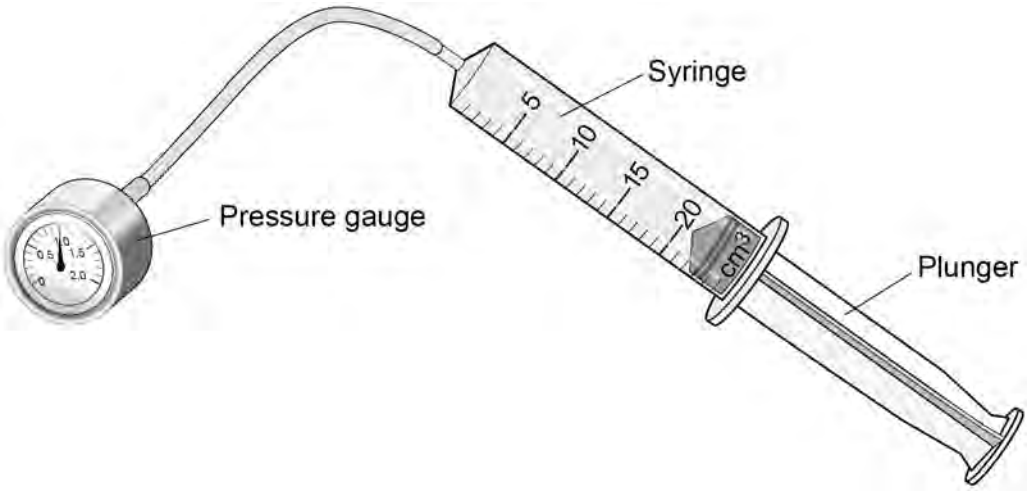
Question 127

June 2024 | 8463/1F | Original Q5

0 5 A student investigated how the pressure in a fixed mass of air varies with the volume of the air.

Figure 10 shows the equipment used.

Figure 10



When the plunger was pushed slowly into the syringe, the temperature of the air stayed the same.

0 5 . 1 How did pushing the plunger in affect the volume of air in the syringe?

[1 mark]

Tick (✓) **one** box.

The volume decreased. ☐

The volume stayed the same. ☐

The volume increased. ☐

4.1.1.1 Energy stores and systems

Question 127 · continued

June 2024 | 8463/1F | Original Q5

0 5 . 2 How did pushing the plunger in affect the distance between the air particles in the syringe?

[1 mark]

Tick (✓) **one** box.

The distance decreased. ☐

The distance stayed the same. ☐

The distance increased. ☐

0 5 . 3 How did pushing the plunger in affect the frequency of collisions between the air particles and the syringe walls?

[1 mark]

Tick (✓) **one** box.

The frequency of collisions decreased. ☐

The frequency of collisions stayed the same. ☐

The frequency of collisions increased. ☐

0 5 . 4 How did pushing the plunger in affect the air pressure in the syringe?

[1 mark]

Tick (✓) **one** box.

The air pressure decreased. ☐

The air pressure stayed the same. ☐

The air pressure increased. ☐

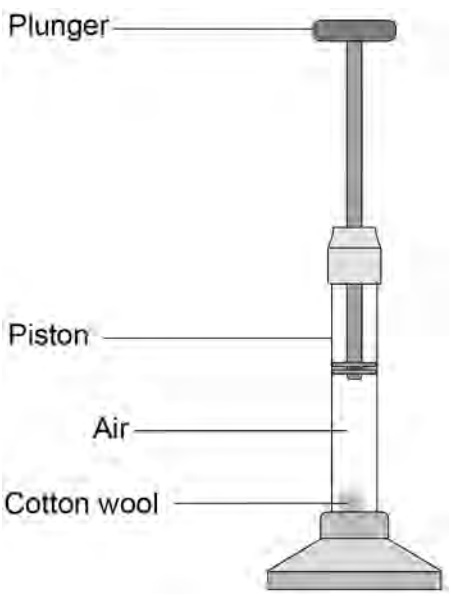
4.1.1.1 Energy stores and systems

Question 127 · continued

A fire piston is a special type of syringe that can be used to start fires.

Figure 11 shows a fire piston.

Figure 11



The plunger is pushed quickly downwards and compresses the air.

When the air is compressed quickly, the temperature of the air increases.

0 5 . 5 How does an increase in temperature affect the mean speed of the air particles inside the syringe?

[1 mark]

Tick (✓) **one** box.

The mean speed of the particles decreases. ☐

The mean speed of the particles does not change. ☐

The mean speed of the particles increases. ☐

4.1.1.1 Energy stores and systems

Question 127 · continued

June 2024 | 8463/1F | Original Q5

0 5 . 6 When the air is hot enough, a small piece of cotton wool in the piston catches fire.

The energy transferred to the air in the piston is 0.0130 J.

The mass of air in the piston is 2.60×10^{-8} kg.

specific heat capacity of air = 1010 J/kg °C

Calculate the temperature change of the air.

Use the Physics Equations Sheet.

[3 marks]

Temperature change = _____ °C

8

4.1.1.1 Energy stores and systems

Question 128

June 2024 | 8463/1F | Original Q9

0 9 **Figure 16** shows a wind turbine.

Figure 16



Wind turbines may generate electricity when the electricity is not needed.

Two methods that can be used to store the energy from the turbine are:

Method A: Heating water to a high temperature.

Method B: Pumping water uphill into a reservoir.

0 9 . 1 Which energy store increases when water is heated?

[1 mark]

0 9 . 2 Which energy store increases when water is pumped uphill into a reservoir?

[1 mark]

4.1.1.1 Energy stores and systems

Question 128 · continued

0 9 . 3 **Table 4** shows information about the two methods of storing energy.

Table 4

Method	Energy stored per 100 kg of water in kJ	Percentage of stored energy wasted	Installation
A: Increasing water temperature by 80 °C	33 600	40%	Anywhere
B: Pumping water uphill to a height of 500 m	490	25%	High mountains

Compare the advantages and disadvantages of the two methods of storing energy.

Include calculations in your answer.

[4 marks]

Question 9 continues on the next page

4.1.1.1 Energy stores and systems

Question 128 · continued

0 9 . 4 Decreasing the amount of carbon dioxide released by different activities will help slow down climate change.

Transport and generating electricity are the two activities that released the largest amounts of carbon dioxide in the UK in 2018.

Explain **one** change that would reduce the amount of carbon dioxide released by **each** activity.

[4 marks]

Transport _____

_____

_____

_____

_____

Generating electricity _____

_____

_____

_____

_____

10

4.1.1.1 Energy stores and systems

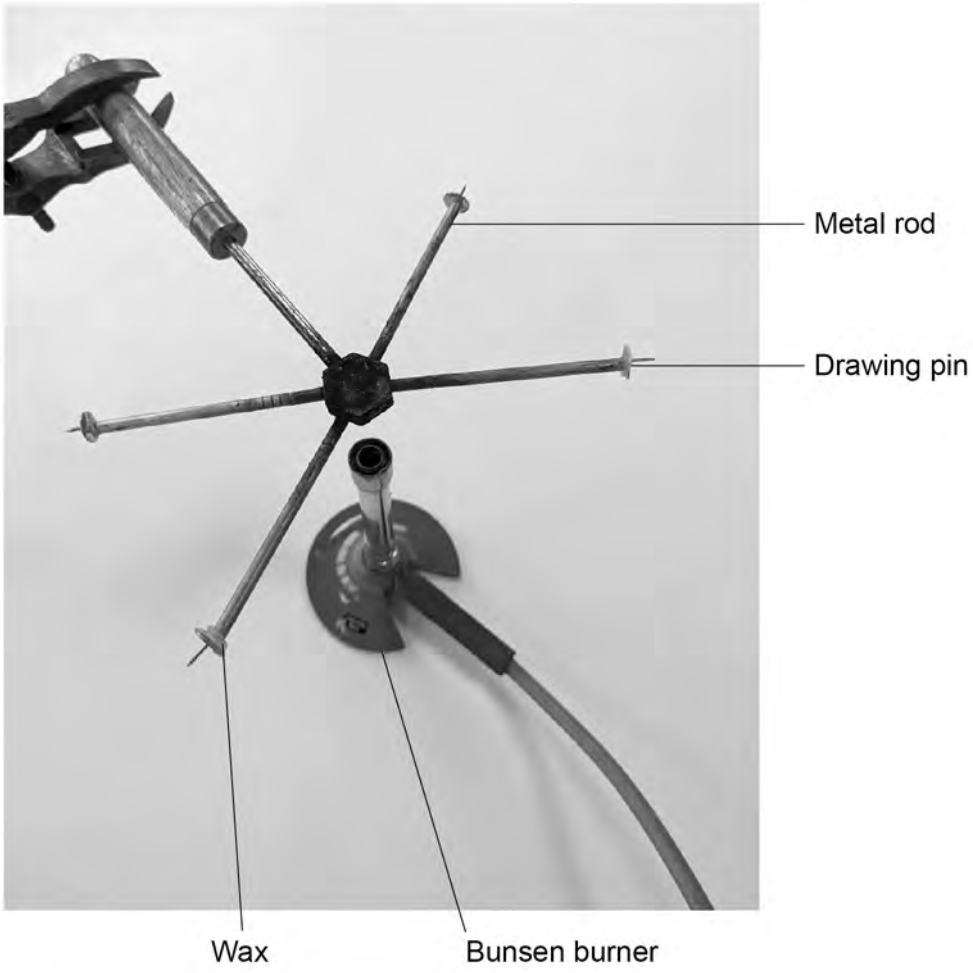
Question 129

June 2025 | 8463/1F | Original Q2

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

Figure 2 shows some of the apparatus used.

Figure 2



Each rod was made from a different metal.

The metal rods are joined at the centre.

The size of each metal rod was the same.

This is the method used.

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

4.1.1.1 Energy stores and systems

Question 129 · continued

Table 1 shows the results.

Table 1

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

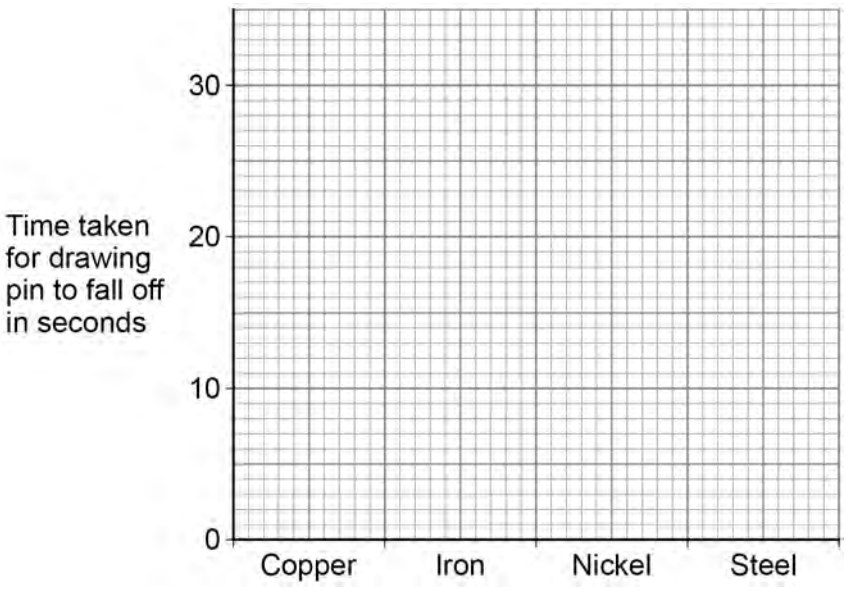
0 2 . 1 Complete **Figure 3**.

You should:

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

[3 marks]

Figure 3



Question 129 · continued

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

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Copper ☐ Iron ☐ Nickel ☐ Steel ☐

Reason _____

_____

_____

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

The temperature change of the rod was 20 °C.

mass of the nickel rod = 0.015 kg

Calculate the specific heat capacity of nickel.

Use the equation:

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

[2 marks]

_____

_____

_____

_____

Specific heat capacity = _____ J/kg °C

4.1.1.1 Energy stores and systems

Question 129 · continued

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

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

[1 mark]

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

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

The mean power transfer was 0.33 W.

Calculate the time taken for the energy transfer.

[3 marks]

Time taken = _____ s

11

4.1.1.1 Energy stores and systems

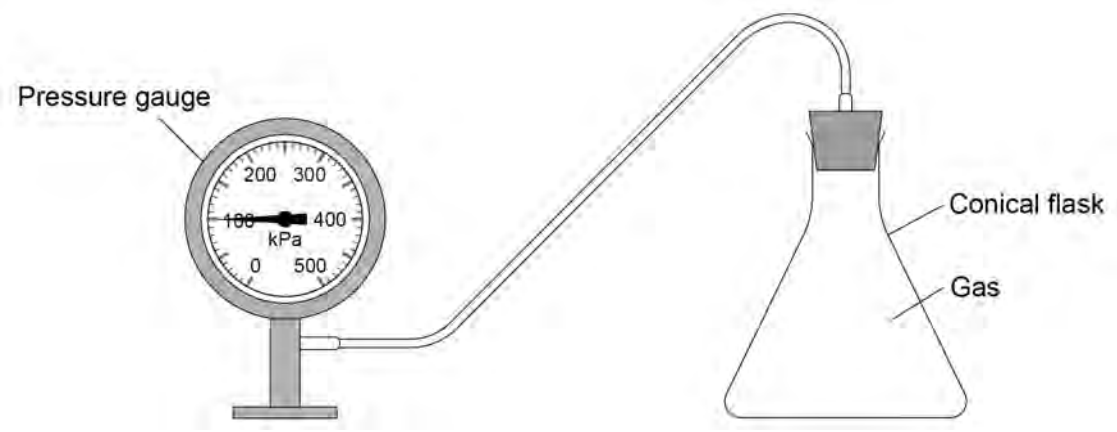
Question 130

June 2025 | 8463/1F | Original Q4

0 4 A teacher demonstrated how the pressure in a gas varies with temperature.

Figure 7 shows some of the apparatus used.

Figure 7



The teacher heated the conical flask.

The temperature of the gas in the flask increased.

0 4 . 1 How did heating the gas affect the average speed of the gas particles?

[1 mark]

Tick (✓) **one** box.

The speed decreased. ☐

The speed stayed the same. ☐

The speed increased. ☐

4.1.1.1 Energy stores and systems

Question 130 · continued

0 4 . 2 How did heating the gas affect the average kinetic energy of the gas particles?

[1 mark]

Tick (✓) **one** box.

The kinetic energy decreased. ☐

The kinetic energy stayed the same. ☐

The kinetic energy increased. ☐

As the temperature of the gas increased, the pressure of the gas inside the flask increased.

0 4 . 3 How did increasing the pressure affect the number of collisions each second between gas particles and the walls of the flask?

[1 mark]

Tick (✓) **one** box.

The number of collisions each second decreased. ☐

The number of collisions each second stayed the same. ☐

The number of collisions each second increased. ☐

Question 4 continues on the next page

4.1.1.1 Energy stores and systems

Question 130 · continued

0 4 . 4 What happened to the force exerted on the walls of the flask by the gas particles when the pressure increased?

[1 mark]

Tick (✓) **one** box.

The force exerted decreased. ☐

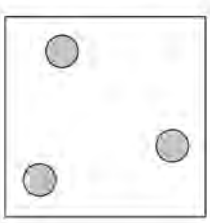
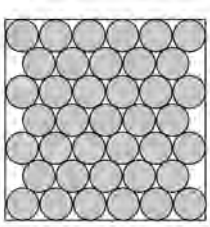
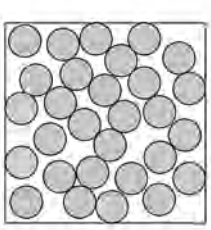
The force exerted stayed the same. ☐

The force exerted increased. ☐

0 4 . 5 At different temperatures, nitrogen can be a gas, a liquid or a solid.

Draw **one** line from the state of matter to the arrangement of particles in each state.

[2 marks]

State of matter	Arrangement of particles
Liquid	
Solid	
Gas	

4.1.1.1 Energy stores and systems

Question 130 · continued

0 4 . 6 The boiling point of nitrogen is –196 °C and the melting point of nitrogen is –210 °C.

What is the state of matter of nitrogen at a temperature of –200 °C?

[1 mark]

Tick (✓) **one** box.

Solid ☐ Liquid ☐ Gas ☐

0 4 . 7 What is the state of matter of nitrogen when the temperature is lower than the melting point of nitrogen?

[1 mark]

Tick (✓) **one** box.

Solid ☐ Liquid ☐ Gas ☐

0 4 . 8 As a substance melts, the temperature of the substance is constant.

What happens to the kinetic energy **and** the potential energy of the particles as the substance melts?

[2 marks]

Tick (✓) **one** box in each row.

	Decreases	Stays the same	Increases
Kinetic energy of particles			
Potential energy of particles			

10

4.1.1.1 Energy stores and systems

Question 131

June 2025 | 8463/1F | Original Q5

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

Figure 8



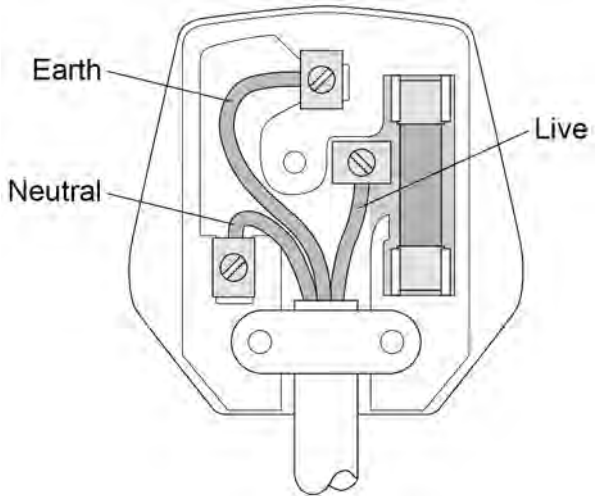
4.1.1.1 Energy stores and systems

Question 131 · continued

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

Figure 9 shows the inside of the plug.

Figure 9



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

[3 marks]

Choose answers from the box.

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

Earth wire _____

Live wire _____

Neutral wire _____

Question 5 continues on the next page

4.1.1.1 Energy stores and systems

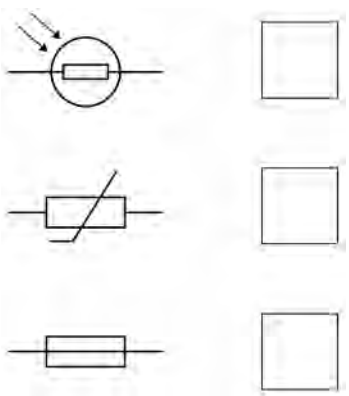
Question 131 · continued

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

What is the circuit symbol for a fuse?

[1 mark]

Tick (✓) **one** box.



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

The power of the heating element is 2420 W.

The current in the heating element is 11.0 A.

Calculate the potential difference across the heating element.

Use the equation:

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

[2 marks]

Potential difference = _____ V

Question 131 · continued

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

The current in the heating element is 11.0 A.

Calculate the resistance of the heating element.

Use the equation:

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

[2 marks]

Resistance = _____ Ω

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

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

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

[2 marks]

Tick (✓) **two** boxes.

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

10

4.1.1.1 Energy stores and systems

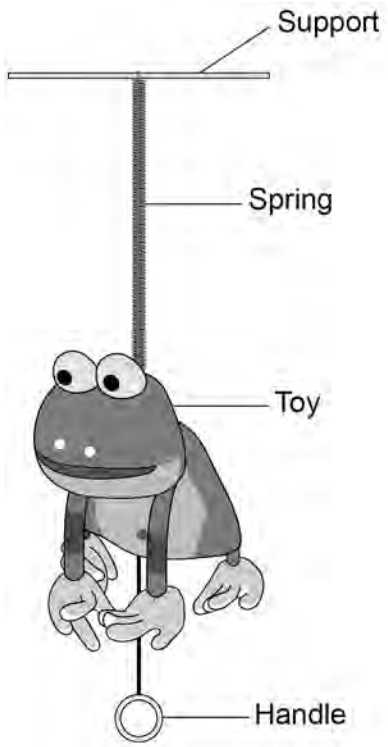
Question 132

June 2025 | 8463/1F | Original Q6

0 6 **Figure 10** shows a toy which is hung from a support.

When the handle is pulled down and then released, the toy bounces up and down.

Figure 10



0 6 . 1 When the handle is pulled down, the spring extends.

The extension of the spring is 0.35 m.

The spring constant of the spring is 5.6 N/m.

Calculate the elastic potential energy stored by the stretched spring.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

4.1.1.1 Energy stores and systems

Question 132 · continued

Use the Physics Equations Sheet to answer questions **06.2** and **06.3**.

0 6 . 2 Which equation links gravitational field strength (g), gravitational potential energy (E_p), height (h) and mass (m)?

[1 mark]

Tick (✓) **one** box.

$E_p = \frac{mg}{h}$ ☐

$E_p = \frac{m}{gh}$ ☐

$E_p = mgh$ ☐

0 6 . 3 When the handle is released, the toy moves upwards through a height of 0.60 m.

The toy has 0.294 J of gravitational potential energy in its highest position.

gravitational field strength = 9.8 N/kg

Calculate the mass of the toy.

[3 marks]

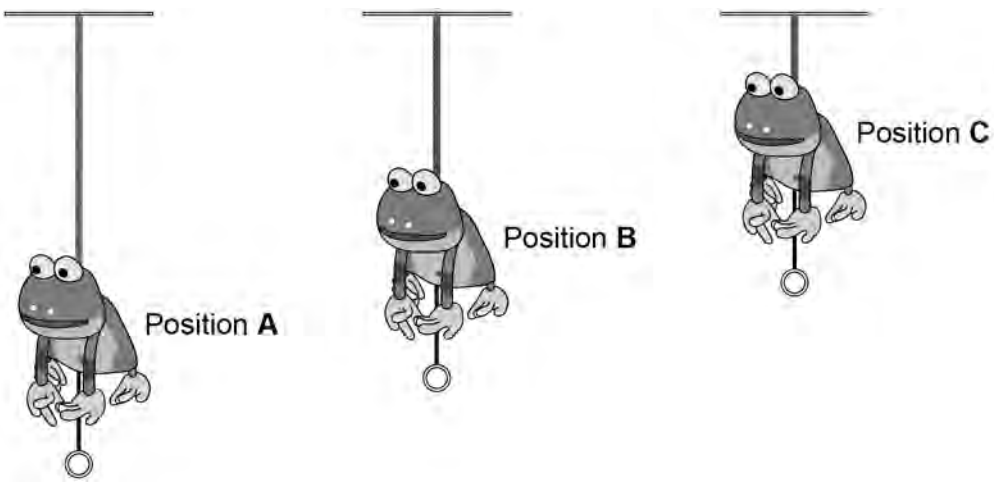
Mass of the toy = _____ kg

Question 6 continues on the next page

Question 132 · continued

Figure 11 shows the toy in three different positions.

Figure 11



The toy is released from position **A** and moves upwards.

The toy is moving upwards in position **B**.

The toy is at maximum height in position **C**.

0 6 . 4 Between position **A** and position **B**, the extension of the spring decreases.

How does the elastic potential energy stored by the spring change as the extension decreases?

[1 mark]

Tick (✓) **one** box.

Elastic potential energy decreases. ☐

Elastic potential energy stays the same. ☐

Elastic potential energy increases. ☐

4.1.1.1 Energy stores and systems

Question 132 · continued

0 6 . 5 Between position **B** and position **C**, the toy slows down.

How does the kinetic energy of the toy change as the toy slows down?

[1 mark]

Tick (✓) **one** box.

Kinetic energy decreases. ☐

Kinetic energy stays the same. ☐

Kinetic energy increases. ☐

0 6 . 6 How does the gravitational potential energy of the toy change as the toy moves from position **B** to position **C**?

[1 mark]

Tick (✓) **one** box.

Gravitational potential energy decreases. ☐

Gravitational potential energy stays the same. ☐

Gravitational potential energy increases. ☐

Question 6 continues on the next page

4.1.1.1 Energy stores and systems

Question 132 · continued

0 6 . 7 The toy moves up and down many times before eventually stopping.

Which **two** of the following are reasons why the toy eventually stops?

[2 marks]

Tick (✓) **two** boxes.

- Air resistance opposes the motion of the toy. ☐
- Energy is destroyed. ☐
- Energy is transferred to the surroundings. ☐
- The gravitational field strength decreases. ☐
- The spring loses its elasticity. ☐

11

4.1.1.1 Energy stores and systems

Question 133

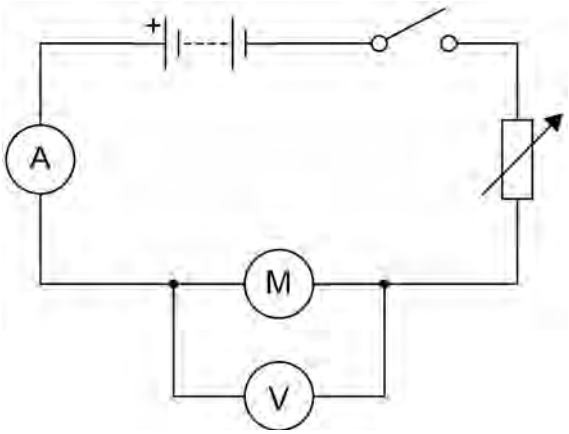
June 2025 | 8463/1F | Original Q7

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

4.1.1.1 Energy stores and systems

Question 133 · 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

4.1.1.1 Energy stores and systems

Question 133 · 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

4.1.1.1 Energy stores and systems

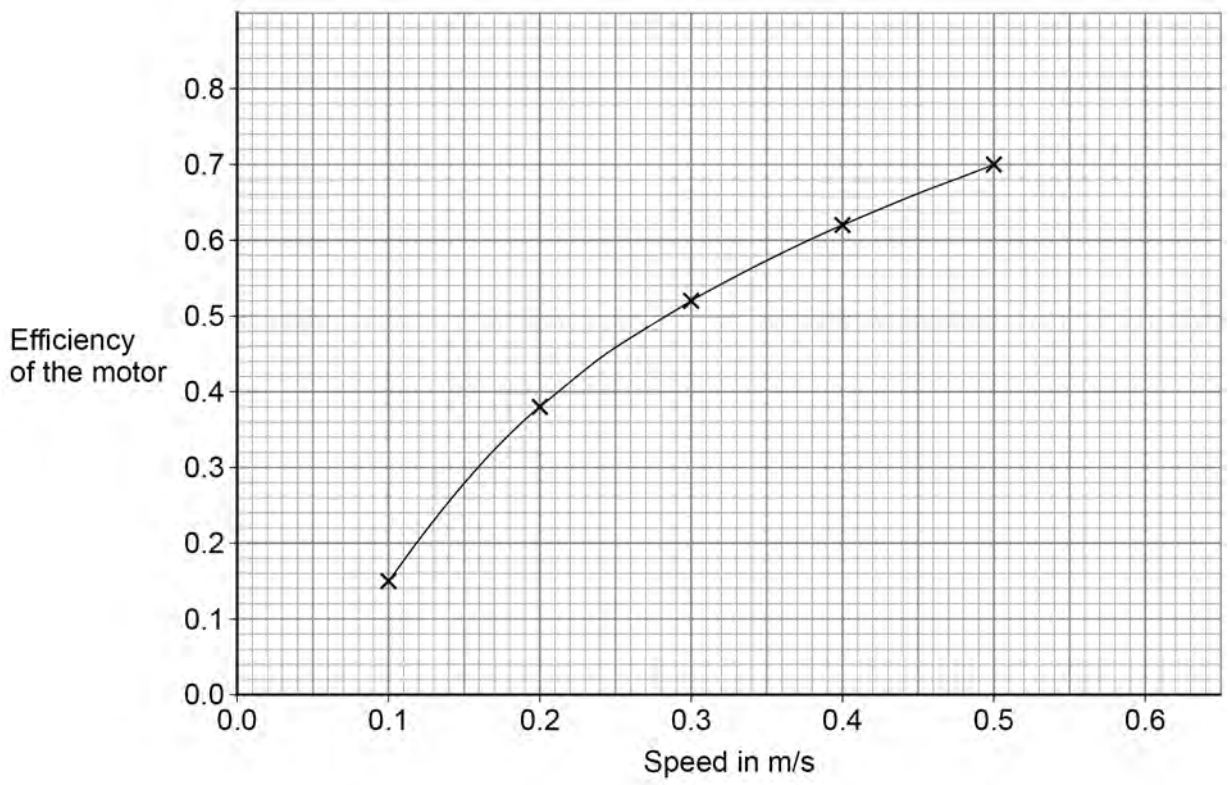
Question 133 · continued

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

4.1.1.1 Energy stores and systems

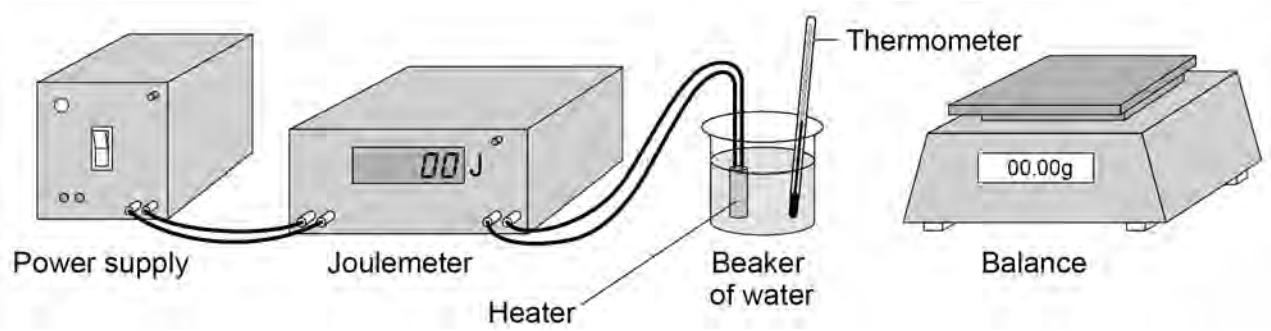
Question 134

June 2025 | 8463/1F | Original Q9

0 9 A student determined the specific heat capacity of water.

Figure 17 shows the apparatus used.

Figure 17



The joulemeter measures energy transfer.

0 9 . 1 Give **one** hazard in the investigation.

[1 mark]

0 9 . 2 Describe how the student could determine the specific heat capacity of water using the apparatus in **Figure 17**.

[6 marks]

4.1.1.1 Energy stores and systems

Question 134 · continued

Extra space

0 9 . 3 One source of error in the experiment was energy loss to the surroundings.

Suggest **one** change to the apparatus to reduce energy loss to the surroundings.

[1 mark]

0 9 . 4 The student's value for the specific heat capacity of water was 4410 J/kg °C.

The actual value for the specific heat capacity of water is 4200 J/kg °C.

Calculate the percentage difference between the student's value and the actual value.

[2 marks]

Percentage difference = _____ %

10