AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.1.3

Energy changes in systems

Past-paper questions

Tier	**Higher**
Question groups	**19**
Available paper years	**2012–2025**

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.

4.1.1.3 Energy changes in systems

Question 01

June 2012 | PH1HP | Original Q1 | Legacy

1 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.

1 (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?

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(2 marks)

4.1.1.3 Energy changes in systems

Question 01 · continued

1 (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.

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Efficiency = ...

(2 marks)

1 (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)

1 (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 .....

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2 .....

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(2 marks)

Question 1 continues on the next page

4.1.1.3 Energy changes in systems

Question 01 · continued

1 (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.

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Energy required = ...

(3 marks)

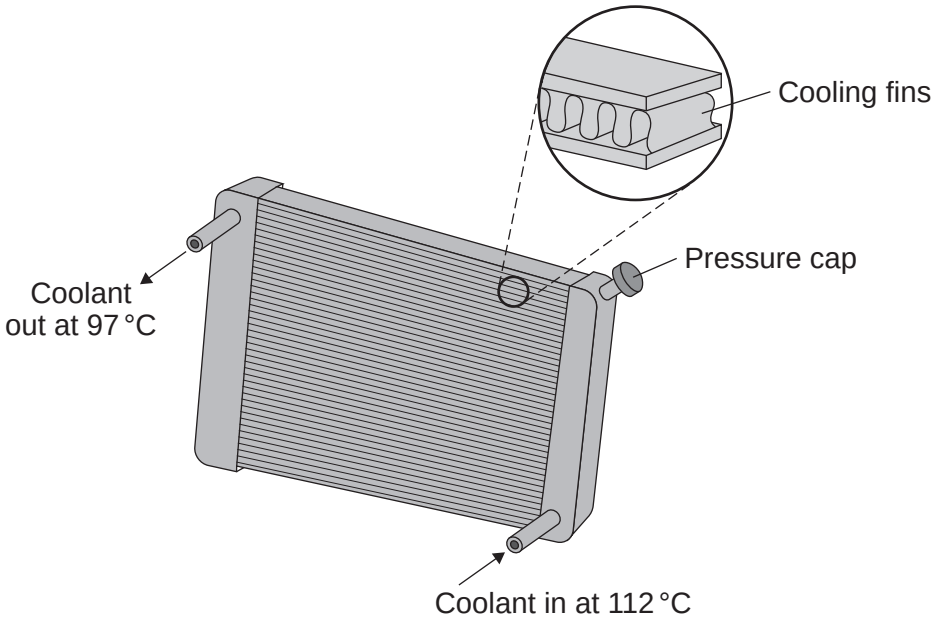
10

4.1.1.3 Energy changes in systems

Question 02

January 2013 | PH1HP | Original Q2 | Legacy

2 The diagram shows a car radiator. The radiator is part of the engine cooling system.



Liquid coolant, heated by the car engine, enters the radiator. As the coolant passes through the radiator, the radiator transfers energy to the surroundings and the temperature of the coolant falls.

2 (a) Why is the radiator painted black?

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(2 marks)

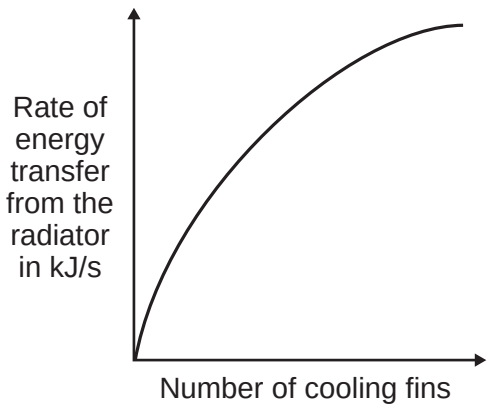
Question 2 continues on the next page

4.1.1.3 Energy changes in systems

Question 02 · continued

2 (b) Different radiators have different numbers of cooling fins along the length of the radiator.

The sketch graph shows how the number of cooling fins affects the rate of energy transfer from the radiator.



The number of cooling fins affects the rate of energy transfer from the radiator.

Explain how.

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(2 marks)

4.1.1.3 Energy changes in systems

Question 02 · continued

2 (c) When the car engine is working normally, 2 kg of coolant passes through the radiator each second. The temperature of the coolant falls from 112 °C to 97 °C.

Calculate the energy transferred each second from the coolant.

Specific heat capacity of the coolant = 3800 J/kg °C.

Use the correct equation from the Physics Equations Sheet.

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Energy transferred each second = ... J

(3 marks)

2 (d) On cold days, some of the energy transferred from a hot car engine is used to warm the air inside the car. This is a useful energy transfer.

What effect, if any, does this energy transfer have on the overall efficiency of the car engine?

Draw a ring around the correct answer.

decreases the efficiency	**does not change the efficiency**	**increases the efficiency**

Give a reason for your answer.

.....

.....

.....

(2 marks)

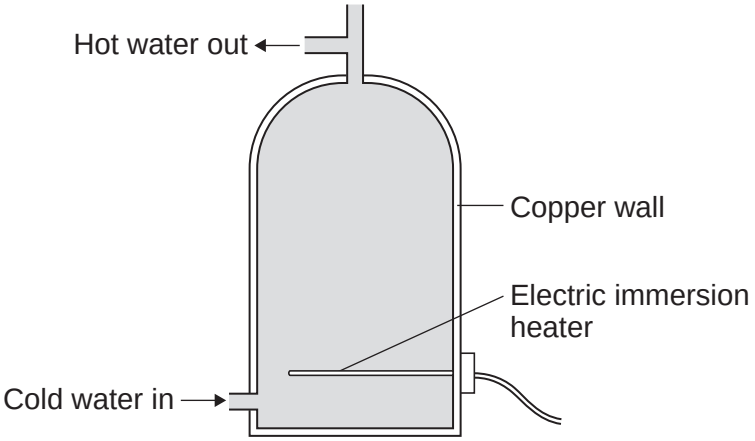
9

4.1.1.3 Energy changes in systems

Question 03

June 2013 | PH1HP | Original Q5 | Legacy

5 An electric immersion heater is used to heat the water in a domestic hot water tank. When the immersion heater is switched on the water at the bottom of the tank gets hot.



5 (a) Energy is transferred by the process of convection from the hot water at the bottom of the tank to the cooler water at the top.

Explain how.

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(4 marks)

5 (b) Complete the following sentence.

The main way the energy is transferred through the copper wall of the water tank is by the process of ..... .

(1 mark)

Question 5 continues on the next page

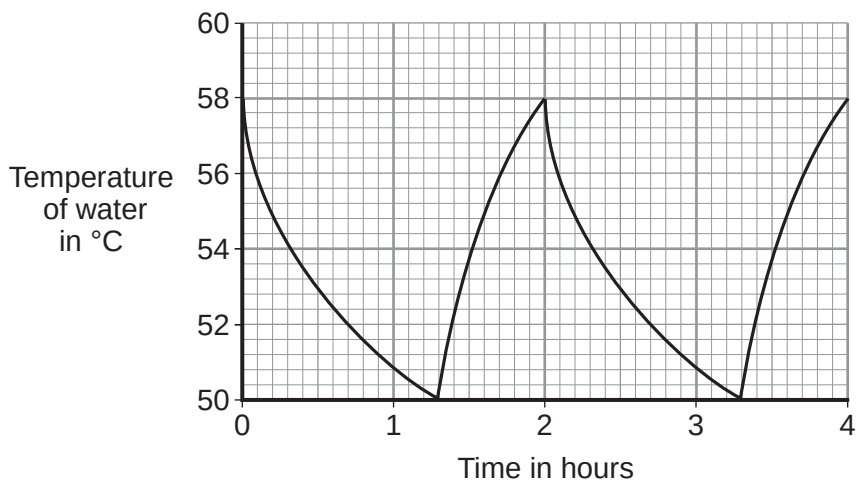
Question 03 · continued

5 (c) The immersion heater has a thermostat to control the water temperature.

When the temperature of the water inside the tank reaches 58°C the thermostat switches the heater off. The thermostat switches the heater back on when the temperature of the water falls to 50°C.

Graph A shows how the temperature of the water inside a hot water tank changes with time. The tank is **not** insulated.

Graph A (no insulation)



5 (c) (i) The temperature of the water falls at the fastest rate just after the heater switches off.

Explain why.

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(2 marks)

5 (c) (ii) To heat the water in the tank from 50°C to 58°C the immersion heater transfers 4032 kJ of energy to the water.

Calculate the mass of water in the tank.

Specific heat capacity of water = 4200 J/kg°C
Use the correct equation from the Physics Equations Sheet.

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.....

.....

Mass = ... kg

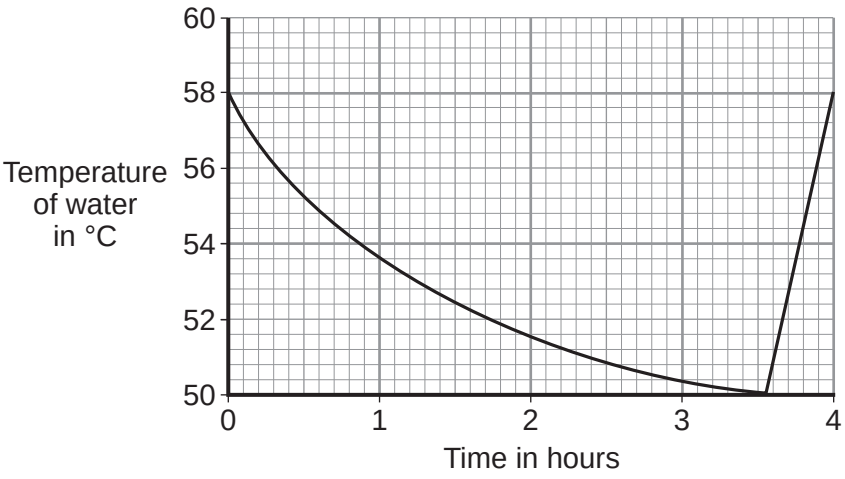
(3 marks)

Question 03 · continued

5 (c) (iii) An insulating jacket is fitted to the hot water tank.

Graph B shows how the temperature of the water inside the insulated hot water tank changes with time.

Graph B



An insulating jacket only costs £12.

By comparing **Graph A** with **Graph B**, explain why fitting an insulating jacket to a hot water tank saves money.

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(3 marks)

13

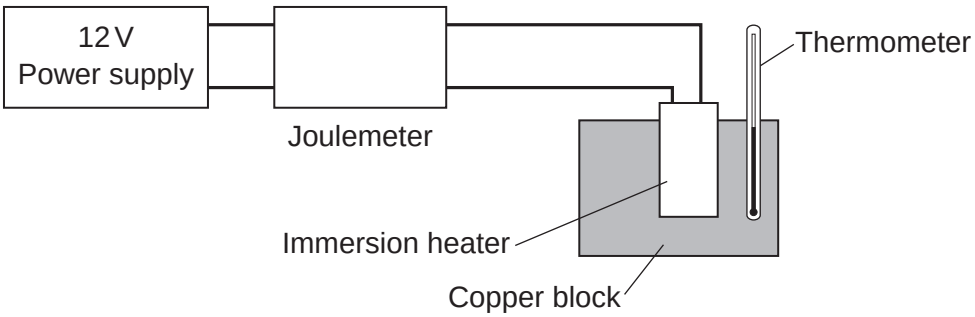
4.1.1.3 Energy changes in systems

Question 04

June 2014 | PH1HP | Original Q7 | Legacy

7 A student used the apparatus in **Figure 7** to obtain the data needed to calculate the specific heat capacity of copper.

Figure 7



The initial temperature of the copper block was measured.

The power supply was switched on.

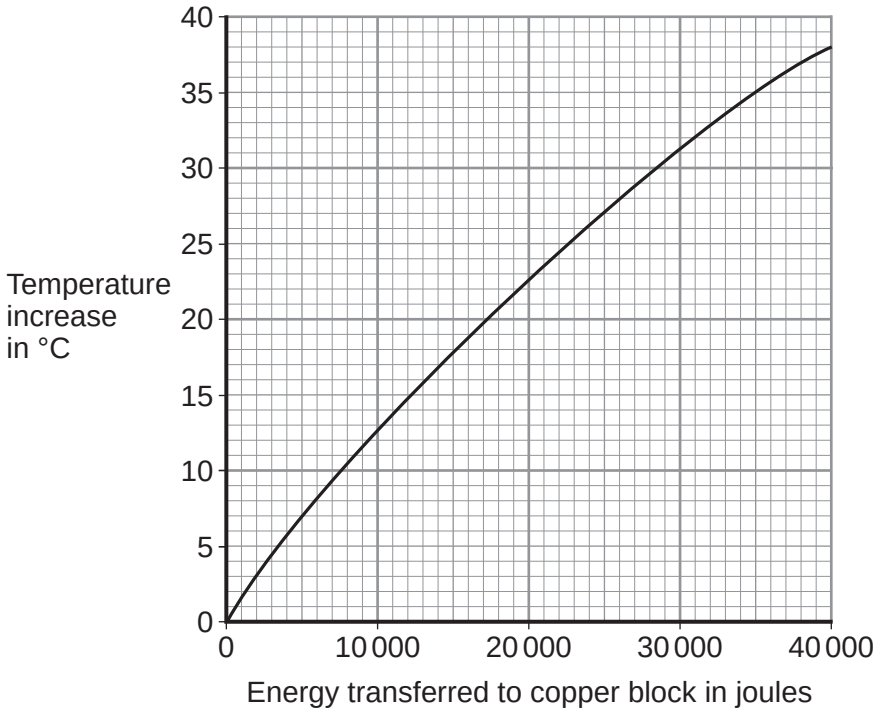
The energy transferred by the heater to the block was measured using the joulemeter.

The temperature of the block was recorded every minute.

The temperature increase was calculated.

Figure 8 shows the student's results.

Figure 8



4.1.1.3 Energy changes in systems

Question 04 · continued

7 (a) Energy is transferred through the copper block.

What is the name of the process by which the energy is transferred?

Tick (✓) **one** box.

[1 mark]

Conduction ☐

Convection ☐

Radiation ☐

7 (b) Use **Figure 8** to determine how much energy was needed to increase the temperature of the copper block by 35 °C.

[1 mark]

..... joules

7 (c) The copper block has a mass of 2 kg.

Use your answer to part **(b)** to calculate the value given by this experiment for the specific heat capacity of copper. Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

.....

.....

.....

.....

Specific heat capacity = ...

7 (d) This experiment does **not** give the correct value for the specific heat of copper.

Suggest **one** reason why.

[1 mark]

.....

.....

6

4.1.1.3 Energy changes in systems

Question 05

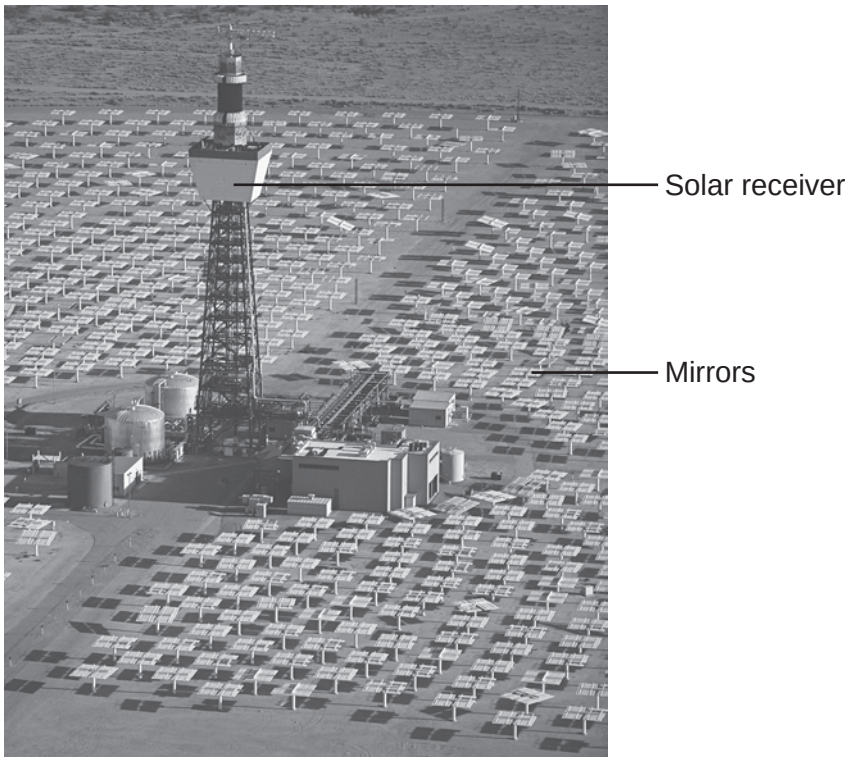
June 2015 | PH1HP | Original Q5 | Legacy

5 **Figure 5** shows a solar thermal power station that has been built in a hot desert.

The power station uses energy from the Sun to heat water to generate electricity.

Energy from the Sun is reflected towards a solar receiver using many mirrors.

Figure 5



5 (a) (i) Which part of the electromagnetic spectrum provides most of the energy to heat the water in a solar thermal power station?

[1 mark]

.....

4.1.1.3 Energy changes in systems

Question 05 · continued

5 (a) (ii) Describe how heated water is used to generate electricity by this solar thermal power station.
The process is the same as in a fossil fuel power station.

[3 marks]

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5 (b) A new type of solar power station, called a solar storage power station, is able to store energy from the Sun by heating molten chemical salts.
The stored energy can be used to generate electricity at night.

5 (b) (i) It is important that the molten chemical salts have a high specific heat capacity.
Suggest **one** reason why.

[1 mark]

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5 (b) (ii) The solar storage power station can store a maximum of 2 200 000 kWh of energy.
The solar storage power station can supply a town with a maximum electrical power of 140 000 kW.

Calculate for how many hours the energy stored by the solar storage power station can supply the town with electrical power.

Give your answer to 2 significant figures.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

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.....

Time = ... hours

Question 5 continues on the next page

5 (b) (iii) **Table 3** gives information about the place where the solar storage power station has been built.

Table 3

Season	Mean number of daylight hours	Mean power received from the Sun per square metre in kW
Spring	11.5	0.90
Summer	13.5	1.10
Autumn	12.0	0.95
Winter	10.5	0.71

The solar storage power station does not operate at the maximum possible electrical output every day of the year.

Suggest why.

[2 marks]

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5 (c) Power stations do not work at maximum possible electrical output all the time.
The 'capacity factor' of a power station is calculated using the equation:

$$\text{Capacity factor} = \frac{\text{actual electrical output per year}}{\text{maximum possible electrical output per year}}$$

4.1.1.3 Energy changes in systems

Question 05 · continued

Table 4 shows capacity factors for different types of power station.

Table 4

Type of power station	Renewable energy source	Capacity factor
Coal	No	0.41
Natural gas	No	0.48
Nuclear	No	0.66
Solar thermal	Yes	0.33
Tidal	Yes	0.26
Wind turbine	Yes	0.30

5 (c) (i) Compare the capacity factors of the renewable power stations with those of the non-renewable power stations in **Table 4**.
Explain the reason for the difference between the capacity factors.

[3 marks]

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5 (c) (ii) The capacity factor of a solar storage power station is higher than for all other renewable power stations.
Suggest **one** reason why.

[1 mark]

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14

4.1.1.3 Energy changes in systems

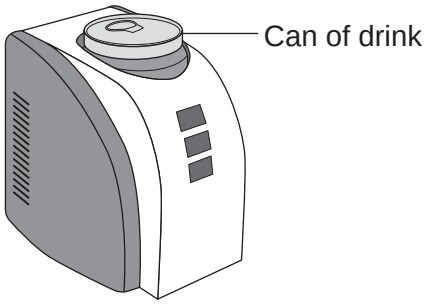
Question 06

June 2015 | PH1HP | Original Q7 | Legacy

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

Figure 7 shows a can-chiller.

Figure 7



7 (a) The initial temperature of the liquid in the can was 25.0 °C.
The can-chiller decreased the temperature of the liquid to 20.0 °C.
The amount of energy transferred from the liquid was 6930 J.
The mass of liquid in the can was 0.330 kg.

Calculate the specific heat capacity of the liquid.

Give the unit.

Use the correct equation from the Physics Equations Sheet.

[4 marks]

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Specific heat capacity = ... unit .....

4.1.1.3 Energy changes in systems

Question 06 · continued

7 (b) Energy is transferred through the metal walls of the can of drink by conduction. Explain how.

[4 marks]

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7 (c) The energy from the can of drink is transferred to the air around the can-chiller. A convection current is set up around the can-chiller. Explain how.

[3 marks]

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7 (d) The can-chiller has metal cooling fins that are designed to transfer energy quickly to the surroundings.

Give **two** features that would help the metal cooling fins to transfer energy quickly to the surroundings.

[2 marks]

1 .....

2 .....

13

4.1.1.3 Energy changes in systems

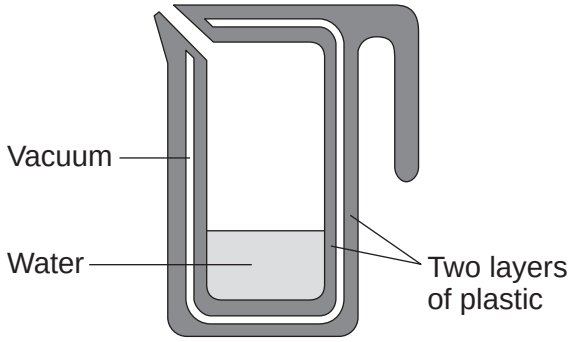
Question 07

June 2016 | PH1HP | Original Q5 | Legacy

5 A new design for a 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 5**.

Figure 5



5 (a) Explain why the vacuum reduces energy transfer to the surroundings.

[2 marks]

4.1.1.3 Energy changes in systems

Question 07 · continued

5 (b) The energy transferred from the water in the kettle to the surroundings in 2 hours is 46 200 J.

The mass of water in the kettle is 0.50 kg.

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

The initial temperature of the water is 100 °C.

5 (b) (i) Calculate the temperature of the water in the kettle after 2 hours.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Temperature after 2 hours = _____ °C

5 (b) (ii) Calculate the average power output from the water in the kettle to the surroundings in 2 hours.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Average power output = _____ W

7

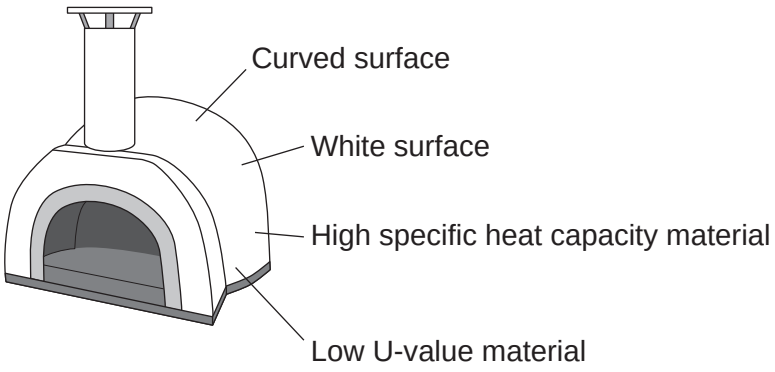
4.1.1.3 Energy changes in systems

Question 08

June 2017 | PH1HP | Original Q5 | Legacy

5 **Figure 5** shows an outdoor pizza oven.

Figure 5



5 (a) A solid biofuel is used to heat the oven.

Name **one** solid biofuel.

[1 mark]

_____

5 (b) The pizza oven is made of concrete. The mass of the concrete is 250 kg

Calculate the temperature increase when 8.36×10^7 J of energy are transferred to the concrete.

Concrete has a specific heat capacity of 880 J/kg °C

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Temperature increase = _____ °C

4.1.1.3 Energy changes in systems

Question 08 · continued

5 (c) The pizza oven is designed to stay hot for at least two hours.

Describe how each of the four labelled design features helps to ensure that the pizza oven stays hot for at least two hours.

[4 marks]

White surface _____

_____

Curved surface _____

_____

High specific heat capacity material _____

_____

Low U-value material _____

_____

7

4.1.1.3 Energy changes in systems

Question 09

June 2018 | 8463/1H | Original Q9

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

Figure 15



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

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

[1 mark]

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

The mains potential difference is 230 V.

Calculate the current in the coffee machine.

[3 marks]

Current = _____ A

4.1.1.3 Energy changes in systems

Question 09 · continued

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

The power output of the coffee machine is 2.53 kW.

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

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

[5 marks]

Mass = _____ kg

9

4.1.1.3 Energy changes in systems

Question 10

June 2019 | 8463/1H | Original Q8

0 8 A student investigated the thermal conductivity of different metals.

This is the method used:

1. Measure the mass of an ice cube.
2. Put the ice cube on a metal block which is at room temperature.
3. Measure the mass of the ice cube after one minute.
4. Repeat with other blocks of the same mass made from different metals.

Figure 10



Table 3 shows the student's results.

Table 3

Metal	Initial mass of ice cube in grams	Final mass of ice cube in grams	Change in mass of ice cube in grams
Aluminium	25.85	21.14	4.71
Copper	26.20	20.27	5.93
Lead	25.53	21.97	3.56
Steel	24.95	19.45	5.50

4.1.1.3 Energy changes in systems

Question 10 · continued

0 8 . 1 The initial temperature of each ice cube was –15 °C

Why was it important that the initial temperature of each ice cube was the same?

[1 mark]

Tick (✓) **one** box.

- Initial temperature was a continuous variable. ☐
- Initial temperature was a control variable. ☐
- Initial temperature was the dependent variable. ☐
- Initial temperature was the independent variable. ☐

0 8 . 2 Which metal had the highest thermal conductivity?

Give a reason for your answer.

[2 marks]

Metal: _____

Reason: _____

_____

_____

0 8 . 3 Suggest **one** source of random error in the student's investigation.

[1 mark]

_____

_____

_____

_____

4.1.1.3 Energy changes in systems

Question 10 · continued

0 8 . 4 An ice cube has a temperature of –15.0 °C

The total thermal energy needed to raise the temperature of this ice cube to 0.0 °C and completely melt the ice cube is 5848 J

specific heat capacity of ice = 2100 J/kg °C
specific latent heat of fusion of ice = 334 000 J/kg

Calculate the mass of the ice cube.

[5 marks]

Mass of ice cube = _____ kg

9

4.1.1.3 Energy changes in systems

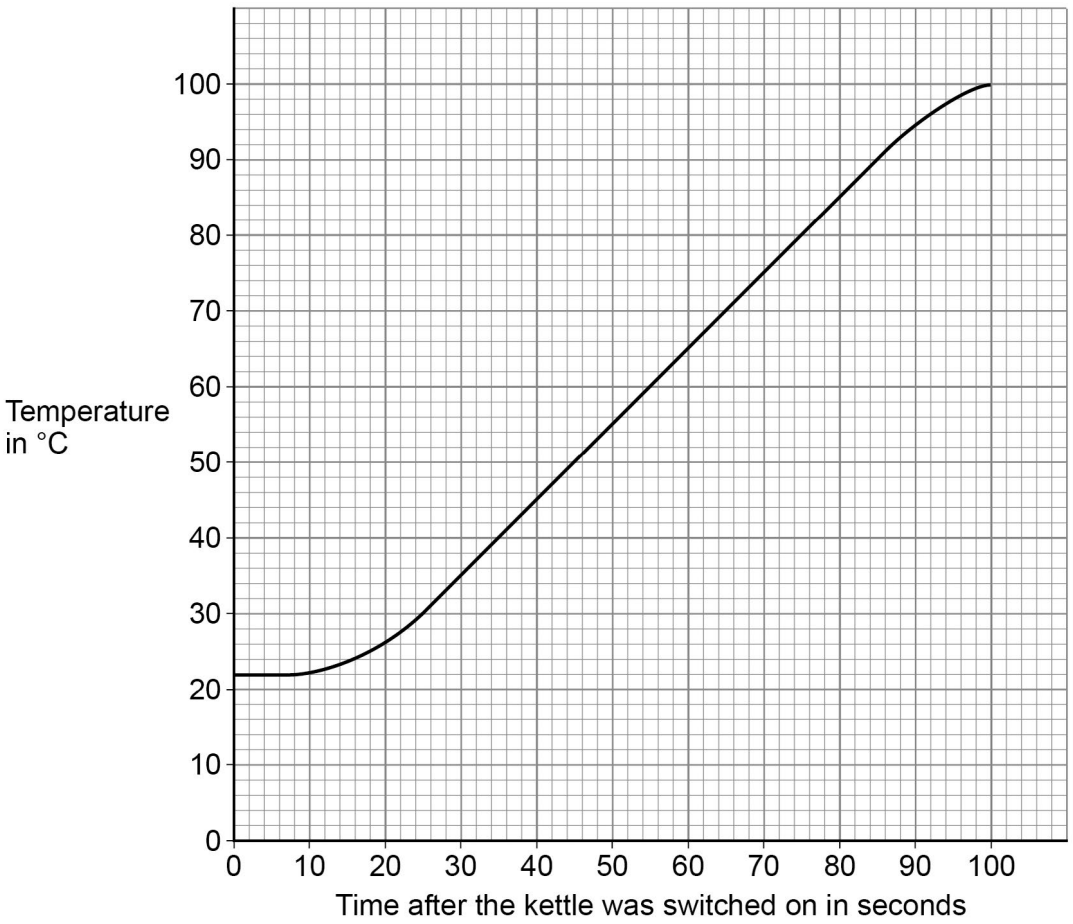
Question 11

November 2020 | 8463/1H | Original Q7

0 7 An electric kettle was switched on.

Figure 10 shows how the temperature of the water inside the kettle changed.

Figure 10



0 7 . 1 When the kettle was switched on the temperature of the water did **not** immediately start to increase.

Suggest **one** reason why.

[1 mark]

4.1.1.3 Energy changes in systems

Question 11 · continued

0 7 . 2 The energy transferred to the water in 100 seconds was 155 000 J.

specific heat capacity of water = 4200 J/kg °C

Determine the mass of water in the kettle.

Use **Figure 10**.

Give your answer to 2 significant figures.

[5 marks]

Mass of water (2 significant figures) = _____ kg

0 7 . 3 The straight section of the line in **Figure 10** can be used to calculate the useful power output of the kettle.

Explain how.

[3 marks]

9

4.1.1.3 Energy changes in systems

Question 12

0 2 Energy from the Sun is released by nuclear fusion.

0 2 . 1 Complete the sentences.

[2 marks]

Nuclear fusion is the joining together of _____.

During nuclear fusion the total mass of the particles _____.

0 2 . 2 Nuclear fusion of deuterium is difficult to achieve on Earth because of the high temperature needed.

Electricity is used to increase the temperature of 4.0 g of deuterium by 50 000 000 °C.

specific heat capacity of deuterium = 5200 J/kg °C

Calculate the energy needed to increase the temperature of the deuterium by 50 000 000 °C.

Use the Physics Equation Sheet.

[3 marks]

Energy = _____ J

4.1.1.3 Energy changes in systems

Question 12 · continued

0 2 . 3 The idea of obtaining power from nuclear fusion was investigated using models.

The models were tested before starting to build the first commercial nuclear fusion power station.

Suggest **two** reasons why models were tested.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

0 2 . 4 Generating electricity using nuclear fusion will have fewer environmental effects than generating electricity using fossil fuels.

Explain **one** environmental effect of generating electricity using fossil fuels.

[2 marks]

_____

_____

_____

_____

_____

9

4.1.1.3 Energy changes in systems

Question 13

November 2021 | 8463/1H | Original Q11

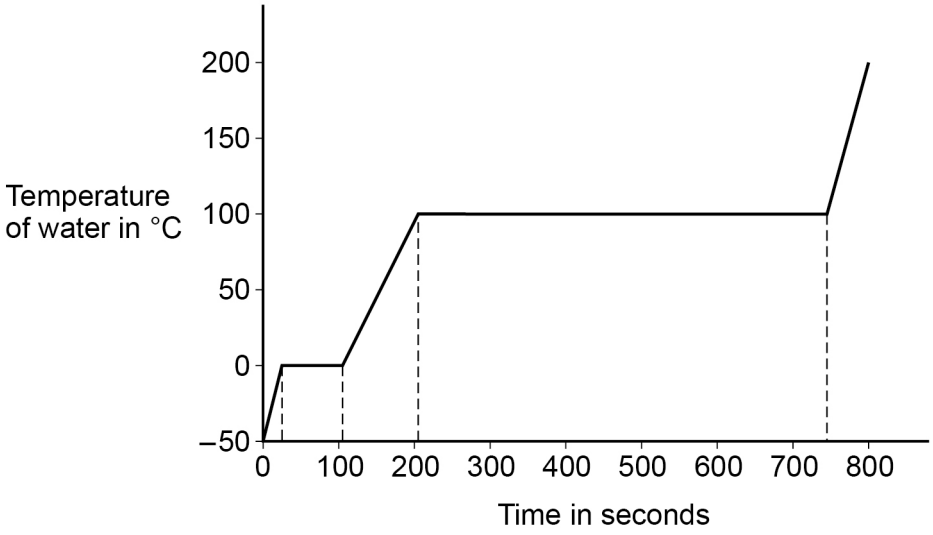
1 1 A student investigated how the temperature of a lump of ice varied as the ice was heated.

The student recorded the temperature until the ice melted and then the water produced boiled.

Figure 17 shows the student's results.

The power output of the heater was constant.

Figure 17



1 1 . 1 The specific heat capacity of ice is less than the specific heat capacity of water.

Explain how **Figure 17** shows this.

[2 marks]

4.1.1.3 Energy changes in systems

Question 13 · continued

1 1 . 2 The specific latent heat of fusion of ice is less than the specific latent heat of vaporisation of water.

Explain how **Figure 17** shows this.

[2 marks]

1 1 . 3 A second student did the same investigation and recorded the temperature until the water produced boiled.

In the second student's investigation more thermal energy was transferred to the surroundings.

Describe **two** ways the results of the experiment in **Figure 17** would have been different.

[2 marks]

1

2

Question 11 continues on the next page

4.1.1.3 Energy changes in systems

Question 13 · continued

11.4 When the water was boiling, 0.030 kg of water turned into steam.

The energy transferred to the water was 69 kJ.

Calculate the specific latent heat of vaporisation of water.

Give the unit.

[5 marks]

Specific latent heat of vaporisation = _____

Unit _____

11

4.1.1.3 Energy changes in systems

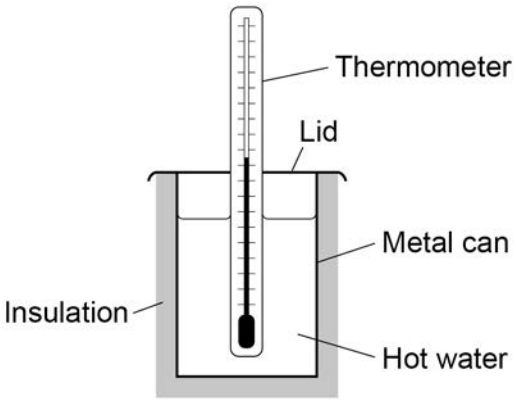
Question 14

June 2022 | 8463/1H | Original Q4

0 4 A student investigated the insulating properties of different materials.

Figure 4 shows some of the equipment used by the student.

Figure 4



This is the method used:

1. Wrap insulating material around the can.
2. Put a fixed volume of boiling water in the can.
3. Place the lid on the top of the can.
4. Measure the time taken for the temperature of the water to decrease by a fixed amount.
5. Repeat steps 1–4 using the same thickness of different insulating materials.

0 4 . 1 Identify the independent variable and the dependent variable in this investigation.

[2 marks]

Independent variable _____

Dependent variable _____

Question 14 · continued

The student used two different types of thermometer to measure the temperature changes.

Figure 5 shows a reading on each thermometer.

Figure 5



0 4 . 2 What is the resolution of thermometer **B**?

[1 mark]

Resolution = _____ °C

0 4 . 3 Thermometer **A** is more likely to be misread.

Give **one** reason why.

[1 mark]

_____

_____

_____

Question 4 continues on the next page

4.1.1.3 Energy changes in systems

Question 14 · continued

0 4 . 4 For one type of insulating material, the temperature of the water decreased from 85.0 °C to 65.0 °C.

The energy transferred from the water was 10.5 kJ.

specific heat capacity of water = 4200 J/kg °C

Calculate the mass of water in the can.

Use the Physics Equations Sheet.

[3 marks]

Mass = _____ kg

4.1.1.3 Energy changes in systems

Question 14 · continued

0 4 . 5 **Table 2** shows the results for two insulating materials.

Table 2

Material	Time for temperature to decrease by 20 °C in seconds
X	450
Y	745

Explain how the results in **Table 2** can be used to compare the thermal conductivity of the two materials.

[2 marks]

9

4.1.1.3 Energy changes in systems

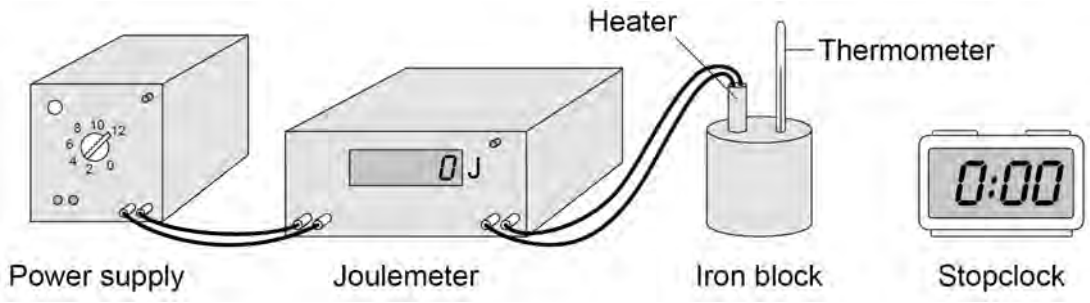
Question 15

June 2023 | 8463/1H | Original Q2

0 2 **Figure 2** 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 2



0 2 . 1 Before the power supply was switched on, the thermometer was used to measure the temperature of the iron block.

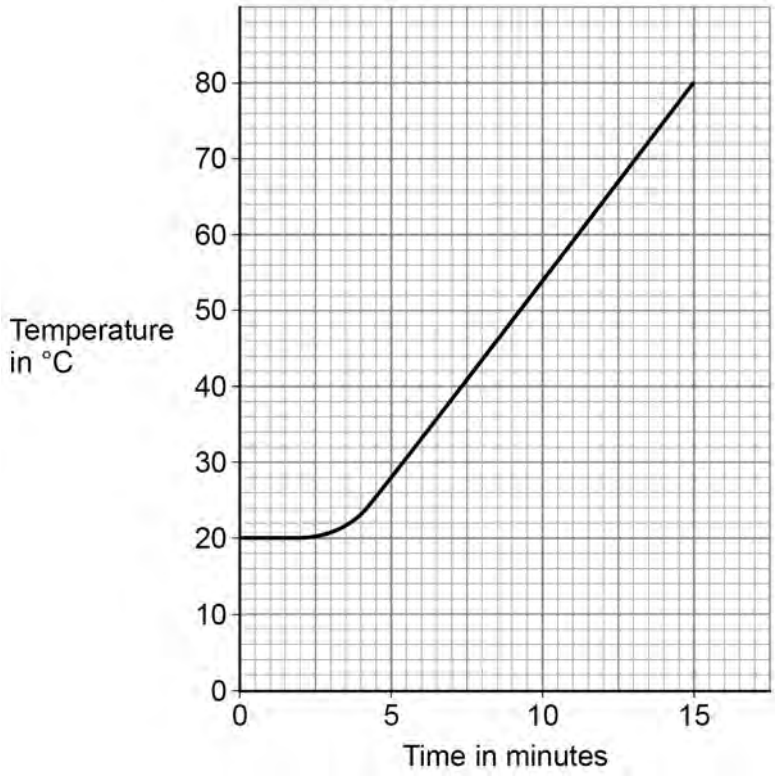
The student left the thermometer in the iron block for a few minutes before recording the initial temperature.

Suggest why.

[1 mark]

0 2 . 2 **Figure 3** shows how the temperature changed after the power supply was switched on.

Figure 3



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 3** and the Physics Equations Sheet.

[4 marks]

Specific heat capacity = _____ J/kg °C

4.1.1.3 Energy changes in systems

Question 15 · continued

0 2 . 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

4.1.1.3 Energy changes in systems

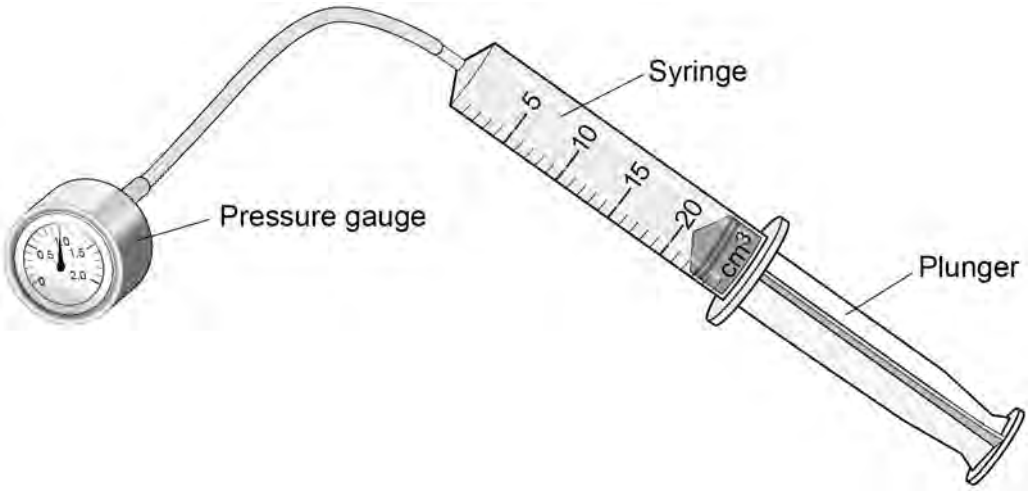
Question 16

June 2024 | 8463/1H | Original Q8

0 8 A student investigated how the pressure in a fixed mass of air varies with the volume of the air.

Figure 12 shows the equipment used.

Figure 12



0 8 . 1 When the plunger was pushed slowly into the syringe, the pressure in the syringe increased.

The temperature of the air remained constant.

Explain why the pressure increased.

[3 marks]

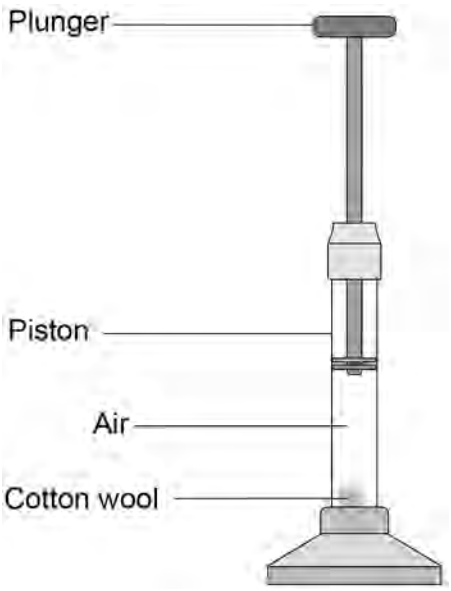
4.1.1.3 Energy changes in systems

Question 16 · continued

A fire piston is a special type of syringe that can be used to start fires.

Figure 13 shows a fire piston.

Figure 13



The plunger is pushed quickly downwards and compresses the air.

When the air is compressed quickly, the temperature of the air increases.

0 8 . 2 How does an increase in temperature affect the air particles inside the piston?

[1 mark]

Tick (✓) **one** box.

- The mean kinetic energy of the particles increases. ☐
- The mean potential energy of the particles increases. ☐
- The mean separation of the particles increases. ☐

4.1.1.3 Energy changes in systems

Question 16 · continued

0 8 . 3 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 = 1.01 kJ/kg °C

Calculate the temperature change of the air.

Use the Physics Equations Sheet.

[4 marks]

Temperature change = _____ °C

8

4.1.1.3 Energy changes in systems

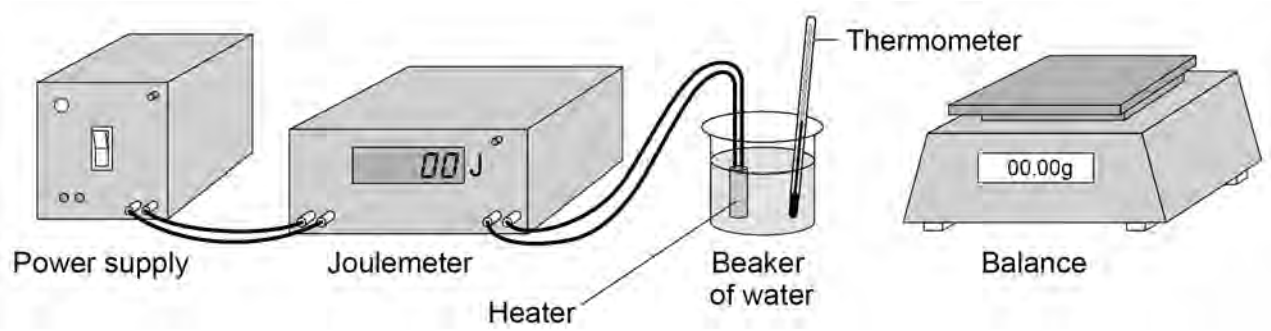
Question 17

June 2025 | 8463/1H | Original Q2

0 2 A student determined the specific heat capacity of water.

Figure 4 shows the apparatus used.

Figure 4



The joulemeter measures energy transfer.

0 2 . 1 Give **one** hazard in the investigation.

[1 mark]

0 2 . 2 Describe how the student could determine the specific heat capacity of water using the apparatus in **Figure 4**.

[6 marks]

4.1.1.3 Energy changes in systems

Question 17 · continued

Extra space

0 2 . 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 2 . 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

4.1.1.3 Energy changes in systems

Question 18

June 2025 | 8463/1H | Original Q5

0 5 Scientists have used lasers to start a nuclear **fusion** reaction.

The scientists used the lasers to heat a small amount of an isotope of hydrogen.

0 5 . 1 Describe what is meant by 'isotopes' of an element.

[2 marks]

0 5 . 2 Explain how nuclear **fusion** releases energy.

[3 marks]

4.1.1.3 Energy changes in systems

Question 18 · continued

0 5 . 3 The fusion reaction releases large amounts of energy.

The fusion reaction takes place in a reactor.

Explain why the walls of the reactor should be made from a material with a very high specific heat capacity.

[2 marks]

0 5 . 4 Nuclear fusion is safer than nuclear fission.

Nuclear **fission** can lead to an uncontrolled chain reaction.

Give **one** consequence of an uncontrolled chain reaction.

[1 mark]

8

4.1.1.3 Energy changes in systems

Question 19

June 2025 | 8463/1H | Original Q6

0 6 **Figure 8** shows a battery-powered hand warmer that contains a heating pad.

The battery transfers energy to increase the temperature of the heating pad.

Figure 8



0 6 . 1 The heating pad has a mass of 0.20 kg.

When the hand warmer was switched on, the energy transferred to the heating pad was 8000 J.

specific heat capacity of heating pad = 1600 J/kg °C

Calculate the temperature increase of the heating pad.

Use the Physics Equations Sheet.

[3 marks]

Temperature increase = _____ °C

4.1.1.3 Energy changes in systems

Question 19 · continued

0 6 . 2 The hand warmer was powered by a 5.0 V battery.

The battery transferred 180 kJ of energy to the heating pad.

Calculate the charge flow through the battery.

Use the Physics Equations Sheet.

[4 marks]

Charge flow = _____ C

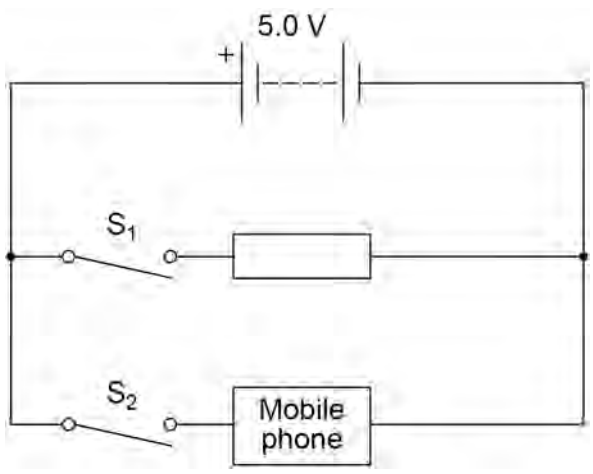
Question 6 continues on the next page

0 6 . 3 The circuit inside the hand warmer can be connected to a mobile phone to recharge the mobile phone.

Figure 9 shows the circuit diagram when the hand warmer is connected to a mobile phone.

The heating pad of the hand warmer is represented by the resistor symbol.

Figure 9



Explain how closing both switches S_1 and S_2 affects the power output of the battery compared with only closing switch S_1.

[3 marks]

10