

Q1.

A student wants to determine the specific heat capacity of copper.

Figure 5 shows a piece of copper, with a thread tied around it, in a glass beaker of boiling water.

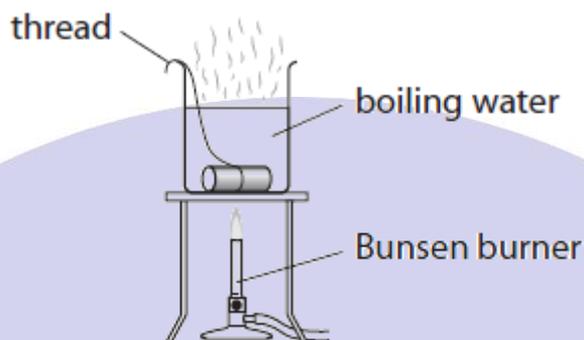


Figure 5

The student leaves the piece of copper in the boiling water so that the copper reaches a temperature of $100\text{ }^{\circ}\text{C}$.

The student uses the thread to take the piece of copper out of the boiling water.

The student puts the hot piece of copper into a different beaker of cold water at $20\text{ }^{\circ}\text{C}$.

The apparatus is shown in Figure 6.

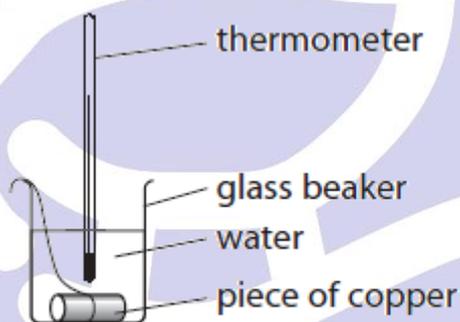


Figure 6

The student assumes that the thermal energy gained by the water equals the thermal energy lost by the piece of copper.

The water and copper both reach a temperature of $22\text{ }^{\circ}\text{C}$.

The cold water gains 1050 J of energy.

The mass of the piece of copper is 0.058 kg .

(i) Calculate a value for the specific heat capacity of copper, using these results.

Use the equation

change in thermal energy = mass \times specific heat capacity \times change in temperature

$$\Delta Q = m \times c \times \Delta\theta$$

(2)

specific heat capacity of copper from these results = J/kg °C

(Total for question = 2 marks)



Q2.

Figure 13 shows a storage heater.

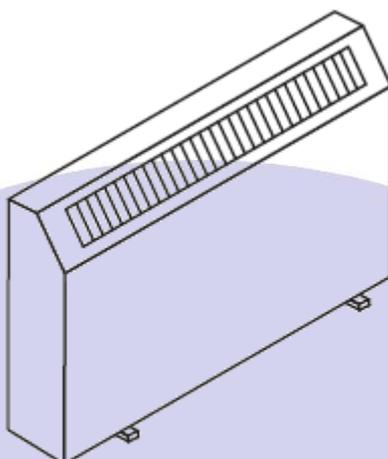


Figure 13

The storage heater contains bricks.

The bricks are heated electrically.

The electrical heater supplies 210 kJ of energy to each brick in the storage heater.

One brick has a mass of 5.8 kg.

The specific heat capacity for the brick is 860 J/kg K.

(i) Use this data to calculate the increase in temperature of the brick.

(2)

temperature increase = °C

(ii) The actual temperature increase will be smaller than you calculated in (i).

Explain why the actual temperature increase will be smaller than the value in (i).

(2)

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.....

(Total for question = 4 marks)

Q3.

A steel ball has a volume of 3.6 cm^3 and a mass of 28 g.

The steel ball is at a room temperature of $20 \text{ }^\circ\text{C}$.

It is then put in a pan of boiling water maintained at $100 \text{ }^\circ\text{C}$.

Calculate how much thermal energy the ball gains as its temperature increases from $20 \text{ }^\circ\text{C}$ to $100 \text{ }^\circ\text{C}$.

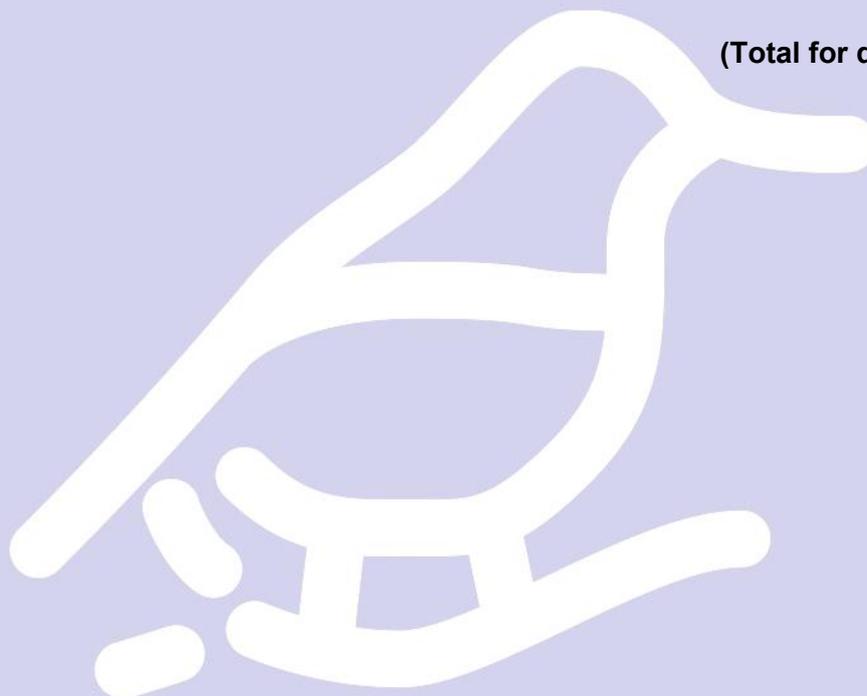
Specific heat capacity of steel = $510 \text{ J/ kg }^\circ\text{C}$

Use an equation selected from the list of equations at the end of this paper.

(2)

thermal energy gained = J

(Total for question = 2 marks)



Q4.

Figure 8 shows a saucepan of milk being heated on an electric cooker.



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Figure 8

Figure 9 is a table of data about the milk being heated.

mass of milk	0.82 kg
starting temperature of milk	10 °C
final temperature of milk	40 °C
change in thermal energy of milk	96 000 J

Figure 9

(i) Using data from the table in Figure 9, calculate the increase in temperature of the milk.

(1)

increase in temperature = °C

(ii) Using data from the table in Figure 9, calculate the specific heat capacity of the milk.

Use the equation

$$\text{specific heat capacity} = \frac{\text{change in thermal energy}}{\text{mass} \times \text{increase in temperature}}$$

(2)

specific heat capacity = J/kg °C

(Total for question = 3 marks)

Q5.

(i) Figure 6 shows an electric kettle.

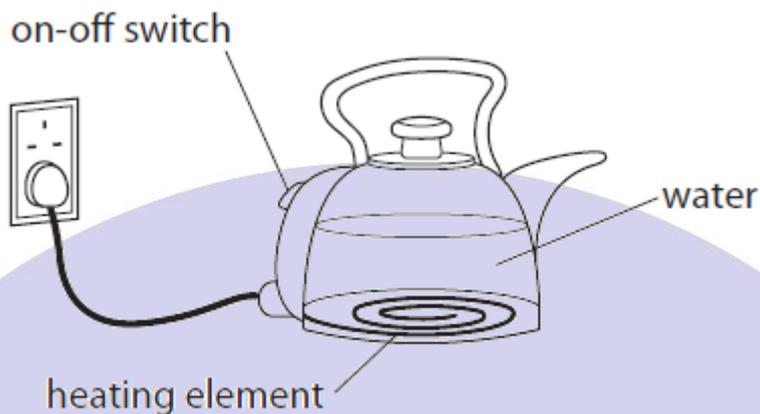


Figure 6

The kettle contains 1.5 kg of water.

The kettle is switched on.

Calculate the energy needed to raise the temperature of the water by 50 °C.

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

Use the equation

$$\Delta Q = m \times c \times \Delta \theta$$

(2)

energy needed = J

(ii) The amount of energy, E , needed to bring the water to boiling point is 670 000 J.

The kettle has a power of 3500 W.

Calculate the time, t , it takes to bring the water to boiling point.

Use the equation

$$P = \frac{E}{t}$$

(3)

time to bring the water to boiling point = s

(Total for question = 5 marks)

Q6.

A beaker contains 0.25 kg of water at room temperature.
The beaker of water is heated until the water reaches boiling point (100 °C).
The specific heat capacity of water is 4200 J/kg °C.
The total amount of thermal energy supplied to the water is 84 000 J.

(i) Calculate the temperature of the water before it was heated.

Use an equation selected from the list of equations at the end of this paper.

(3)

temperature before heating = °C

(Total for question = 3 marks)

Q7.

A student sets up an experiment to measure the specific heat capacity of a metal.

Figure 5 shows the apparatus.

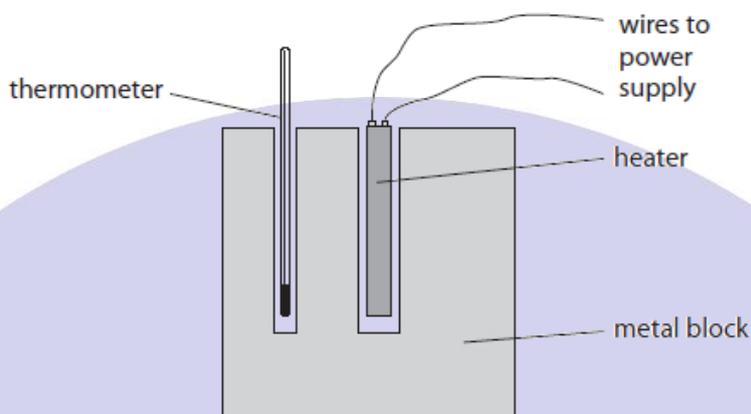


Figure 5

The heater is connected to a power supply and has a power of 50 W.

The student switches on the heater and measures the temperature rise after 5 minutes.

(i) Figure 6 shows the student's results.

mass of metal block	0.92 kg
power of heater	50 W
starting temperature	20 °C
finishing temperature	54 °C
time	300 s

Figure 6

Use the data in Figure 6 to calculate a value for the specific heat capacity of the metal.

Use the equation

$$\text{specific heat capacity} = \frac{\text{power} \times \text{time}}{\text{mass} \times \text{temperature rise}}$$

(3)

specific heat capacity = J/kg °C

(Total for question = 3 marks)

Q8.

An electric kettle contains 1.41 kg of water at 25 °C.

The kettle is switched on.

After a while, the water reaches boiling point at 100 °C.

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

- (i) Calculate the amount of thermal energy supplied to the water by the kettle.
Give your answer to the appropriate number of significant figures.

Use an equation selected from the list of equations at the end of the paper.

(3)

energy supplied = J

(Total for question = 3 marks)

Q9.

The espresso machine shown in Figure 27 is an electrical appliance.



(Source: © tanawaty/123RF)

Figure 27

The espresso machine has an electrical heater connected to a 440 V mains supply.

The power of the electrical heater is 3.5 kW.

(ii) Before the espresso machine can be used, its heater must raise the temperature of some cold water.

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

Show that it takes the heater about 90 s to raise the temperature of 1 kg of water from 18°C to 95°C.

Use an equation from the formula sheet.

(3)

(Total for question = 3 marks)