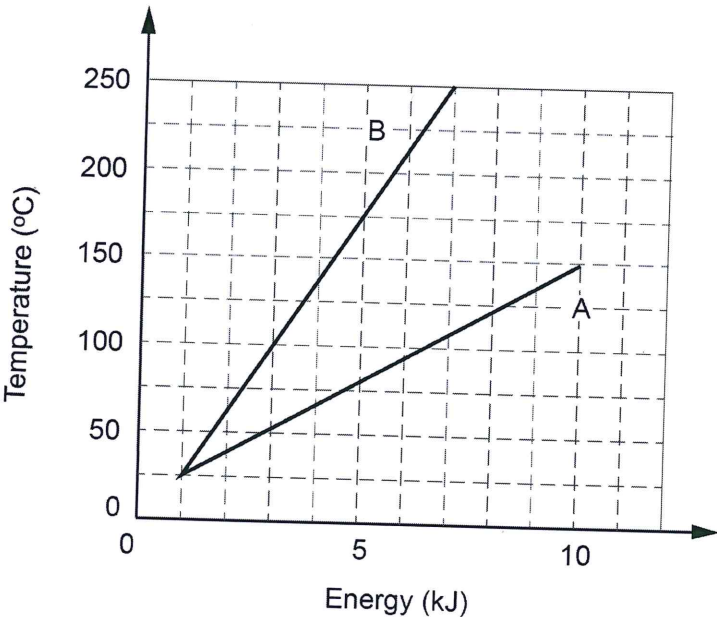


(6 marks)

Two objects, A and B, have the same sizes but different masses. The specific heat capacity of each is $234 \text{ J kg}^{-1} \text{ K}^{-1}$. A and B each receive the same amount of energy from an external source. The graph shows the result.



- (a) Which object has the larger mass? Using the correct mathematical formula, explain your reasoning for this choice. (3 marks)

Description	Marks
Object A;	1
Because $Q = mc(T_f - T_i)$, and $m = Q / c(T_f - T_i)$	1
For same material, the greater mass needs more heat energy to raise its temperature.	1
Total 3	

- (b) From the data in the graph, determine the mass of object A. (3 marks)

Description	Marks
$m_A = Q / c(T_f - T_i)$	1
$m_A = 9000 / 234 (150 - 25) = 0.308 \text{ kg or } 308 \text{ g}$	1-2
Total 3	

A jeweller is making a gold bar by melting small pieces of pure gold. The gold pieces have a total mass of $4.00 \times 10^{-2} \text{ kg}$ and are initially at 20.3°C . The energy required to bring the gold up to its melting point is $5.24 \times 10^3 \text{ J}$. If the specific heat capacity of gold is $126 \text{ J kg}^{-1} \text{ K}^{-1}$, determine the melting point of gold.

Description	Marks
$Q = mc\Delta T$	
$5.24 \times 10^3 = 0.0400 \times 126 \times (T - 20.3)$	1
$5.24 \times 10^3 / 5.04 = T - 20.3$	
$T = 1039.7 + 20.3$	1-2
$= 1.06 \times 10^3^\circ\text{C}$	1
Total	4

Chapter 1.3 Solutions

Answer 3

page 2

(5 marks)

The heating element of an electric kettle connected to the 240 V mains supply is used to heat 0.500 kg of water from 20.0 °C to the boiling point (100 °C). Knowing that heat energy is equivalent to electrical work, determine the amount of charge that passed through the heating element during this time. Include the correct unit for charge.

Description	Marks
Heat energy = electrical work (stated in questions) $mc\Delta T = qV$	1
$0.500 \times 4180 \times (100 - 20) = q \times 240$ $167\,200 = 240 \times q$	1-2
697	1
C	1
Total	5

Answer 4

(12 marks)

- (a) The heater in the dishwasher draws half the total current to heat the water during the washing cycle. Determine the power rating of the heater, including the correct unit. Show **all** workings. (3 marks)

Description	Marks
$P = VI$ 240×6.00	1
1.44×10^3	1
W	1
Total	3

- (b) During the washing cycle, the dishwasher heats 6.50 kg of water from 15.0 °C to 90.0 °C. Using your answer from Part (a) above, calculate the time taken to heat the water. If you were unable to calculate a value for the power in Part (a), use a value of 1.50×10^3 . Show **all** workings. (4 marks)

Description	Marks
$E = Q = mc\Delta T$ $= 6.50 \times 4180 \times (90 - 15)$	1
$E = Q = 2\,037\,750 \text{ J}$	1
$P = E/t$ So $t = E/P$ $t = 2\,037\,750 / 1.44 \times 10^3 = 1415$	1
$1.42 \times 10^3 \text{ s}$ (23.6 minutes)	1
Alternative answer: 1.36×10^3 (22.6 minutes)	
Total	4

Chapter 1.3 Solutions

Answer 4 cont

page 3

- (c) In reality, the time taken to heat the water is longer than the time calculated in part (b). Suggest **two** reasons why this is so. (2 marks)

Description	Marks
Not all the electrical energy is converted into heat energy	1
Heat energy is lost to the dishes and metal of the dishwasher	1
Or any other reasonable reason	
Total	2

- (d) Occasionally a piece of toast will get caught in the toaster. Explain why it is dangerous to use a metal knife to remove this toast without first turning off the toaster. (3 marks)

Description	Marks
If the toaster is still on, the knife may touch a 'live' part of the circuit	1
The metal knife would then act as a path for the current to pass from the toaster to the user	1
This could cause serious injuries such as burns, heart attack, etc	1
Total	3