

3 (a) Define specific heat capacity.

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(b) A block of aluminium has a volume of $3.612 \times 10^{-3} \text{ m}^3$ at a temperature of 0°C .

Aluminium has a density of $2.700 \times 10^3 \text{ kg m}^{-3}$ at 0°C .
It has a density of $2.620 \times 10^3 \text{ kg m}^{-3}$ at 500°C .

The block is heated so that its temperature increases from 0°C to 500°C at an atmospheric pressure of $1.01 \times 10^5 \text{ Pa}$.
The increase in internal energy of the block is 4.38 MJ .

(i) Calculate the mass of the block.

mass = kg [2]

(ii) Show that the volume of the block at a temperature of 500°C is $3.722 \times 10^{-3} \text{ m}^3$.

[1]

(iii) Use the information in (b)(ii) to determine the magnitude of the work done on the block when its temperature is raised from 0°C to 500°C .

work done = J [2]

(iv) Explain whether the work done on the block is positive or negative.

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(v) Use the first law of thermodynamics to determine, to three significant figures, a value for the specific heat capacity of aluminium. Explain your reasoning. Give a unit with your answer.

specific heat capacity = unit [3]

(c) Without further calculation, suggest with a reason how doubling the pressure in (b) is likely to affect the answer in (b)(v).

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[Total: 13]