inkPhysics

ANSWER BOOK

Thermal energy transfer and specific heat capacity

Thermal physics · Year 13

AQA 3.6.2.1 · CIE 14.1, 14.3, 16.1, 16.2 · OCR A 5.1.1, 5.1.2, 5.1.3

10 questions · 30 marks

NAVY EDITION

inkphysics.co.uk

SECTION A · Warm-up

A1 The internal energy is the sum of the randomly distributed kinetic and potential energies of all the particles in the substance. [2]

A2 $Q = mc\Delta\theta = 0.50 \times 4200 \times 20 = 42000$ J. [2]

A3 The supplied energy goes into breaking the bonds between particles (increasing their potential energy), not into increasing their kinetic energy. Since temperature depends on average kinetic energy, it stays constant until the change of state is complete. [2]

SECTION B · Standard

B1 $Q = mc\Delta\theta = 2.0 \times 900 \times (70 - 20) = 90000$ J. [3]

B2 $Q = ml = 0.30 \times 3.34 \times 10^5 = 1.002 \times 10^5$ J. [4]

B3 $c = Q/(m\Delta\theta) = 5000/(0.20 \times 25) = 1000$ J kg^{-1} K^{-1}. [3]

B4 $Q = mc\Delta\theta = 1.5 \times 4200 \times 30 = 189000$ J. $t = Q/P = 189000/2000 = 94.5$ s. [3]

SECTION C · Stretch

C1 Melting: $Q = ml = 0.20 \times 3.34 \times 10^5 = 66800$ J. Warming: $Q = mc\Delta\theta = 0.20 \times 4200 \times 20 = 16800$ J. Total = 83600 J. [4]

C2 Energy lost by hot = energy gained by cold: $0.10 \times c \times (80 - T) = 0.20 \times c \times (T - 20)$. The c cancels, giving T = 40°C. [4]

C3 Heating transfers energy because of a temperature difference, from a hotter body to a cooler one. Doing work transfers energy mechanically, for example by compressing the gas with a piston. Both raise the internal energy, but by different means. [3]