InkPhysics

QUESTION WORKBOOK

# 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

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## SECTION A · Warm-up

**A1** Define the internal energy of a substance. [2]

**A2** Calculate the energy needed to raise the temperature of 0.50 kg of water by 20°C (specific heat capacity of water = 4200 J $kg^{-1}$ $K^{-1}$). [2]

**A3** Explain why the temperature of a substance stays constant while it changes state, even though energy is being supplied. [2]

## SECTION B · Standard

**B1** Calculate the energy needed to heat 2.0 kg of a metal (specific heat capacity 900 J $kg^{-1}$ $K^{-1}$) from 20°C to 70°C. [3]

**B2** Calculate the energy needed to melt 0.30 kg of ice at its melting point (specific latent heat of fusion = $3.34 \times 10^5$ J kg$^{-1}$). [4]

**B3** Supplying 5000 J of energy raises the temperature of a 0.20 kg block by 25°C. Calculate the specific heat capacity of the block. [3]

**B4** A 2.0 kW heater warms 1.5 kg of water by 30°C (c = 4200 J kg$^{-1}$ K$^{-1}$). Assuming no losses, calculate the time taken. [3]

## SECTION C · Stretch

**C1** Calculate the total energy needed to turn 0.20 kg of ice at 0°C into water and then warm it to 20°C (latent heat of fusion = $3.34 \times 10^5$ J kg$^{-1}$, $c_{water}$ = 4200 J kg$^{-1}$ K$^{-1}$). [4]

**C2** 0.10 kg of water at 80°C is mixed with 0.20 kg of water at 20°C. Assuming no energy is lost to the surroundings, calculate the final temperature. [4]

**C3** Explain the difference between heating and doing work as ways of increasing the internal energy of a gas. [3]