More SHC Questions – Answers

10.20 $P = \Delta Q / \Delta t = \Sigma (m\ c\ \Delta\theta) / \Delta t = (C_{kettle} + M_w C_w)\ \Delta\theta / \Delta t$

$2.25 \times 10^3 = (450 + 1 \times 4200)\ \Delta\theta / \Delta t$

$\Delta\theta / \Delta t = 0.484\ K\ s^{-1} = 29\ K\ min^{-1}$

10.25 $KE = \frac{1}{2} m v^2 = 0.5 \times 800 \times 20^2 = 160\ kJ$ 10 times = 1600 kJ 20% = 320 kJ

$m\ c\ \Delta\theta = 320\ kJ$ $(4 \times 1.5) \times 420 \times \Delta\theta = 320\ kJ$ $\Delta\theta = 127\ ^oC$

10.26 $KE_1 = \frac{1}{2} m v^2 = 0.5 \times 0.046 \times 40^2 = 36.8\ J$ $KE_2 = \frac{1}{2} m v^2 = 0.5 \times 0.046 \times 25^2 = 14.4\ J$

Δ KE = 22.4 J (Note, do not use the speed difference - that would be very wrong!)

$m\ c\ \Delta\theta = 22.4\ J$ $0.046 \times 1600 \times \Delta\theta = 22.4\ J$ $\Delta\theta = 0.30\ ^oC$

b) Both $\frac{1}{2} m v^2$ and $m\ c\ \Delta\theta$ involve the same mass, which cancels

c) The temperature of the ball will rise until it reaches a 'dynamic equilibrium', where the rate of gain of energy from hitting the wall equals the rate of loss of energy to the surroundings (i.e. a constant temperature).

10.29 a) $(95 - \theta)$ $(\theta - 20)$

b) Using $m\ c\ \Delta\theta$: $1.0 \times 4200 \times (95 - \theta) = 0.70 \times 385 \times (\theta - 20)$

Solution gives $\theta = 90.5\ ^oC$ (90.47 ^oC, so rounds to 90 ^oC to 2 s.f.)

c) Comment on much higher SHW of water than copper

SQ 3 a) $mgh = 0.50 \times 1.30 \times 9.81 = 6.38\ J$ 50 times = 319 J

b) $m\ c\ \Delta\theta = 319\ J$ $0.50 \times c \times (23 - 18) = 319\ J$ $c = 128\ J\ kg^{-1}\ K^{-1}$

SQ 4 $P = \frac{m\ c\ \Delta\theta}{t} = 0.025 \times 4200 \times (40 - 10) = 3150\ W = 3.2\ kW$