HW- Problems Ch. 14

14-1 a) P.E. of Falling water → Internal Energy

$\Delta P.E. = mgh = (1.4 kg)(9.8 \frac{m}{s^2})(2.5 m) = \boxed{3.4 J}$

b) This Internal Energy will appear as increased I.E. of water ⇒ higher T

14-9) $1 Watt = J/s$, $1 J = 1 W \cdot sec$

$1 kJ = 10^3 W sec = 1 kW \cdot sec = 1 kW \cdot sec \cdot \frac{1 hr}{3600 s} = \frac{1}{3,600} = 2.8 \times 10^{-4} kWh_r$

14-12) $Q = cm\Delta T$ $\Delta T = \frac{Q}{cm}$

$\Delta T = \frac{125.6 \times 10^3 J}{4.2 \frac{kJ}{kg \cdot K} \cdot 5 \times 10^2 gm}$ $\frac{kJ}{kg} = \frac{J}{g}$

$\Delta T = \frac{125.6 \times 10^3}{21 \times 10^2} = (6 \times 10)^\circ K$ $T_F = T_i + \Delta T = 82^\circ C$

14-19) $Q = (cm)_{kettle} \Delta T + (cm)_{water} \Delta T$ $\Delta T = 100 - 15 = 85^\circ C = 85^\circ K$

$Q = \left(.9 \frac{kJ}{kg\,^\circ C}\right) \cdot .4 kg \cdot 85^\circ C + (4.2 \frac{kJ}{kg\,^\circ C}) \cdot 2 kg \cdot 85^\circ C = 30.6 kJ + 714 kJ = \boxed{745 kJ}$

(742 if I used C = 4.186

14-20) $Q = (cm)_{human\ tisse} \Delta T$ c For human tissue is $3.5 \frac{kJ}{kg} {}^\circ C$

$\Delta T = 1.4^\circ C$

$Q = (3.5) \cdot (50)(1.4) = \boxed{245 kJ}$

14-25) H_2 is diatomic $C_v = 20.8 \frac{J/K}{mol}$. Must Find number of moles

We need to convert, P, T, V to standard units

~~P=10 atm~~ $P = 10 atm = 10.1 \times 10^5 Pa$, $T = 273^\circ K$, $V = 250 \times 10^{-3} m^2$

$n = \frac{PV}{RT} = 1.1 \times 10^2$ $Q = (C_v)(n)\Delta T = \boxed{57 kJ}$

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14-47) a) $R = \frac{d}{KA}$ we want to compare thickness of cork & equivil air

$d = RKA$ set up ratio between cork & air

$\frac{d_{cork}}{d_{air}} = \frac{RK_{cork}A}{RK_{air}A}$ $\frac{d_{cor}}{d_{air}} = \frac{K_{cork}}{K_{air}} = \frac{.046}{.023} = 2$ $\boxed{d_{cork} = 2\text{cm}}$

b) $\frac{d_{tin}}{d_{air}} = \frac{66.8}{.023} = 2{,}900\text{cm} = 29\text{m}$

14-52) The rate of heat Flow thru cork = heat Flow thru wood

$P_w = P_c$ $K_w A \frac{\Delta T_w}{d} = K_c A \frac{\Delta T_c}{d}$

$\boxed{K_w \Delta T_w = K_c \Delta T_c}$

a) cork inside $\Delta T_c = T-20$ $\Delta T_w = (0-T)$ $-TK_w = K_c(T-20)$

~~$T = 20K_c$~~ $K_cT + TK_w = 20K_c$ $T = \frac{20K_c}{K_c+K_w} = \boxed{52°C}$

b) cork outside

$\Delta T_c = T-0$ $\Delta T_w = (20-T)$

$K_w(20-T) = K_c(T)$ $T = \frac{20K_w}{K_c+K_w} = 15°$

c) Since total heat Flow is same in both cases thermal resistance is same and it doesn't matter if cork is inside or outside

14-59) $\lambda_{max}T = 2.9\times10^{-3}\text{ m K}$, $T = 1650\text{K}$ $\boxed{\lambda_{max} = 1.76\mu m}$

14-63) heat lost = heat absorbed + heat produced

heat produced = 90W

heat absorbed = Intensity × Area $= (7\times10^2 \text{ W/m}^2)\times.57\times(1.8\text{m}^2)\times(.42)$

$= 300\text{W}$

heat loss = 90W + 300W = $\boxed{390\text{W}}$