HW

51. a) $P_{rad} = \sigma \varepsilon A T^4$

$A = 4\pi R^2$; $T = 273 + 27 = 300K$

$P_{rad} \approx 1.23 \times 10^{-3}$ (W)

b) $P_{abs} = \sigma \varepsilon A T_{env}^4$

$T_{env} = 273 + 77 = 350$ (K)

$P_{abs} \approx 2.27 \cdot 10^{-3}$

c) $P_{net} = P_{abs} - P_{rad} = 2.27 \cdot 10^{-3} - 1.23 \cdot 10^{-3}$

$= 1.04 \cdot 10^{-3}$ (W)

54) a) the heat transfer is

$P_{rad} = \sigma \varepsilon A T^4$

$P_{rad} = 5.67 \cdot 10^{-8} \cdot 0.9 \cdot 2 \cdot 0.3 \cdot 10^4$

$= 9.4 \cdot 10^2$

b) $E = P_{rad} \times t = 9.4 \cdot 10^2 \cdot 30 = 2.8 \cdot 10^4$ (J)

59) a) $P_{cond} = kA \frac{T_H - T_C}{L} = k A_a \frac{T_H - T_C}{L_A}$

b) $P_{cond\,b} = \frac{A_b L_a}{A_a L_b} P_{cond,a}$

$= 2 \times 2 \times P_{cond,a} = 4 P_{cond,a}$

So the required time is $2 \cdot \frac{0}{4} = 0,5$ m 30s

b) $E = P_{rad} \times t = 9.4 \cdot 10^2 \cdot 30 = 2.8 \cdot 10^4$ (J)

60) a) $P_{cond} = \frac{A(T_H - T_C)}{\sum(L/K)} = \frac{A \Delta T_2}{L_2/K_2}$

$\Delta T_2 = \frac{(L_2/K_2)(T_H - T_C)}{\sum(L/K)} \approx 16,5°C$

b) conductivity k_2 increase $\Rightarrow$ conduction rate increase

c) repeat the calculation in part (a):

$\Delta T_2 \approx 14,5°C$