Homework 12 (due on April 25, put it into my mail box, or earlier)

1. Problem 7.44 (only (a) part) (5 points)

2. Heat shields (5 points)
A black (non-reflective) plane at temperature T_u is parallel to a black plane at temperature T_l. The net energy flux density in vacuum between the two planes is $J_U = \sigma_B \left(T_u^4 - T_l^4\right)$, where σ_B is the Stefan-Boltzmann constant. A third black plane is insert between the other two and allowed to come to steady state temperature T_m. Find T_m in terms of T_u and T_l, and show that the net flux is cut in half because of the presence of this plane. This is the principle of the heat shield and is widely used to reduce radiant heat transfer. Comment: the result for N independent heat shields between the planes at T_u and T_l is that the net energy flux density is $J_U = \sigma_B \left(T_u^4 - T_l^4\right)/(N+1)$.

Extra-grade
#1 (4 points)
Estimate the maximum size of aluminum dust particle that under the influence of the sun radiation moves in space out of the Sun. Make all needed reasonable assumptions. You will need to find out what is the sun radiation pressure.

#2 (8 points). Problem is not as trivial as it may look
Find the energy flux transferring from one parallel plate to the other if temperatures of the plates are T_1 and T_2 and emissivity is e_1 and e_2, respectively. The area of each plate is S, the distance between them is much smaller than their size.

Blackbody has emissivity equal to 1.
If emissivity is not equal to 1 then radiation laws change in the following way
Emitted power from area S: $W = S\sigma e T^4$
If W_{in} is power of radiation incoming on area S then power of absorbed radiation is $W_a = eW_{in}$, and power of reflected radiation is $W_r = (1-e)W_{in}$.