Outside Problem HW#3-1
due Fri. 04/22 along with the rest of HW#3

On a separate piece of paper answer the following question:

1. (a) The intensity of sunlight reaching the earth is 1360 W/m$^2$. Assuming all the sunlight is absorbed, what is the radiation-pressure force on the earth? Give your answer in newtons and as a fraction of the sun’s gravitational force on the earth.

(b) A low cost way of sending spacecraft to other planets would be to use the radiation pressure on a solar sail. The intensity of the sun’s electromagnetic radiation at distances near the earth’s orbit is about 1300 W/m$^2$. What size sail (in m$^2$) would be needed to accelerate a 10,000 kg spacecraft toward Mars at 0.010 m/s$^2$? Compare this sail to the size of UCSD’s main campus (i.e. is the sail much smaller, much larger, or about the same size as UCSD).

(c) You’ve recently read about a chemical laser that generates a 20 cm diameter, 25 MW laser beam. One day, after Physics 100C class, you start to wonder if you could use the radiation pressure from this laser beam to launch small payloads into orbit. To see if this might be feasible, you do a quick calculation of the acceleration of a 20 cm diameter, 100 kg, perfectly absorbing block. What speed would such a block have if pushed horizontally 100 m along a frictionless track by such a laser? Does this seem like a promising method for launching satellites?