

ENEE 381 Spring 2003, Problem Set #2

2/18/03 - due 2/27/03

(1) Calculate the electric field and magnetic field amplitudes produced 1km from a radio transmitter whose output is 4W at 100MHz. The waves coming from the transmitter are spherical, but to a good approximation they are plane far enough away from the transmitter. Compare these field amplitudes with those produced by a laser beam whose intensity is $10\text{GW}/\text{cm}^2$ at a wavelength of $1\mu\text{m}$.

(2) Calculate the electric and magnetic field amplitudes produced 50mm from a cellular phone that is isotropically transmitting 1W at 850 MHz. Use a plane wave approximation to calculate the fields. If all this power is absorbed in a spherical region of radius 100mm whose specific heat is 1 calorie/gram, what is the rate of heating expected?

(3) Cheng Problem 7.7

(4) Cheng Problem 7.10

(5) Cheng Problem 7.23

(6) Calculate the time it would take for a light sail powered space craft to accelerate to $0.1\times$ the velocity of light. Use a sail area of 100km^2 , a space craft mass of 10,000 kg, and a light intensity on the sail of $1\text{W}/\text{m}^2$.