

Physics 106c: Electrodynamics

Problem Set 7

Due: 4pm Friday, May 29, 2009

Remember: Late homework will be granted 50% credit up to one week late, unless you have a note from the Dean or a health official.

Reading: Griffiths Chapter 10 and 11.

Problems:

1. Griffiths 10.13
2. Griffiths 11.9
3. Griffiths 11.11
4. Griffiths 11.24
5. This one is from the 2008 final exam:

A linearly polarized plane electromagnetic wave of frequency ω , propagating in vacuum along the z -axis with an electric field of amplitude E_0 polarized along the x -axis, falls upon a point charge q of mass m , originally sitting at the origin of coordinates. The point charge is free to move in response to the electromagnetic wave.

a) Solve for the motion of the charge, assuming that its velocity remains very small compared to that of light.

b) The moving charge radiates its own electromagnetic waves. Find magnitude and angular dependence of the time-averaged outgoing power, in terms of E_0 , q , m , and ω . Be clear about any angles you need to define.

c) The total scattering cross-section is defined to be that area σ over which the total power in the *incoming* electromagnetic wave equals the total power (integrated over all solid angle) radiated by the point charge. Find a formula for σ appropriate to the preceding discussion.