

Hints to Assignment #12 -- 8.022

[1] Lorentz invariance and waves

Follow instructions given in text. Express E and B (vectors) as sum of two vectors each, i.e., $E(B)_{\text{parallel}}$ and $E(B)_{\text{perpendicular}}$ and expand the vector product $E'E'-B'B'$. You will have to manipulate the cross terms using the transformation of fields equations given in chapter 6.

[2] Electromagnetic (E/M) plane waves

Check out hints from last week's problem [7] (Purcell 9.5). The only potentially tricky point is that some of the given E/M plane waves might not be valid.

[3] Coaxial cable and Poynting vector

Interesting problem that shows how describing E/M phenomena in terms of field can make things look different. We have seen this in class while working on the energy flow in a capacitor that is being charged up. Use Ampere and Gauss' laws to find E and B fields in between the two conductors that make up the coax cable. According to the field description of this phenomenon the energy flows in the ring in between the two conductors- the wires are simply fixing the boundary conditions the fields have to obey!

[4] Radiation from the Sun

The average radiant flux is the so called intensity which is the time-averaged Poynting vector. Use the definition of all rest as given in your lecture notes or in the handout. Choose your system of units before you take off.

[5] E and B fields in a capacitor

Start with reading our derivation in class, i.e., <http://web.mit.edu/8.022/www/lecture/lec20p4.html> Then apply Faraday's law in the shown path. You should show that the relative error is equal or less than our "slow varying" approximation. If this is negligible, then our relative error is even more so.

[6] Wave Polarization

Review lecture notes and/or handout on polarization. Remember that the general direction of propagation is determined by the spatial argument in the wave's phase. You probably want to rewrite the two trigonometric functions that appear in the given formula as one of the same type. This will yield immediately the phase difference between the two linear polarized constituents of the final wave resulting from superposition.