HW#5
(due 03/08)

Reading
(a) Omar (8) Ch.5
(b) Handout 5 "Photonic crystals: Semiconductors of light" (see course website)

Problems
1. O Ch.4 Q.5
2. O Ch.4 Q.8
3. O Ch.4 Pr.10
4. O Ch.5 Q.2
5. O Ch.5 Pr.12
6. O Ch.5 Pr.14
7. Use the eq'n $\mathbf{m}(\frac{d\mathbf{v}}{dt} + \frac{\mathbf{v}}{c}) = -e\mathbf{E}$ for the $\mathbf{e}$ drift velocity $\mathbf{v}$ to show that conductivity at freq $\omega$ is given by $\sigma(\omega) = \sigma_0 \frac{1+i\omega\tau}{1+(i\omega\tau)^2}$, where $\sigma_0 = \frac{\hbar e^2 \omega}{m}$.
8. Kittel Ch.7 Pr.1 (see below)
9. Please describe, using info from Handout 5, recent developments in the field of photonic crystals. Use 24 sentences in your response.

1. **Square lattice, free electron energies.** (a) Show for a simple square lattice (two dimensions) that the kinetic energy of a free electron at a corner of the first zone is higher than that of an electron at midpoint of a side face of the zone by a factor of 2.
   (b) What is the corresponding factor for a simple cubic lattice (three dimensions)?
   (c) What bearing might the result of (b) have on the conductivity of divalent metals?