HW set 1

1) sp2 hybridization: give the orbitals as linear combination of atomic orbitals and explain why the coefficients are what they are.

2) A single C-C σ bond has carbon-carbon distance 1.47A, a double C=C bond has carbon-carbon distance 1.35 A. Explain how come the measured carbon-carbon distance in benzene is 1.42A for all bonds.

3) AM Chpt. 1 problem 2 (Joule heating).

4) (a) Assume a metal has 2 types of charge carriers with charges e_1 and e_2, masses m_1 and m_2, Drude relaxation times τ_1 and τ_2 and carrier concentration n_1, n_2. Deduce an expression for the Hall coefficient R_H. Write your answer in terms of the mobilities $\mu_i=|e_i|\tau_i/m_i$.
(note that mobilities are by definition positive; e_i may be positive or negative).
(b) Discuss in which limits it reduces approximately to the form with only one type of charge carrier.
(c) Find a condition for $R_H=0$.
(d) In a recent measurement of Hall coefficient as function of pressure in a material it was found that the Hall coefficient decreases in magnitude by a factor of 4 without changing sign as the pressure increases. Propose a different explanation for this observation than the one given in the paper.