Hints for Assignment 1

Problem 2

The force, F = dE/dr. then (from class and from the book)

$$E_N = -\frac{A}{r} + \frac{B}{r^n} = E_A + E_R$$

$$F_N = \frac{dE_N}{dr} = \frac{A}{r^2} - \frac{nB}{r^{n+1}} = F_A + F_R$$

The attractive force, $F_A = \frac{A}{r^2}$, (from class and from Figure 2.8a)

From the book (page 31):

$$A = \frac{(Z_1 e)(Z_2 e)}{4\pi\varepsilon_o}, \text{ then } F_A = \frac{(Z_1 e)(Z_2 e)}{4\pi\varepsilon_o r^2}$$

$$Z_1 = Z_2 = 2,\ \varepsilon_o = 8.85x10^{-12}\ farads/m,\ e = 1.602x10^{19}\ Coulombs,\ r = 1.25x10^{-9}\ m\ (given)$$

$$farad = \frac{(Coulombs)^2}{Joule} = \frac{C^2}{J}$$

Then solve for F_A (recall J = Nm)

Problem 3

The net potential energy between two atoms is (from class, and from above):
The bonding energy, E_o, is the minimum on the energy vs. separation distance curve (Fig. 2.8b). This is when the atoms are in equilibrium, in their lowest energy state.

You know the equation, to find the minimum, take the derivative and set it = 0.

$$E_N = -\frac{A}{r} + \frac{B}{r^n}$$

$$\frac{dE_N}{dr} = \frac{A}{r^2} - \frac{nB}{r^{n+1}}$$

When $dE_N/dr = 0$, $r = r_o$, then

$$\frac{A}{r_o^2} = \frac{nB}{r_o^{n+1}}$$

Then solve for r_o

To find E_o, substitute the expression for r_o into

$$E_o = -\frac{A}{r_o} + \frac{B}{r_o^n}$$