Homework #3
Due 23 September 2003
Each Problem is worth 10 Points

1.)   For C and Ni ions impinging on an Al substrate, calculate the screening radius a
        for the Bohr formulation, the Firsov formulation, and the Lindhard formulation.
        Compare all of these to the universal screening radius.

2.)   Calculate the value of the screening function $\chi(r/a)$ at values of x = r/a = 1, 5, 10,
        and 15 for the Sommerfeld, Moliere, and Lenz-Jensen forms.

3.   Using the following equation:

$$0 = 1 - \frac{V(r_{min})}{E} - \frac{b^2}{r_{min}^2}$$

        and assuming a pure Coulomb potential, calculate the value of r_{min} for a 100keV
        boron atom on silicon for an impact parameter b = 1nm. What is the significance
        of your answer?

4.   Solve the scattering integral for the unscreened Coulomb potential $V(r) = Z_1Z_2e^2/r$.

        a.)   Derive a general expression for the distance of closest approach, r_{min}, for
                the unscreened potential.

        b.)   What is the value of r_{min} for 2MeV ^{4}He incident on gold for a head-on
                collision, b = 0, and for b = $0.5a_L$ and $5a_L$, where a_L is the Lindhard
                screening length.