**Question 1**

Germanium, silicon, and diamond have the same crystal structure (diamond cubic). Bonding in each case involves sp3 hybridization.

The following data file contains data on physical properties of these elements.

<http://www.buffalo.edu/~erikeina/MDI505/Carbon-group-properties.csv>

From these data, we can see the bonding energy decreases as period increases (i.e., as we move from C down to Sn).

1. Assuming linear relationships, plot the band gap as a function of each of the other properties (melting temperature, covalent radius, bond energy, and first ionization energy) and predict the band gap of diamond.
2. For which property is the prediction closest to the experimental value of 5.47 eV?

**Question 2**

The following file contains X-ray emission data for Mg.

<http://www.buffalo.edu/~erikeina/MDI505/x-ray-emission-data-Mg.csv>

1. Plot and estimate the Fermi energy from the data. Note you should project both the steepest rise and steepest fall to the x-axis to estimate the cut-off. (This can be done by inspection or calculation.)
2. Given the electron density in Mg to be 8.62×1028 m-3 calculate the Fermi energy. How does the calculated value compare to the experimental value obtained in part (a)?