MSE160 – Molecules and Materials
Problem Set #2- Due January 23rd, 2020

1. An electron is confined within a 1-micron layer of silicon. If this can be assumed to be a 1D box (an infinite potential box), calculate the lowest possible energy within the material. If this energy is entirely kinetic, what is the velocity of the electron? For the electron mass in this problem, assume that the effective mass of electrons in silicon is equal to $0.26m_o$.

2. Consider an electron in the ground state of a box (with infinite potential) with a length of q.
    a. For this problem, find and sketch the probability density $|\psi|^2$. Where is this electron most likely to be found?
    b. If the probability of finding any particle within a small interval of x is given by following equation, what is the probability that the electron will be found between x = 0.41q to 0.42q.

$$P \text{ (small interval)} \approx |\psi(x)|^2 \Delta x$$

3. If you know an electron has a principle quantum number of 3, what are the possible values for its other quantum numbers?

4. Each of the following hypothetical electron configurations are incorrect for the ground state of fluorine. For each possible configuration, state why it is incorrect and provide the correct electron configuration
    a. $1s^3 2s^2$
    b. $1s^2 2s^1 2p^6$
    c. $1s^2 2s^1 1p^5$

5. The net potential energy (E_N) between two adjacent ions can be represented by the formula below, where r is the interatomic distance, and A and B are constants. Derive an expression for r_O (the equilibrium interatomic spacing) where the energy is at a minimum.

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