Please show all work and all equations to receive any credit

1. How many values of the quantum number l are there when n=4? State each of the values as well as the letter of the subshell associated with each of these.

2. For a 5f electron, state the possible values of the quantum number m_l.

3. For a particle in a one-dimensional box, compare the relative probabilities of the particle being in the left third of the box for each of the first three energy levels. You must show a diagram and state specifically what quantum mechanical probability corresponds to.

4. Using a noble gas core format, write the electron configuration for each of the following:

    a. Fe^{2+}

    b. Cu

    c. As

    d. O

5. Compare the 1st ionization energies for argon and krypton atoms. Clearly explain, in underlying scientific principles using Coulomb's Law, the reason for this difference.

6. Compare the 3rd ionization energies for magnesium and aluminum atoms. Clearly explain, in underlying scientific principles using Coulomb's Law, the reason for this difference.