1. Assuming electron to be free, calculate the total number of states below E= 5eV in a cubical box of volume $10^{-5}m^3$.

2. The atomic radius of Na is $1.86A^o$. Calculate the fermi energy of Na atom at absolute zero (consider the unit cell of Na as BCC).

3. Find the lowest energy of an electron confined in a box of side $1A^o$. Find the temperature at which the average energy of the molecule of perfect gas would be equal to the lowest energy of electron.

4. Calculate the Hall coefficient of sodium based on free electron model. Sodium has BCC structure and the side of cube is $4.28A^o$.

5. The Magnetic moment of an electron in ground state of Hydrogen atom is 1 Bohr magneton. Calculate the induced magnetic moment in a field of 1 T.

6. Metallic silver is an excellent conductor. It has 5.86×10^{28} conduction electrons per cubic meter. (a) Calculate its Fermi energy. (b) Compare this energy to the thermal energy k_BT of the electrons at a room temperature of 300 K.

7. The susceptibility of magnesium at 400K is 1.5×10^{-5}. At what temperature will the susceptibility increases to 1.8×10^{-5}

8. An iron rod is subjected to a magnetizing field of 1200 A/m. The susceptibility of iron is 599. Find the permeability and magnetic flux per unit area produced.

9. A thin film Hall probe is placed in the magnetic field and the transverse voltage (on the order of microvolts) is measured. For a given hall probe of 2 m thickness, the applied current of 1 ampere and magnetic field of 2 Tesla (n = 8.47×10^{28} electrons/m^3). Find the Hall voltage.

10. Answer the following using Hund's rule:
(A) The ground configuration of a Ti^{2+} ion is $[Ar]3d^2$. What is the term of lowest energy state?
(B) What is the term of lowest energy state for the following atoms and ions:
C:[He]$2s^2 2p^2$; N:[He]$2s^2 2p^3$; O:[He]$2s^2 2p^4$; Cr^{3+}: [Ar]$3d^3$; Mn^{3+}: [Ar]$3d^4$; Fe^{3+} : $[Ar]3d^5$.