Answer on Question #51573, Physics, Solid State Physics

Calculate the probability for an electron to be found at an energy of (E_F +2k_BT) in a metal.

Solution

Electrons are particles with half-integer spin. And they obey Fermi-Dirac statistics. The function of Fermi-Dirac distribution is written as follows:

$$P(E,T)=\frac{1}{1+\exp\left(\frac{E-E_F}{kT}\right)}$$

where $P(E,T)$ P (E, T) - the probability that the electron occupies an energy level E, above or below the Fermi level E_F.

Then

$$P(E_F+2k_BT,T)=\frac{1}{1+\exp\left(\frac{E_F+2k_BT-E_F}{k_BT}\right)}=\frac{1}{1+e^2}\approx 0.119=11.9\%$$

Answer: $P(E_F+2k_BT,T)=\frac{1}{1+e^2}\approx 11.9\%$