TREX

9.24 WHAT FRACTION OF e^- IN A GOOD CONDUCTOR HAVE ENERGIES BETWEEN $0.95E_F$ AND E_F AT $T=0$?

THE NUMBER OF ELECTRONS WITH $E < \text{ENERGY} < E+dE$ IS

$$n(E)\,dE = \frac{3N}{2} E_F^{-3/2} E^{1/2} \frac{1}{e^{(E-E_F)/kT}+1}$$

FOR $E < E_F$ AND $T=0$, THE EXPONENTIAL FACTOR GOES TO $e^{-\infty} \approx 0$ SO THE FERMI-DIRAC FACTOR GOES TO ONE. THUS

$$N(0.95E_F - E_F) = \frac{3N}{2}\int_{0.95E_F}^{E_F} E_F^{-3/2} E^{1/2}\,dE$$

$$N_{0.95} = \frac{3N}{2} E_F^{-3/2} \left(\frac{2}{3} E^{3/2}\right\rvert_{0.95E_F}^{E_F}$$

$$= N \frac{1}{E_F^{3/2}} E_F^{3/2}\left(1^{3/2} - 0.95^{3/2}\right)$$

$N_{0.95} =$

THE RATIO OF $N_{0.95}$ TO N IS

$$\frac{N_{0.95}}{N} = 0.074 \Rightarrow \frac{N_{0.95}}{N} = 7.4\%$$