

1. **Electron Lifetime:** For simplicity, we treat the problem at $T = 0$ and consider an added electron at energy E above the Fermi energy. The more physical problem of electron lifetime at finite temperature T is given, up to numerical constant, by replacing E by T .
 - (a) Show that the lifetime τ due to electron phonon scattering of an electron with energy E above the Fermi energy is given by $\hbar/\tau \approx E^3/(\hbar\omega_D)^2$ for $E \ll \hbar\omega_D$, where $\hbar\omega_D$ is the Debye frequency.
 - (b) For transport properties, we need the momentum relaxation time τ_t which weights the scattering probability from \mathbf{k} to \mathbf{k}' by $1 - \cos\theta$ where θ is the angle between \mathbf{k} and \mathbf{k}' . Show that $\hbar/\tau_t \approx E^5/(\hbar\omega_D)^4$.