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 $\tau$ 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 Deybe frequency.

(b) For transport properties, we need the momentum relaxation time $\tau_t$ which weights the scattering probability from $k$ to $k'$ by $1 - \cos \theta$ where $\theta$ is the angle between $k$ and $k'$. Show that $\hbar/\tau_t \approx E^5/(\hbar \omega_D)^4$. 