In Lecture 8, we developed a current equation for electrons in the presence of a gradient in the electrochemical potential and temperature as

\[ J_{ns} = \sigma_n \frac{d(F_n/q)}{dx} + [SG] \frac{dT}{dx} \]

where

\[ \sigma_n(E) = \frac{2q^2}{h} \lambda(E) \frac{M(E)}{A} \left( -\frac{\partial f_0}{\partial E} \right) \]

and

\[ [SG] = \left( \frac{k_B}{q} \right) \int \sigma_n(E) \left( \frac{E - E_F}{k_B T} \right) dE \]

1a) Assume a 3D non-degenerate n-type semiconductor with a constant mfp and evaluate the two parameters, \( \sigma_n \) and \([SG]\).

1b) Give a physical explanation for the sign of \([SG]\).