1.1 Deduce the following expressions for k_F, $n(E_F)$ and $D(E_F)$ for 1, 2, and 3 dimensional systems.

Dimension	k_F	$n(E_F)$	$D(E_F)$
3	$(3\pi^2 n)^{1/3}$	$\frac{1}{3\pi^2}\left(\frac{2mE_F}{\hbar^2}\right)^{3/2}$	$\frac{1}{2\pi^2}\left(\frac{2m}{\hbar^2}\right)^{3/2}\sqrt{E_F}$
2	$\sqrt{2\pi n}$	$\frac{m}{\pi\hbar^2}E_F$	$\frac{m}{\pi\hbar^2}$
1	$\frac{\pi n}{2}$	$\frac{2}{\pi\hbar}\sqrt{2mE_F}$	$\frac{\sqrt{2m}}{\pi\hbar}\frac{1}{\sqrt{E_F}}$

1.2 Calculate the Fermi wavelength (De Broglie wavelength at the Fermi surface) for two conductors with carrier density of 10^{23} cm^{-3} (a metal) and 10^{18} cm^{-3} (a semiconductor), respectively. Which of the two systems will be first to exhibit quantum size effects as the sample sizes are reduced?

1.3 Calculate the scattering time and the mean free path of Cu at room temperature, which has a carrier density $n = 8.47 \times 10^{22}$ cm^{-3}, and resistivity $\rho = 1/\sigma = 1.72$ μm•cm.