1. For 3-nines pure (99.9%) and 5-nines pure (99.999%) copper and gold, find the mean free path at room temperature and at 4.2 K. State all sources. (The CRC will probably be helpful, though totally unverified online sources are okay).

2. Find the electronic contribution to the specific heat of a two-dimensional metal of area A with N electrons. Recall from last homework we derived that the density of states in 2-D is constant, $g = \frac{mA}{\pi\hbar^2}$; and the Fermi energy is $E_F = \frac{N}{A}\frac{\pi\hbar^2}{m}$.

   To find the specific heat exactly, you'll want to go through the "tedious math" the book skips that I outlined in class. You'll need to use this change of variables: $x = \frac{E-E_F}{k_B T}$. Keep in mind that $E_F \gg k_B T$ so $-\frac{E_F}{k_B T} \approx -\infty$. To help you, I'll provide an intermediate step you should arrive at:

$$c_{v,e} = \frac{g}{A} k_B^2 T \int_{-\infty}^{\infty} \frac{x^2 e^x}{(e^x+1)^2} dx \tag{1}$$

3. Hook&Hall 3.6 In ^{3}He and neutron stars, the particles are the nucleus and the neutron, respectively. Comment on what your results imply.