Week 6 - Free Electron Model

Comprehension Check

Total points = 25 (scaled by a factor of 1/10 in the system)

Question 1 (8 points)

The energy of an electron in a potential well of length L is given by

$$\epsilon = \frac{\hbar^2}{2m} \left(\frac{n\pi}{L}\right)^2$$

(i) What is the ground state energy of the system (ε_{\circ}) ?

(ii) If 7 electrons are to be placed in the potential well, what would be the energy of the top most filled level (ε_F) in terms of the ground state energy (ε_o) ?

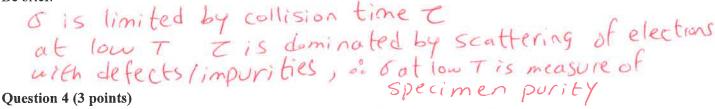
$$7$$
 electrons $=>$ $n=4$

Question 2 (6 points)

What dependence does the electronic heat capacity exhibit at low temperatures? How does that compare to the phonon heat capacity at low temperatures?

Question 3 (8 points)

Explain why and how measurements of electrical conductivity can be used to evaluate purity of specimen. Be brief.



What sort of important interactions are not accounted for in the free electron model?