Quiz 6

Tuesday, March 01, 2011

1. [10 points] The specific heat of an electron gas is given by, up to a numerical factor of order 1, $C \sim Nk_B \left(\frac{T}{T_F}\right)$, when $T \ll T_F$. That is, $C = \gamma T$, with $\gamma \sim Nk_B/T_F$. Imagine a gas of *quasi*-electrons, particles that are just like electrons except having a different mass m^*. Show that $\gamma \propto m^*$.

2. [10 points] For a gas of free electrons in one dimension, the chemical potential increases as T increases from absolute zero. True or false? Explain *briefly* for a (potentially huge) bonus point.

3. [10 points] In a typical metal, what is the value of the Fermi energy ϵ_F in eV? What temperature (T_F) does it correspond to? Provide a short derivation of your answer (for ϵ_F) for a (potentially huge) bonus point.