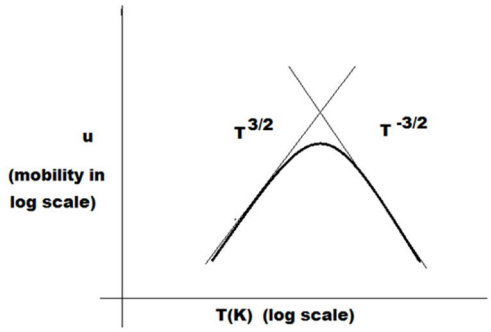
CSR5201 Introduction to Semiconductor Materials HW #1 Due (2024/9/26)

(Your grade will depend on the accuracy, thoroughness, and clarity of your response.)

1. Material carrier mobility is a function of temperature. Generally, it exhibits a temperature dependence of $T^{3/2}$ **at low temperatures and** $T^{-3/2}$ **at high temperatures**, as shown below. Please explain the rationale behind the temperature exponents 3/2 and -3/2 in the low and high temperature regimes. (30 points) (Hint: cross section of scattering center)



2. In the past, blacksmiths used various **heating, cooling, forging, and carburization** techniques to control the mechanical properties of metals. They knew the methods but not the science behind them. Could you explain how these treatments affect the microstructure and properties of materials? (30 pts) (Hint: Fe-C phase diagram.)
3. There are no **face-centered tetragonal** and **base-centered tetragonal** unit cells listed in the fourteen Bravais lattices. Please explain why and draw the equivalent unit cells. (25 pts)
4. Please describe what you anticipate gaining from this course. (15 pts)