18) Tunneling experiment

In a tunneling experiment, the energy gap of Indium was found to be $\Delta_0 = 5.3 \cdot 10^{-4}$ eV. What is the critical temperature of Indium according to BCS theory? Compare the result to the experimental value at $T_{C,\text{In}} = 3.37$ K.

19) Isotope effect

Recall that the Debye frequency varies with the atomic mass as $\omega_D \sim M^{-1/2}$. The critical temperature of a mixture of Mecury isotopes, having an average atomic weight of $M_{\text{Hg}} = 199.7$ g, is $T_C = 4.161$ K. By how much will the critical temperature of the mixture change, if the average atomic weight changes to $M_{\text{Hg}} = 200.7$ g? Will the temperature increase or decrease?

20) Current-Voltage characteristics of the SIS-Junction

A SIS-junction consists of two superconductors which are isolated from each other by a thin insulating tunnel barrier. Consider the case that the superconducting materials are different from each other and have the gaps Δ_1 and Δ_2.
Explain the shown voltage biased current-voltage characteristic of such a system from its energy spectrum, for the cases of

a) T = 0, positive and negative voltages,

b) T > 0, positive and negative voltages.