
Problem #4 Using results learned in class today, and re-derive equation necessary for calculating the relationship between \( b/R \) and \( qR \) as shown in Fig. C in today’s lecture. Explain the meaning of positive and negative \( b \) in terms of Fermi pseudopotential. (10 points)

Problem #5 \( \text{Cu}_3\text{Au} \) is cubic with one stoichiometric unit of \( \text{Cu}_3\text{Au} \) per unit cell. It undergoes an order-disorder phase transition at a temperature, \( T_c = 390°C \). For \( T<T_c \), it is in the ordered state where \( \text{Au} \) occupies (000) position in the unit cell and \( \text{Cu} \) occupies the face-centered positions (0, 1/2, 1/2), (1/2, 0, 1/2) and (1/2, 1/2, 0). For \( T>T_c \), it is in the disordered state where all of the sites are randomly occupied such that an average occupancy of 1/4 for \( \text{Au} \) and 3/4 for \( \text{Cu} \) can be considered at each site. (10 points)

(a) In the disordered state, calculate the neutron coherent and incoherent scattering cross sections, assuming natural isotope distribution for \( \text{Cu} \) and \( \text{Au} \) for one unit cell.
(b) Repeat the calculation now for ordered state, and discuss why or whether they are different from the disordered state.