Lectures of

Solid State Physics

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Question 1

Velocity of Bloch electrons in a given band $E_n(\mathbf{k})$. Discuss and give a proof of the expression $\frac{1}{\hbar} \vec{\nabla}_{\mathbf{k}} E_n(\mathbf{k}) = \vec{v}_{n\mathbf{k}}$.

Question 2

Effective mass m^* of Bloch electrons. Discuss and give a proof of the expression $\left(\frac{1}{m^*}\right)_{i,j} = \frac{1}{\hbar^2}\left(\frac{\partial^2 E}{\partial k_i \partial k_j}\right)$.

Question 3

Show that thermal expansion of crystalline solids can be described through a single parameter γ (Grüneisen).

Question 4

Discuss and give a proof of the equations describing the thermoelectric power and the "Peltier" effect.