

Problem set 1

Deadline 05.03.2025

Use the material from

V.F. Gantmakher "Electrons and Disorder in Solids", Chapter 1

A.A. Abrikosov "Fundamentals of Theory of Metals", Chapter 3

1. Derive the expression for electronic diffusion coefficient D in a metal (consider two- and three-dimensional cases). Derive the Einstein relation between D and electrical conductivity. Estimate resistivity of a typical metal (take Cu or Au as an example) assuming the mean free path ~ 100 nm.
2. Plot schematically temperature dependence of electrical resistivity for a typical metal and discuss its main features in terms of various mechanisms of electronic scattering (impurities, electron-electron and electron-phonon interaction).