

# HW #24

**1. (Kasap Problem 4.12) Conductivity of metals in the free electron model** Consider the general expression for the conductivity of metals in terms of the density of states  $g(E_F)$  at  $E_F$  given by

$$\sigma = \frac{1}{3} e^2 v_F^2 \tau g(E_F)$$

Show that within the free electron theory, this reduces to  $\sigma = e^2 n \tau / m_e$ , the Drude expression.

**2. (Kasap Example 4.10) Conduction in silver** For silver, the Fermi energy at zero temperature is given by  $E_{F0} = 5.5$  eV and  $\phi = 4.5$  eV. Assuming a free electron model,

- a) What is the density of states at  $E_{F0}$ ?
- b) What is the velocity of electrons at the Fermi level?
- c) The conductivity of silver at room temperature is  $62.5 \times 10^6 / \Omega\text{m}$ , what is the mean scattering time for electrons?
- d) What is the mean free path?