

HW Assignment #1

Recommended Completion Date, Friday 10 April 2009

Solid State Engineering, Part II, Chapter 7

Problems 1-7

Revisions

- 2. Polarizability of conducting sphere.** Derive the polarizability of a metallic sphere of radius a . Assume that $E = 0$ inside the sphere, and use the depolarization factor of $1/3$.

Bonus Problem

8. Polarizability of dielectric sphere.

- (a) Derive the polarizability of a sphere of radius a and dielectric constant ϵ_r .
- (b) Assume a large number of dielectric spheres is distributed in space with concentration n_s . Use the polarizability expression from (a) and the Clausius-Mosotti expression to derive the effective dielectric constant ϵ_{eff} of the collection of spheres in space. The resulting relation between ϵ_{eff} and ϵ_r is called the Maxwell-Garnett formula – the first step in a very interesting branch of condensed-matter physics called “effective media” theory.