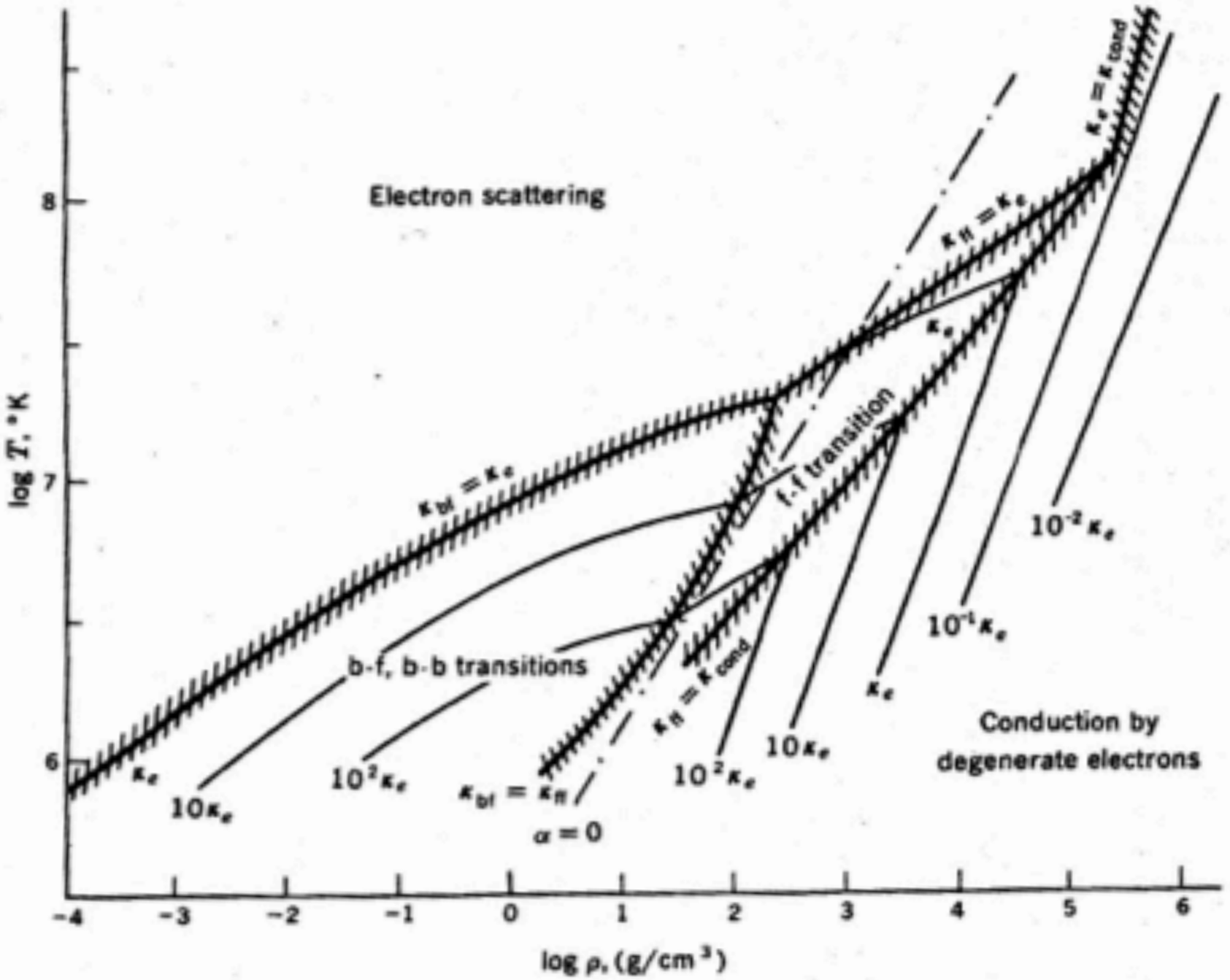

Fig. 3-15 The total opacity of population I composition. The ρT plane is divided into four domains according to which opacity source is the most important for energy transport, electron scattering, bound-free transitions, free-free transitions, and conduction by degenerate electrons (to be discussed in Sec. 3-4). The lines designating these boundaries are cross-hatched. Contours of constant opacity are labeled by the value of κ in terms of the opacity κ_e due to electrons. A dashed line shows where the degeneracy parameter $\alpha = 0$. (*After C. Hayashi, R. Hoshi, and D. Sugimoto, Progr. Theoret. Phys. Kyoto, Suppl.* 22, 1962.)

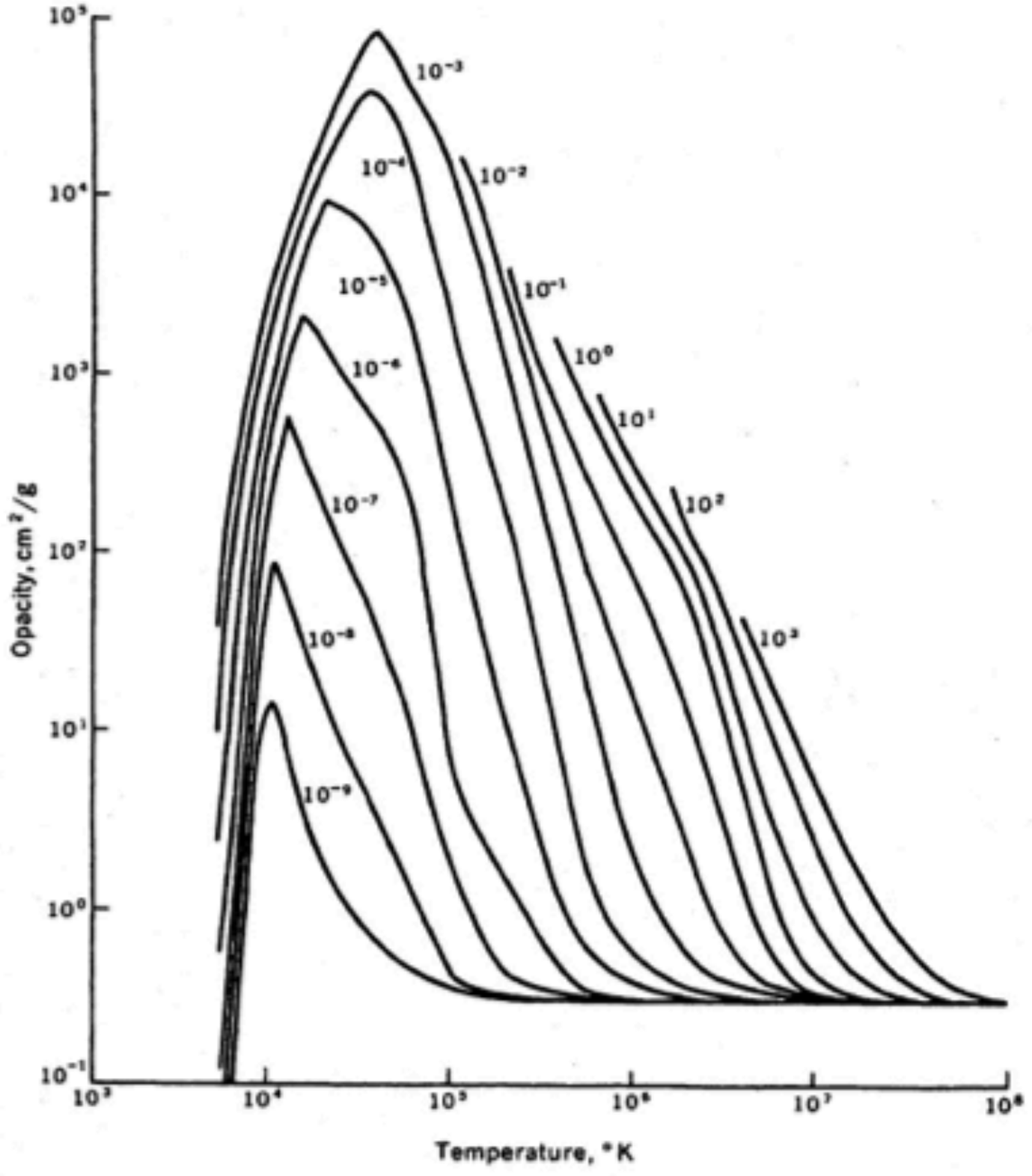

Fig. 3-16 The total opacity of material of solar composition as a function of temperature. Each curve is labeled by the value of the density. The range of values shown was chosen to illustrate the characteristic values of the opacity within the sun. [*After D. Ezer and A. G. W. Cameron, Icarus*, **1**:422 (1963).]

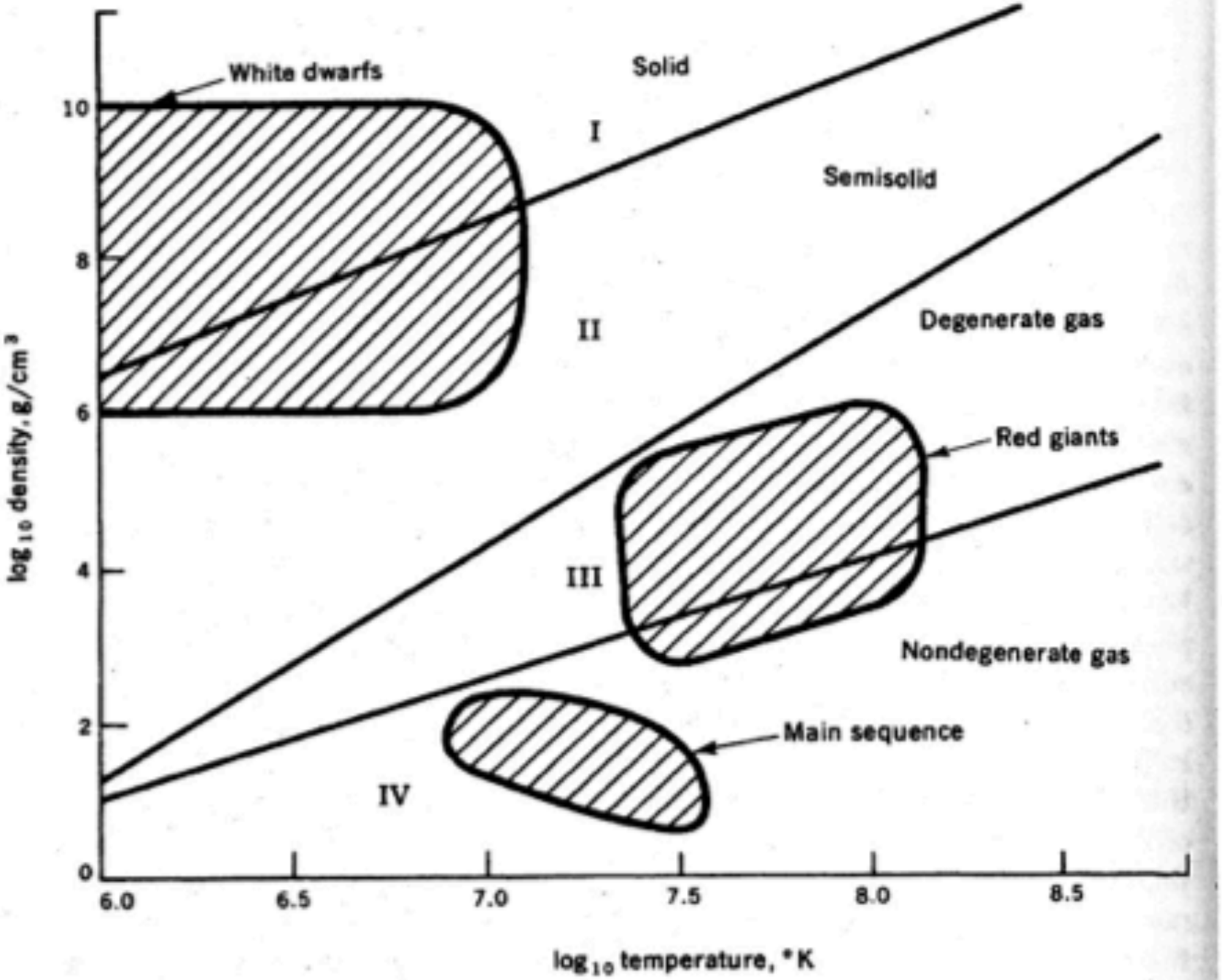

Fig. 3-24 The state of the ions in an ionized medium depends upon temperature and density. Those two quantities determine the relative importance of the coulomb interaction energy per ion and kT. When U_c/kT is greater than unity, the ions are forced into a lattice structure in order to minimize the potential energy, and the state may be described as solid. In region II, $U_c/kT \sim 1$, the ion spheres interpenetrate to a considerable degree, and the state may be described as semisolid. At the somewhat smaller values of U_c/kT in region III, the electron gas remains strongly degenerate, but the ions now move as a nondegenerate gas. In region IV both ions and electrons are nondegenerate gases. The conductivity depends not only upon the state of the electron gas but on the state of the ion gas as well, by virtue of the degree of correlation among ionic scattering centers. [*R. A. Wolf, Phys. Rev.*, **137**:B1634 (1965).]

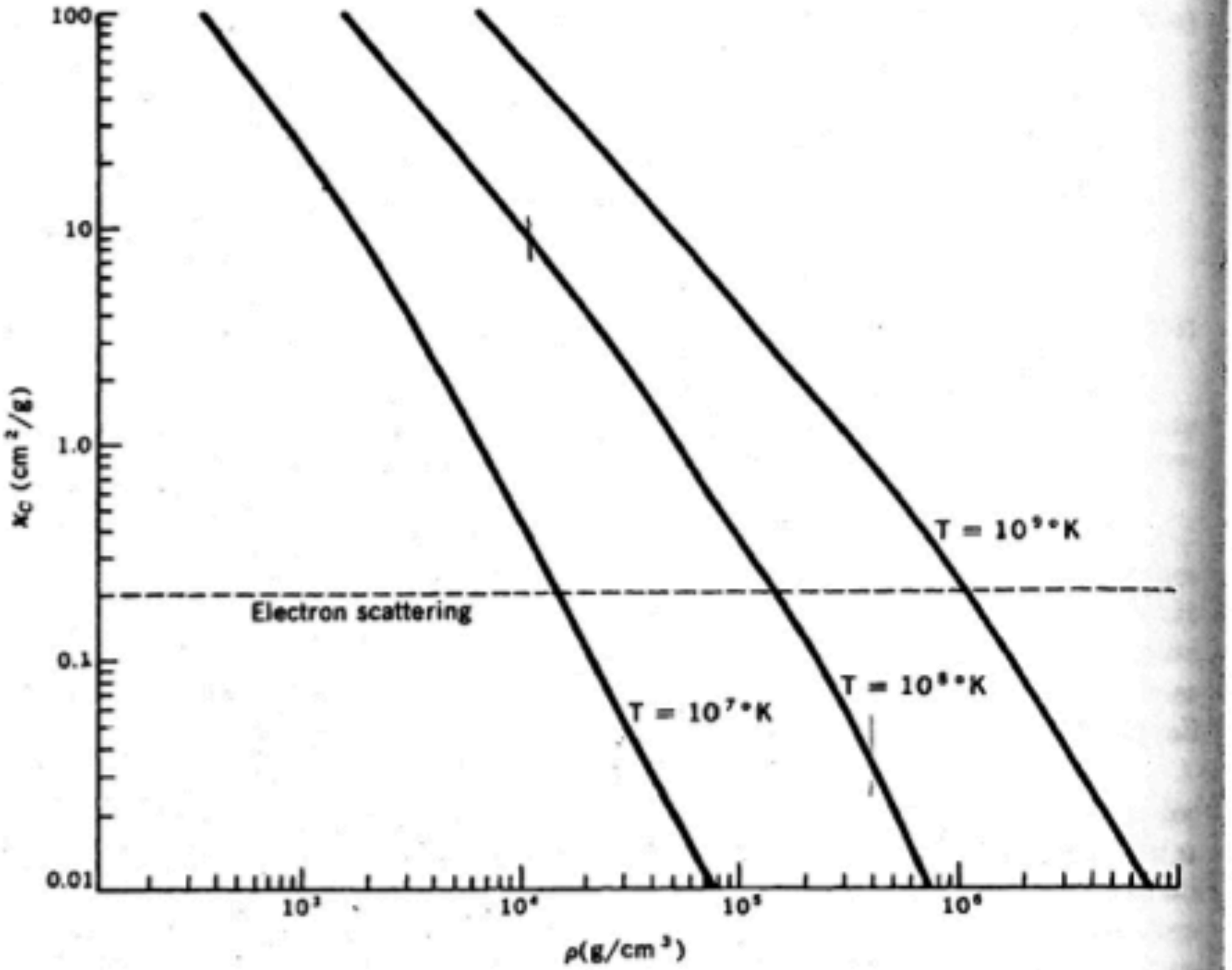

Fig. 3-27 Conductive opacity of a helium gas. The conductivities were computed from Table 3-1. The density at which the conductive opacity equals the radiative opacity due to scattering from the electrons is seen to increase by roughly one order of magnitude for each order-of-magnitude increase in the temperature.