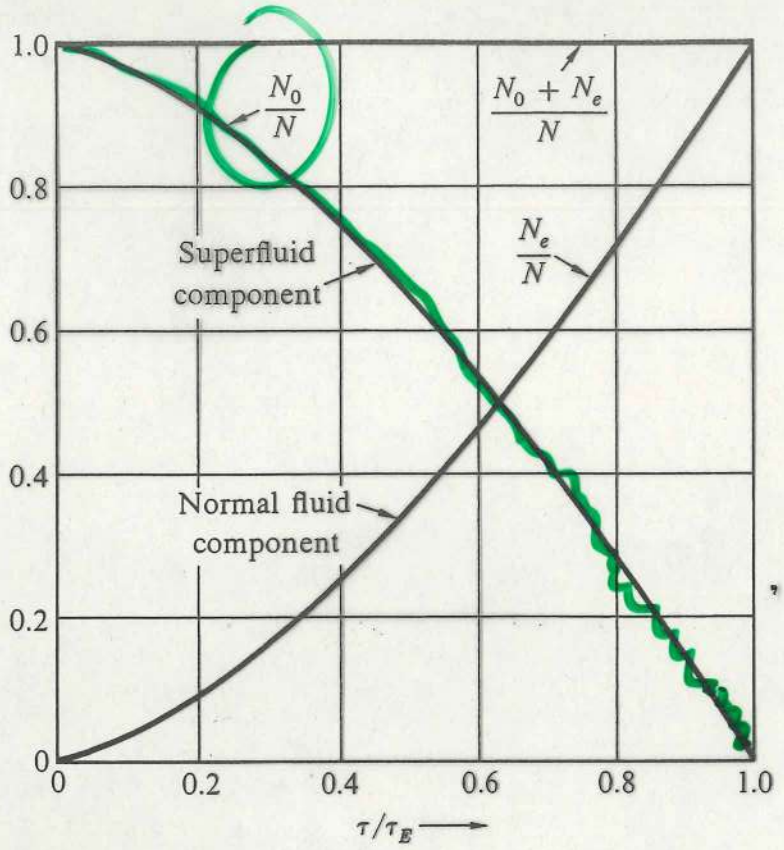

Figure 7.11 Condensed boson gas: temperature dependence of the proportion N_0/N of atoms in the ground orbital and of the proportion N_e/N of atoms in all excited orbitals. We have labeled the two components as normal and superfluid to agree with the customary description of liquid helium. The slopes of all three curves are intended to be zero at $\tau = 0$.

The number of particles in the ground orbital is found from (73):

$$N_0 = N - N_e = N[1 - (\tau/\tau_E)^{3/2}]. \tag{74}$$

We note that N may be of the order of 10^{22}. For τ even slightly less than τ_E a large number of particles will be in the ground orbital, as we see in Figure 7.11. We have said that the particles in the ground orbital below τ form the condensed phase or the superfluid phase.

The condensation temperature in kelvin is given by the numerical relation

$$T_E(\text{in K}) = (115/V_M^{2/3}M) , \tag{75}$$

where V_M is the molar volume in $\text{cm}^3\ \text{mol}^{-1}$ and M is the molecular weight. For liquid helium $V_M = 27.6\,\text{cm}^3\,\text{mol}^{-1}$ and $M = 4$; thus $T_E = 3.1\,\text{K}$.