22.103 Microscopic Theory of Transport
(Fall 2003)

Problem Set No. 5   **Due: October Nov. 7, 2003**

Problem 1

Summarize the discussion of the H-theorem and the equilibrium solution to the
Boltzmann equation given in Chap 18 of McQuarrie (and repeating enough of the
derivational steps for yourself). Itemize the main results of Sec. 18-5 and their
implications as part of your study notes on understanding the Btolzmann equation.

Problem 2

Summarize the paper, M. Nelkin and A. Ghatak, "Simple Binary Collision Model for Van
Hove's G_s(r,t)", Phys. Rev. **135**, A4 (1964), so far as the calculation of $S_s(k,\omega)$ using the
Boltzmann equation is concerned. Follow the details to derive Eq.(28) and then obtain
the two limits, the ideal gas and simple diffusion. Relative to these two limiting
behavior, what is the significance of the kinetic model description of G_s(r,t)?

Problem 3

Relative to the paper of Nelkin and Ghatak, what is the significance of the paper, S. Yip
and M. Nelkin, "Application of a Kinetic Model to Time-Dependent Density Correlation
in Fluids", Phys. Rev. **135**, A1241 (1964) from the standpoint of calculating density
correlation functions using kinetic theory?