

PHY 410
HW#5

Assigned 8 Feb 10: Due 15 Feb 10

- 5.1 What are the thermal wavelengths λ_{th} (or quantum length l_Q) for the following particles
(i) N_2 molecules at $T=300K$; (ii) electrons at $300K$; (iii) He atoms at $1K$
If the densities for these systems are $10^{19}/cc$, $10^{22}/cc$, and $10^{22}/cc$ respectively, then which of these can be treated as classical systems. (6 points)
- 5.2 An ideal gas is isothermally compressed from volume V to $V/2$ keeping N fixed. What is the change in entropy σ per particle? If the same gas is heated from temperature τ to 2τ , keeping the volume V and N constant, what is the change in σ per particle? (4 points)
- 5.3 Problem # 6, Chapter 3 of the Text (Kittel and Kroemer). This problem deals with the rotation of diatomic molecules. (12 points)
- 5.4 Problem # 8, Chapter 3 of the Text (Kittel and Kroemer). (10 points)
- 5.5 Problem # 11, Chapter 3 of the Text (Kittel and Kroemer). This problem explores the relationship between thermodynamics (or statistical physics) and the physical dimensionality of a system. (8 points).