2/19/02. **Due:** Tuesday, February 26, 2002 (in class).

Physics 540: Statistical Mechanics I

Read: LL 19,15,24

"**LL** 1" means section 1 from Landau and Lifshitz book

Homework 3

Exercise 1

The thermodynamic system consists of a hot brick of temperature T_1 and specific heat C and of an iceberg at $T_2 = 0^{\circ}$C. What is the maximal work W that can be performed by bringing this system to the state of thermal equilibrium? Consider the effects due to the change of the total volume of the system as negligible.

Exercise 2

In the presence of magnetic field H one defines magnetization of the body as $\mathcal{M} = -\left(\frac{\partial E}{\partial H}\right)_{S,V}$. Then one thinks about the energy as of function of three independent thermodynamic variables $E = E(S, V, H)$ with $dE = TdS - PdV - \mathcal{M}dH$.

Assume that we know the complete equation of state $P(T, V, H)$, the temperature dependence of (constant volume, constant magnetic field) specific heat $C_V(T, V_0, H_0)$ at some given V_0 and H_0 and temperature and magnetic field dependence of magnetization $\mathcal{M}(T, V_0, H)$ at some given V_0.

a) Show that there are 6 independent thermodynamic coefficients for such a system.

b) Show that this data gives all 6 independent thermodynamic coefficients.

c) Find the full dependence of $C_V(T, V, H)$ and $\mathcal{M}(T, V, H)$ from this data.