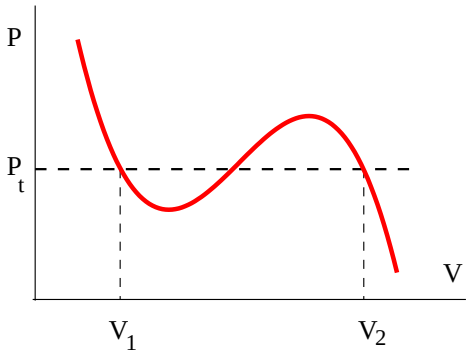
Physics 831 - 2002

Statistical Physics

Problem Set 3

1. Problem 2.2(a) (4 pt)

2. Consider an isotherm $P(V)$ for a system which experiences a first-order phase transition (see the figure). This isotherm is determined by the equation of state, and you may (but don't have to) think of the Van der Waals equation of state. Use the condition that the chemical potential of the two phases at equilibrium is the same to find, in terms of an equation $P(V)$ and graphically, the value of the pressure (for given T) and the specific volumes of the phases [the *Maxwell rule*] (6 pt)



3. Consider a set of curves $P(V)$ for adiabatic transformations of a given system. Show that these curves may not intersect each other. (5 pt)

4. Plot a phase portrait of (i) a harmonic oscillator (2 pt), and (ii) a pendulum (3 pt). Find the phase volume $\Sigma(E)$ for a harmonic oscillator of unit mass and unit angular frequency with energy smaller than E (2 pt).

The problems are from Kerson Huang, *Statistical Mechanics*, 2nd edition, (Wiley, NY 1987).