Phys 404
Spring 2010
Homework 3, CHAPTER 3
~~Due Thursday, February 18, 2010 @ 12:30 PM~~
NOW DUE Thursday, February 25, 2010 @ 12:30 PM

Early Warning: First hour exam is Thursday, March 4. **It will cover Chapters 1-4 (roughly) in the text. Books, notes, formula sheets, cell phones, and calculators may not be used during the test.**

Chapter 3 assignment: Read chapter 3, then do these problems in chapter 3:

1. K+K, Chapter 3, Problem 1

2. K+K, Chapter 3, Problem 9

3. K+K, Chapter 3, Problem 2, part (a), only. Expand the magnetization in the limit of small ($mB << \tau$) and large ($mB >> \tau$) magnetic fields.

4. K+K, Chapter 3, Problem 3

5. K+K, Chapter 3, Problem 4

6. K+K, Chapter 3, Problem 6

7. K+K, Chapter 3, Problem 11

8. A Legendre transformation of the form $d(\tau\sigma)=\tau d\sigma+\sigma d\tau$ changes the fundamental thermodynamic relation $dU(\sigma,V)=\tau d\sigma-pdV$ into $dF(\tau,V)=-\sigma d\tau-pdV$, while also providing the formula $F=U-\tau\sigma$. Use a Legendre transformation on the –pdV term to *derive* expressions for $dH(\sigma,P)$ and for $H(\sigma,P)$. H is called the enthalpy, and is useful for processes that occur at constant pressure.

Hints:

1. Find the free energy directly from the partition function.

2. Do the second problem in the list before doing problem 3, then use the generalization of the second problem, that the partition function for N independent *distinguishable* systems is $Z(\mathbf{1+2+3+...+N})=Z(\mathbf{1})Z(\mathbf{2})Z(\mathbf{3})...Z(\mathbf{N})$.

3. You do <u>not</u> need to convert the partition sum to an integral; the sum can be evaluated exactly. Remember that $\exp(sx)=[\exp(x)]^s$.