

PHY411 Homework Set 13

1. [5 pts] Kittel-Kroemer, problem 10-2.
2. [5 pts] Kittel-Kroemer, problem 10-3.
3. [10 pts] Consider the model of a ferromagnet developed in chapter 10 of the textbook and in the lecture.

- (a) Demonstrate that the energy per unit volume in this model, at sub-Curie temperatures, is

$$\frac{U}{V} = -\frac{\lambda M^2}{2}.$$

- (b) Determine the heat capacity C in this model, advancing the result as much as possible. Note that you will need to differentiate the relation arrived at in the class

$$\frac{MV}{Nm} = \tanh\left(\frac{m\lambda M}{\tau}\right),$$

yielding a parametric equation for $dM/d\tau$. Here m is the magnetic moment of a single atom. You may consider using reduced variables $\hat{\tau} = \tau/\tau_c$ and $\hat{M} = M/M_{\max}$.

- (c) Make a sketch of C vs τ , in parallel to the sketch for M .