Physics 512 (Fall 2006)

HOMEWORK 3

due 9/19/06

1. Neel temperature of an antiferromagnet

Taking the effective fields on the two-sublattice model of an antiferromagnet as

$$\begin{aligned} B_A &= H - \mu M_B - \epsilon M_A \\ B_B &= H - \mu M_A - \epsilon M_B \end{aligned}$$

where H is external field. μ and ϵ are the constants (same meaning as λ in the case of a ferromagnet). Determine Neel temperature in a mean-field approximation

2. Schottky anomaly

Consider a two-level system, $E = \pm\Delta$ (for example, hyperfine interaction can split the energy levels). Derive

a) Thermally averaged internal energy

b) Heat capacity

c) Plot heat capacity in units of C/k_B as function of $x = k_B T/\Delta$