Physics 410 - 2002

Thermal Physics

Problem Set 2

1. Consider a system of $N = 10^8$ spins, each of magnetic moment $m = e\hbar/(2m_e)$ (e and m_e are the electron charge and mass), in a magnetic field $B = 1$ T. Assume that, as a result of interaction, each energy level $-2msB$ (s is the spin excess) is split, so that the energy levels of the stationary states fill the gap $2mB$ uniformly. For $s = N^{1/2}$, make an estimate of how long it will take to determine that the system is in a stationary state. For what N does this time become of the order of the age of the universe? (6 pt)

2. Problem 1, Chapter 2 (5 pt)

3. Problem 2, Chapter 2 (6 pt)

4. Problem 5, Chapter 2 (5 pt)

You need to have 20 points out of 22 (2 points are extra credit).

The problems are from Kittel & Kroemer, *Thermal Physics*, 2nd edition, (Freeman, NY 1980).