PROBLEM SET 9

Reading: Handout on NMR

1. **Thermodynamics of a Simple System of Spin-1/2 Particles**

   Consider a solid with N weakly interacting spin-1/2 particles, each with magnetic
   moment of magnitude μ_B. The solid is in a uniform external magnetic field $\vec{H}$ pointing
   along the z-axis. The solid is in contact with a heat bath at temperature T. The
   Hamiltonian $\mathcal{H}$ is

   $$\mathcal{H} = -\vec{\mu} \cdot \vec{H} \tag{1}$$

   where $\vec{\mu}$ is the magnetic moment. Find, as a function of temperature,

   (a) the magnetization M

   (b) the susceptibility χ. Plot or sketch the susceptibility vs. T. (This is called the
   Curie susceptibility.)

   (c) the specific heat at constant volume C_V. Plot or sketch the C_V vs. T. (This is
   called the Schottky specific heat.)