1. Consider a lattice gas model of a system in which there are $N$ sites, each of which can be empty or occupied by one particle, the energy being 0 for no particles on a site and $\varepsilon$ for one particle. Each particle has a magnetic moment $\mu$ which in the presence of a magnetic induction field leads to a shift in energy into either $\mu H$ or $-\mu H$. What is the partition function of the system? Evaluate the mean energy and the magnetization of the lattice gas.

**Answer**
2. Find the pressure, entropy, and specific heat at constant volume of an ideal Boltzmann gas of indistinguishable particles in the extreme relativistic limit. Express your answer as functions of the volume \( V \), temperature \( T \), and number of particle \( N \). [Hint: \( \int_{0}^{\infty} x^n e^{-ax} \, dx = \frac{n!}{a^{n+1}} \)]

**Answer**