1 Potential energy of gas in gravitational field

Consider a column of atoms each of mass M at temperature T in a uniform gravitational field g. Find the thermal average potential energy per atom. The thermal average kinetic energy is independent of height. Find the total heat capacity per atom. The total heat capacity is the sum of contributions from the kinetic energy and from the potential energy. Take the zero of the gravitational energy at the bottom $h = 0$ of the column. Integrate from $h = 0$ to $h = \infty$. *You may assume the gas is ideal.*