[tex66] Interaction pressure produced by Gaussian interparticle potential

Consider a dilute gas of density n, where the particles interact via a Gaussian central-force potential, $\phi(r) = \phi_0 e^{-r^2/a^2}$, with $\phi_0 = 1\text{eV} = 1.6 \times 10^{-19}\text{J}$, $a = 2 \times 10^{-10}\text{m}$.
(a) Calculate the interaction pressure p_{int} under the assumption that the particles are distributed randomly in space. Express the result as a function of ϕ_0, n, a.
(b) Compare the interaction pressure p_{int} with the kinetic pressure p_{kin} for a dilute gas at $T = 293\text{K}$ and $n = 2.7 \times 10^{25}\text{m}^{-3}$.

Solution: