SMSpring99B

A two-dimensional classical gas of N particles, each of mass m, maintained at temperature T, is confined in the x-y plane by a radial potential:

$$V(r) = \frac{1}{2} m\omega^2 (r-R)^2.$$

where ω and R are positive constants, and $r^2 = x^2 + y^2$. For this problem, take ωR to be so large that the probability of finding particles near $r = 0$ is essentially zero.

(a) Write down the normalized distribution function $\rho(\mathbf{r},\mathbf{p})$ that gives the probability of finding any particular particle with position **r** and momentum **p**.

(b) Calculate the internal energy per particle of the gas.

(c) Calculate the mean radius $\langle r \rangle$ of the distribution.

(d) Calculate the expansion coefficient $d\langle r \rangle/dT$ of the gas.