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

(a) Write down the normalized distribution function \( \rho(r,p) \) 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.