

Differential of internal energy

Write down the total differential of the internal energy as a function of entropy and volume, $u(s,v)$. Compare to the first Gibbs equation (the one with the internal energy) and determine the partial derivatives of the total differential. They are equal to:

The total differential of the internal energy as a function of entropy and volume, $u(s,v)$ is: $du(s,v) = \left(\frac{\partial u}{\partial s}\right)_v ds + \left(\frac{\partial u}{\partial v}\right)_s dv$. Comparing to: $du = Tds - Pdv$ results in $\left(\frac{\partial u}{\partial s}\right)_v = T$ and $\left(\frac{\partial u}{\partial v}\right)_s = -P$. Note the - for the pressure!