GIBBS EQUATION

The Gibbs equation for a simple compressible substance (SCS) comes from: $s = s(u, v)$. The differential change in the specific entropy is:

$$ds = \left(\frac{\partial s}{\partial u}\right)_{\mathrm{v}} du + \left(\frac{\partial s}{\partial v}\right)_{\mathrm{u}} dv$$

Introducing the thermodynamic definitions of temperature and pressure:

$$\frac{1}{T} = \left(\frac{\partial s}{\partial u}\right)_{\mathrm{v}}$$

and

$$\frac{P}{T} = \left(\frac{\partial s}{\partial v}\right)_{\mathrm{u}}$$

we obtain the Gibbs equation or relation:

$$ds = \frac{1}{T}\, du + \frac{P}{T}\, dv$$

This relation is frequently written as

$$T\, ds = du + P\, dv$$

This very important equation provides a means for the evalution of entropy changes from macropscropic experimental data.