9.3: Latent Heat and Enthalpy

Consider a liquid of volume V_1 at its boiling point. Suppose a quantity of heat L is supplied, sufficient to vaporize the liquid. The new volume (of what is now vapour) is V_2. If the vapour has expanded against a constant pressure P (e.g. the pressure of the atmosphere), the work done by it is $P(V_2 - V_1)$. The increase in the internal energy of the system is the heat supplied to the system minus the work done by it (this is the engineer's version of the first law of thermodynamics). That is, $U_2 - U_1 = L - P(V_2 - V_1)$, and so

$$H_2 - H_1 = L. \tag{9.3.1}$$

So, during a change of state at constant pressure the increase or decrease of enthalpy is equal to the latent heat of transformation. This, of course, is just a simple example of our earlier statement, in Section 9.1, that the increase of enthalpy of a system is equal to the heat supplied to it in an isobaric process.