

4.1: Prelude to Putting the First Law to Work

As has been seen in previous chapters, many important thermochemical quantities can be expressed in terms of partial derivatives. Two important examples are the molar heat capacities C_p and C_V which can be expressed as

$$C_p = \left(\frac{\partial H}{\partial T} \right)_p$$

and

$$C_V = \left(\frac{\partial U}{\partial T} \right)_V$$

These are properties that can be measured experimentally and tabulated for many substances. These quantities can be used to calculate changes in quantities since they represent the slope of a surface (H or U) in the direction of the specified path (constant p or V). This allows us to use the following kinds of relationships:

$$dH = \left(\frac{\partial H}{\partial T} \right)_p dT$$

and

$$\Delta H = \int \left(\frac{\partial H}{\partial T} \right)_p dT$$

Because thermodynamics is kind enough to deal in a number of **state variables**, the functions that define how those variable change must behave according to some very well determined mathematics. This is the true power of thermodynamics!

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