8.7: Standard State Heat Capacities

We have observed that C_V depends on volume and temperature, while C_P depends on pressure and temperature. Compilations of heat capacity data usually give values for C_P, rather than C_V. When the temperature-dependence of C_P is known, such compilations usually express it as an empirical polynomial function of temperature. In Chapter 10, we find an explicit function for the dependence of C_P on pressure:

$$\left(\frac{\partial C_P}{\partial P}\right)_T = -T\left(\frac{\partial^2 V}{\partial T^2}\right)_P$$

If we have an equation of state for a substance, we can find this pressure dependence immediately. It is usually negligible. For ideal gases, it is zero, and C_P is independent of pressure.

Compilations often give data for the ***standard state heat capacity***, C_P^o, at a specified temperature. For condensed phases, this is the heat capacity for the substance at one bar. For gases, this is the heat capacity of the substance in its ideal gas standard state.

	300 K	400 K	$a\,(\mathrm{J})$	$b\,(\mathrm{J\,K^{-1}})$
C_s	0	0	-1.482	0.03364
$H_2\,(g)$	0	0	27.853	0.00332
$O_2\,(g)$	0	0	27.221	0.00722
$CH_4\,(g)$	-74.656	-77.703	21.167	0.04866
$CH_3OH\,(g)$	-201.068	-204.622	21.737	0.07494