

Chapter 6: Standard States and Standard Enthalpies of Formation**Goal: Calculate ΔH for any chemical reaction**

(1) Define standard states for all elements: The most stable form at 1 atm and 298.15 K

E.g.

- (a) What is the standard state of carbon?
- (b) Assume gases behave ideally (a good assumption at 1 atm!)

(2) Define the standard enthalpy of formation for a substance (ΔH_f°): The ΔH for a reaction in which 1 mole of a given substance is formed from elements, all in their standard states.

- (a) The substance of interest need not itself be in its standard state.
- (b) The ΔH_f° for an element in its standard state is zero (follows from definition).
- (c) The ΔH_f° of $H^+(aq)$ is defined to be zero.

Example (using Hess' Law):

(3) For the reaction $a A + b B \rightarrow c C + d D$,

$$\Delta H = c \Delta H_f^\circ(C) + d \Delta H_f^\circ(D) - a \Delta H_f^\circ(A) - b \Delta H_f^\circ(B)$$

ΔH_f° values are tabulated for many substances—watch out for phases!