⟨Summary of Thermodynamics⟩

Enthalpy

$$H = U + pV \tag{0.1}$$

Gibbs energy = Maximum non-expansion work

$$G = H - TS \tag{0.2}$$

Gibbs energy change of a closed system (in the absence of non-expansion work)

$$\left(\frac{\partial G}{\partial p}\right)_T = V \tag{0.3}$$

$$\left(\frac{\partial G}{\partial T}\right)_p = -S \tag{0.4}$$

Chemical potential of a pure substance = molar Gibbs energy

$$\mu = \left(\frac{\partial G}{\partial n}\right)_{p,T} = G_m \tag{0.5}$$

Chemical potential of an ideal gas A at a partial pressure p_A [from (0.3)]

$$\mu_A = \mu_A^\circ + RT \ln\left(\frac{p_A}{p^\circ}\right) \tag{0.6}$$

μ_A°: chemical potential at the standard pressure p° ($\equiv 1$ bar)

Chemical potential of B in an ideal solution of molality b_B [from (0.3) & Raoult's law]

$$\mu_B = \mu_B^\circ + RT \ln\left(\frac{b_B}{b^\circ}\right) \tag{0.7}$$

μ_B°: chemical potential at the standard molality b° ($\equiv 1$ mol kg^{-1})

Chemical potential of A in an ideal solution of mole fraction x_A [from (0.3) & Raoult's law]

$$\mu_A = \mu_A^* + RT \ln x_A \tag{0.8}$$

μ_A^*: chemical potential of a pure substrate A

Chemical potential of an incompressible liquid or solid C at a pressure p [from (0.3)]

$$\mu_C = \mu_C^\circ + V_m(p - p^\circ) \tag{0.9}$$

μ_C°: chemical potential at the standard pressure p° ($\equiv 1$ bar)

⟨Thermodynamic Data Source⟩

The sources of the thermodynamic data appearing in exercises are as follows:

(no source shown) "Physical Chemistry, 6th Ed.," P. W. Atkins, Oxford Univ. Press (1998).

[JANAF] "JANAF Thermochemical Tables, 3rd Ed.," M. W. Chase, Jr., *et al. J. Phys. Chem. Ref. Data* **14**, Supplement 1 (1985).

⟨Averaged Atomic Weights⟩

H: 1.008   C: 12.01   N: 14.01   O: 16.00   F: 19.00   Na: 22.99   Mg: 24.30
Al: 26.98   Si: 28.09   P: 30.97   S: 32.07   Cl: 35.45   K: 39.10   Ca: 40.08

⟨Schedule⟩

[1] May 31 (Mon.) 13:00~   [Problem-1] Due Date: June 14 (at the end of the class)
 * June 2 (Wed.) **NO CLASS**
[2] June 7 (Mon.) 13:00~
[3] June 9 (Wed.) 8:30~
[4] June 14 (Mon.) 13:00~   [Problem-2] Due Date: 17:00 June 28 (to the box in the dept. office)

 # The papers (reports) must be submitted until the corresponding due dates.
 # Submissions via e-mail will not be accepted.