⟨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

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

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

$$\mu_{\mathrm{A}} = \mu_{\mathrm{A}}^{\circ} + RT \ln\left(\frac{p_{\mathrm{A}}}{p^{\circ}}\right) \tag{0.6}$$

$\mu_{\mathrm{A}}°$: chemical potential at the standard pressure $p°$ (≡ 1 bar)

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

$$\mu_{\mathrm{B}} = \mu_{\mathrm{B}}^{\circ} + RT \ln\left(\frac{b_{\mathrm{B}}}{b^{\circ}}\right) \tag{0.7}$$

$\mu_{\mathrm{B}}°$: chemical potential at the standard molality $b°$ (≡ 1 mol kg^{-1})

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

$$\mu_{\mathrm{A}} = \mu_{\mathrm{A}}^{*} + RT \ln x_{\mathrm{A}} \tag{0.8}$$

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)]

$$\mu_{\mathrm{C}} = \mu_{\mathrm{C}}^{\circ} + V_{\mathrm{m}}(p - p^{\circ}) \tag{0.9}$$

$\mu_{\mathrm{C}}°$: chemical potential at the standard pressure $p°$ (≡ 1 bar)

⟨Thermodynamic Data Source⟩

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

(no source shown) "Atkins' Physical Chemistry, 8th Ed.," P. W. Atkins and J. de Paula, Oxford Univ. Press (2006).
[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: 24.31
Al: 26.98	Si: 28.09	P: 30.97	S: 32.06	Cl: 35.45	K: 39.10	Ca: 40.08

⟨Schedule⟩

[1] June 1 (Mon) 13:00~
[2] June 8 (Mon) 13:00~
[3] June 10 (Wed) 8:30~
[4] June 15 (Mon) 13:00~ [Problem-1] Due Date: June 29 (until the end of the class)

The paper (report) must be submitted until the due date.
Submissions via e-mail will not be accepted.