Вибрані формули статистичної фізики

$$dE = TdS - pdV - \sum Ada + \mu dN,$$
$$d\Omega = -SdT - pdV - \sum Ada - Nd\mu, \qquad \Omega = F - \mu N = -pV - \sum A^i a^e.$$

$$C = \frac{\delta Q}{\delta T} = T\frac{dS}{dT}, \qquad C_p - C_V = -T\left(\frac{\partial p}{\partial T}\right)_V^2 \left(\frac{\partial p}{\partial V}\right)_T^{-1},$$
$$\left(\frac{\partial T}{\partial p}\right)_H = -\frac{1}{C_p}\left(T\left(\frac{\partial p}{\partial T}\right)_V \left(\frac{\partial p}{\partial V}\right)_T^{-1} + V\right).$$

Заміна $(x, y) \to (u, y)$

$$\left(\frac{\partial F}{\partial x}\right)_y = \left(\frac{\partial F}{\partial u}\right)_y \left(\frac{\partial x}{\partial u}\right)_y^{-1}, \qquad \left(\frac{\partial F}{\partial y}\right)_x = \left(\frac{\partial F}{\partial y}\right)_u - \left(\frac{\partial F}{\partial u}\right)_y \left(\frac{\partial x}{\partial y}\right)_u \left(\frac{\partial x}{\partial u}\right)_y^{-1}.$$

$$F^{\text{ideal}} = NT \ln \frac{An}{f(T)}.$$

ван дер Ваальса $\quad p = \dfrac{nT}{1-bn} - an^2,$

Дітерічі $\quad p = \dfrac{nT}{1-bn} \exp\left(-\dfrac{an}{T}\right),$

Бертело $\quad p = \dfrac{nT}{1-bn} - a\dfrac{n^2}{T},$

Редліха–Квонга $\quad p = \dfrac{nT}{1-bn} - \dfrac{an^2}{\sqrt{T}(1+bn)}.$

$$\Gamma(E) = \sum_{\{n\}:E_n \le E} 1 = \int_{H(p,q)\le E} \mathrm{d}\Gamma, \qquad \mathrm{d}\Gamma = \frac{\mathrm{d}p\mathrm{d}q}{(2\pi\hbar)^s},$$
$$g(E) = \sum_{\{n\}:E_n = E} 1 = \int \delta(E - H(p,q))\mathrm{d}\Gamma \equiv \frac{\mathrm{d}\Gamma(E)}{\mathrm{d}E}.$$

$$N = \sum_i \frac{1}{e^{\frac{\varepsilon_i-\mu}{T}} \pm 1} = \int_0^\infty \frac{g(\varepsilon)\mathrm{d}\varepsilon}{e^{\frac{\varepsilon-\mu}{T}} \pm 1},$$
$$E = \sum_i \frac{\varepsilon_i}{e^{\frac{\varepsilon_i-\mu}{T}} \pm 1} = \int_0^\infty \frac{\varepsilon g(\varepsilon)\mathrm{d}\varepsilon}{e^{\frac{\varepsilon-\mu}{T}} \pm 1},$$
$$pV = \pm T\sum_i \ln\left(1 \pm e^{-\frac{\varepsilon_i-\mu}{T}}\right) = \int_0^\infty \frac{\Gamma(\varepsilon)\mathrm{d}\varepsilon}{e^{\frac{\varepsilon-\mu}{T}} \pm 1}.$$