Formulae for Exam #3

$$k = 1.381 \cdot 10^{-23}\ \text{J/K} = 8.617 \cdot 10^{-5}\ \text{eV/K}$$

$$h = 6.626 \cdot 10^{-34}\ \text{Js} = 4.136 \cdot 10^{-15}\ \text{eVs}$$

$$c = 2.998 \cdot 10^{8}\ \text{m/s}$$

$$N_{\text{A}} = 6.022 \cdot 10^{23}$$

$$H = U + pV \qquad F = U - TS \qquad G = U - TS + pV$$

$$\mathrm{d}U = T\ \mathrm{d}S - p\mathrm{d}V + \mu\ \mathrm{d}N$$

$$\ln\ N! \approx N\ln N - N$$

$$\overline{X} = \sum_s X(s)\, P(s)$$

$$P(s) = \frac{\mathrm{e}^{-E(s)/(kT)}}{Z} \qquad P(s) = \frac{\mathrm{e}^{-(E(s)-\mu N(s))/(kT)}}{\mathcal{Z}}$$

$$\overline{n}_{\text{FD}} = \frac{1}{\mathrm{e}^{(\epsilon-\mu)/(kT)} \quad +1} \qquad \overline{n}_{\text{BE}} = \frac{1}{\mathrm{e}^{(\epsilon-\mu)/(kT)} \quad -1}$$

$$D(v) = \left(\frac{m}{2\pi kT}\right)^{3/2} 4\pi v^2 \mathrm{e}^{-mv^2/(2kT)} \qquad \overline{E} = -\frac{\partial}{\partial\beta}\left(\ln Z\right)$$

$$F = -kT\ \ln Z$$

$$Z_{\text{idealgas}} = \frac{1}{N!}\left(\frac{VZ_{\text{int}}}{v_{\text{Q}}}\right)^N \text{ where } v_{\text{Q}} = \left(\frac{h}{\sqrt{2\pi mkT}}\right)^3$$

$$\int_0^\infty \mathrm{e}^{-ax^2}\mathrm{d}x = \tfrac{1}{2}\sqrt{\tfrac{\pi}{a}}$$

$$\int_0^\infty x^2\mathrm{e}^{-ax^2}\mathrm{d}x = \tfrac{\sqrt{\pi}}{4}a^{-3/2}$$

$$\int_0^\infty x^4\mathrm{e}^{-ax^2}\mathrm{d}x = \tfrac{3}{8}\sqrt{\tfrac{\pi}{a^5}}$$

$$\sum_{n=0}^{\infty} x^n = \tfrac{1}{1-x}$$

$$\cosh(x) = \tfrac{1}{2}\left(\mathrm{e}^x + \mathrm{e}^{-x}\right) \qquad \sinh(x) = \tfrac{1}{2}\left(\mathrm{e}^x - \mathrm{e}^{-x}\right)$$