Equações para consulta nos exames de TTC – TTCA

0°C = 273K
1 Pa = $9.86923267 \times 10^{-6}$ atm
1 bar = 0.986923267 atm

$N_A = 6.02214129 \times 10^{23}$ mol^{-1}
$k_B = 1.3806488 \times 10^{-23}$ m^2 kg s^{-2} K^{-1}
R = 8.3144621 J K^{-1} mol^{-1}
$k_B = R/N_A$

$$\Delta U = Q + W$$
$$dW = -pdV$$
$$dS = dQ_{rev}/T$$
$$\oint \frac{dQ}{T} \le 0$$
$$dU = TdS - pdV + \mu dN$$
$$dU = TdS - pdV + \sum_{i=1}^{L} \mu_i dN_i$$
$$H = U + pV$$
$$F = U - TS$$
$$G = U + pV - TS$$

$$CdT = dQ$$
$$c = C/m$$
$$C_V = \left(\frac{\partial U}{\partial T}\right)_V$$
$$C_p = \left(\frac{\partial H}{\partial T}\right)_p$$
$$C_p - C_V = nR$$

$$pV = nRT$$
$$pV = Nk_BT$$
$$pV^\gamma = const.$$
$$TV^{\gamma-1} = const.$$
$$p^{1-\gamma}T^\gamma = const.$$
$$\gamma = C_p / C_V$$

$$\eta = \frac{W}{Q_h}$$
$$\eta = \frac{Q_h - Q_l}{Q_h}$$
$$\eta_{carnot} = 1 - \frac{T_l}{T_h}$$
$$\frac{Q_h}{Q_l} = \frac{T_h}{T_l}$$

$$\beta = 1/K_BT$$
$$P(E) \propto \exp(-\beta E)$$

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial p}{\partial S}\right)_V$$
$$\left(\frac{\partial T}{\partial p}\right)_S = \left(\frac{\partial V}{\partial S}\right)_p$$
$$\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial p}{\partial T}\right)_V$$
$$\left(\frac{\partial S}{\partial p}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_p$$
$$\left(\frac{\partial x}{\partial y}\right)_z \left(\frac{\partial y}{\partial z}\right)_x \left(\frac{\partial z}{\partial x}\right)_y = -1$$
$$\left(\frac{\partial x}{\partial z}\right)_y = \frac{1}{\left(\partial z / \partial x\right)_y}$$

$$g(v_x) = \sqrt{\frac{m}{2\pi k_BT}} e^{-mv_x^2/2k_BT}$$
$$g(v_y) = \sqrt{\frac{m}{2\pi k_BT}} e^{-mv_y^2/2k_BT}$$
$$g(v_z) = \sqrt{\frac{m}{2\pi k_BT}} e^{-mv_z^2/2k_BT}$$
$$f(v) = \frac{4}{\sqrt{\pi}} \left(\frac{m}{2k_BT}\right)^{3/2} v^2 e^{-mv^2/2k_BT}$$

$$\langle v \rangle = \sqrt{\frac{8k_BT}{\pi m}}$$
$$\langle v^2 \rangle = \frac{3k_BT}{m}$$
$$v_{rms} = \sqrt{\frac{3k_BT}{m}}$$
$$v_{\max} = \sqrt{\frac{2k_BT}{m}}$$

$$p = \frac{RT}{V-b} - \frac{a}{V^2}$$
$$p_c = a/27b^2$$
$$T_c = 8a/27Rb$$
$$V_c = 3b$$

$$L = T\left(S_2 - S_1\right)$$
$$\frac{dp}{dT} = \frac{L}{T(V_2 - V_1)}$$

$$\int_{-\infty}^{+\infty} e^{-ax^2}\, dx = \sqrt{\frac{\pi}{a}}$$
$$\int_{-\infty}^{+\infty} x^{2n} e^{-ax^2}\, dx = \frac{(2n)!}{n!2^{2n}} \sqrt{\frac{\pi}{a^{2n+1}}}, n \ge 0$$
$$\int_{0}^{\infty} x^{2n+1} e^{-ax^2}\, dx = \frac{n!}{2a^{n+1}}, n \ge 0$$

$$U = TS - pV + \sum_{i=1}^{l} \mu_i N_i$$
$$SdT - Vdp + \sum_{i=1}^{l} N_i d\mu_i = 0$$

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