

$$G = 6.674 \cdot 10^{-11} \text{ Nm}^2/\text{kg}^2, N_A = 6.022 \cdot 10^{23} \text{ mol}^{-1}, p_{\text{atm}} = 1.013 \cdot 10^5 \text{ Pa}$$

$$R = 8.3145 \text{ J mol}^{-1}\text{K}^{-1}, k_B = 1.381 \cdot 10^{-23} \text{ J/K}, \sigma = 5.67 \cdot 10^{-8} \text{ Wm}^{-2}\text{K}^{-4}$$

$$0 \text{ K} = -273.15^\circ \text{ C}$$

$$\text{Maa: } g = 9.80 \text{ m/s}^2, m_E = 5.974 \cdot 10^{24} \text{ kg}, R_E = 6.371 \cdot 10^6 \text{ m}$$

$$\vec{F} = -\nabla U = -\left(\frac{\partial U}{\partial x}\hat{i} + \frac{\partial U}{\partial y}\hat{j} + \frac{\partial U}{\partial z}\hat{k}\right)$$

$$f_\mu = \mu n$$

$$W = \int_{P_1}^{P_2} \vec{F} \cdot d\vec{l} \quad W = \int_{\theta_1}^{\theta_2} \tau_z d\theta$$

$$W_{\text{other}} = \Delta E \quad E = K + U$$

$$\vec{J} = \int_{t_1}^{t_2} \sum \vec{F} dt \quad \vec{J} = \Delta \vec{p}$$

$$P = \vec{F} \cdot \vec{v}$$

$$\sum \vec{F} = \frac{d\vec{p}}{dt} \quad \frac{d\vec{L}}{dt} = \vec{r} \times \sum \vec{F} = \sum \vec{\tau}$$

$$\vec{v}_{P/A} = \vec{v}_{P/B} + \vec{v}_{B/A} \quad I_P = I_{\text{cm}} + md^2$$

$$I = \int r^2 dm \quad \vec{\tau} = \vec{r} \times \vec{F} \quad \vec{L} = \vec{r} \times \vec{p} = I\vec{\omega}$$

$$a_{\text{rad}} = v^2/r \quad s = r\theta \quad \sum \tau_z = I\alpha_z$$

$$F_g = \frac{Gm_1m_2}{r^2} \quad U = -\frac{Gm_E m}{r}$$

$$Y = \frac{F_\perp/A}{\Delta l/l_0} \quad p = \frac{dF_\perp}{dA} \quad B = -\frac{\Delta p}{\Delta V/V_0}$$

$$p = p_0 + \rho gh \quad \frac{dV}{dt} = Av$$

$$p + \rho gy + \frac{1}{2}\rho v^2 = \text{vakio}$$

$$\omega = 2\pi f = 2\pi/T \quad x = A \cos(\omega t + \phi)$$

$$\omega = \sqrt{\frac{k}{m}} \quad \omega = \sqrt{\frac{mgd}{I}}$$

$$\phi = \arctan\left(-\frac{v_{0x}}{\omega x_0}\right) \quad A = \sqrt{x_0^2 + \frac{v_{0x}^2}{\omega^2}}$$

$$x = Ae^{-(b/2m)t} \cos(\omega't + \phi) \quad \omega' = \sqrt{\frac{k}{m} - \frac{b^2}{4m^2}}$$

$$k = \frac{2\pi}{\lambda} \quad v = f\lambda = \frac{\omega}{k}$$

$$y(x, t) = A \cos(kx \pm \omega t)$$

$$\frac{\partial^2 y(x, t)}{\partial x^2} = \frac{1}{v^2} \frac{\partial^2 y(x, t)}{\partial t^2}$$

$$v = \sqrt{\frac{F}{\mu}} \quad P_{\text{av}} = \frac{1}{2} \sqrt{\mu F} \omega^2 A^2 \quad \lambda_n = \frac{2L}{n}$$

$$\Delta L = \alpha L_0 \Delta T$$

$$Q = mc\Delta T \quad Q = nC\Delta T \quad Q = \pm mL$$

$$H = \frac{dQ}{dt} = kA \frac{T_H - T_C}{L} \quad H = Ae\sigma(T^4 - T_s^4)$$

$$pV = nRT \quad M = N_A m$$

$$K_{\text{tr}} = \frac{3}{2} nRT \quad v_{\text{rms}} = \sqrt{(v^2)_{\text{av}}} = \sqrt{\frac{3kT}{m}}$$

$$C_V = \frac{\#\text{vap.aste}}{2} R \quad C_p = C_V + R \quad \gamma = \frac{C_p}{C_V}$$

$$\nu = \frac{m_{\text{H}_2\text{O}}}{V} = \frac{M_{\text{H}_2\text{O}}}{RT} p_{\text{H}_2\text{O}} \quad \text{RH} = \frac{\nu}{\nu_m} = \frac{p_{\text{H}_2\text{O}}}{p_m}$$

$$W = \int_{V_1}^{V_2} p dV \quad \Delta U = U_2 - U_1 = Q - W$$

$$e = \frac{W}{Q_H} = 1 + \frac{Q_C}{Q_H} = 1 - \frac{|Q_C|}{|Q_H|}$$

$$K = \frac{|Q_C|}{|W|} = \frac{|Q_C|}{|Q_H| - |Q_C|} \quad e_{\text{Carnot}} = \frac{T_H - T_C}{T_H}$$

$$\Delta S = \int_1^2 \frac{dQ}{T}$$

$$pV^\gamma = \text{vakio} \quad TV^{\gamma-1} = \text{vakio}$$