

$$p + \rho gh + \frac{1}{2} \rho v^2 = \text{const.}$$

$$\frac{p_1}{\rho} + gh_1 + \frac{1}{2} v_1^2 = \frac{p_2}{\rho} + gh_2 + \frac{1}{2} v_2^2$$

$$2 \text{ NNG: } F = m \cdot a = \textcircled{I}$$

$$a = \frac{\Delta v}{\Delta t} \quad \vec{a} = \frac{d\vec{v}}{dt} = \frac{\partial \vec{v}}{\partial t} + (\vec{v} \cdot \nabla) \cdot \vec{v}$$

$$i = m \cdot \vec{v} \quad \vec{q} = \frac{d(m \cdot \vec{v})}{dt} = \frac{d\vec{i}}{dt} \quad v = \frac{\Delta l}{\Delta t}$$

$$Re = \frac{\rho \cdot h \cdot v}{\mu_{vis}}, \quad Re_{lam} < 2300$$

$$v = \pi \cdot r^2 \cdot l \quad \vec{F}_x = \frac{d(mv_x)}{dt} \quad \rho = \frac{m}{V}$$

$$v = \int \pi r^2(x) dx \quad \Delta x = L$$

$$\Delta p = R \cdot Q = \frac{8 \mu \cdot \Delta x}{\pi \cdot r^4} \cdot Q$$

$$\Delta p_{inspo} = p_u - p_A = -p_A = R \cdot Q = \frac{128 \cdot \mu \cdot L}{\pi \cdot D^4} \cdot Q$$

$$\Delta p_{exp} = p_A - p_u = p_A = R \cdot Q = \frac{128 \cdot \mu \cdot L}{\pi \cdot D^4} \cdot Q$$

$$\Delta p_{total} = p_{aus} - p_{ein} \quad \left[\Delta p = R \cdot Q = \frac{128 \mu L}{\pi D^4} \cdot Q \right]$$

$$\frac{1}{R_1} + \frac{1}{R_2} : R = R_1 + R_2$$

$$\Rightarrow \Delta p = p_{aus} - p_{ein} = -(R_1 + R_2) \cdot Q$$

$$\Rightarrow Q = \frac{\Delta p}{R} = \frac{\Delta p}{R_1} + \frac{\Delta p}{R_2}$$

$$p_d - p_p = \Delta p = -\frac{1}{2} \cdot \rho \cdot v_s^2 \neq \Delta p = R \cdot Q \text{ (s.o.)}$$

$$\Delta p = p_A - p_S = \frac{1}{2} \rho (v_s^2 - v_A^2)$$

$$dW_{lib} = p_a \cdot \pi \cdot r^2 \cdot s = p_a \cdot dV_B$$

$$dV_B = \pi \cdot r^2 \cdot s$$

$$W = -(p_{unges} - p_{enge}) \cdot \Delta V = p_f \cdot \Delta V$$

$$p_{nech} = \frac{dW}{dt} = p_a \cdot \frac{dV_B}{dt} = p_a \cdot Q_B$$

$$\frac{dG}{dt} = J_{G,ein} - J_{G,aus} + \Phi_G \Rightarrow B = \frac{dG_{w}}{dt} \Rightarrow \Delta V \Rightarrow G$$

$$\Rightarrow F_{inkom} = \rho \left(\frac{\partial v}{\partial t} + \vec{v} \cdot \nabla \right) \vec{v} \cdot d\vec{x} \cdot dy \cdot dz$$

$$\Rightarrow \frac{\partial p_a}{\partial t} = -\nabla_j = -\left(\frac{\partial j_x}{\partial x} dx + \frac{\partial j_y}{\partial y} dy + \frac{\partial j_z}{\partial z} dz \right)$$

$$\Rightarrow \frac{\partial p}{\partial t} = \frac{\partial (\rho \cdot v_x)}{\partial x}$$

$$\Rightarrow \frac{d}{dt} \int_V \rho \cdot dV = \int_A \rho \cdot v_n \cdot dA$$

$$\Rightarrow \frac{\partial p}{\partial t} - \nabla \cdot (\rho \vec{v}) = \rho \vec{v} \cdot \vec{v} = 0$$

$$E_{Dr} = \frac{\rho}{\gamma}$$

$$E_{Po} = gh$$

$$E_{kin} = \frac{1}{2} \rho v^2$$

$$E_{uspek} = \frac{\sigma_a}{\epsilon} = \frac{F_a}{A \cdot \epsilon}$$

$$\hookrightarrow \epsilon = \frac{\Delta l}{l_0} = \frac{l}{l_0} - 1 \longleftrightarrow$$

$$F_x[N] = \tau_{yx} \cdot A$$

$$A_0 = \frac{\pi}{4} D^2 = \pi r^2$$

$$\tau = \mu \cdot \frac{dv_x}{dy} = \frac{\tau}{A} (t)$$

$$\tau / \sigma / p = \frac{F}{A} \quad dA_{inf} = 0 \cdot p_a$$

$$\mu \nabla^2 \vec{v} + \rho \vec{g} - \nabla p = \rho \left(\frac{\partial \vec{v}}{\partial t} + (\nabla \vec{v}) \cdot \vec{v} \right)$$

$$\rho \vec{g} - \nabla p = \text{const}_{Eu}$$

$$\rho \vec{g} - \nabla p = \rho \left(\frac{\partial \vec{v}}{\partial t} + (\nabla \vec{v}) \cdot \vec{v} \right)$$

$$\rho \vec{g} - \nabla p = 0$$

$$\epsilon = \frac{p_a \cdot D}{2 \cdot E \cdot s} \quad F \Leftrightarrow F \quad p = \sigma_w$$

$$p_B \cdot D = 2 E_G \cdot \epsilon_G \cdot s_G + 2 E_B \cdot \epsilon_B \cdot s_B$$

$$= 2 \cdot s (\sigma_G + E_B \cdot \epsilon_B)$$

$$p - p_p = \frac{2 \cdot \sigma \cdot s}{r} = \frac{2 \cdot E \cdot \epsilon \cdot s}{r}$$

$$p_{gemittelt} = \frac{2}{3} \cdot (p_{elast} + p_{sys})$$

$$L_{stat} \cdot 2 \cdot \sigma_v \cdot s = p_v \cdot D$$

$$2 \cdot (E_v + E_v + \sigma_{kl}) \cdot s = p_v \cdot D$$

$$\Delta p = p_1 - p_2$$

$$\dot{\gamma} > 100 \text{ 1/s} \Rightarrow F_{l,neut} \text{ (Blut)}$$

$$C = \frac{\Delta V}{\Delta p_{ges}} = \frac{\Delta V}{p_{elast} - p_{gesw}} \Rightarrow C = \frac{\pi \cdot D^3 \cdot l}{4 \cdot E \cdot s}$$

$$C_{rel} = \frac{\Delta V}{V} \cdot \frac{1}{dp_k} \Rightarrow C_{rel} = \frac{\Phi}{E \cdot s}$$

$$\hookrightarrow D = \frac{\Phi_s + \Phi_o}{2}$$

$$\gamma(r) = -\frac{r}{2} \cdot \frac{dp}{dx}$$

$$\gamma_{r,sten} = \frac{4 \cdot \mu}{\pi \cdot r^3} \cdot Q$$

$$\sigma_v = E_{ent} \cdot \epsilon_{ent}$$

$$\sigma_{v,gest} = E_{ent} \cdot \epsilon_{ent} + \sigma_{myk}$$

$$C_{TH+L} = \frac{\Delta V}{\Delta p_a}$$

$$p = k_H \cdot p_c \cdot C_i$$

$$n_i = -D_i \cdot A \cdot \frac{\partial c_i}{\partial x} = \frac{m}{s} = c_a$$

$$\frac{\partial c}{\partial x} = -\frac{\partial n_i}{\partial x} \Rightarrow n_i = -\frac{\partial}{\partial x} \left(-DA \frac{\partial c_i}{\partial x} \right) = DA \cdot \frac{\partial^2 c_i}{\partial x^2} = V_E \cdot \frac{dc}{dt}$$

$$\alpha_i = \frac{k_{Ai}}{p}$$

$$F_{Dr} = 1,4 \cdot F_2$$

$$\nabla = \left(\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z} \right)$$

$$g = 9,8 \frac{m}{s^2}$$

$$2D: F_{q,y} = \frac{F_q}{2}$$

$$F_{ax} = F_{ay} \cdot \tan(\alpha) \quad \left[\tan = \frac{G}{A} \right]$$

$$\hookrightarrow x^* \dots$$

$$F_a = \sqrt{F_{ax}^2 + F_{ay}^2} = \dots$$

$$3D: F = \sqrt{F_x^2 + F_y^2 + F_z^2}$$

$$x: \alpha = \cos^{-1} \left(\frac{F_x}{F} \right) \quad \left[\cos(\alpha) = \frac{A}{H} \right]$$

$$y: \beta = \cos^{-1} \left(\frac{F_y}{F} \right)$$

$$z: \gamma = \cos^{-1} \left(\frac{F_z}{F} \right)$$

$$g = \frac{m}{V_B} = \frac{m}{h \cdot b \cdot t}$$

$$E = \frac{F}{EA} = \frac{\Delta L}{L_0} \cdot A$$

$$A_1 v_1 = A_2 v_2 + A_3 v_3 \Rightarrow \dots$$

$$A_1 v_1 = A_4 v_4 \Rightarrow \dots$$

$$\frac{v_4 - v_3}{v_2} \cdot 100\% < 10\%, \quad \frac{v_2 - v_1}{v_2} \cdot 100\% < 10\%$$

$$W = -V_{min} \cdot p_{min} - \frac{1}{2} V_{min} (p_{2max} - p_{1min}) + V_{min} \cdot p_{min} + \frac{1}{2} V_{min} (p_{1max} - p_{2min})$$

$$A_A \cdot v_A = A_{An} \cdot v_{An} \Rightarrow \dots$$

$$p_A + \rho g \frac{1}{2} v_A^2 = p_{An} + \rho g \frac{1}{2} v_{An}^2 \Rightarrow \dots$$

$$2 \cdot \sigma_v \cdot s = p_v \cdot D$$

$$\hookrightarrow \sigma_v = E_v + E_v + \sigma_{kl} \Rightarrow \dots$$

$$R_{gas} + R_{GV} + \frac{(R_{KA} + R_{KV} + R_{KV})(R_{KA} + R_{KV} + R_{KV})}{2 R_{KV} + 2 R_{KV} + R_{KA} + R_{KA}}$$

$$Q_a = \left(\frac{1}{2} \right) \cdot Q_{ges} = \dots$$

$$R_{ges} = \frac{\Delta p_{ges}}{Q_{ges}}, \quad R_{GA} = \frac{\Delta p_{GA}}{Q_{GA}}, \dots$$

$$Q_{KA} = Q_{GV}, \quad Q_{KA} = Q_{KV}, \dots$$

$$R_a + k \cdot v = \frac{\Delta p_{akv}}{Q_{akv}}$$

$$R_s = \frac{8 \mu L}{\pi r^4}, \quad R_s = 2 \cdot R_A \Rightarrow \dots$$

$$\hookrightarrow r_s^4 = \frac{1}{2} \cdot r_A^4 \Rightarrow \dots$$

$$R_{gas} + R_{GV} + \frac{(R_{KA} + R_{KV} + R_{KV})(R_{KA} + R_{KV} + R_{KV})}{2 R_{KV} + 2 R_{KV} + R_{KA} + R_{KA}}$$

$$N_A = 6,022 \times 10^{23} \frac{1}{mol}$$

$$1 \text{ kPa} = 10^3 \text{ Pa}$$

$$1 \text{ MPa} = 10^6 \text{ Pa}$$

$$1 \text{ Pa} = 10^6 \mu \text{Pa}$$

$$1 \text{ Pa} = 10^9 \text{ nPa}$$

$$\frac{[\sigma]}{[p]} / \frac{[\tau]}{[\epsilon]} = \frac{N}{m^2} = \frac{kg}{m \cdot s^2} = Pa$$

$$[W] = \frac{kg \cdot m^2}{s^2} = Nm = W \cdot s = J$$

$$[P] = \frac{kg \cdot m^2}{s^3} = \frac{J}{s} = W$$

$$[R] = \frac{mm \cdot Hg}{ml/min} = \frac{mm \cdot Hg}{Q}$$

$$\frac{[a]}{[g]} = \frac{m}{s^2} = \frac{1}{Pa}$$

$$[i] = \frac{m}{s^3} \quad [m] = kg$$

$$[y] = \frac{g}{cm^3} \quad [h] = m$$

$$[A] = m^2 \quad [Q] = m^3/min$$

$$[v] = \frac{m}{s} \quad [\mu] = \frac{kg}{m \cdot s}$$

$$[F] = N = \frac{kg \cdot m}{s^2} \quad [c] = \frac{m^3}{kg}$$

$$1 \text{ atm} = 760 \text{ mmHg}$$

$$1 \text{ bar} = 10^5 \text{ Pa}$$

$$1 \text{ Pa} = 101325 \text{ atm}$$

$$x^\circ C = (273,15 + x) K$$

$$1 L = 10^{-3} m^3$$

$$1 \text{ mmHg} = 133,328$$

$$1 \text{ cm}^3 = 1 L$$

$$m \quad dm \quad cm \quad mm$$

$$1 \quad 10^1 \quad 10^2 \quad 10^3$$

$$10^4 \quad 1 \quad 10^1 \quad 10^2$$

$$10^3 \quad 10^4 \quad 1 \quad 10^1$$

$$10^2 \quad 10^3 \quad 10^4 \quad 1$$

$$m^2 \quad dm^2 \quad cm^2 \quad mm^2$$

$$1 \quad 10^2 \quad 10^4 \quad 10^6$$

$$10^3 \quad 1 \quad 10^2 \quad 10^4$$

$$10^2 \quad 10^3 \quad 1 \quad 10^2$$

$$10^1 \quad 10^2 \quad 10^3 \quad 1$$

$$m^3 \quad dm^3 \quad cm^3 \quad mm^3$$

$$1 \quad 10^3 \quad 10^6 \quad 10^9$$

$$10^3 \quad 1 \quad 10^3 \quad 10^6$$

$$10^6 \quad 10^3 \quad 1 \quad 10^3$$

$$10^9 \quad 10^6 \quad 10^3 \quad 1$$