

## Kinematika

$$\begin{array}{llll} a = \frac{\Delta v}{t} & s = \frac{1}{2}at^2 \dots h = \frac{1}{2}gt^2 & a_D = \frac{v^2}{r} = r \cdot \omega^2 & \omega = \omega_0 + \varepsilon \cdot t \\ s = v_0 t + \frac{\Delta v t}{2} & v = \omega \cdot r & \varepsilon = \frac{\Delta \omega}{t} & \varphi = \omega_0 t + \frac{1}{2}\varepsilon t^2 \\ v = g \cdot t = a \cdot t & s = \varphi \cdot r & & \end{array}$$

## Dynamika

$$F = m \cdot a \qquad p = m \cdot v \text{ [kg} \cdot \text{m} \cdot \text{s}^{-1}] \qquad F = \frac{\Delta p}{t} \qquad F_T = F_N \cdot f$$

## Práce, výkon, energie

$$\begin{array}{lll} W = \vec{F} \cdot \vec{s} = F \cdot s \cdot \cos \alpha \text{ [J]} & P_p = \frac{W}{t} \text{ [W]} \text{ (výkon)} & \eta = \frac{P}{P_0} \text{ (účinnost)} \\ E_p = mgh & P = F \cdot v \text{ (okamžitý výkon)} & \\ E_k = \frac{1}{2}mv^2 & P_0 = \frac{\Delta E}{\Delta t} \text{ (příkon)} & \end{array}$$

Dokonale pružná srážka:

$$V_1 = v_1 \cdot \frac{m_1 - m_2}{m_1 + m_2} + v_2 \cdot \frac{2m_2}{m_1 + m_2} \qquad V_2 = v_2 \cdot \frac{m_2 - m_1}{m_1 + m_2} + v_1 \cdot \frac{2m_1}{m_1 + m_2}$$

Pozn. Dokonale nepružná srážka – platí zákon zachování hybnosti.

## Radiální gravitační pole

$$\begin{array}{lll} F_g = G \frac{m_1 m_2}{r^2} & v^2 = G \cdot \frac{M}{r} & v_{II} = \sqrt{2} \cdot v_I \\ \vec{K} = \frac{\vec{F}_g}{m} \text{ (intenzita grav. pole)} & \frac{4\pi^2}{GM} = \frac{T^2}{r^3} & E_p = -G \frac{Mm}{r} \\ \frac{T^2}{a^3} = \text{konst} & v_I = \sqrt{\frac{GM}{r}} & G = 6,67 \cdot 10^{-11} \end{array}$$

## Vrhy v homogenním gravitačním poli

Osa x:

$$\begin{array}{l} v_{0x} = \cos \alpha \cdot v_0 \\ v_x = v_{0x} \\ x = v_{0x} t \end{array}$$

Osa y:

$$\begin{array}{l} v_{0y} = \sin \alpha \cdot v_0 \\ v_y = v_{0y} - gt \\ y = v_{0y} t - \frac{1}{2}gt^2 \end{array}$$

## Tuhé těleso

$$\begin{array}{ll} M = F \cdot a \cdot \sin \alpha \text{ [Nm]} & J_0: \text{obruč: } mr^2, \text{ koule: } \frac{2}{5}mr^2, \text{ válec: } \frac{1}{2}mr^2, \text{ tyč: } \frac{1}{12}ml^2 \\ E_r = \frac{1}{2}J\omega^2 & J = J_0 + md^2 \end{array}$$

## Struktura a vlastnosti látek

$$\begin{array}{lll} A_r = \frac{m_a}{u} & N_A = 6,022 \cdot 10^{23} \text{ mol}^{-1} & M_m = 10^{-3} \cdot M_r \\ u = 1,66 \cdot 10^{-27} \text{ kg} & n = \frac{N}{N_A} \text{ [mol]} & V_m = \frac{V}{n} \text{ [m}^3 \cdot \text{mol}^{-1}] \\ M_r = \frac{m_m}{u} & M_m = \frac{m}{n} \text{ [kg} \cdot \text{mol}^{-1}] & \rho = \frac{M_m}{V_m} \end{array}$$

## Termodynamika

$$\begin{array}{lll} \Delta U = Q + W & c = \frac{C}{m} & \Delta l = l_0 \alpha \Delta t \\ Q = \frac{S \cdot \Delta t \cdot \lambda}{d} \cdot \tau & C_m = \frac{Q}{u \cdot \Delta t} & l = l_0 (\alpha \Delta t + 1) \\ C = \frac{Q}{\Delta t} \text{ [J}^{-1}] & Q = mc \Delta t & \Delta V = V_0 \beta \Delta t \\ & & V = V_0 (\beta \Delta t + 1) \\ & & \beta = 3\alpha \\ & & \rho = \rho_0 (1 - \beta \Delta t) \end{array}$$

## Struktura a vlastnosti plynů

$$\begin{array}{ll} p = \frac{1}{3}\rho v^2 & pV = NkT = RnT, \text{ tj. } \frac{pV}{T} = \text{konst} \\ E = \frac{i}{2}kT, \text{ kde } k = 1,38 \cdot 10^{-23} \text{ JK}^{-1} & R = 8,31 \text{ J} \cdot \text{mol}^{-1} \text{K}^{-1} \\ v = \sqrt{\frac{ikT}{m_0}}, \text{ pro pohyb } i = 3 & Q = \Delta U + W' \\ & \Delta U = \frac{i}{2}nR\Delta T \end{array}$$

i. izotermický:  $T = \text{konst}$  a  $Q = W'$

ii. izochorický:  $V = \text{konst}$  a  $Q = \Delta U$

iii. izobarický:  $p = \text{konst}$  a  $W' = p \cdot \Delta V$

iv. adiabatický:  $Q = 0$  a  $p \cdot V^\kappa = \text{konst}$ , kde  $\kappa = 1 + \frac{2}{i}$

## Mechanika tekutin

$$W = Fx$$

$$p = h\rho g$$

$$F_V = V\rho g$$

$$Q_V = \frac{V}{t}$$

$$S_1 v_1 = S_2 v_2$$

$$E_T = p\Delta V$$

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

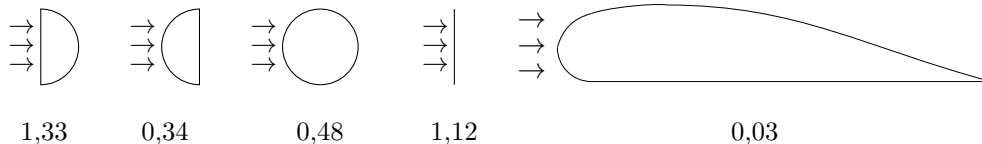
$$h = \text{konst} \Rightarrow \frac{1}{2}\rho v^2 + p = \text{konst}$$

$$v = \sqrt{2hg}$$

$$d = 2\sqrt{h \cdot h'}$$

$$F_{ODP} = \frac{1}{2}CS\rho v^2, \text{ kde } \rho \text{ je prostředí}$$

Hodnoty součinitele odporu  $C$  pro vybraná tělesa:



## Struktura a vlastnosti kapalin

$$\sigma = \frac{F}{l}$$

$$W = \sigma \cdot \Delta S$$

$$p_k = \frac{2\sigma}{r}$$

$$V = V_0(1 + \beta\Delta t)$$

## Struktura a vlastnosti pevných látek

$$\sigma = \frac{F}{S}$$

$$\Delta l = l - l_0$$

$$\varepsilon = \frac{\Delta l}{l_0} \dots \text{rel. prodloužení} \quad \sigma = E \cdot \varepsilon$$

## Změny skupenství

$$l_V = \frac{L_V}{m}$$

## Kmitání

$$\omega = 2\pi f$$

$$v = 2\pi r f$$

$$y = y_m \sin(\omega t + \varphi_0)$$

$$v = \omega y_m \cos(\omega t + \varphi_0)$$

$$a = -\omega^2 y$$

$$F_p = -ky, k \dots \text{tuhost}$$

$$T = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{l}{g}} = 2\pi\sqrt{\frac{J}{mgd}}$$

$$y = y_m e^{\frac{-bt}{2m}} \sin(\omega' t + \varphi_0)$$

$$\omega' = \sqrt{\frac{4km - b^2}{4m^2}}$$

$$E_k = \frac{1}{2}ky_m^2 \cos^2 \omega t$$

$$E_p = \frac{1}{2}ky_m^2 \sin^2 \omega t$$

$$E_k + E_p = \frac{1}{2}ky_m^2$$

$$y = y_m \sin\left[2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right)\right]$$

$$y = y_m \sin(\omega t - kx), k = \frac{2\pi}{\lambda}$$

$$y = Y_m \sin(\omega t)$$

$$Y_m = 2y_m \cos(kx)$$

$$L = \log \frac{I}{I_0}, I = \frac{p}{S}$$

$$f = f_0 \frac{c \pm v_{DET}}{c \pm v_{ZDR}}$$

## Elektrostatika

$$E = \frac{F_e}{Q} [NC^{-1}]$$

$$E = k \cdot \frac{Q_1}{r^2}$$

$$\varphi = \frac{E_p}{Q} [JC^{-1}]$$

$$W = EQs \cos \alpha$$

$$U = \Delta\varphi = Ed$$

$$W = UQ$$

$$E_p = -kQ_1Q_2\frac{1}{r}, k = \frac{1}{4\pi\varepsilon}$$

$$\sigma = E\varepsilon = \frac{Q}{S}$$

$$Q = CU$$

$$E = \frac{1}{2}QU = \frac{1}{2}CU^2$$

$$C = \frac{\varepsilon S}{d}$$

## Elektrodynamika

$$I = \frac{Q}{t}$$

$$U = RI$$

$$R = \frac{l}{S\rho}$$

$$R = R_0(1 + \alpha\delta t)$$

$$R_A = \frac{R_b R_c}{R_a + R_b + R_c}$$

$$W = UI t$$

$$P = UI$$

$$U = U_e - IR_i$$

## Elektrický proud v kapalinách a plynech

$$m = AQ = AIt$$

$$A = \frac{M_m}{Fz}$$

$$K = It [C]$$

## Stacionární magnetické pole

$$B = \frac{F_m}{Il} [T]$$

$$\text{přímý vodič: } B = \frac{\mu}{2\pi} \cdot \frac{I}{d}$$

$$\text{smyčka: } B = \mu \cdot \frac{I}{2r}$$

$$\text{cívka: } B = \mu \cdot \frac{NI}{l}$$

$$\mu_{\text{vakua}} = 4\pi \cdot 10^{-7} \text{ TmA}^{-1}$$

$$F_m = I(\vec{l} \times \vec{B}) = Q(\vec{v} \times \vec{B})$$

$$F_{12} = \frac{\mu}{2\pi} \cdot \frac{I_1 I_2 l}{d}$$

$$M = SIB$$

## Nestacionární magnetické pole

$$F = QvB$$

$$E = \frac{F}{Q} = vB$$

$$E = \frac{U}{d}$$

$$U = \frac{\Delta(BS)}{t}$$

$$\Phi = \vec{B} \cdot \vec{S} [Tm^2] = [Wb] \text{ (Weber)}$$

$$U_i = \frac{-\Delta\Phi}{t} = -L \cdot \frac{\Delta I}{t}$$

$$\Phi = LI$$

$$L = \mu \cdot \frac{N^2 S}{l} [H]$$

$$E_m = \frac{1}{2} LI^2$$