

1 Kinematika

$$\begin{aligned}a &= \frac{\Delta v}{t} \\s &= v_0 t + \frac{\Delta v t}{2} \\v &= g \cdot t = a \cdot t \\s &= \frac{1}{2} a t^2 \dots h = \frac{1}{2} g t^2 \\v &= \omega \cdot r\end{aligned}$$

$$\begin{aligned}s &= \varphi \cdot r \\a_D &= \frac{v^2}{r} = r \cdot \omega^2 \\\varepsilon &= \frac{\Delta \omega}{t} \\\omega &= \omega_0 + \varepsilon \cdot t \\\varphi &= \omega_0 t + \frac{1}{2} \varepsilon t^2\end{aligned}$$

2 Dynamika

$$\begin{aligned}F &= m \cdot a \\p &= m \cdot v \text{ [kg} \cdot \text{m} \cdot \text{s}^{-1}\text{]}\end{aligned}$$

$$\begin{aligned}F &= \frac{\Delta p}{t} \\F_T &= F_N \cdot f\end{aligned}$$

3 Práce, výkon, energie

$$\begin{aligned}W &= \vec{F} \cdot \vec{s} = F \cdot s \cdot \cos \alpha \text{ [J]} \\E_p &= mgh \\E_k &= \frac{1}{2} m v^2 \\P_p &= \frac{W}{t} \text{ [W]} \text{ (výkon)}\end{aligned}$$

$$\begin{aligned}P &= F \cdot v \text{ (okamžitý výkon)} \\P_0 &= \frac{\Delta E}{\Delta t} \text{ (příkon)} \\\eta &= \frac{P}{P_0} \text{ (účinnost)}\end{aligned}$$

Dokonale pružná srážka:

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

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

Pozn. Dokonale nepružná srážka – platí zákon zachování hybnosti.

4 Radiální gravitační pole

$$\begin{aligned}F_g &= G \frac{m_1 m_2}{r^2} \\\vec{K} &= \frac{\vec{F}_g}{m} \text{ (intenzita grav. pole)} \\\frac{T^2}{a^3} &= \text{konst} \\v^2 &= G \cdot \frac{M}{r} \\\frac{4\pi^2}{GM} &= \frac{T^2}{r^3}\end{aligned}$$

$$\begin{aligned}v_I &= \sqrt{\frac{GM}{r}} \\v_{II} &= \sqrt{2} \cdot v_I \\E_p &= -G \frac{Mm}{r} \\G &= 6,67 \cdot 10^{-11}\end{aligned}$$

5 Vrh v homogenním gravitačním poli

Osa x:

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

Osa y:

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

6 Tuhé těleso

$$\begin{aligned}M &= F \cdot a \cdot \sin \alpha \text{ [Nm]} \\E_r &= \frac{1}{2} J \omega^2\end{aligned}$$

$$\begin{aligned}J_0: \text{obruč: } mr^2, \text{ koule: } \frac{2}{5} mr^2, \text{ válec: } \frac{1}{2} mr^2, \text{ tyč: } \frac{1}{12} ml^2 \\J = J_0 + md^2\end{aligned}$$

7 Struktura a vlastnosti látek

$$\begin{aligned}A_r &= \frac{m_a}{u} \\u &= 1,66 \cdot 10^{-27} \text{ kg} \\M_r &= \frac{m_m}{u} \\N_A &= 6,022 \cdot 10^{23} \text{ mol}^{-1} \\n &= \frac{N}{N_A} [\text{mol}]\end{aligned}$$

$$\begin{aligned}M_m &= \frac{m}{n} [\text{kg} \cdot \text{mol}^{-1}] \\M_m &= 10^{-3} \cdot M_r \\V_m &= \frac{V}{n} [\text{m}^3 \cdot \text{mol}^{-1}] \\\rho &= \frac{M_m}{V_m}\end{aligned}$$

8 Termodynamika

$$\begin{aligned}\Delta U &= Q + W \\Q &= \frac{S \cdot \Delta t \cdot \lambda}{d} \cdot \tau \\C &= \frac{Q}{\Delta t} [J^{-1}] \\c &= \frac{C}{m} \\C_m &= \frac{Q}{u \cdot \Delta t}\end{aligned}$$

$$\begin{aligned}Q &= mc\Delta t \\\Delta l &= l_0 \alpha \Delta t \\l &= l_0 (\alpha \Delta t + 1) \\\Delta V &= V_0 \beta \Delta t \\V &= V_0 (\beta \Delta t + 1) \quad \beta = 3\alpha \\\rho &= \rho_0 (1 - \beta \Delta t)\end{aligned}$$

9 Struktura a vlastnosti plynů

$$\begin{aligned}p &= \frac{1}{3} \rho v^2 \\E &= \frac{i}{2} kT, \text{ kde } k = 1,38 \cdot 10^{-23} \text{ JK}^{-1} \\v &= \sqrt{\frac{ikT}{m_0}}, \text{ pro pohyb } i = 3\end{aligned}$$

- i.* izotermický: $T = \text{konst}$ a $Q = W'$
ii. izochorický: $V = \text{konst}$ a $Q = \Delta U$

$$\begin{aligned}pV &= NkT = RnT, \text{ tj. } \frac{pV}{T} = \text{konst} \\R &= 8,31 \text{ J} \cdot \text{mol}^{-1} \text{K}^{-1} \\Q &= \Delta U + W' \\\Delta U &= \frac{i}{2} nR\Delta T\end{aligned}$$

- iii.* izobarický: $p = \text{konst}$ a $W' = p \cdot \Delta V$
iv. adiabatický: $Q = 0$ a $p \cdot V^\kappa = \text{konst}$, kde $\kappa = 1 + \frac{2}{i}$