AP 2000 – AI

1.1.1 $F = m \cdot a = m \cdot \frac{\Delta v}{\Delta t} = \frac{50 \cdot 10^{-3}\,kg \cdot 4{,}5\,ms^{-1}}{7{,}5 \cdot 10^{-3}\,s} \Rightarrow \underline{F = 30\,N}$

1.1.2 $E_{ges} = E_{kin}(B) = E_{pot}(h) + E_{kin}(h)$

$\Leftrightarrow E_{kin}(B) = \frac{1}{2} m v_0^2 = mgh + \frac{1}{2} m \left(v(h)\right)^2$

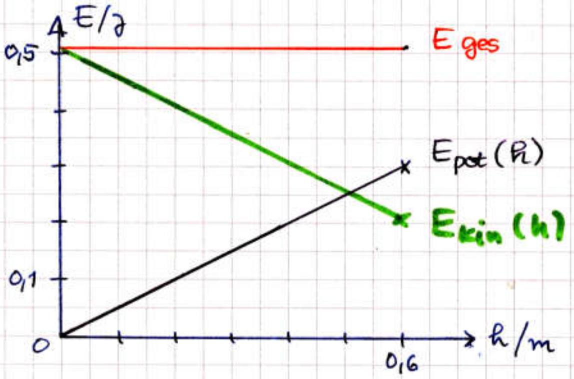
$\Leftrightarrow \underline{v(h) = \sqrt{v_0^2 - 2gh}}$

1.1.3 $E_{pot}(B) = 0 \quad (h = 0)$; $E_{pot}(h) = mgh$ (linearer Verlauf)

$E_{pot}(C) = mg \cdot 2r = 50 \cdot 10^{-3}\,kg \cdot 9{,}81\,\frac{N}{kg} \cdot 2 \cdot 0{,}31\,m \Rightarrow \boxed{E_{pot}(C) = 0{,}30\,J}$

$E_{ges} = E_{kin}(B) = \frac{1}{2} m v_0^2 = \frac{1}{2} \cdot 50 \cdot 10^{-3}\,kg \cdot \left(4{,}5\,\frac{m}{s}\right)^2 \Rightarrow \underline{E_{ges} = 0{,}51\,J}$

$E_{kin}(C) = E_{ges} - E_{pot}(C) = 0{,}51\,J - 0{,}30\,J \Rightarrow \underline{E_{kin}(C) = 0{,}21\,J}$



1.1.4

$\vec{F}_{Ri}$: Kraft der Rinne auf den Ball

$\vec{F}_G$: Gewichtskraft des Balls

$\vec{F}_Z$: Zentripetalkraft als Resultierende aus $\vec{F}_{Ri}$ und $\vec{F}_G$

$F_Z = F_{Ri} + F_G \Leftrightarrow F_{Ri} = F_Z - F_G = m \cdot \frac{v_C^2}{r} - mg = m\left(\frac{v_C^2}{r} - g\right)$

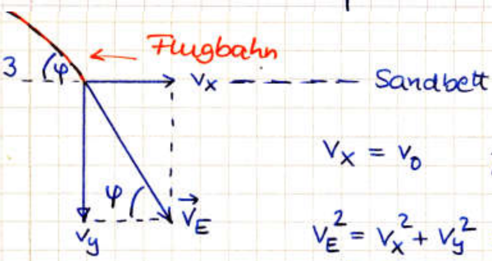
$F_{Ri} = 50 \cdot 10^{-3}\,kg \cdot \left(\frac{(4{,}5\,m/s)^2 - 4 \cdot 9{,}81\,\frac{m}{s^2} \cdot 0{,}31\,m}{0{,}31\,m} - 9{,}81\,ms^{-2}\right)$ $\quad v_C^2 = v_0^2 - 2g \cdot 2r$

$\underline{F_{Ri} = 0{,}81\,N}$

1.2.1 $x = v_0 t \Leftrightarrow t = \frac{x}{v_0}$ in $y = \frac{1}{2} g t^2 = \frac{1}{2} g \cdot \frac{x^2}{v_0^2} \Leftrightarrow \underline{y = \frac{g}{2 v_0^2} \cdot x^2}$

1.2.2 $x_E = \sqrt{\frac{2 \cdot h_1 v_0^2}{g}} = \sqrt{\frac{2 \cdot 0{,}17\,m \cdot (4{,}5\,ms^{-1})^2}{9{,}81\,ms^{-2}}} \Rightarrow \underline{x_E = 0{,}84\,m}$

1.2.3



$v_x = v_0 \quad ; \quad v_y^2 = 2gh_1 \Leftrightarrow v_y = \sqrt{2gh_1}$

$v_E^2 = v_x^2 + v_y^2 = v_0^2 + 2gh_1$

$v_E = \sqrt{(4{,}5\,ms^{-1})^2 + 2 \cdot 9{,}81\,ms^{-2} \cdot 0{,}17\,m} \Rightarrow \underline{v_E = 4{,}9\,\frac{m}{s}}$

$\tan(\varphi) = \frac{v_y}{v_x} = \frac{\sqrt{2gh_1}}{v_0} \Rightarrow \varphi = \tan^{-1}\left(\frac{\sqrt{2 \cdot 9{,}81\,\frac{m}{s^2} \cdot 0{,}17\,m}}{4{,}5\,ms^{-1}}\right) \Rightarrow \underline{\varphi = 22^\circ}$