Physik, TBM 3E, 3.1.2012

① $F_Z = \frac{mv^2}{R} = \mu g m = F_{Reib}$

$\Rightarrow R = \frac{v^2}{\mu g} = \frac{(33.\bar{3})^2}{0.68 \cdot 9.81} \approx \underline{166.56m}$

② $v = 600\,km/h = 166.\bar{6}\,m/s$

$R = 566.3m$

$a_Z = \frac{v^2}{R} = 49.051\,m/s^2 = 5g$

↪ "oben" $\underline{4g}$, "unten" $\underline{6g}$

③ $F_G = G\frac{m_1 m_2}{R^2} = 1N$

$R = 1m,\ m_1 = m_2 = m$

$G\frac{m^2}{R^2} = 1N$

$m = \sqrt{\frac{1N \cdot 1m^2}{G}} \approx 122'404.6kg$

$\underline{m \approx 122.4\,Tonnen}$

Radius einer Kugel aus Gold ($\rho = 19'300\,kg/m^3$) mit 122.404 t Masse

$m = \rho \cdot V\ ;\quad V = \frac{4}{3}\bar{\pi} R^3$

$m = \rho \cdot \frac{4}{3}\bar{\pi} R^3$

$\sqrt[3]{\frac{3}{4}\frac{m}{\rho \cdot \bar{\pi}}} = R = 1.148m \approx \underline{1.15m}$

(4) Umlaufbahn in 100 km über Erde:

$$F_G = G\frac{mM}{R^2} = \frac{mv^2}{R} = F_Z, \quad R = R_{Erde} + 100\,km$$

$$\Rightarrow \quad v = \sqrt{\frac{GM}{R}} \qquad M = M_{Erde}$$

$$v = 7'850.94\ m/s = 28'263.4\ km/h$$

$$v_{Aufprall} = 2v = 56'526.8\,km/h = 15'701.9\,\frac{m}{s}$$

(5) $f = 30\,kHz$; $R = 5\,cm$, $m = 1\,g$

$$F_Z = m\omega^2 R, \quad \omega = 2\pi f$$

$$\hat{=}\ \underline{1'776.5\,kN \hat{=} 1.777\,MN}$$

(6) $v_1 = v_{oben}$; $v_2 = v_{unten}$

Energieerhaltung:

$$\frac{1}{2}mv_1^2 + mgh = \frac{1}{2}mv_2^2; \quad h = 2R = 1m$$

"oben": $a_Z = 2g = \frac{v_1^2}{R}$

$$\Rightarrow v_1^2 = 2gR, \quad v_1 \hat{=} 3.13\,m/s$$

↳ $\frac{1}{2}mv_1^2 + mgh = \frac{1}{2}mv_2^2 \;/:m$

$$\frac{1}{2}v_1^2 + gh = \frac{1}{2}v_2^2$$

$$\frac{1}{2}\cdot 2gR + 2gR = \frac{1}{2}v_2^2$$

$$3gR = \frac{1}{2}v_2^2$$

$$\sqrt{6gR} = v_2 = \underline{5.42\,m/s}$$