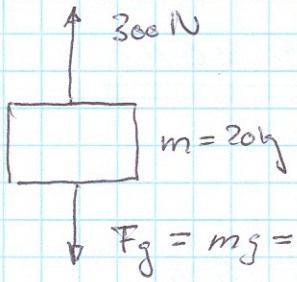
ML Aufgabenblatt Kräfte, Dichte, Reibung etc.

(4) $F_{Mars} = m \cdot g_{Mars} \Rightarrow m = \frac{F_{Mars}}{g_{Mars}} = \underline{23.8\,kg}$

$F_{Erde} = m \cdot g = 23.8\,kg \cdot 9.81\,N/kg = \underline{233.478}$

$F_{Sonne} = 23.8\,kg \cdot 274\,N/kg = \underline{6'521.2\,N}$

(5)



$F_{res} = 300\,N - 196.2\,N$

$= \underline{103.8\,N}$

(6) $\rho_{Hg} = 13'546\,kg/m^3$

$\rho = \frac{m}{V} \Leftrightarrow m = \rho \cdot V = 13'546\,\frac{kg}{m^3} \cdot 0.025\,m^3$

$= \underline{338.65\,kg}$

(7) $\rho_{Au} = 19'320\,kg/m^3$

$\rho = \frac{m}{V} \Leftrightarrow V = \frac{m}{\rho} = 0.05176\,m^3 = \underline{51.76\,Liter}$

(8) $V_{Al} = V_{Pb}$ | $V = \frac{m}{\rho}$

$\rho_{Al} = 2'700\,kg/m^3$

$\rho_{Pb} = 11'342\,kg/m^3$

$\frac{m_{Al}}{\rho_{Al}} = \frac{m_{Pb}}{\rho_{Pb}}$

$m_{Al} = \frac{m_{Pb} \cdot \rho_{Al}}{\rho_{Pb}} \approx \underline{11.9\,kg}$

(9) $M = 30\,kg$, $f_{Haft} = 0.72$,

$f_{Gleit} = 0.45$

Haftreibungskraft: $F_{HR} = f_H \cdot M \cdot g = 211.896\,N$

Gleitreibungskraft: $F_{GR} = f_{Gl} \cdot M \cdot g = 132.435\,N$

Gleichgewicht: $F_{HR} = Mg$

$$M = \frac{F_{HR}}{g} = f_H \cdot M = \underline{21.6\,kg}$$

$$F_{Res} = \underbrace{F_G}_{\text{Masse } m} - F_{Gleitreib} = 21.6\,kg \cdot 9.81\,N/kg - 132.435\,N$$

$$= \underline{79.46\,N}$$

(10) $m = 80\,kg$, $f_H = 0.7$, $f_{Gl} = 0.4$

a) $F_{HR} = mg f_{HR} = \underline{549.36\,N}$

b) $F_{Gleitreib} = mg f_{Gl} = 313.92\,N$

$$F_{Res} = 350\,N - 313.92\,N = \underline{36.08\,N}$$

(11) $c_w = 0.22$; $A = 100\,dm^2 = 1\,m^2$, $v = 360\,km/h$

$c_w = 0.7$, $A = 5\,m^2$, $v = 80\,km/h$

$$F_L = \frac{1}{2} c_w \rho_{Luft} A v^2$$

PW: $F_L = \frac{1}{2} \cdot 0.22 \cdot 1.293 \cdot 1 \cdot (100)^2 = \underline{1'422.3\,N}$

LKW: $F_L = \frac{1}{2} \cdot 0.7 \cdot 1.293 \cdot 5 \cdot (22.\overline{2})^2 = \underline{11'117.4\,N}$

(12) $R = 50\,cm$; $\rho_{Fe} = 7'874\,kg/m^3$, $c_w = 0.45$

$F_L = \frac{1}{2} c_w \rho_{Luft} \cdot A \cdot v^2$

Gleichgewicht: Luftwiderstand = Gewichtskraft

$\frac{1}{2} c_w \rho_L \cdot A \cdot v^2 = m \cdot g$

$A = \pi R^2$ $\quad m = \rho_{Fe} \cdot V$, $V = \frac{4}{3}\pi R^3$

$\frac{1}{2} c_w \rho_L \pi R^2 v^2 = \rho_{Fe} \cdot \frac{4}{3}\pi R^3 \cdot g \;/ : \pi : R^2$

$\frac{1}{2} c_w \rho_L v^2 = \rho_{Fe} \cdot \frac{4}{3} R g$

$v^2 = \frac{8}{3} \frac{R \cdot g \cdot \rho_{Fe}}{c_w \rho_L}$

$v = \sqrt{\frac{8}{3} \frac{R \cdot g \cdot \rho_{Fe}}{c_w \cdot \rho_L}} = \underline{\underline{420.72\,m/s}}$

(13)

$\rho_{Pb} = 11'342\,kg/m^3$

$\frac{1}{2} c_w \rho_L v^2 = \rho_{Pb} \cdot \frac{4}{3} R g$

$R = \frac{3}{8} \frac{c_w \rho_L \cdot v^2}{\rho_{Pb} \cdot g} = 0.2267\,m$

$= \underline{\underline{22.67\,cm}}$

(14) analog zu 13

(15) $\rho_{Al} = 2'700\ kg/m^3$; $\rho_{Au} = 19'320\ kg/m^3$

nach Aufgabe 12 gilt

$$v_{Al} = \sqrt{\frac{8}{3}\,\frac{R_1 g \cdot \rho_{Al}}{c_w \cdot \rho_L}} \qquad v_{Au} = \sqrt{\frac{8}{3}\,\frac{R_2 g\, \rho_{Au}}{c_w \cdot \rho_L}}$$

$$v_{Al} = v_{Au}$$

$$\sqrt{\frac{8}{3}\,\frac{R_1 g\, \rho_{Al}}{c_w \cdot \rho_L}} = \sqrt{\frac{8}{3}\,\frac{R_2 g \cdot \rho_{Au}}{c_w \cdot \rho_L}} \quad / \,x^2$$

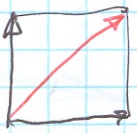
$$\frac{8}{3}\,\frac{R_1 g\, \rho_{Al}}{c_w \cdot \rho_L} = \frac{8}{3}\,\frac{R_2 g\, \rho_{Au}}{c_w \rho_L} \quad / : \tfrac{8}{3} : g \cdot c_w \cdot \rho_L$$

$$R_1 \cdot \rho_{Al} = R_2 \cdot \rho_{Au} \qquad R_1 = R_{Al}, \quad R_2 = R_{Au}$$

$$R_{Al} \cdot \rho_{Al} = R_{Au} \cdot \rho_{Au}$$

$$R_{Al} = \frac{R_{Au} \cdot \rho_{Au}}{\rho_{Al}} \approx \underline{\underline{7.16\,cm}}$$

(17)



a)

$$F_{Res}^2 = F_1^2 + F_2^2$$

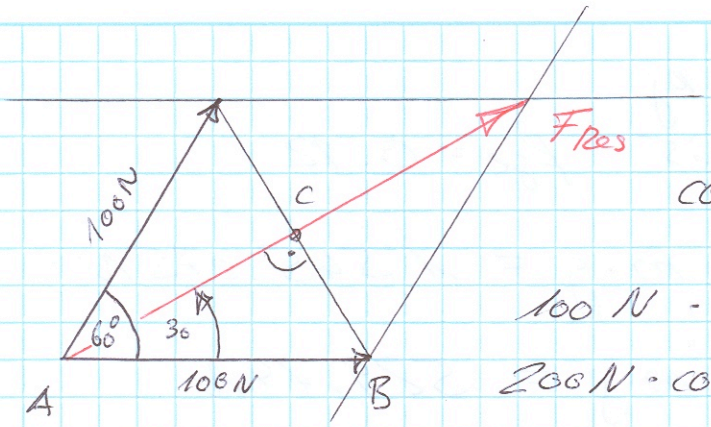
$$= 15^2 + 15^2 = 450$$

$$F_{Res} = \sqrt{450} = 21.21$$

oder: $F_{Res} = \sqrt{2} \cdot F_1$ (Diagonale im Quadrat)

b) $F_{Res} = \sqrt{F_1^2 + F_2^2}$

c)



ΔABC:

$\cos 30° = \frac{\frac{1}{2} F_{res}}{100\,N} \quad | \cdot 100$

$100\,N \cdot \cos 30° = \frac{1}{2} F_{Res} \quad | \cdot 2$

$200\,N \cdot \cos 30° = F_{Res} \cong \underline{173.21\,N}$

d) $F_{Res} = 0$

e) $\vec{F_1} + \vec{F_2} = 0 \Rightarrow \vec{F_{Res}} = \vec{F_1}$

f) wie c): $\cos 15° = \frac{\frac{1}{2} F_{Res}}{100\,N}$

$200\,N \cdot \cos 15° = F_{Res} \cong \underline{193.19\,N}$

(18) $E = mgh = 0.10194\,kg \cdot 9.81\,N/kg \cdot 1\,m$

$= \underline{1\,Joule}$

$P = \frac{E}{t} = 1\,\frac{Joule}{s} = \underline{1\,Watt}$

(19) $F_{Reib} = f \cdot m \cdot g = 0.12 \cdot 2\,kg \cdot 9.81\,N/kg$

$\cong 2.35\,N$

a) $E = F \cdot s = 2.35\,N \cdot 5\,m = \underline{11.772\,Joule}$

b) ~~$P = \frac{E}{t} = \frac{F \cdot s}{t} \quad | \cdot t$~~ ~~$P = 3W = \frac{E}{t}$~~

~~$\frac{P}{F} = \frac{s}{t} = v =$~~ ~~$t = \frac{E}{P} = \frac{11.772\,J}{3\,W}$~~

~~$= 3.924\,s$~~

~~5 m in 3.924 s ⇒~~

~~$v = \frac{5\,m}{3.924\,s} =$~~

$P = \frac{E}{t}$, $E = 11.772\,J$

$P = 3\,W$

$\Rightarrow t = 3.924\,s$, 5 m in 3.924 s $\Rightarrow v = \underline{1.27\,m/s}$

(20) $m = 450\,kg$

$f_H = 0.35 \quad f_{ge} = 0.12$

a) $F = f_H \cdot m \cdot g = 1'545.075\,N$

b) $F = f_{ge} \cdot m \cdot g = 529.74\,N$

c) $E = F \cdot s = 529.74\,N \cdot 1000\,m = 529.74\,KJ$

d) $P = F \cdot v = 529.74\,N \cdot 3.5\,\frac{m}{s} = 1.854\,KW$

(21) $E_{kin} = \frac{1}{2} m v^2 = F \cdot s$

$= F_{Reib} \cdot \frac{Bremsweg}{s}$

$F_{Reib} = f_H \cdot m \cdot g$

$\Rightarrow \quad \frac{1}{2} m v^2 = f_H \cdot m \cdot g \cdot s \quad | : m$

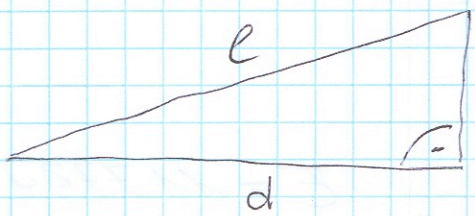
$\frac{1}{2} v^2 = f_H \cdot g \cdot s$

$\frac{v^2}{2 f_H g} = s \approx \underline{\underline{66.5\,m}}$

(22) $E_{kin} = E_{pot}$

$\frac{1}{2} m v^2 = m \cdot g \cdot h$

$\frac{v^2}{2g} = h = \underline{\underline{56.63\,m}}$



$\frac{h}{d} = 0.05 = 5\%$

$d = \frac{h}{0.05}$

$l = \sqrt{h^2 + d^2} = \underline{\underline{1'134.05\,m}}$

(19) $m = 2kg$, $s = 5m$, $f_R = 0.12$

a) $E = F \cdot s = F_{Reib} \cdot s$

$= f \cdot m \cdot g \cdot s$

$= 0.12 \cdot 2kg \cdot 9.81 \frac{N}{kg} \cdot 5m$

$= 11.772$ Joule

b) $P = \frac{E}{t} = \frac{F \cdot s}{t} = F \cdot \frac{s}{t} = F \cdot v$

$\Rightarrow \frac{P}{F} = v = \frac{3 Watt}{f \cdot m \cdot g} = \underline{\underline{1.27 \frac{m}{s}}}$

(23)

$\sin 30° = \frac{h}{20} \Rightarrow h = 20 \cdot \sin 30° = \underline{\underline{10\,m}}$

$E = mgh = F \cdot s = f \cdot m \cdot g \cdot s \quad | : m : g$

$\Rightarrow s = \frac{h}{f} \approx \underline{\underline{14.29\,m}}$

(24)

$E_{kin} = E_{pot}$

$\frac{1}{2} m v^2 = mgh$

$v^2 = 2gh \Rightarrow v = \sqrt{2gh} = 4.43\,m/s$

$= 15.95\,km/h$

(25)

$\frac{1}{2} m v^2 = mgh$

$\Rightarrow h = \frac{v^2}{2g} = \underline{\underline{39.33\,m}}$

(26) wie (25)

(27) Energie nimmt mit der Geschwindigkeit quadratisch zu!