Physik, 62e, 7.6.2011

(1) $p = 1\,atm = 101325\,Pa = \rho g h$, $\rho = 13'546\,kg/m^3$

$$h = \frac{p}{\rho g} \qquad \underline{\underline{h = 762.494\,mm}}$$

$$\Delta h = \frac{\Delta p}{\rho g} = \frac{5\,mbar}{\rho g} = \frac{500\,Pa}{\rho \cdot g}$$

$$\underline{\underline{\Delta h \cong 3.76\,mm}}$$ vernünftige Einheiten!

b) $5\,mbar = 500\,Pa$

(2) $m = 35'000\,t = 35'000'000\,kg$

$l = 300\,m$, $b = 50\,m$, $\rho = 7'850\,kg/m^3$

a) Schiff verdrängt 35'000 t Wasser $\hat{=} 35'000\,m^3$

$$\Delta V = 35'000\,m^3 = l \cdot b \cdot \Delta h$$

$$\Delta h_1 = \frac{35'000\,m^3}{300m \cdot 50m} = \underline{\underline{2.3\,m}}$$

b) $V_{Stahl} = \frac{m}{\rho_{Stahl}} = \frac{35'000'000\,kg}{7850\,kg/m^3} \cong 4'458.599\,m^3$

$$\underline{\underline{\approx 4'458.6\,m^3}}$$

$$\Delta h_2 = \frac{4'458.599\,m^3}{300m \cdot 50m} \cong 0.2972\,m$$

$$\Delta h = \Delta h_1 - \Delta h_2 = \underline{\underline{2.036\,m}}$$

c) $F_{Grund} = F_G - F_{Auftrieb} = mg - \rho_{Wasser} \cdot V \cdot g$

$= 35'000'000\,kg \cdot g - 1000\,\frac{kg}{m^3} \cdot 4458.6\,m^3 \cdot g$

$= 299'611'146.497\,N$

$\approx 299.61\,MN$

(3) $F = 400N$, $A = 9dm^2 = 900cm^2 = 0.09m^2$

$\Delta p = \rho g h$ $\quad \Delta p_{max} = \frac{400N}{9dm^2} = \frac{400N}{0.09m^2}$

$= 4'444.4Pa$

$p_{max} = \rho_{Wasser} \cdot g h$

$h_{max} = \frac{p_{max}}{\rho_W \cdot g} = \frac{\frac{F}{A}}{\rho_W \cdot g} = \frac{F}{\rho_W \cdot g \cdot A}$

$= \frac{400N}{1000N/m^3 \cdot 9.81 m/s^2 \cdot 0.09m^2} \cong 0.453m$

$\sim 45.31cm \sim 453.05mm$

(4) 15 Atemzüge à 1/2 L pro Minute

Faustregel! Druck vs. Überdruck

$V_1 = 20L$, $p_1 = 100bar$

a) $p_2 = 1atm$; $V_1 p_1 = V_2 p_2$

$V_2 = \frac{V_1 p_1}{p_2}$

$= \frac{0.02m^3 \cdot 10^7 Pa}{101'325 Pa} \cong 1.973'847m^3$

ALT:

$= \frac{20L \cdot 100bar}{1.01325bar} \cong 1973.847L$

Minus 20 Liter, die in Flasche bleiben:

$V = 1953.847L : 0.5L : 15min^{-1}$

$260.51 Min. \cong 4.34 Std.$

(5) $h = 15cm$, $\phi = 6cm$, $l = 0.03m$

Wasser: $V = \pi r^2 h = 424.115\,ml$

$m = \rho_{Wasser} \cdot \pi r^2 h = 424.115g$

$F_G = mg = 4.161N$

$F_{Druck} = p \cdot A = 1atm \cdot \pi r^2 = 286.49N$

$- \quad 4.161$

$282.33N$

$28.78kg$

(4b) $100bar = 10^7 Pa$

$p_{50} = 1atm + \rho g h$ $\qquad 440'500\,Pa$

$= 101325Pa + 1000 \cdot 9.81 \cdot 50\,Pa$

$= 591'825Pa$

$p_1 V_1 = p_{50} V_{50}$

$V_{50} = \frac{p_1 V_1}{p_{50}} = \frac{10^7 Pa \cdot 0.02m^3}{591'825Pa}$

$\approx 0.338m^3 \approx 337.938\,Liter$

$- \quad 20\,L$

$317.938\,Liter$

$: 0.5 : 15 = 42.39\,min.$

$0.707\,h$