TBM 4E, 12.6.12

Druck, Auftrieb

(1) $F = \frac{?}{A} \Rightarrow F = p \cdot A$; $55\,mm^2 = 55 \cdot 10^{-6}\,m^2$

$F = p \cdot A = 100\,Pa \cdot 0.000'055\,m = \underline{5.5\,mN}$

(2) $F_{Auftrieb} = F_G$ $\quad V$ = gesamtes Vol.

$\rho_W \cdot V' \cdot g = \rho_{Holz} \cdot V \cdot g$ $\quad V'$ = V unter Wasser

$\frac{V'}{V} = \frac{\rho_{Holz}}{\rho_{Wasser}}$

a) $\frac{V'}{V} = 0.79 = \frac{\rho_{Holz}}{1000\ kg/m^3}$

$\underline{\rho_{Holz} = 790\ kg/m^3}$

b) $\frac{V'}{V} = \frac{1000\ kg/m^3}{13'546\ kg/m^3} = \underline{7.38\,\%}$

(3) $m = 75'000\,t = 75 \cdot 10^6\,kg$

$\rho_{Wasser} = 1'020\,kg/m^3$

$\rho_{Stahl} = 7'850\,kg/m^3$

$l = 380\,m,\ b = 68\,m,\ h = 36\,m,\ h_{max} = 29.5\,m$

a) $F_G = F_{Auftrieb} = F_{G,Wasser}$

$mg = \rho_{Wasser} \cdot V g$

$\Rightarrow V = \frac{mg}{\rho_W \cdot g} = \frac{m}{\rho_W} = \frac{75 \cdot 10^6\,kg}{1020\,kg/m^3}$

$= \underline{\underline{73'529.412\,m^3}}$

b) $F_{res} = F_G - F_{Auftrieb}$; $V_{Stahl} = \frac{m}{\rho_{Stahl}} = 9'554.14\,m^3$

$= mg - \rho_{Wasser} \cdot \frac{m}{\rho_{Stahl}} \cdot g$

$= g\left(m - \frac{m \cdot \rho_{Wasser}}{\rho_{Stahl}}\right)$

$= mg\left(1 - \frac{\rho_{Wasser}}{\rho_{Stahl}}\right) = 640'149'363.058\,N$

$\cong \underline{\underline{640.15\,MN}}$

c) $F_G = F_A$

$mg = \rho_W \cdot l \cdot b \cdot h \cdot g$

$h = \frac{mg}{\rho_W \cdot l \cdot b \cdot g} = \frac{m}{\rho_W \cdot l \cdot b} = \underline{\underline{2.846\,m}}$

d) $g\, m_{Ladung} = F_A - mg$

$= \rho_W \cdot l \cdot b \cdot h_{max} \cdot g - mg$

$\Rightarrow m_{Ladung} = \rho_W \cdot l \cdot b \cdot h_{max} - m$

$= 570'741'600\,kg$

$= \underline{570.74\,kT}$

e) $m = 570'741'600\,kg$

$\rho_{Öl} = 850\,kg/m^3$

$V_{Öl} = \frac{m}{\rho_{Öl}} = 671'460.706\,m^3$

$= 671'460'705.882\,L$

$\hat{=} 4'276'819.78$ Fässer

$\hat{=} \underline{422.892\ Mio.\ \$}$

⑥ $\rho = 13'546\,kg/m^3$

a) $\rho g h = 101'325\,Pa \Rightarrow h = \frac{101'325\,Pa}{13'546 \cdot 9.81}$

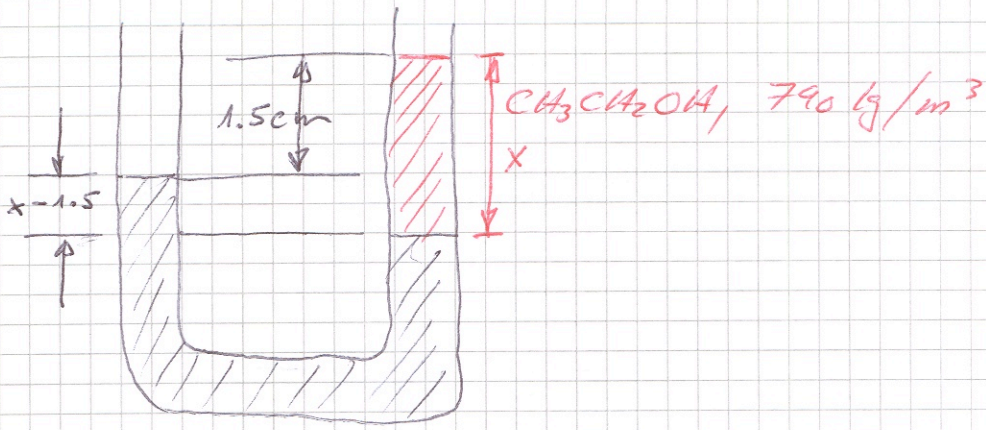
$= \underline{76.249\,cm}$

$\hat{=} 76.25\,cm$

b) $\rho g h = 1\,bar = 1000\,Pa$

$h = \frac{1000}{13546 \cdot 9.81} = \underline{7.53\,mm}$

(4)



$$\rho_W \cdot g (x - 0.015m) = \rho_A \cdot g \cdot x \quad / : g$$

$$\rho_W \cdot x - \rho_W \cdot 0.015 = \rho_A \cdot x$$

$$\rho_W \cdot x - \rho_A \cdot x = \rho_W \cdot 0.015$$

$$x = \frac{0.015 \cdot \rho_W}{\rho_W - \rho_A} = \underline{\underline{7.14cm}}$$

(5) $V_1 = 60L$, $p_1 = 2.5 atü = 3.5 atm$

$= 354'637.5 Pa$

Druck in 5m Tiefe:

$$p_2 = p_0 + \rho g h$$

$$= 101'325 Pa + 1000 \cdot 9.81 \cdot 5$$

$$= 150'375 Pa$$

$$p_1 V_1 = p_2 V_2$$

$$V_2 = V_1 \cdot \frac{p_1}{p_2} = \underline{\underline{141.501L}}$$

(= 60 Liter)