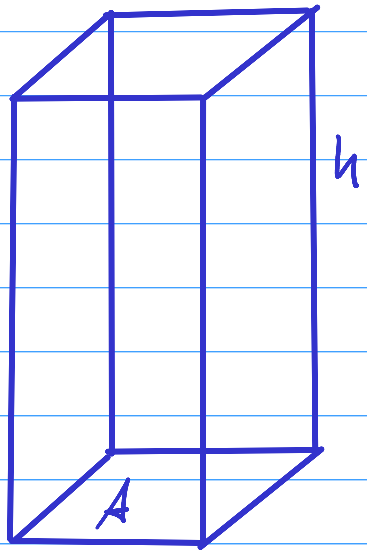
Chap. 2. p. 12

Force and pressure at bottom of a liquid column (incompressible: density = const.)



liquid density ρ

liquid volume

$$V = A \cdot h$$

$$F_G = g \rho V = g \rho A h$$

$$\Rightarrow \quad p = \frac{F_G}{A} = g \rho h$$

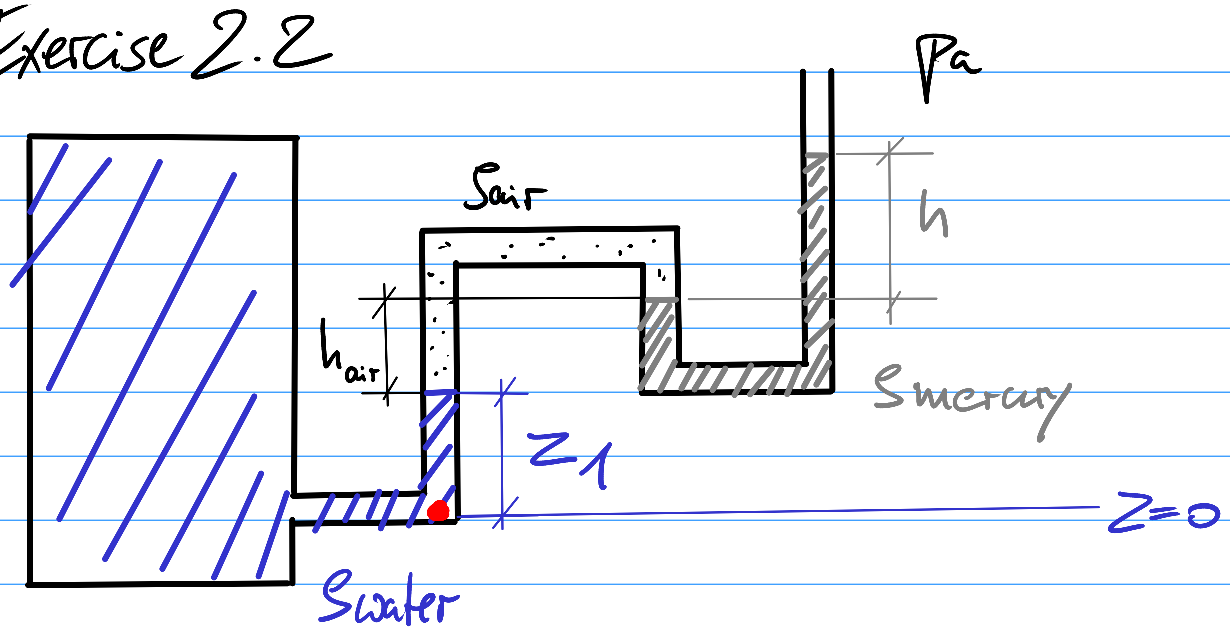
Exercise 2.2:

absolute pressure: ambient pressure plus pressure inside fluid

gauge pressure: pressure inside fluid

absolute pressure $= \quad p(z) = p_0 + \underbrace{g \rho (h - z)}_{\text{gauge pressure}}$

Exercise 2.2



a)

$$p(z=0) = p_{water\,column} + p_{air\,column} + p_{mercury\,column}$$

$$= g\,\rho_{water}\,z_1 + \underbrace{g\,\rho_{air}\,h_{air}}_{\text{negligible for } h_{air} \lesssim 1000\text{ m}} + g\,\rho_{mercury}\,h$$

$$\rho_{air} = 1\ \frac{kg}{m} \ll \rho_{water} < \rho_{mercury}$$

$$\rho_{water} = 1000\ \frac{kg}{m^3}$$

$$\rho_{mercury} = 13600\ \frac{kg}{m^3}$$

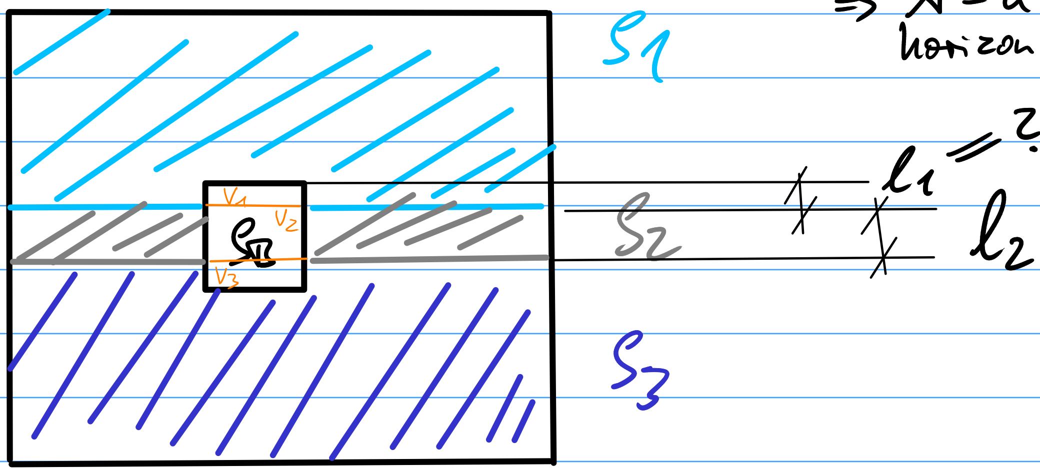
$$\approx g\,\rho_{water}\,z_1 + g\,\rho_{mercury}\,h$$

$= \ldots$ numbers $\ldots = p_{gauge}$

b) $p_{abs} = p_a + p_{gauge} = \ldots$

Exercise 2.3

Cube with edges a
$\Rightarrow A = a^2$ is horizontal area



Bouyancy effects from all 3 liquids:

$$F_{B1} = g\rho_1 V_1 = g\rho_1 A l_1$$

$$F_{B2} = g\rho_2 V_2 = g\rho_2 A l_2$$

$$F_{B3} = g\rho_3 V_3 = g\rho A \underbrace{(a - l_1 - l_2)}_{l_3 \text{ ist what remains from } a}$$

$$F_G = F_B = F_{B1} + F_{B2} + F_{B3}$$

$$\cancel{g}\cancel{A}\cdot a\rho_B = \cancel{g}\rho_1\cancel{A}l_1 + \cancel{g}\rho_2\cancel{A}l_2 + \cancel{g}\rho_3\cancel{A}(a - l_1 - l_2)$$

$$a\rho_B = \rho_1 l_1 + \rho_2 l_2 + \rho_3 a - \rho_3 l_1 - \rho_3 l_2$$

$$a\rho_B - \rho_2 l_2 - \rho_3 a + \rho_3 l_2 = (\rho_1 - \rho_3) l_1$$

$$\frac{a(\rho_B - \rho_3) + l_2(\rho_3 - \rho_2)}{(\rho_1 - \rho_3)} = l_1 = \ldots \text{numbers}$$

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