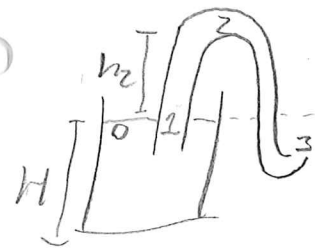
Strømning, Øving 5, Vegard G. Jervell



Oppg. 1a)

$$\frac{1}{2}v_0^2 + \frac{p_0}{\rho} + gz_0 = \frac{1}{2}v_1^2 + \frac{p_1}{\rho} + gz_1$$

$$0 + \frac{p_0}{\rho} + 0 = \frac{1}{2}v_1^2 + \frac{1}{\rho}(p_0 - \rho g h_1) + 0$$

$$\frac{1}{2}v_1^2 = gh_1$$

$$v_1 = \sqrt{2gh_1}$$

$$\left(\frac{1}{2}v^2 + \frac{p}{\rho} + gz\right)_0 = \left(\frac{1}{2}v^2 + \frac{p}{\rho} + gz\right)_2$$

$$\frac{p_0}{\rho} = \frac{1}{2}v_2^2 + \frac{1}{\rho}\left(p_0 - \rho g(h_1 + h_2)\right) + gh_2$$

$$\frac{1}{2}v_2^2 = gh_1$$

$$v_2 = v_1 = \sqrt{2gh_1}$$

$$\left(\frac{1}{2}v^2 + \frac{p}{\rho} + gz\right)_0 = \left(\frac{1}{2}v^2 + \frac{p}{\rho} + gz\right)_3$$

$$\frac{p_0}{\rho} = \frac{1}{2}v_3^2 + \frac{p_0}{\rho} + g(-h_1)$$

$$v_3 = \sqrt{2gh_1}$$

1b) $p_2 = p_0 - \rho g h_2$

$p_2 \geq p_{vap,H_2O}\ (T = 25°C)$ $\qquad p_{vap,H_2O}(T = 25°C) = 3{,}4\,kPa$

$h_2 \leq \frac{1}{\rho g}\left(p_0 - p_{vap,H_2O}(T = 25°C)\right) = 9{,}91\,m$

Oppg 2a)

$$\frac{1}{2}v_1 + \frac{p_0}{\rho} + g h_1 = \frac{1}{2}v_2 + \frac{p_0}{\rho} + g h_2$$

$$\frac{1}{2}v_2^2 = \frac{1}{2}v_1^2 + g(h_1 - h_2)$$

I) $\underline{v_2 = \left(v_1^2 + 2g(h_1 - h_2)\right)^{1/2}}$ =

$$v_1 b h_1 = v_2 b h_2$$

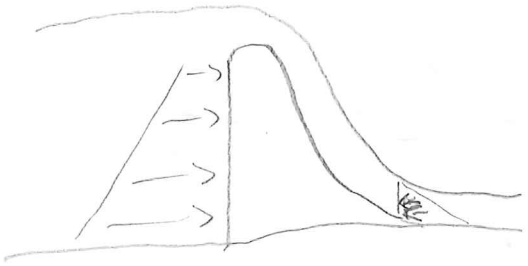
II) $v_1 = \frac{h_2}{h_1} v_2$

II → I) $v_2^2 = \left(\frac{h_2}{h_1} v_2\right)^2 + 2g(h_1 - h_2)$

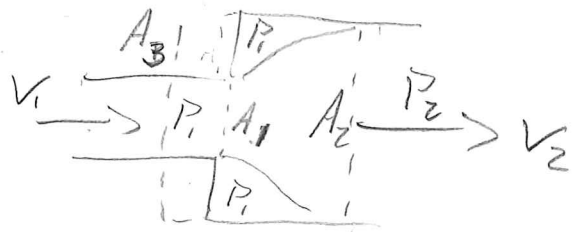
$$v_2^2 = \frac{2g(h_1 - h_2)}{1 - \left(\frac{h_2}{h_1}\right)^2}$$

$$\underline{\underline{v_2 = 9{,}28\ m/s}}$$

2b)



Oppg. 3)



I) $\frac{P_1}{\rho} + \frac{V_1^2}{2} = \frac{P_2}{\rho} + \frac{V_2^2}{2} + TAP$

II) $\frac{\partial}{\partial t}(mv) = \sum F$

$$\int_{A_3} p\,dA + \int_{A_2} p\,dA = \dot{m}V_2 - \dot{m}V_1$$

$$P_1 A_3 - P_2 A_2 = \dot{m}V_2 - \dot{m}V_1$$

II) $A_2(P_1 - P_2) = \dot{m}(V_2 - V_1)$

$A_3 = A_2$

III) $A_1 V_1 = A_2 V_2 = \dot{m}$

I) $P_1 - P_2 = \frac{\rho}{2}(V_2^2 - V_1^2) + \rho \cdot TAP$

I → II)

$$\frac{\dot{m}}{A_2}(V_2 - V_1) = \frac{\rho}{2}(V_2^2 - V_1^2) + \rho \cdot TAP$$

III → II)

$$\underbrace{\frac{\dot{m}}{A_2}}_{=V_2}\left(\frac{A_1}{A_2}V_1 - V_1\right) = \frac{\rho}{2}\left(\left(\frac{A_1}{A_2}V_1\right)^2 - V_1^2\right) + \rho \cdot TAP$$

$$V_1\left(\left(\frac{A_1}{A_2}\right)^2 - \left(\frac{A_1}{A_2}\right)\right) = \frac{\rho}{2}V_1^2\left(\left(\frac{A_1}{A_2}\right)^2 - 1\right) + \rho \cdot TAP$$

$$TAP = -\frac{V_1^2}{2}\left(\left(\frac{A_1}{A_2}\right)^2 - 1\right) + \frac{V_1}{\rho}\left(\left(\frac{A_1}{A_2}\right)^2 - \left(\frac{A_1}{A_2}\right)\right)$$

$$TAP = \frac{V_1^2}{2}\left(1 - \left(\frac{A_1}{A_2}\right)^2\right) + \underbrace{\frac{V_1 A_1}{\rho A_2}\left(\left(\frac{A_1}{A_2}\right) - 1\right)}$$

Finner ikke feilen :(