일반물리 I. Chapter. 15

13.

(a) $\rho = \frac{M}{V} = \frac{8.8\,kg}{0.050\,m^3} = 176\ kg/m^3$

(b). $\rho = 1.2\,kg/m^3$

$V = \frac{M}{\rho} = \frac{8.8\,kg}{1.2\,kg/m^3} = 약\ 7.33\,kg$

15.

$r = 200\mu m = 100 \times 10^{-6}\,m$

$F = 6\,kN = 6 \times 10^3\,N$

$P = \frac{F}{A} = \frac{6 \times 10^3\,N}{\pi (100 \times 10^{-6}\,m)^2} = \frac{6 \times 10^3\,N}{\pi (1 \times 10^{-4}\,m)^2}$

$= 약\ 2 \times 10^{11}\,N/m$

$200 \times 10^9\,N/m = 200\,GPa$

30. $r = 3\,cm$, 시간 당 흐르는 물의 질량 $= 15\,kg/s$

$\rho v A =$ constant 이다.

$\left[\frac{kg}{m^3}\right]\left[m/s\right]\left[m^2\right] = \left[\frac{kg}{s}\right]$: 질량흐름률

$\rho v A = 15\,kg/s$

$\rho v_1 A_1 = \rho v_2 A_2 \rightarrow v_1 A_1 = v_2 A_2$ $(\rho = 1.0 \times 10^3\,kg/m^3)$

$(10^3\,kg)\, v_1 \pi (0.05\,m)^2 = 15\,kg/s \Rightarrow \boxed{v_1 = 6\,m/s}$ (a)

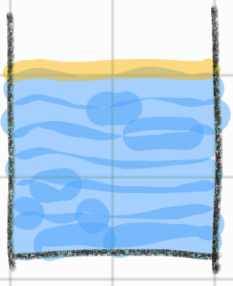
$(6\,m/s)\cdot\pi(0.05\,m)^2 = v_2\cdot\pi(0.025\,m)^2$

$\Rightarrow \boxed{v_2 = 24\,m/s}$ (b)

43. $\rho_{oil} = 0.82\,g/cm^3$, $m_{oil} = \rho_{oil} V_{oil}$

$2r = 1.0\,cm \rightarrow r = 0.5\,cm$.

$V_{oil} = (\pi r^2) h_{oil} \rightarrow m_{oil} = 5.0\,g = \rho_{oil} (\pi r^2) h_{oil}$



(a). 경계면의 압력은 절대압과 대기압의 차.

$P - P_{atm} = \rho_{oil} g h_{oil}$ (깊이 h_{oil}의 압력)

$\rho_{oil} g h_{oil} = \rho_{oil} g \frac{m_{oil}}{\rho_{oil} A} = \frac{m_{oil} g}{A}$

약 620Pa

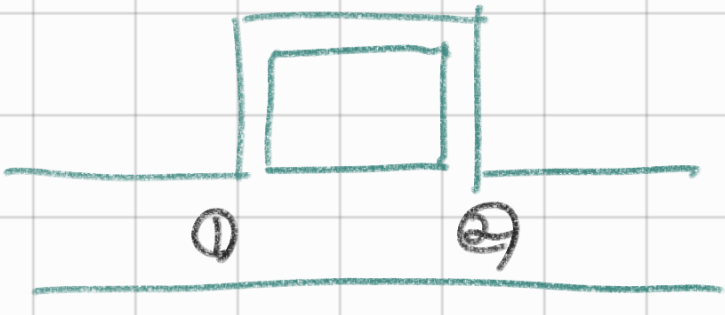
(b). $P_{바닥} = P_{atm} + (m_{oil} + m_{water}) \frac{g}{A}$

↑ 절대압력

바닥의 계기 압력 : $(m_{oil} + m_{water}) \frac{g}{A} =$ **약 1.2kPa**

58.

베르누이 eq : $p + \frac{1}{2}\rho v^2 + \rho g y = \text{constant}$



ρ : 물의 밀도

$P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$, $v_1 A_1 = v_2 A_2$

$$P_1 - P_2 = \frac{1}{2}\rho(v_2^2 - v_1^2) = \frac{1}{2}\rho v_1^2 A_1^2\left(\frac{1}{A_2^2} - \frac{1}{A_1^2}\right)$$

$$v_1 A_1 = \pm\sqrt{\frac{2(P_1 - P_2)}{\rho(A_2^{-2} - A_1^{-2})}}, \quad P_1 - P_2 = (\rho - \rho_{oil})gh$$

$$v_1 A_1 = \sqrt{\frac{2(P_1 - P_2)}{\rho(A_2^{-2} - A_1^{-2})}} = \frac{\pi}{\psi}\sqrt{\frac{2(\rho - \rho_{oil})gh}{\rho(d_2^{-4} - d_1^{-4})}}$$

$$A = \pi\left(\frac{d}{2}\right)^2$$

$$v_1 A_1 = \frac{\pi}{\psi}\sqrt{\frac{2(1.0\,g/cm^3 - 0.82\,g/cm^3)(9.80\,cm/s^2)(1.9\,cm)}{(1.0g \times 10cm)^3\left[(0.64cm)^{-4} - (0.19cm)^{-4}\right]}}$$

$$= \text{약 } 8.4\,cm^3/s$$