

Subject :

Year. Month.

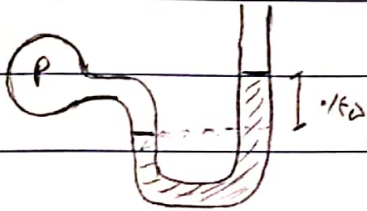
۱-۲. اگر در یک سیستم دو سیال با یکدیگر در تماس باشند و در هر دو طرف یک سیال با یکدیگر در تماس باشند

$$P = \rho_{Ga} h_{Ga} + \rho_w h_w + \rho_{oil} h_{oil} + \rho_{Gly} h_{Gly} + \rho_{Hg} h_{Hg} \quad 9-2$$

$$\Rightarrow P_1 = 9140 \times 2 + 9810 \times 2 + 8000 \times 0.5 + 12150 \times 0.2 + 13300 \times 0.1$$

$$\Rightarrow P_1 = 0.5 \times 8000 + 42100 \Rightarrow \rho_{oil} = 8000 \text{ KN/m}^3$$

$$\rho_{oil} = 0.8 \times 9810 \frac{\text{KN}}{\text{m}^3} \quad 10-5$$



$$P - \rho_{oil} \times 0.15 \Delta = P_0$$

$$P = 0.15 \times 8000 \times 9.81 \times 0.15 + 9810 = 10117.5 \text{ Pa}$$

$$P_A + \rho_w \times a + \rho_{Hg} \times 2a - \rho_w \times a = P_B \quad 22-2$$

$$P_B - P_A = 2 \rho_{Hg} \times a \Rightarrow a = \frac{P_B - P_A}{2 \rho_{Hg}} = \frac{2000}{2 \times 13600 \times 9.81} = 0.0075 \text{ m}$$

$$\sin \theta = \frac{2a}{0.248} = \frac{2 \times 0.0075}{0.248} = 0.0605 \Rightarrow \theta = 3.44^\circ$$

$$P_0 + 0.1 \times 8000 = (2(1 - 0.8) \rho_w + 0.1 \rho_{oil}) + P_A \quad 29-2$$

$$P_A = P_0 - P = 0.1 \times 13600 - 0.1 \times 8000 - 110 \times 9.81 \times 0.1 = -1412.9 \text{ Pa}$$

$$P_{A_{abs}} = P_0 + P_A = 10117.5 - 1412.9 = 8704.6 \text{ kPa}$$

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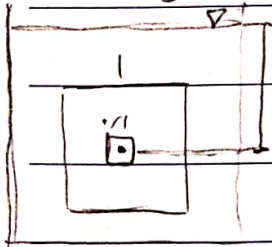
Subject :

Year. Month.

$$P_w + 0.4 \times 9.81 - 0.1 \times 12.4 \times 9.81 - 0.17 \times 0.122 \times 9.81 + 0.15 \times 1.3 \times 9.81 = P_w - 34.2$$

در این معادله P_w و $0.17 \times 0.122 \times 9.81$ را حذف می‌کنیم

$$\Rightarrow P_w - P_w = 3.47 \text{ kPa}$$



$$F_R = \gamma h_c A \Rightarrow F_R = 8 \times \Delta x (1 - 0.1)^2 \quad 34.2$$

$$\Rightarrow F_R = 6.19 \Delta x \quad \text{در نتیجه}$$

$$F x^2 = 1.22 \Rightarrow x = 0.155 \text{ m}$$

$$\int_0^{0.002} F x^2 dx = \frac{F}{3} x^3 \Big|_0^{0.002} = 0.122 F$$

$$A = 0.155 \times 1.22 = 0.19 \text{ m}^2$$

$$F_R = 6.19 \times 0.19 = 1.176 \text{ kN}$$

$$F_R = \gamma h_c A$$

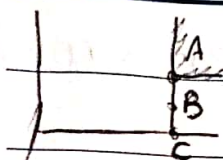
$$y_c = \frac{3 \times 1.22}{4} + 0.1 = 1.0475 \text{ m} \Rightarrow h_c = y_c \sin 30^\circ = 0.52375 \text{ m}$$

$$\Rightarrow F_R = 9.81 \times 0.52375 \times 0.19 \times 2 = 190.5 \text{ N}$$

subject :

Year. _____

Month. _____

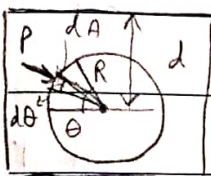


۲-۵۲ - T با اندازه H تغییر نمی کند و T با اندازه H اندازه گیری می شود

درجه A → در قسمتی که لولای بازگشوده در وسط قرار دارد هر اندازه ای ارتفاع و در سطح اندازه گیری شود هر قدر ارتفاع بیشتر باشد

زیرا اندازه ای که در (AB) با (BC) طاقب است (یعنی $\sum M = 0$) که نتایج آنست که

درجه B → در قسمتی که لولای بازگشوده در بالا (A) قرار می گیرد با اندازه h طبق اصل $F_c F_s h_A$ زیاد شود پس T درجه B زیاد شود



$$dA = 2\pi R \cos \theta \times R d\theta$$

$$h = d - R \sin \theta$$

$$F_z = \int -\gamma h \sin \theta dA = \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} -\gamma (d - R \sin \theta) \sin \theta (2\pi R^2 \cos \theta d\theta)$$

$$= -2\pi R^2 \gamma d \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos \theta \sin \theta d\theta + 2\pi R^3 \gamma \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos \theta \sin^2 \theta d\theta$$

$$= -2\pi R^2 \gamma d \left(\frac{1}{2} \sin^2 \theta \Big|_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \right) + 2\pi R^3 \gamma \left(\frac{1}{3} \sin^3 \theta \Big|_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \right) = \frac{\gamma}{3} \pi R^3$$



3.144 m

$$h = \frac{P}{\gamma} = \frac{50000}{10000} = 5.144 \text{ m}$$

40 T

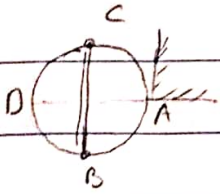
$$F_v = \gamma (V_{AEBDC}) = \gamma (V_{ABDC} - V_{AEB}) = 9810 \times \left(\pi \times \left(\frac{r}{2}\right)^2 \times 3.144 \right)$$

$$= \frac{1}{2} \left(\frac{\gamma}{3} \pi \times \left(\frac{r}{2}\right)^3 \right) = 11.7825 \text{ N}$$

Subject : _____
 Year. _____ Month. _____

$$F_b = \frac{1}{b} (F - W) = \frac{1}{r} (117820 - 4800) = 29442 \text{ N} = 29.44 \text{ kN}$$

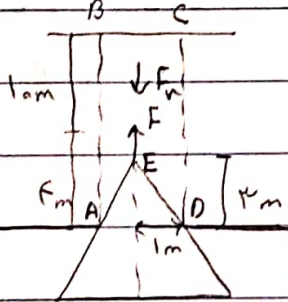
نصف قطر
 نصف طول



$$N_B = W - F = W - 8r \quad \text{--- VI ---}$$

$$\Rightarrow N_B = 20000 - (1000 \times 1 \times (\frac{1}{r} \times \pi \times (\frac{r}{2})^2 \times 4))$$

$$\Rightarrow N_B = 29442 \text{ N} = 29.44 \text{ kN} \quad \text{نصف قطر}$$

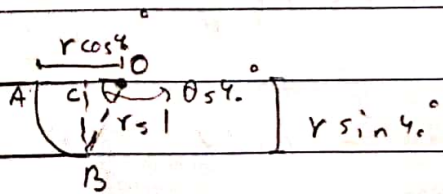


$$h = \frac{P}{8} = \frac{10000}{1000} = 10 \text{ m} \quad \text{--- VII ---}$$

$$\sum F_y \rightarrow F = F = 8 (V_{ABCOEA}) - 8 (V_{ABCD} + V_{AED})$$

$$= 10000 \times \left((\pi \times 1^2 \times 4) - (1 \times \pi \times 1^2 \times 3) \right)$$

$$= 13000 \pi \text{ N} \quad \text{نصف قطر}$$



$$F = 8 (V_{ABC}) = 8 (V_{ABO} + V_{OBC}) \quad \text{--- VIII ---}$$

$$\Rightarrow F = 10000 \times 9.81 \times \left(\frac{40}{360} \times (\pi \times 1^2 \times 1) - \frac{1}{r} \times (1 \times \sin 40^\circ \times (1 \times \cos 40^\circ)) \right)$$

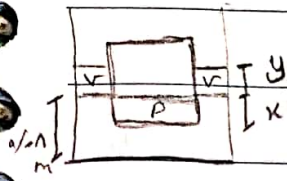
$$= 301214 \text{ N} \quad \text{نصف قطر}$$

SINACO

Subject :

Year. Month.

92 2



$$V_r = V_p \Rightarrow (2x \cdot 0.1 \Delta + 2x \cdot 0.1) \times 0.000xy = 0.1x \cdot 0.1 \times x$$

$$\Rightarrow x = 2/0.4y$$



$$F_B = W \Rightarrow \frac{8}{\mu} \times (0.1x \cdot 0.1) (x+y) = \Delta$$

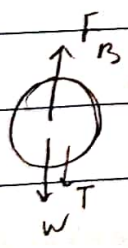
$$\Rightarrow (0.1 \times 9.81 \cdot 0) \times (0.1x \cdot 0.1) (2/0.4y + y) = \Delta$$

$$\Rightarrow y = 0.0118 \text{ m} = 11.8 \text{ mm}$$

$$0.01 \text{ m} + y = 0.01 + 0.01 = 0.02 \text{ m} \leftarrow \text{مجموع الارتفاعين}$$

93 2

$$d = 1/0 \text{ m}, \delta_w = 9.81$$



$$\Rightarrow F_B = W = 0.1 \text{ kN} \quad (1)$$

(T) μ $\frac{d}{r}$

$$F_B = \frac{8}{\mu} \frac{V_r}{\omega} = 9.81 \times \frac{F}{\mu} \times \pi \times \left(\frac{1/0}{r}\right)^2 = 14.1 \text{ kN} \quad (2)$$

$$1, 2 \Rightarrow 14.1 \text{ kN} = W = 0.1 \text{ kN} \Rightarrow W = 14.1 \text{ kN}$$

$$\tan \theta = \frac{12}{r} \Rightarrow \theta = 30.94^\circ, d = 2y \tan \theta \quad (1) \quad 1.2 2$$

$$F_B = W \Rightarrow \frac{8}{\mu} \left(\frac{1}{r} \times \frac{\pi d^2}{4} \times y \right) = (SG \frac{8}{\mu}) \times \left(\frac{1}{\mu} \times \frac{\pi \times D^2}{4} \times H \right)$$

SINACO

Subject :

Year. Month.

$$\Rightarrow d^r y = SG \times D^r H \quad (2)$$

$$1, 2 \Rightarrow (r y \tan \theta)^r y = SG (r H \tan \theta)^r H \Rightarrow y^3 = SG \cdot H^3$$

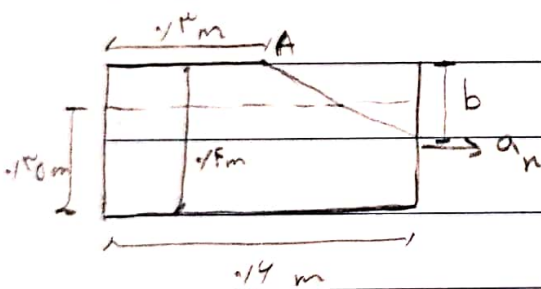
$$\Rightarrow y = (SG)^{\frac{1}{3}} \times H = (0.1)^{\frac{1}{3}} \times 0.12 = 0.114 \text{ m}$$

0.011(m)

$$\overline{BG} = \overline{OG} - \overline{OB} = \frac{3}{4} H - \frac{3}{4} y = \left(\frac{3}{4} \times 0.12\right) - \left(\frac{3}{4} \times 0.114\right) =$$

$$\overline{GM} = \overline{BM} - \overline{BG} = \frac{I}{V} - \overline{BG} = \frac{(\pi d^4 / 4 \epsilon)}{\frac{1}{4} (\pi d^2 / \epsilon) y} \quad 0.011$$

$$= \frac{r}{14} \times \frac{(r y \tan \theta)^r}{y} \quad 0.011 = 0.039 \quad \Rightarrow \text{مستقر}$$



35-5: آب و اشرفی تاندر A با بدنه بهرین تندر:

آب بهرین تندر است پس هم تندر است:

$$V_0 = V_1 \Rightarrow 0.14 \times 0.15 \times W = \left(0.14 \times 0.05 - \frac{0.07 \times b}{2}\right) W$$

$$\Rightarrow 0.21 = 0.24 - 0.05b \Rightarrow b = 0.12 \text{ m}$$

$$\tan \theta = \frac{dz}{dn} = -\frac{a_n}{g} = -\frac{0.12}{9.81} \Rightarrow a_n = \frac{r}{r} \times 9.81 = 4.124 \text{ m/s}^2$$

$$\tan \theta = \frac{dz}{dy} = -\frac{ay}{g} = -\frac{r/\Delta}{9.81} \Rightarrow \tan \theta = -0.25 \Delta - 9.1 \Delta$$

$$h = \frac{1}{2} h = r \times 0.25 \Delta = 1.02 \text{ m} \Rightarrow h = 2 \times 1.02 = 2.04 \text{ m}$$

SINACO

Subject :

Year. Month.

$$h = 2 + 1/0.2 = 3/0.2 \text{ m}$$

سطح عمیق

$$a = 0 \Rightarrow \left\{ \begin{aligned} F_f &= \delta h_c A = 9810 \times \frac{0.2}{2} \times (0.2 \times 2) = 9444 \text{ N} \\ F_b &= \delta h_c A = 9810 \times \frac{3/0.2}{2} \times (0.2 \times 2) = 19444 \text{ N} \end{aligned} \right.$$

$$\Rightarrow \Delta F = 19444 - 9444 = 10000 \text{ N}$$

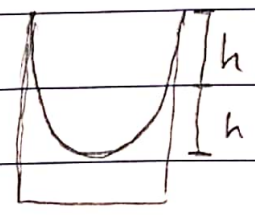
$$F = Ma = \rho V a = 1000 \times (1 \times 2 \times 2) \times 2.5 = 10000 \text{ N}$$

شردنی لازم برای تثبیت دال این مقدار است. برای برابری اختلاف شردنی در دو سطح عمیق و سطح آزاد

برای اینکه آب سیرک نرزد $\Rightarrow z = 2 \text{ m}, r = 1 \text{ m}$ 44 - 5

$$z = \frac{\omega^2 r^2}{2g} \Rightarrow \omega^2 = \frac{2 \times 2 \times 10}{1} = 40 \Rightarrow \omega = 2\sqrt{10} < 10 \Rightarrow \text{آب سیرک نرزد}$$

$$\Rightarrow h = z = \frac{10^2}{2 \times 10} \times 1^2 = 5 \text{ m}$$



حجم کل آب در ابتدا: $V_0 = \pi \times 1^2 \times 2 = 2\pi$

حجم کل آب در انتها: $V_1 = \pi \times 1^2 \times 5 = 5\pi$

$$\Rightarrow \Delta V = 5\pi - 2\pi = 3\pi = 1107 \text{ m}^3$$

مقدار آب سیرک ریزه

$$P_B = P_A = \frac{\rho \omega^2 r_B^2}{2} - \delta z_B + C = \left(\frac{\rho \omega^2 r_A^2}{2} - \delta z_A + C \right) - \delta \Delta z$$

$$= \frac{\rho \omega^2}{2} (r_B^2 - r_A^2) = \frac{0.9 \times 981}{2} \times (1^2 - 0^2) = 14124.5 \text{ kPa}$$