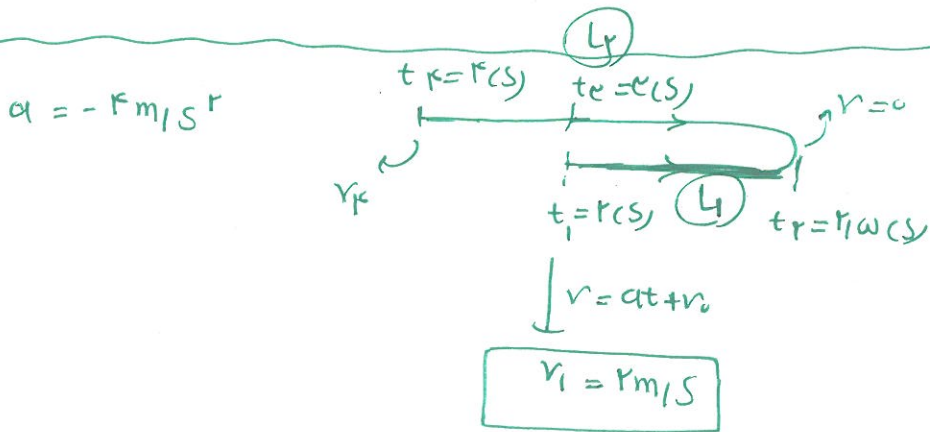


۱۵۶



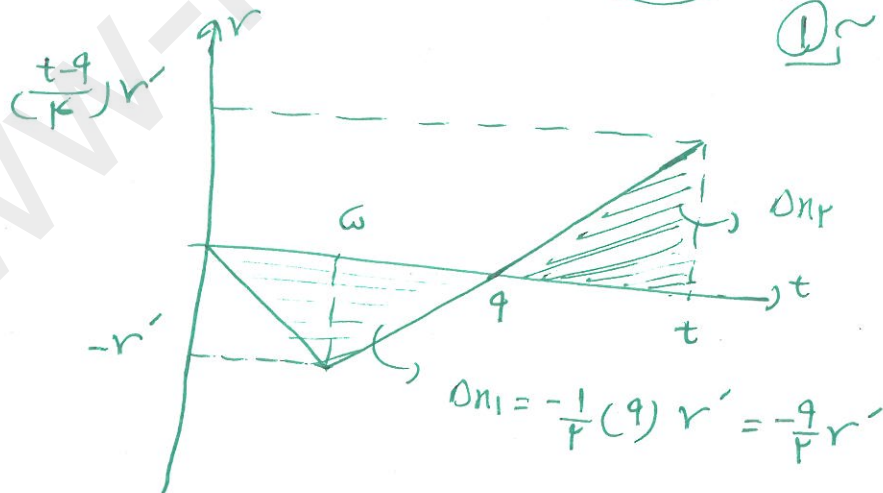
۱۵۷

$t_1 = rcs \implies v_f = -4 \text{ m/s}$

$L_1 = \frac{r+0}{2} \left(\frac{1}{2} \right) = 0.5 \omega m$

$L_2 = \frac{0+4}{2} \left(\frac{1}{2} \right) = 1 \omega m \implies L_T = 1.5 \omega m$

$\Delta n_T = 0$



۱۵۸

$\Delta n_T = 0 \implies \Delta n_T = \frac{1}{2} r' = \frac{1}{2} (t-1) \left(\frac{t-1}{2} \right) r'$

$\implies (t-1)^2 = 2 \implies t-1 = \sqrt{2}$

$\implies t = 1 + \sqrt{2}$

~~و~~

$$n_B = \frac{1}{r} a_B t^r$$

$$n_A = v_A t + n_{0A}$$

$$n_A = n_B$$

$$t_r = r v_A$$

$$1 a_B = r v_A + n_{0A} \quad \text{تفاضل دو طرف}$$

$$r^2 a_B = 1 v_A$$

$$t_r = 1 r v_A$$

$$v_A a_B = 1 v_A + n_{0A}$$

$$v_A = 1 a_B$$

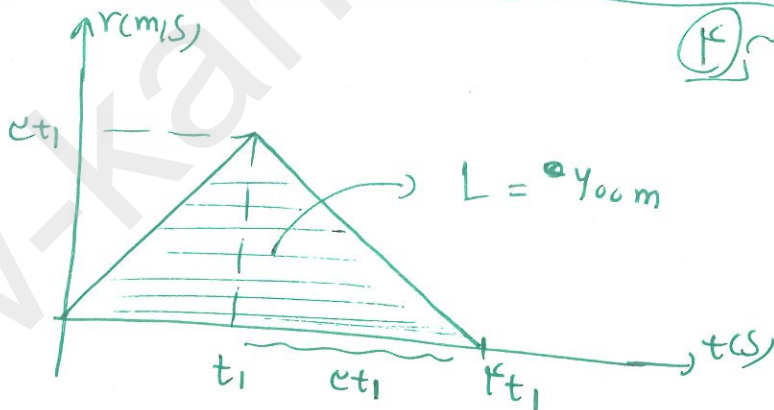
$$n_{0A} = -r^2 a_B$$

$$v_A = v_B$$

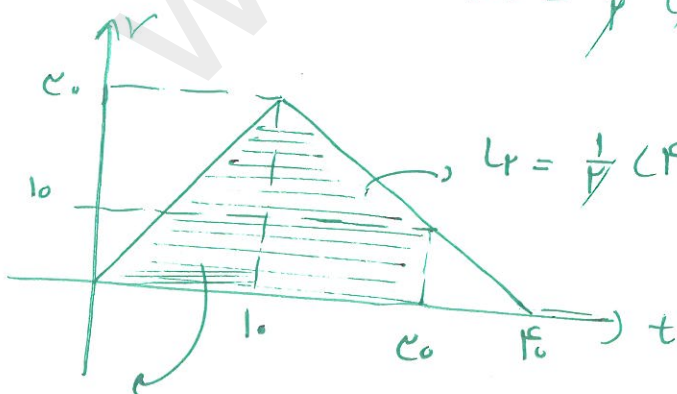
$$1 a_B = a_B t \implies t = 1 (s)$$

$$v_0 = 0$$

$$a = 1 \text{ m/s}^2$$



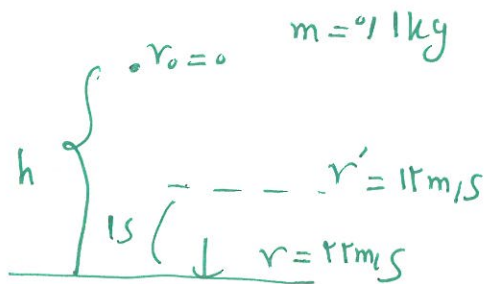
$$400 = \frac{1}{2} (2t_1) (2t_1) \implies t_1 = 10 (s)$$



$$L_1 = \frac{1}{2} (10) (10) = 50 \text{ m}$$

$$L_1 = \frac{1}{2} (10) (10) = 50 \text{ m}$$

$$L_T = L_1 + L_2 = 500 \text{ m}$$

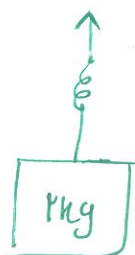


$$k = \frac{1}{r} m v^2 \rightarrow r F_c = \frac{1}{r_0} v^2$$

$$\rightarrow \boxed{v = 22 \text{ m/s}}$$

$$\hookrightarrow v_{av} = \frac{12 + 22}{2} = 17 \text{ m/s}$$

(۲) (۱۶۱)



$L_0 = 20 \text{ cm}$ $k \Delta x = m(g + |a|)$ $-$ سوزنده و سبب بالا

$$\rightarrow k (4 \times 10^{-2}) = (2) (12)$$

$$\rightarrow \boxed{k = 200 \text{ N/m}}$$

(۱۶۲)



$$k \Delta x' - \phi_k = m a$$

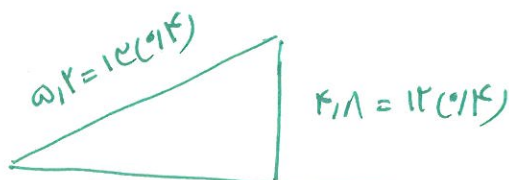
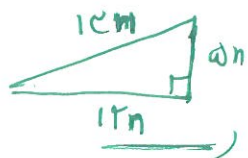
$$\rightarrow 200 (4 \times 10^{-2}) - \mu_k (20) = 2$$

$$\rightarrow 1 = 20 \mu_k \rightarrow \boxed{\mu_k = 0.05}$$

$$a_y = 10 \text{ m/s}^2 \rightarrow 10 = \frac{F_{\perp} \lambda}{m} \rightarrow m = 0.141 \text{ kg}$$

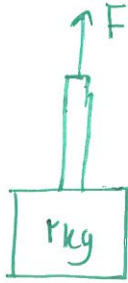
(۱۶۳)

$$F_{net} = m a \rightarrow F_{net} = (0.141 \times 10) \left(\frac{4}{5} \right) = 0.1128 \text{ (N)}$$



$$\boxed{F_{\parallel} = 0.1128 \times \left(\frac{12}{13} \right) = 0.104 \text{ (N)}}$$

(۱۶۴)



$$F = m(g + |a|) = r(12) = 12r \text{ (N)}$$

(۱۴۴)

(۲)

$$F' - mg = ma' \quad \xrightarrow{F'=rF} \quad rF - r_0 = r a'$$

$$\rightarrow a' = 11^r m / 5^r$$

$$\rightarrow \frac{a'}{a} = \frac{11^r}{r} = \sqrt{\quad}$$

$$\frac{m_B}{m_A} = \frac{\omega}{\lambda}$$

(۱۴۵)

$$k = \frac{P^r}{r m}$$

$$\frac{k_A}{k_B} = \left(\frac{P_A}{P_B}\right)^r \times \frac{m_B}{m_A}$$

(۱)

$$\frac{P_A}{P_B} = \frac{r}{c}$$

$$\downarrow \frac{k_A}{k_B} = \frac{r}{9} \times \frac{\omega}{\lambda} = \frac{10}{9}$$

$$F_N = mg = 2 \times 10^4 \text{ (N)}$$

(۱۴۶)

(۲)

$$R = \sqrt{F_N^r + F_S^r}$$

$$R = 10^4 \sqrt{10} \text{ (N)}$$

$$F_S = 10^4 \text{ (N)} = F_{\text{موتور}}$$

$$E = \frac{1}{2} k A^2 = \left(\frac{1}{2}\right) (\omega^2 m r) \left(\frac{1}{2} \times 10^{-2}\right)^2 = 0.14 \text{ J} \quad (1) \quad (147)$$

$\frac{1}{2} \text{ J} \leftarrow \quad \rightarrow \frac{1}{2} \text{ J}$

$E = k + U$

$k = 0.14 \text{ J}$

$k = \frac{1}{2} m r^2$

$2 \times 10^{-1} = \frac{1}{2} r^2$

بزر $\rightarrow r = \frac{\sqrt{10}}{\omega} \text{ m/s} = 20\sqrt{10} \text{ cm/s}$

$T = 2\pi \sqrt{\frac{m}{k}} \rightarrow \frac{T_2}{T_1} = \sqrt{\frac{m_2}{m_1}}$

(2) (148)

توازن (2)

$\left(\frac{9}{10}\right)^2 = \frac{m_2 \cdot 0.14}{m} \rightarrow$

$m = 1 \text{ kg}$

$\rightarrow 10^{-1} \text{ s} = 2\pi \sqrt{\frac{1}{k}}$

توازن (2)

$k = 400 \frac{\text{N}}{\text{m}} = 4 \frac{\text{N}}{\text{cm}}$

$T = 2\pi \sqrt{\frac{L}{g}} = \frac{t}{N}$

$\rightarrow \frac{N_2}{N_1} = \sqrt{\frac{L_1}{L_2}}$

(149) (2)

$\rightarrow \frac{F_0}{F_0} = \sqrt{\frac{L_1}{L_2}}$

$\rightarrow \frac{L_1}{L_2} = \frac{11}{44}$

$\frac{T_1}{T_2} = \frac{v_2}{v_1} = 1/4 \text{ (s)}$

$1/4 = 2\pi \sqrt{\frac{L_1}{g}}$

توازن (2)

$L_1 = 11 \text{ cm}$ (2)

(1) (2)

$L_2 = 44 \text{ cm}$

$\rightarrow \Delta L = 44 - 11 = 33 \text{ cm}$

$$\beta_1 - \beta_2 = 11 \text{ dB} = 10 \log \left(\frac{d_r}{d_i} \right)^2$$

(۲) (۱۷۰)

$$\rightarrow 1,1 = 2 \log \frac{d_r}{d_i} \rightarrow \log \frac{d_r}{d_i} = \frac{1}{2} \log 2 = \log 2^{\frac{1}{2}}$$

$$\Rightarrow \boxed{\frac{d_r}{d_i} = 1}$$

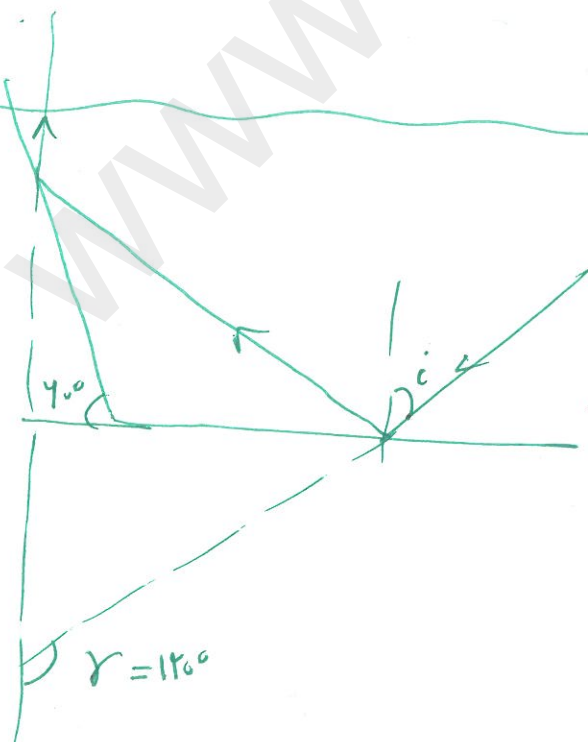
$$\frac{c}{f} \lambda = 120 \text{ cm} \rightarrow \lambda = 120 \text{ cm} = \frac{1}{5} \text{ m}$$

(۱۷۱)

(۲)

$$\lambda = vT \rightarrow \frac{1}{5} = 10 T \rightarrow T = \frac{1}{50} \text{ (s)} = 0,02 \text{ (s)}$$

$$\Delta t = 0,04 \text{ (s)} = \frac{T}{f} \rightarrow \boxed{L = \lambda A = 4 \text{ cm}}$$



(۲) (۱۷۲)

با افتادن $\sqrt{2}$ زاویه λ قائمه می‌شوند.

$$r = 120 \text{ cm}$$

$$\frac{t_2}{t_1} = \frac{r_2}{r_1} = \frac{n_1}{n_2} = \frac{\sin \theta_2}{\sin \theta_1}$$

$$\begin{matrix} \theta_2 = 45^\circ \\ \theta_1 = 90^\circ \end{matrix} \quad \frac{t_2}{t_1} = \frac{\sqrt{2}}{\frac{1}{\sqrt{2}}} = \sqrt{2}$$

(173)

(17)

$$\phi_1 = 120 \text{ Hz} \quad ; \quad \phi' = 70 + 120 = 190 \text{ Hz}$$

(174)

(17)

$$n' = 2$$

$$n = 7$$

رابطه فرکانس درازان

$$\frac{1}{t} = R \left(\frac{1}{n'r} - \frac{1}{nr} \right)$$

(175)

$$\frac{1}{t} = 11 \times 10^{-9} \left(\frac{1}{nm} \right) \left(\frac{1}{2} - \frac{1}{7} \right)$$

$$\rightarrow t = 290,90 \text{ nm} \approx \boxed{291 \text{ nm}}$$

$$w_{0A} = f_1 \omega e r$$

$$w_{0B} = e r$$

$$k_{max} = h\phi - w_{0A} = \frac{hc}{t} - w_{0A}$$

(176)

(17)

$$\rightarrow \left\{ \begin{aligned} k_{maxA} &= \frac{12 \times 10^{-9}}{10 \times 10^{-9}} - f_1 \omega = e_1 \omega e r \\ k_{maxB} &= \frac{12 \times 10^{-9}}{10 \times 10^{-9}} - e = \omega e r \end{aligned} \right.$$

$$\rightarrow \frac{k_{maxA}}{k_{maxB}} = 1.4$$

رابطه k_{maxA} و k_{maxB} از $e_1 \omega e r$ و $\omega e r$ به دست می آید

$r_1 = 10 \text{ cm}$

$r_2 = 20 \text{ cm}$

$E_2 = E_1 - (117 \times 10^4)$

$\frac{E_2}{E_1} = \left(\frac{r_1}{r_2}\right)^2 \rightarrow \frac{E_1 - (117 \times 10^4)}{E_1} = \frac{1}{4}$

(۱۷۷)

$E_1 = 4E_2 - (117 \times 10^4) \times 4 \Rightarrow E_1 = 111 \times 10^4 \text{ N/C}$

$r_c = 100 \text{ cm} \rightarrow \frac{E_c}{E_1} = \left(\frac{r_1}{r_c}\right)^2 \rightarrow \frac{E_c}{111 \times 10^4} = \frac{1}{100}$

$E_c = 1110 \text{ N/C}$

برای q_c : $\frac{19r_1}{r^2} = \frac{\frac{q}{r} 19r_1}{(r+r_1)^2} \xrightarrow{\text{ضرب}} \frac{1}{r} = \frac{r}{r(r+r_1)}$

(۱۷۸)

$r_1 = r + r_1 \Rightarrow \frac{r}{r} = 2$

برای q_r : $\frac{\frac{q}{r} 19r_1}{r^2} = \frac{19r_1}{r^2} \Rightarrow \frac{19r_1}{19r_1} = 1$

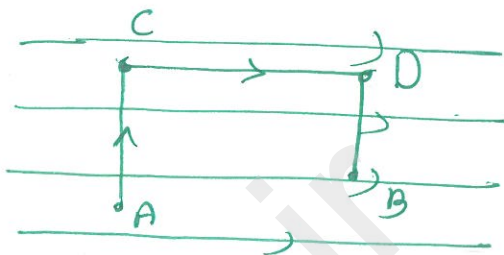
برای q_1 و q_c باید همان بازنویسی برای q_r و q_c داشته باشیم

$\frac{q_c}{q_r} = -9$

① (179)

$$\Delta u_E = -E|q||d| \cos \theta$$

$$\begin{aligned} \Delta u_{AB} &= \Delta u_{AC} + \Delta u_{CD} + \Delta u_{DB} \\ &= (-1) \cdot 10^6 \cdot (5 \times 10^{-4}) \cdot (2 \times 10^{-1}) \cdot (-1) \\ &= \boxed{115 \text{ J}} \end{aligned}$$



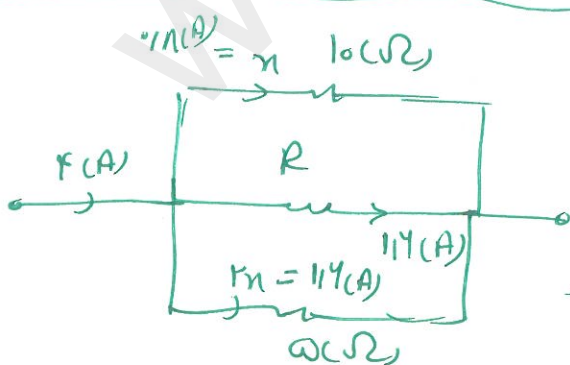
$$Q_2 = Q_1 - q \quad \rightarrow \quad \Delta u = -r_1 q \omega \mu J \quad \text{② (180)}$$

$$u = \frac{Q^2}{rC} \quad \rightarrow \quad \Delta u = \frac{1}{rC} (Q_2^2 - Q_1^2)$$

$$\rightarrow (-r_1 q \omega) (r) (1/r) = -1/r Q_1 + q/r$$

$$\rightarrow -Q_1 + q = r(-r_1 q \omega) = -\omega r$$

$$\rightarrow \boxed{Q_1 = 40 \mu C} \quad r_1 = \frac{Q_1}{C_1} \quad \boxed{r_1 = \omega(r)}$$

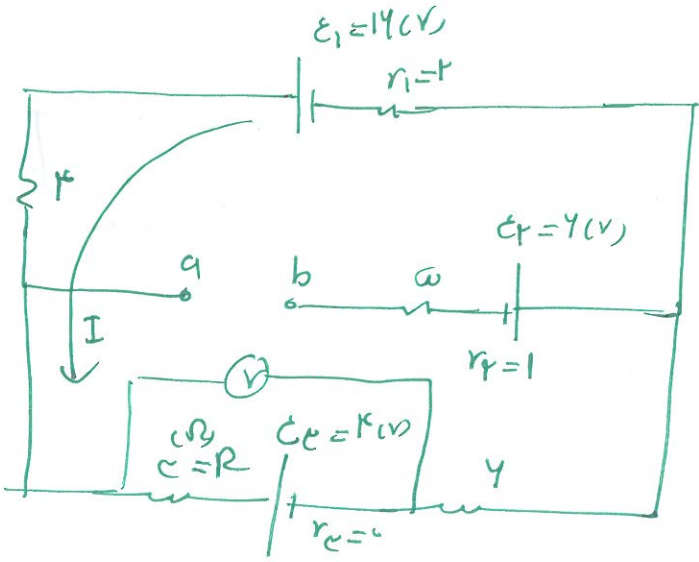


$$en = r_1 I(A) \quad \rightarrow \quad n = 117(A)$$

$$\rightarrow \boxed{R = \omega(r_2)}$$

$$u = R I^2 t \quad \rightarrow \quad u = (\omega) (117) (117) (10^{-1}) (10^{-1}) (10^{-1})$$

$$= \boxed{19,2 \text{ kJ}}$$



$\textcircled{4} \sim \textcircled{112}$

$$I = \frac{14 - 4}{10} = 1 \text{ A}$$

$$V = \varepsilon_2 + R I$$

$$\rightarrow r = (4) + (1)(1) = 5 \Omega$$

کتابچه: $I_1 = \frac{1A}{10} = 0.1 \text{ A} \rightarrow r_1 = (5)(0.1) = 0.5 \text{ V}$ $\textcircled{113}$

کتابچه: $I_2 = \frac{1A}{9} = 0.11 \text{ A} \rightarrow r_2 = (5)(0.11) = 0.55 \text{ V}$

$$\rightarrow r_2 - r_1 = -0.05 \text{ V}$$



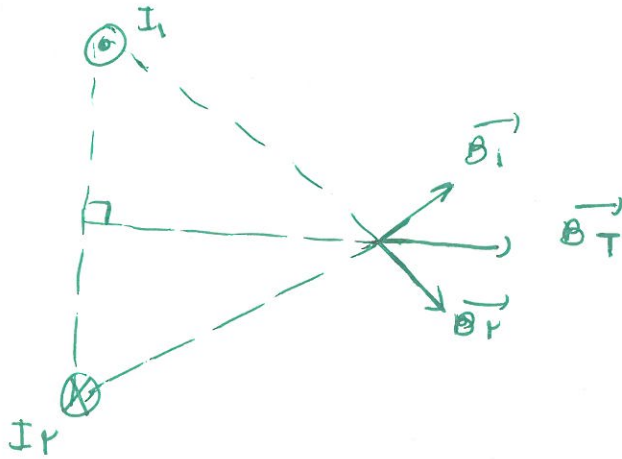
$R = 4 \Omega$

$$R' = \frac{R}{k} = 1.1 \Omega$$

$\textcircled{114}$
 $\textcircled{4}$

طول این سیم $\textcircled{4}$ برابر سیم اول

$$R'' = 14 R' = 15.4 \Omega$$



-118

①

② -114

$$\Phi = B A \cos \theta \rightarrow \Phi = (4 \times 10^{-2}) (2 \times 10^{-4}) \left(\frac{\sqrt{2}}{2} \right)$$

$$= 4\sqrt{2} \times 10^{-6} \text{ wb}$$

-117

③

$$I = I_m \sin(\omega t) = I_m \sin\left(\frac{2\pi}{T} t\right)$$

④ -118

$$\frac{\omega}{2\pi} T = \frac{1}{10} \rightarrow T = \frac{1}{10} \text{ (s)} \quad t = \frac{1}{200} \text{ (s)} \rightarrow t = \frac{T}{2}$$

$$t = \frac{T}{2}, I = (0.1 \sqrt{2}) \sin\left(\frac{2\pi}{T} \times \frac{T}{2}\right) = (0.1 \sqrt{2}) \left(\frac{\sqrt{2}}{2}\right) = 0.1 \text{ (A)}$$

$$0.1 \sqrt{2} \text{ A} \xrightarrow{\text{تقریب}} 0.14 \text{ A} \pm 0.01 \text{ A}$$

-119

⑤

$$\Delta K = -\Delta U \rightarrow \frac{1}{2} (v_2^2 - v_1^2) = -g \Delta h \quad (190)$$

$$\implies \frac{1}{2} (25 - 0) = -10 \Delta h \rightarrow \Delta h = 0.125 \text{ m}$$

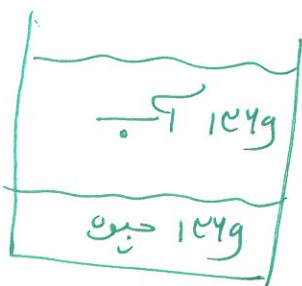
$$\Delta h = h_2 - h_1 \implies 0.125 = 0 - h_1 \implies \boxed{h_1 = 0.125 \text{ m}}$$

$$P_{\text{av}} = \frac{mgh}{\Delta t} = \frac{(2 \times 10^3) (10) (25)}{40} = 12.5 \times 10^3 \text{ W} \quad (191)$$

$$\% R_e = \frac{P_{\text{av}}}{P_{\text{کل}}} \times 100 \%$$

$$\implies \% R_e = \frac{12.5 \times 10^3}{20 \times 10^3} \% = 62.5 \%$$

طبق اصل بنولتر با افزایش شگرتان، فشارتان (کاهش) میابد و ارتفاع آب بالا آمده رزی قائم (افزایش) میابد. (192)



$$P_T = \frac{(mg)_{\text{آب}} + (mg)_{\text{جیوه}}}{A} + P_0 \quad (193)$$

$$\implies P_T = \frac{(146 \times 10^{-3}) + (146 \times 10^{-3})}{0.01} + 10^5 (1460)$$

$$= 101100 \text{ Pa}$$

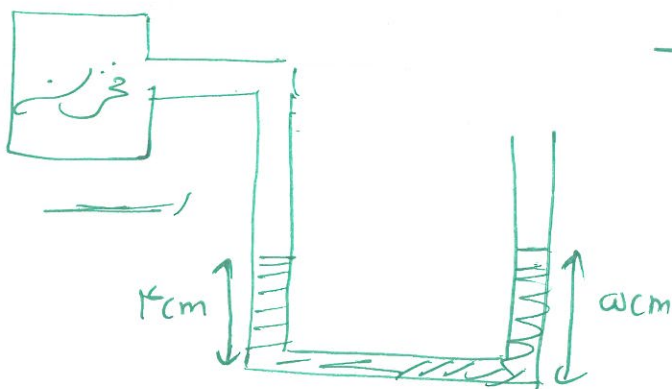
$$(Ph)_{\text{چپ}} = (Ph)_{\text{صیوه}} \rightarrow (1)(\gamma_A) = 1014 h_1$$

۱۹۴
۵

$$\rightarrow h_1 = 0.07 \text{ cm}$$

$$(Ph)_{\text{روغن}} = (Ph)_{\text{صیوه}} \rightarrow (0.8)(\gamma_A) = 1014 h_2$$

$$\rightarrow h_2 = 0.06 \text{ cm}$$



$$\rightarrow P_{\text{تحت}} = 1 \text{ cm Hg} = 10 \text{ mm Hg}$$

$$m_A = m_B$$

$$\frac{\rho_A}{\rho_B} = \frac{1}{4}$$

۱۹۵
۴

$$\frac{V_B}{V_A} = 4$$

$$\frac{\Delta V_A}{\Delta V_B} = \frac{V_A}{V_B} \times \frac{\rho_A}{\rho_B} \times \frac{\Delta \theta_A}{\Delta \theta_B} \quad (1)$$

$$\rho_A = \rho_B$$

$$\frac{C_A}{C_B} = \frac{1}{4}$$

$$\frac{\rho_A}{\rho_B} = \frac{m_A}{m_B} \times \frac{C_A}{C_B} \times \frac{\Delta \theta_A}{\Delta \theta_B}$$

$$\hookrightarrow 1 = 1 + \frac{1}{4} \times \frac{\Delta \theta_A}{\Delta \theta_B} \rightarrow \frac{\Delta \theta_A}{\Delta \theta_B} = 4 \quad (2)$$

① ②

$$\frac{\Delta V_A}{\Delta V_B} = \frac{1}{4} \times \frac{1}{4} + 4 = \frac{1}{4}$$

(۱۹۶) $|\frac{v_1}{v_2}| = \frac{v_1}{v_2} \rightarrow m(\frac{v_1}{v_2})(\omega_0) = m'(1.0)(\frac{v_1}{v_2})$
 جسم زودتر از آن

$\rightarrow m' = \frac{\omega}{\lambda} m$

$\rightarrow \frac{m_T}{v_1} = m + \frac{\omega}{\lambda} m = \frac{1.0}{\lambda} m = \frac{1.0}{\omega v_0}$ $\rightarrow m = 2.0g$

$P_1 = P_2 \rightarrow \frac{v_1}{T_1} = \frac{v_2}{T_2} \rightarrow \frac{v}{2.0} = \frac{v_2}{2.0}$ (۱۹۷)

$\rightarrow v_2 = \frac{4}{P} Lit$

$T_r = T_e \rightarrow P_r v_r = P_e v_e \rightarrow (2 \times 10^5) v_r = P_e (\frac{v}{\omega} v_r)$
 $\rightarrow P_e = 2.1 \times 10^5 Pa$

(۱۹۸) فن آید AB هم فشار را و حجم گاز را هم برابر \rightarrow در (۱)
 $P_r = nRT$ $v_c = n \times 10^{-6} m^3$ $P_c = 1.0^5 Pa$ \rightarrow در (۲)
 $T_c = 2.0 \times 10^3 K$
 فن آید BC هم را \rightarrow در (۳)

۲)

۱۹۹

$W = 0$ ← فرآیند AB هم‌حجم است
 $Q_{BC} = \frac{Q}{\gamma} n R \Delta T$ ← فرآیند BC هم‌شارا است

$\rightarrow Q_{BC} = \left(\frac{Q}{\gamma}\right) (1) \left(\frac{4}{\cancel{\lambda}}\right) (200) = 4000 \text{ J}$

$\left(\frac{Pr}{T}\right)_{\text{اولی}} = \left(\frac{Pr}{T}\right)_{\text{باقی‌مانده}} + \left(\frac{Pr}{T}\right)_{\text{خارج‌شده}}$

۲۰۰

$\rightarrow \left(\frac{50 \times 10^5}{200}\right) (200 \times 10^{-2}) = \left(\frac{219 \times 10^5}{290}\right) (200 \times 10^{-2}) + \left(\frac{Pr}{T}\right)_{\text{خارج‌شده}}$

$\rightarrow \left(\frac{Pr}{T}\right)_{\text{خارج‌شده}} = 10 = (nR)_{\text{خارج‌شده}} = \left(\frac{m}{M} R\right)_{\text{خارج‌شده}}$

$\rightarrow m = \frac{(20) \left(\frac{4}{\cancel{\lambda}}\right)}{\cancel{\lambda}} = 10 \text{ g}$

