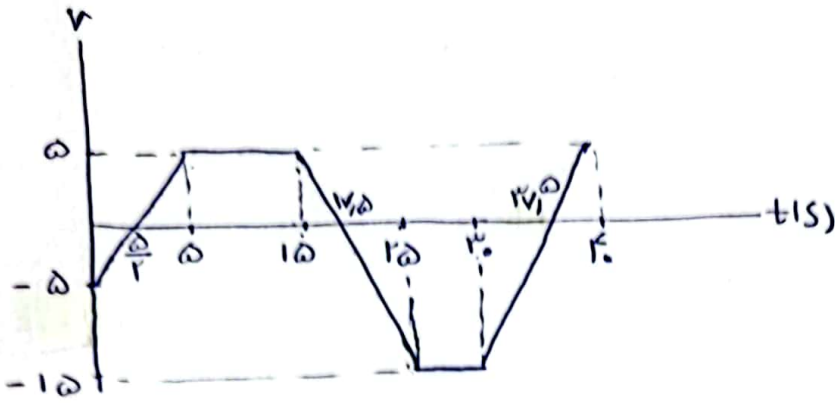
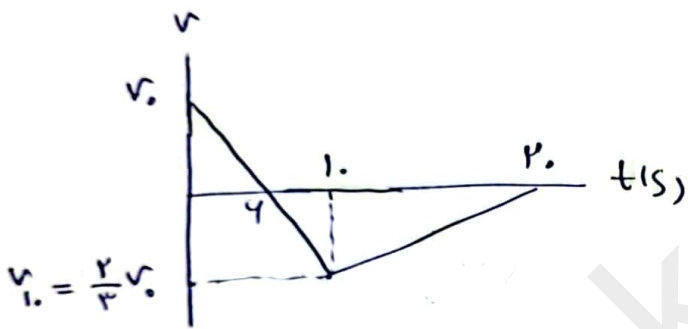


(f) - a.



$$l = \frac{r\Delta}{r} + \frac{(r\Delta + \Delta)\Delta}{r} + \frac{(r\Delta + \Delta)\Delta}{r} + \frac{r\Delta \times \Delta}{r} = 4r\Delta$$

(1) - a1

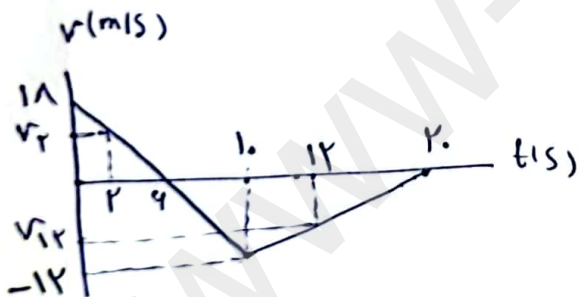


$$\frac{v_0}{4} = \frac{|v_1|}{r} \Rightarrow |v_1| = \frac{r}{4} v_0$$

$$l = \frac{4v_0}{r} + \frac{1r \times \frac{r}{4} v_0}{r} = 1r$$

$$rv_0 + \frac{1r}{4} v_0 = 1r \Rightarrow v_0 = 1 \text{ m/s}$$

$$v_1 = -1r \text{ m/s}$$

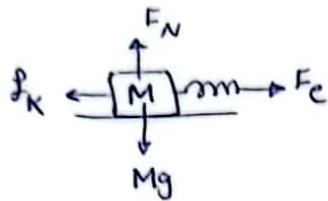


$$v_r = -v_1 = 1r \text{ m/s}$$

$$\frac{1r}{|v_{1r}|} = \frac{1}{1} \Rightarrow |v_{1r}| = 9.4$$

$$a_{av} = \frac{v_{1r} - v_r}{\Delta t} = \frac{-9.4 - 1r}{1} = -10.4 \text{ m/s}^2$$

$$kx = mg \rightarrow k = \frac{mg}{x} = \frac{mg}{l_0} \quad (1)$$



$$\begin{cases} F_N = Mg \\ F_c - f_k = \mu_k Mg \rightarrow kx' = \mu_k Mg \end{cases}$$

$$\xrightarrow{(1)} \frac{mg}{l_0} \times r = \mu_k \times Mg \rightarrow m = M$$

$$P = At^r + Bt + C \xrightarrow{t=0} C = 14$$

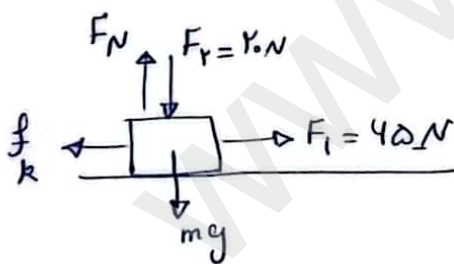
$$t_s = -\frac{B}{rA} \rightarrow r = -\frac{B}{rA} \rightarrow B = -4A \rightarrow P = At^r - 4At + 14$$

$$t=2 \rightarrow P=0 \rightarrow 8A - 8A + 14 = 0 \quad \boxed{A=2}, \quad \boxed{B=-12}$$

$$P = 2t^2 - 12t + 14 \quad \begin{cases} t_1 = 2s \rightarrow P_1 = 2 \times 4 - 24 + 14 = -2 \text{ kgm/s} \\ t_2 = 5s \rightarrow P_2 = 2 \times 25 - 60 + 14 = 4 \text{ kgm/s} \end{cases}$$

$$F = \frac{\Delta P}{\Delta t} = \frac{4 - (-2)}{5 - 2} = \frac{6}{3} = 2 \text{ N}$$

(عملکرد ثابت ندارد است)
باید فقط می شد نمودار سرعت است

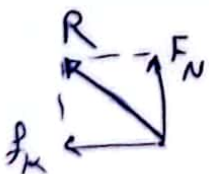


$$\begin{cases} F_N = F_r + mg = r_0 + 50 = v_0 \cdot N \\ F_1 - f_k = ma \rightarrow 40 - f_k = 5 \times 4 \\ f_k = 20 \text{ N} \end{cases}$$

$$v_0^2 - v_0^2 = 2a \Delta x$$

$$144 = 2a \times 12 \rightarrow a = 4 \text{ m/s}^2$$

$$R = \sqrt{F_N^2 + f_k^2} = \sqrt{v_0^2 + r_0^2} = 20\sqrt{5+1} = 20\sqrt{6}$$



① - 25

$$T = \frac{t}{n} = \frac{14}{1} = 14 \text{ s}$$

$$T = 2\pi \sqrt{\frac{l}{g}} \rightarrow 14 = 2\pi \sqrt{\frac{l}{9.8}} \rightarrow 7 = \sqrt{l} \rightarrow l = 49 \text{ m} = 4900 \text{ cm}$$

$$\frac{T_2}{T_1} = \sqrt{\frac{l_2}{l_1}} \rightarrow \frac{14}{14} = \sqrt{\frac{49}{49}} = 1 \rightarrow T_2 = 14 \text{ s}$$

$$T_2 = \frac{t_2}{n_2} \rightarrow 14 = \frac{14}{n_2} \rightarrow n_2 = 1$$

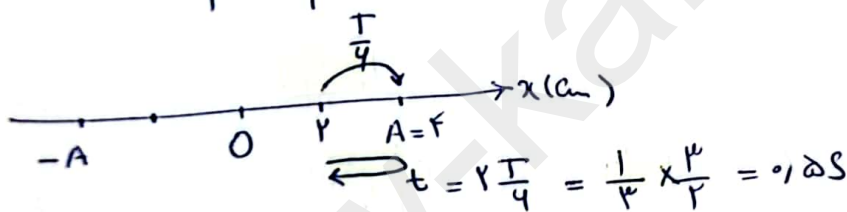
② - 24

$$v = \sqrt{\frac{FL}{m}} = \sqrt{\frac{F}{\rho A}} = \sqrt{\frac{100}{1000 \times 1 \times 10^{-4}}} = 100 \text{ m/s}$$

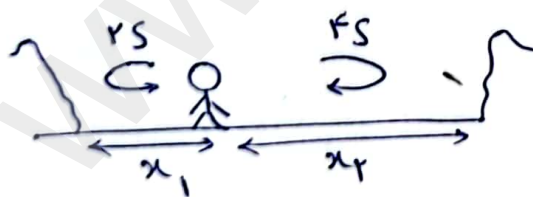
$$v = \lambda f \rightarrow \lambda = \frac{100}{100} = 1 \text{ m} = 100 \text{ cm} \rightarrow \text{طول موج} = \frac{\lambda}{f} = 1 \text{ cm}$$

① - 25

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{1} \rightarrow T = \frac{2}{\omega} \text{ s}$$



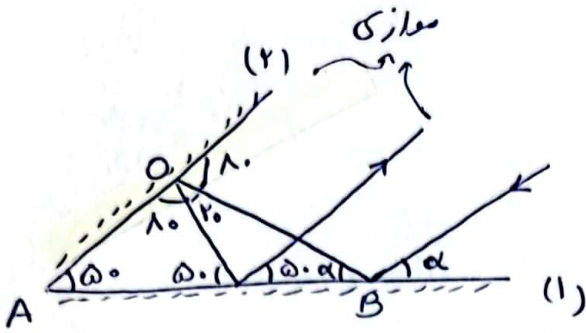
② - 26



حين تزدى سرعة التذبذب

$$\frac{x_1}{2} = \frac{x_2}{4} \rightarrow x_2 = 2x_1$$

$$x_1 + x_2 = 1.0 \rightarrow 3x_1 = 1.0 \rightarrow x_1 = \frac{1}{3} \text{ m}$$



$\Delta OAB \rightarrow \lambda_0 + \lambda_0 + \alpha + \alpha = 180 \rightarrow \alpha = 45^\circ$

مطابق نسب اریستی ۱ - ۴

۳ - ۴۱

کم انرژی ترین فوتون $n_u = 5 \rightarrow n_L = 4$

پرانرژی ترین فوتون $n_u = 2 \rightarrow n_L = 1$

- ۰.۵۴۴ eV $n = 5$
- ۰.۱۸۵ eV $n = 4$
- ۱.۵۱ eV $n = 3$
- ۳.۴ eV $n = 2$
- ۱۳.۴ eV $n = 1$

$\Delta E = hf = \frac{hc}{\lambda}$

$-0.544 + 0.185 = \frac{12E_0}{\lambda_1} \rightarrow \lambda_1 = 4.52, 2$

$-3.4 + 13.4 = \frac{12E_0}{\lambda_2} \rightarrow \lambda_2 = 121, 54$

$\lambda_1 - \lambda_2 = 4940, 48 \approx 4941 \text{ nm}$

۱ - ۴۲

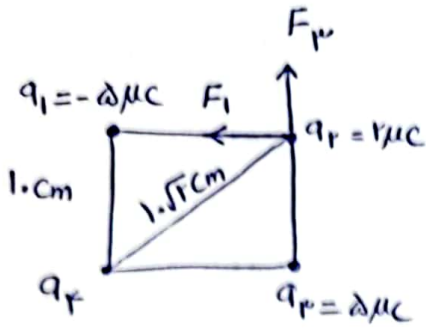
$Q_2 = \frac{r}{R} Q_1$

$\Delta u = r\omega \mu J \rightarrow \Delta u = \frac{1}{rC} (Q_2^2 - Q_1^2)$

$\Delta u = \frac{1}{\lambda_0} \left(\frac{\partial}{\partial F} Q_1^2 \right) \rightarrow r\omega = \frac{1}{\lambda_0} \times \frac{\partial}{\partial F} Q_1^2 \rightarrow Q_1^2 = 140$

$Q_1 = 11.8 \mu C$

(F) - 44



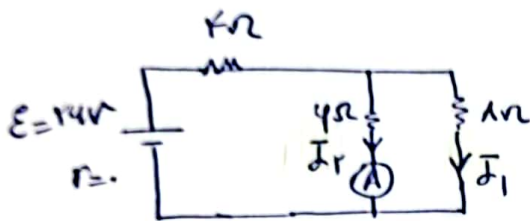
$$F_1 = \frac{q_1 \times q_2 q_3}{r^2} = \frac{q_1 \times \delta \times \delta}{1.0} = q_1 \delta \rightarrow \vec{F}_1 = -q_1 \vec{i}$$

$$F_f = F_1 = q_1 \delta \rightarrow \vec{F}_f = q_1 \vec{j}$$

$$\vec{F}_f + \vec{F}_1 + \vec{F}_p = -1 \delta \vec{i}$$

$$\vec{F}_f - q_1 \vec{i} + q_1 \vec{j} = -1 \delta \vec{i} \rightarrow \vec{F}_f = -q_1 \vec{i} - q_1 \vec{j} \rightarrow q_f < 0$$

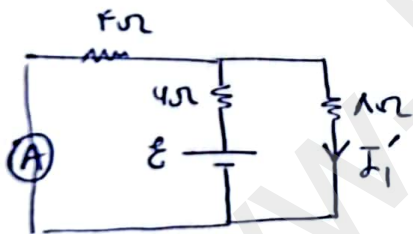
$$F_f = q \sqrt{2} \delta \rightarrow q \sqrt{2} = \frac{q_1 \times |q_f| \times \delta}{r_0} \rightarrow |q_f| = 1.0 \sqrt{2}$$



$$R_{eq} = 4 + \frac{4 \times 1}{1+4} = \frac{24}{5} \Omega$$

$$I = \frac{\epsilon}{R_{eq} + r} = \frac{14}{\frac{24}{5}} = 2.9 \text{ A}$$

$$I_1 = \frac{4}{1+4} I = \frac{4}{5} \times 2.9 = 2.32 \text{ A}$$



$$R'_{eq} = 4 + \frac{4 \times 1}{1+4} = \frac{24}{5} \Omega$$

$$I_1' = \frac{1}{1+4} I = \frac{1}{5} \times 2.9 = 0.58 \text{ A}$$

$$I_1' - I_1 = 0.58 - 2.32 = -1.74 \text{ A}$$

$$I_1' - I_1 = 1 - 1.74 = -0.74 \text{ A}$$

(4) - 45

3-45

$$P_1 = R_{eq} I^2 = R_{eq} \left(\frac{\mathcal{E}}{R_{eq} + r} \right)^2 \rightarrow P_1 = 0.48 P_2$$

$$P_2 = R'_2 \left(\frac{\mathcal{E}}{R'_{eq} + r} \right)^2$$

$$\frac{0.48 R'_{eq}}{(R'_{eq} + r)^2} = \frac{R_{eq}}{(R_{eq} + r)^2} \rightarrow R_{eq} = r + R_2$$

$$R'_{eq} = \frac{\mathcal{E} R_2}{r + R_2}$$

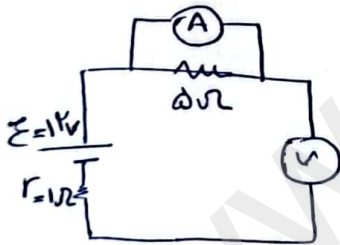
از جانبداری هر سه ها استفاده می‌کنیم

$$R_2 = 4 \Omega \rightarrow \left. \begin{array}{l} R_{eq} = 1 \Omega \\ R'_{eq} = 2 \Omega \end{array} \right\} \rightarrow \frac{0.48 \times 2}{14} = \frac{1}{100} \rightarrow \text{بقرار}$$

44-1 درصدهای اول :

$$I = \frac{\mathcal{E}}{r + R} = \frac{12}{4} = 3 \text{ A}$$

$$V = IR = 3 \times 0.5 = 1.5 \text{ V}$$



$$I' = 0$$

$$V' = \mathcal{E} = 12 \text{ V}$$

$$I' - I = -3 \text{ A}$$

$$V' - V = 12 - 1.5 = 10.5 \text{ V}$$

اختلاف تپانسی در هر مدار است که اهمی در این حالت صفر خواهد شد.

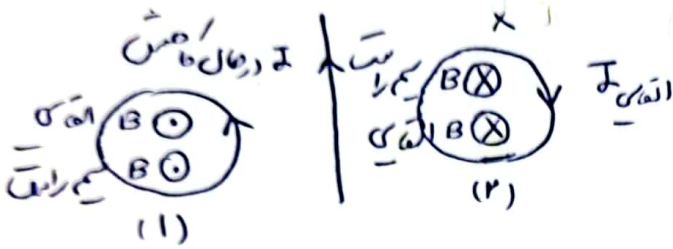
درصدهای دوم :

$$\mathcal{E} = -N \frac{\Delta \Phi}{\Delta t} = -N \Lambda \frac{\Delta B}{\Delta t} = -100 \times \Delta \times 10^{-4} \frac{0 - 100 \times 10^{-4}}{0.1}$$

(ف) - 47

$$\mathcal{E} = \Delta \times 100 \times 10^{-4} = 0.1 \text{ V}$$

(د) - 48



(ج) - 49

$$P = \left(\frac{mg}{A} \right)_{\text{air}} + \left(\frac{mg}{A} \right)_{\text{water}} + P_0$$

$$P_0 = \rho \Delta C m g = \rho \Delta \times 1340 = 1.2000 \text{ Pa}$$

$$P = \frac{(2.72 + \Delta 2.4) \times 10^{-3} \times 10}{2.0 \times 10^{-4}} + 1.2000 = 13.80 + 1.2000 = 1.5010 \text{ Pa}$$

(ف) - 50

مبلغ زمین مبدأ به مبدأ

$$W_{fD} = \bar{E}_r - E_1 = (U_r + K_r) - (U_1 + K_1)$$

$$W_{fD} = \frac{1}{2} m (v_r^2 - v_1^2) - mgh = \frac{1}{2} \times 0.2 (18^2 - 1^2) - 0.2 \times 10 \times 10$$

$$W_{fD} = 27.1 - 20 = -7.1 \text{ J}$$

(2) - VI

$$Q_{\text{ت}} + Q_{\text{س}} + Q_{\text{ن}} = 0 \quad \begin{matrix} Q = mc\Delta\theta \\ Q = C\Delta\theta \end{matrix}$$

$$1.5 \times 4.2 \times (1. - 1.5) + 2.1 \times (1.5 - 0) \times 1 + C(1. - 4.) = 0$$

$$2.1 \times 1.5 - 1.05 = C \rightarrow C = 2.1 \text{ J/K}$$

$$K = \frac{1}{2} m v^2 = \frac{1}{2} \times 1.6 \times 10^{-19} \times (1.5 \times 10^6)^2 = 1.8 \times 10^{-13} \text{ J} = 1.125 \text{ eV}$$

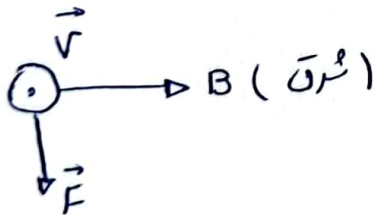
$$v = 1.5 \times 10^6 \text{ m/s} = 1.5 \times 10^6 \text{ m/s}$$

$$F = 1.8 \times 10^{-13} \text{ J} \rightarrow \Delta\theta = 1.8 \times 10^{-13} \text{ J} \rightarrow \theta = 1.0^\circ \text{ C}$$

$$T = \theta + 273 = 274 \text{ K}$$

$$Q = 1.4 \times 10^{-10} \text{ C} = 1.4 \times 10^{-10} \times 1.6 \times 10^{-19} \text{ C} = 2.24 \times 10^{-29} \text{ C}$$

(1) - Va



$$F_{\text{max}} = 1.9 \text{ V/B}$$

$$F \times 1.6 \times 10^{-19} = 1.4 \times 10^{-10} \times 1.6 \times 10^{-19} \times B$$

$$B = \frac{F \times 1.6 \times 10^{-19}}{1.4 \times 10^{-10}} = 1.14 \text{ T}$$