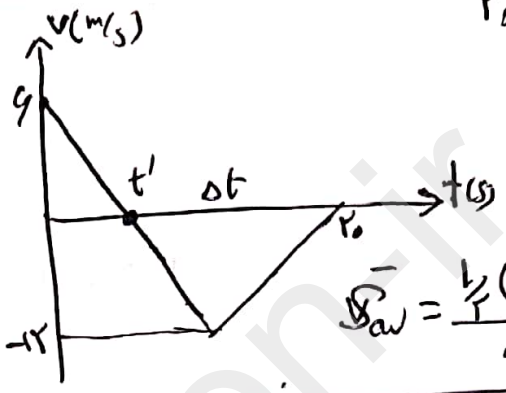
۱۵۶- گزینه ۱

گزینه الف صحیح.

گزینه ب صحیح

$^{A}_{Z}X \rightarrow {}^{0}_{+1}\beta^{-} + {}^{A}_{Z-1}Y$

۱۵۷- گزینه ۲



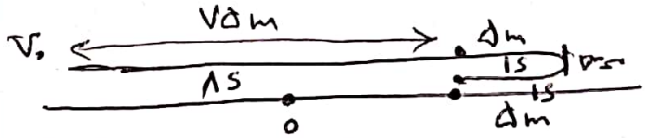
$\bar{v}_{av} = \frac{\frac{1}{2}(+12)\Delta t}{\Delta t} = +6$

۱۵۸- گزینه ۴

$t=0 \quad v_0>0$

$v_{av} = \frac{x_{10}-x_0}{10} \rightarrow x_{10}-x_0 = 75$

$L_{10}-L_0 = 8\Delta m$

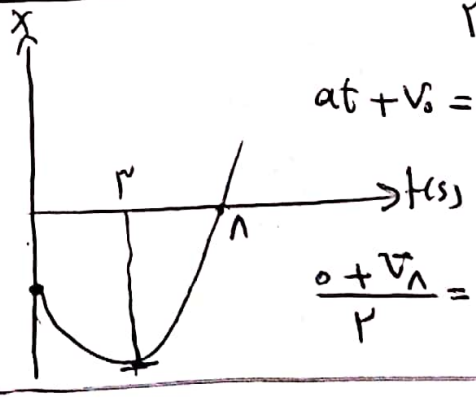


$\bar{v} = \frac{8}{8} = 1 m/s = \frac{0+v_0}{2} \rightarrow v_0 = 2 m/s$

$a = \frac{0-2}{8} = -0.5 m/s^2$

$v_0 - 5a + v_0 - 10a \rightarrow 2v_0 - 2a = 2(2) - 5 = 3m$

۱۵۹- گزینه ۳



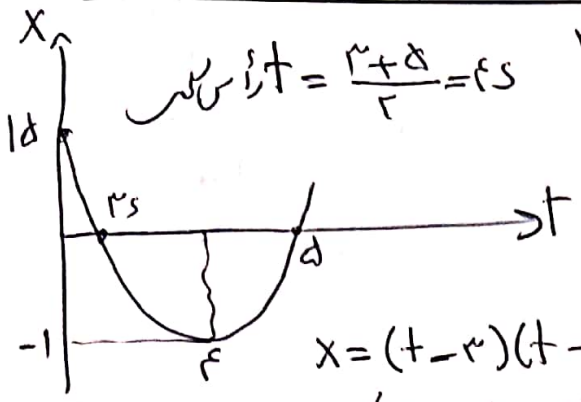
$at + v_0 = 0 \rightarrow \boxed{v_0 = -3a}$

$\frac{0+v_8}{2} = \frac{0-x_3}{5}$

$\frac{L}{\Delta n} = \frac{4.5a + 4.5a + 8a}{3.5a + 4.5a} = \frac{17a}{8a} = \frac{17}{8}$

$\boxed{\frac{\Delta n}{L} = \frac{8}{17}}$

۱۶۰- گزینه ۳



از راس سهمی $t = \frac{3+5}{2} = 4s$

$x = (t-3)(t-5)m$

$x = (t^2 - 8t + 15)m$

$-1 = x_4 = (16 - 8(4) + 15)m$

$\boxed{m=1}$

$v_{av} = \frac{L}{\Delta t} = \frac{17}{5}$

۱۶۱- ۳

$K_3 > K_2 > K_1$ تغییر ندارد

$30 = K_2(4) \rightarrow K_2 = 7.5$

$K_3 x_3 = K_2 x_2 = K_1 x_1$

طول فنر S_3 را کمتر از ۴ و تواند افزایش دهد

$x_3 < 4 \qquad x_1 > 4$

۱۶۲- گزینه ۴

$F_k = k\Delta x = 2 \times 5 \times 10 = 100 N$

$15 - 10 = 5a$

$a = 1 m/s^2$

$v_2 = 2 m/s$

$25a + 15a = 2a = 2m$

$\Delta x = \frac{v_2^2}{2a_{kg}} = \frac{4}{2 \times \frac{4}{5} \times 10} = 1m$

$\boxed{\Delta x_t = 3m}$

۱۴۳ـ گزینه ۴

$Kx_1 = m(g-a_1) \to x_1 = \frac{5(10-2)}{20} = 20cm$

$Kx_2 = m(g+a_2) \to x_2 = \frac{5(10+1)}{2} = 22.5$

$\Delta x = 2.5\ cm$

۱۴۴ـ گزینه ۱

$a = \omega^2 r = \frac{100\pi^2}{20} = 5\pi^2$

$10\pi = 20 \times \frac{2\pi}{T} \to T = 4s$

$\bar{a} = \frac{v\sqrt{2}}{1} = 10\pi\sqrt{2}$

$\frac{\bar{a}}{a} = \frac{10\pi\sqrt{2}}{5\pi^2} = \frac{2\sqrt{2}}{\pi}$

۱۴۵ـ گزینه ۲

$x_1 = 0.2\cos\frac{\pi}{2} \times \frac{1}{12}$ $\quad \frac{2\pi}{T} = \frac{\pi}{2} \to T = 4s$

$\Delta t = \frac{25}{12} - \frac{1}{12} = \frac{24}{12} = 2$

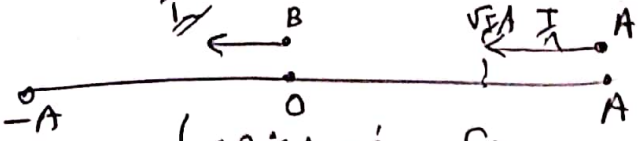
$\frac{\Delta t}{T} = \frac{1}{2}$ $\quad S_{av} = \frac{2A}{2} = \frac{2 \times 0.2}{2} = 2\ cm/s$

۱۴۶ـ گزینه ۳

$\frac{3\lambda}{2} = 30 \to \lambda = 20cm$

$T = \frac{\lambda}{v} = \frac{2/10}{10} = \frac{2}{100}s$

$\frac{\Delta t}{T} = \frac{9/4}{2/1} = \frac{9}{8} \to \Delta t = \frac{9}{8}T = T + \frac{T}{8}$



حرکت ذره A تندشونده است

۱۴۷ـ گزینه ۲

$\frac{T}{4} + \frac{T}{4} + \frac{T}{6} = \frac{2}{15} \to \frac{4T}{6} = \frac{4}{15}$

$T = 1/5\ s$ $\quad \omega = 10\pi$

$E = \frac{1}{2} m A^2 \omega^2 = \frac{1}{2} \times \frac{5}{100} \times \frac{16}{100} \times 100\pi^2$

$E = \frac{4}{100} = \frac{1}{25}$

۱۴۸ـ گزینه ۱

$\beta_2 - \beta_1 = 10 \log \frac{I_c}{I_1}$

$92 - 28 = 64 = \log \frac{I_c}{I_1}$

$V - 0.6 = \log \frac{I_c}{I_1} \to \log 10^V - 2\log 2 = \log \frac{I_c}{I_1}$

$\frac{10^V}{4} = \frac{I_c}{I_1} \to \frac{I_c}{I_1} = 2.5 \times 10^V = 6.5 \times 10^6$

۱۴۹ـ گزینه ۴

$f_1 + 2f_1 = 275 \to f_1 = 125$

$f_1 = \frac{v}{2L} = \frac{\sqrt{\frac{FL}{m}}}{2L = 2(\frac{4}{10})}$

$125 \times \frac{10}{10} = \sqrt{\frac{FL}{m}}$

$100gr = \frac{F \times \frac{4}{10}}{\frac{1}{100}}$

$F = \frac{1600}{4} = 250N$

۱۷۰ـ گ ۱

$\theta_1 = 60^\circ$

$\theta_2 = 90^\circ$

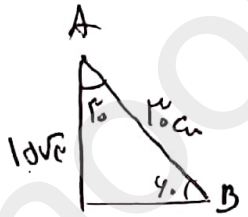
$\frac{\sin\theta_2}{\sin\theta_1} = \frac{\lambda_2}{\lambda_1} \rightarrow \frac{0.6}{0.8} = \boxed{\frac{\lambda_2}{\lambda_1} = \frac{3}{4}}$

$\lambda_2 = \frac{3}{4}\lambda_1$

$\lambda_1 - \frac{3}{4}\lambda_1 = \frac{1}{4}\lambda_1 = \frac{1}{20}\mu m \rightarrow \lambda_1 = 5\mu m$

$f = \frac{c}{\lambda} = \frac{3\times10^8}{\frac{1}{2}\times10^{-6}} = 6\times10^{14}\ Hz$

۱۷۱ـ گ ۳



$\Delta t = \frac{\Delta x}{v} = \frac{\frac{10}{30}\times10^{-2}}{\frac{3\times10^8}{\sqrt{2}}}$

$= \sqrt{2}\times10^{-1}\times10^{-8} = \sqrt{2}\ ns$

۱۷۲ـ گ ۲

$f_0 = \frac{5}{8}\times10^{15}\ Hz$

$\frac{1}{2}\times9\times10^{-31}\times v^2 = 4.25\times10^{-19} - 4\times10^{-19}$

$\frac{1}{2}\times9\times10^{-31}v^2 = 0.25\times10^{-19}$

$v^2 = \frac{0.25\times10^{-3}\times2}{9\times10^{-12}} = \frac{25}{9}\times10^{10}$

$v = \frac{5}{3}\times10^5\ m/s = \frac{10}{6}\times10^5 = \frac{1}{6}\times10^6$

۱۷۳ـ گ ۴

۱۷۴ـ گ ۲

$\frac{1}{\lambda} = R_H\left(\frac{1}{4}\right) \rightarrow \lambda = \frac{4}{R_H} = 400\ nm$

$\frac{1}{\lambda} = R_H\left(\frac{1}{4} - \frac{1}{9}\right) = \frac{1}{4}\times\frac{5}{36} \rightarrow \lambda = 720$

$720 - 400 = 320\ nm$

۱۷۵ـ گ ۱

$\Delta E = 12.6 - 2.4 = 10.2\ eV$

$10.2\times1.6\times10^{-19} = 16.32\times10^{-19}$

$= 1.632\times10^{-18}$

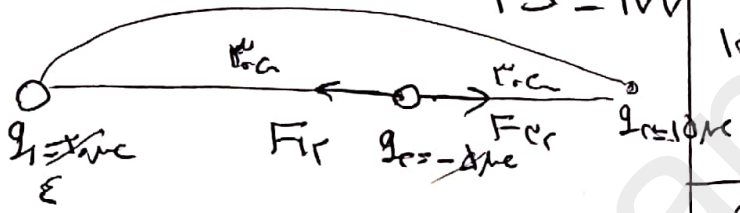
۱۷۶ـ گ ۳

$n = \frac{t}{T} = \frac{2.592}{0.720} = 4$

$m = \frac{m_0}{2^n} \Rightarrow \frac{m}{m_0} = \frac{1}{2^n} = \frac{1}{16}\times100\%$

$= 6.25\%$

۱۷۷ـ گ ۲

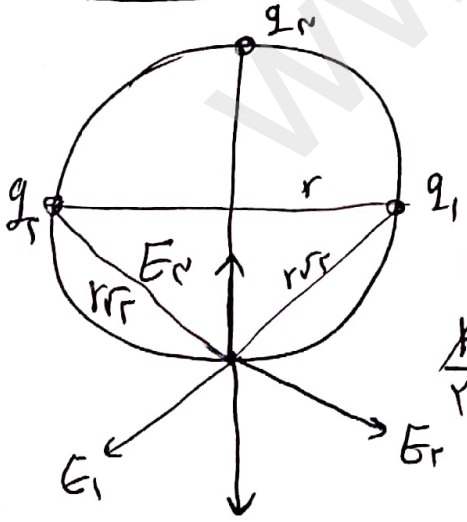


$F_{32} = \frac{9\times10\times5}{\frac{9}{10}} = 5N$

$F_{12} = \frac{9\times4\times5}{9} = 20N$

$F_T = 15N$

۱۷۸ـ گ ۲



$E_3 = E_1\sqrt{2}$

$\frac{kq_3}{2r^2} = \frac{kq_1\sqrt{2}}{r^2}$

$\frac{q_3}{q_1} = 2\sqrt{2}$

۱۷۹- ۴

$F = K\frac{q_1 q_2}{}$

$q'_1 = q'_2 = \frac{q_1 - q_2}{2}$

$\frac{\varepsilon F}{5F} = \frac{\left(\frac{q_1 - q_2}{2}\right)^2}{4 q_1 q_2}$

$16 q_1 q_2 = 5(q_1^2 + q_2^2 - 2q_1 q_2)$

$3.2 q_1 q_2 = q_1^2 + q_2^2 - 2q_1 q_2$

$q_2^2 + q_1^2 - 5.2 q_1 q_2 = 0$

۱۸۰- گ ۳

$\frac{q_A + q_B}{2} = \frac{20 + (-4)}{2} = 8\mu C = q'_A = q'_B$

$\frac{\delta_A}{\delta_B} = \frac{q'_A}{q_B} = \frac{8}{20} = \frac{1}{2.5} = \frac{2}{5} = 0.4$

$\Delta\delta = -60\%$

$\delta_A = \frac{20}{\frac{9\times10^9 \times 25 \times 10^{-4}}{10^{-2}}} = \frac{2000}{3}$

$\Delta\delta = -\frac{60}{100} \times \frac{2000}{3} = -400$

۱۸۱- گ ۱

لیزر سبز / میکروسکوپ

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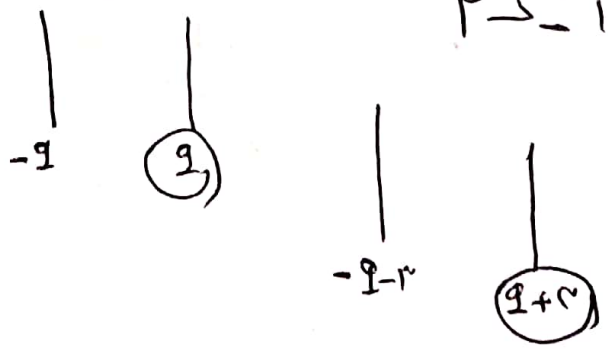
۱۸۲- گ ۲



$\Delta U = \frac{1}{2C}\left[(q+5)^2 - q^2\right]$

$\underbrace{4 \times 5 \times 2 \times 5}_{40} = 6q + 9 \rightarrow 36 = 6q$

$q = 6\mu C$

۱۸۳- گ ۱

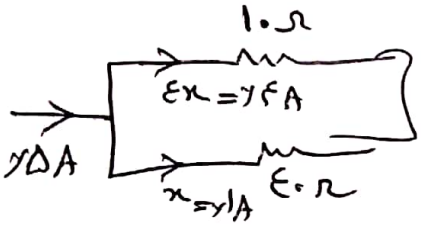
$3 + 1I = 3.5$

$I = 0.5A$

ضد موازی

$I = \frac{5}{2 + 0.8R} = \frac{1}{2}$

$10 - 2 = 0.8R \rightarrow R = 10\Omega$

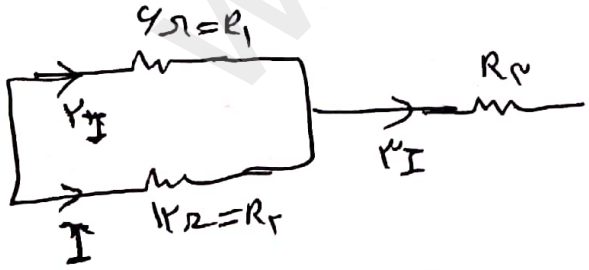


$P = 10(0.4)^2 = 1.6W$

۱۸۴- گ ۲

لامپ با صرف مقاومت و لامپ ۲ با صرف ۷۲ موازی هستند

۱۸۵- گ ۳



$R_3(3I)^2 = 6 \times 12 I^2$

$R_3 \times 9 I^2 = 72 \times 12 I^2$

$R_3 = 8\Omega$

۱۸۶ - گ ۴

$R=0 \longrightarrow$ اتصال کوتاه $\longrightarrow$ صرف نظر

$V=0$

$I_2=\frac{12}{4.5+1.5}=2A \quad V=12-2(1.0)=9V$

۱۸۷ - گ ۱

$F=ma=qVB \quad B=\frac{ma}{qV}=\frac{9.8\times10^{-30}\times4\times10^{3}}{2\times1.6\times10^{-19}\times5}\,G$

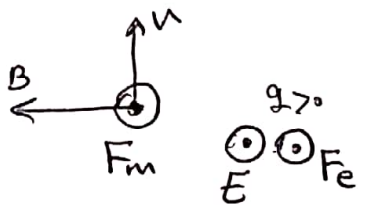
$B=1.7\,G$

۱۸۸ - ۴

$I_1>I_2$

هم می‌کند.

۱۸۹ - گ ۱



$F_e+F_m=F_{max}$

۱۹۰ - ۴

$I\uparrow$ لحظه وصل کلید

$I\uparrow$

$\leftarrow R$

۱۹۱ - گ ۲

$\frac{B_A}{B_B}=1$

$\frac{d_2}{d_1}=\left(\frac{N_2}{N_1}\right)^2\times\frac{L_1}{L_2}=4\times\frac{1}{2}=2$

۱۹۲ - گ ۴

$W_{mg}=-mgh=-60\times10^{3}\times10\times600$

$=-36\times10^{7}=-3.6\times10^{10}$

$E_2-E_1=(K_2+U_2)-(K_1+U_1)$

$=\frac{1}{2}(60\times10^{3})((140)^2+\frac{10\times600}{6000}-(10)^2)$

$=6\times10^{4}(19600+600-400)$

$=6\times10^{4}\times15600=9.36\times10^{8}$

۱۹۳ - گ ۱

$P_g+\rho_1 g\frac{5}{10}=P_0+\rho_2 g\times\frac{9}{10}$

$P_g-P_0=1000\times10\times\frac{9}{10}-1200\times10\times\frac{9}{2}$

$=9000-9000=0\,Pa$

۱۹۴ - ۳

$100000=P_0+\rho g(5)$

$104000=P_0+\rho g(26)$

$4000=\rho g(15)\rightarrow \rho g(10)=2000$

$P_0=98000\,Pa=98\,kPa$

۱۹۵ـ ۴

$\Delta Q = 1.8\Delta\theta \rightarrow \Delta\theta = \frac{50}{1.8} = 28$

یخ صفر → آب صفر → آب ۱۰°C

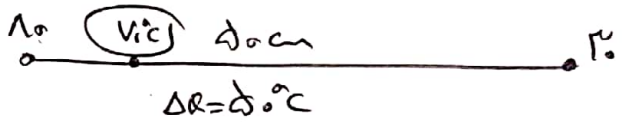
$50 = 1.8\theta + 18 \rightarrow 18 = 1.8\theta \rightarrow \theta = 10°C$

$mL_f + mC(10) = 90mc$

$Q = 90 \times \frac{2}{100} \times 4200 = 7560$

۱۹۶ـ ۲

$\frac{Q}{t} = \frac{KA\Delta\theta}{L} = \frac{400 \times 5 \times 10^{-2} \times 50}{50 \times 10^{-2}} = 20 \frac{J}{s}$



10cm $10°C = \Delta\theta$

۱۹۷ـ ۳

$k = \frac{T_C}{T_H - T_C} = \frac{300}{100} = 3$

۱۹۸ـ ۱

$V_1 \rightarrow V_2$

$V\downarrow \rightarrow T\uparrow \rightarrow P\uparrow \rightarrow U\uparrow \rightarrow W > 0$

۱۹۹ـ ۳

$P_1 = 150000 \qquad U_1 = 600\,J$

$P_2 = 200000 \qquad V_2 = 2V_1$

$\frac{T_2}{T_1} = \frac{P_2}{P_1} \times \frac{V_2}{V_1} = \frac{4}{3} \times 2 = \frac{U_2}{U_1}$

$\frac{8}{3} = \frac{U_2}{600} \rightarrow U_2 = 1600\,J$

۲۰۰ـ ۳

$\Delta U_{AC} = Q_{AC} + W_{AC}$

1000

$\Delta U = P(\Delta V) = 1000$

$10^5 \times \Delta V \times 10^{-3} \times \frac{5}{2} = 1000 \rightarrow \Delta V = 4\,lit$

$V_2 = 7\,lit$

$Q_{ABC} + W_{ABC} = 1000 \rightarrow Q_{ABC} = 1600\,J$

-600

$W_{AB} + |W_{BC}| = (\frac{2+1}{2}) 4 \times 10 = 600$