۲۰۶ـ گزینه (۲)

$\Delta V = (3\alpha) V_0 \Delta\theta$

$\Rightarrow \frac{\Delta V}{V_0} = 3\times10^{-5}\times100 = 0.03 \Rightarrow \Delta V = 0.03\, V_0$

۲۰۷ـ گزینه (۳)

$mQ_{L_f} + 0.400\times420(0-0) + 0.2\times840(0-100) = 0$

$\Rightarrow m\,336000 + 8400 - 2\times840 = 0 \quad m = \frac{840}{336000} = 0.025\,kg = 25\,gr$

۲۰۸ـ گزینه (۴)

$\vec V = 10\hat i - 20t\hat j \Rightarrow \vec r = 10t\hat i - 10t^2\hat j$

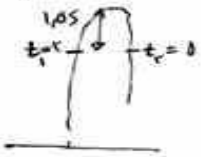
$\Rightarrow \vec r(0) = 0 \Rightarrow \vec r(2) = 30\hat i - 40\hat j \Rightarrow |r| = \sqrt{900+1600} = 50$

۲۰۹ـ گزینه (۳)

$V_{10} = at + \cancel{V_0} = -2\times10 = -20 \qquad V_{25} = at + V_{20} = 2\times15 - 20 = 10$

$V_{20} = \cancel{at} + V_{10} = -20$

۲۱۰ـ گزینه (۲)



$t_{\text{بالا}} = \frac{V_0}{g} \Rightarrow \boxed{V_0 = 25\,s}$

$\Delta y = -\frac{1}{2}gt^2 + V_0 t = -\frac{1}{2}\times10\times2^2 + 25\times2 = 90$

$V = \frac{\Delta y}{\Delta t} = \frac{50}{5} = 10\ m/s$

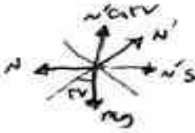
۲۱۱ـ گزینه (۳)

$\omega = \pi t + \frac{3}{2}\pi$

$\omega = \alpha t + \omega_0 \Rightarrow \begin{cases}\alpha = \pi \\ \omega_0 = \frac{3}{2}\pi\end{cases}$

$\Delta\theta = \frac{1}{2}\alpha t^2 + \omega_0 t \Rightarrow 2\pi = \frac{1}{2}\pi t^2 + \frac{3}{2}\pi t \Rightarrow 4 = t^2 + 3t \Rightarrow t = \begin{cases}-4 \times \\ 1 \checkmark\end{cases}$

۲۱۲ـ گزینه (۱)



$N'\cos37 = mg$

$N' = 400\times\frac{10}{8} = 500$

$N'\sin37 = N \Rightarrow N = 500\times\frac{6}{10} = 300$

۲۱۳ـ گزینه (۴)

حالت اول $f_k - mg\sin\alpha = 0 \Rightarrow \boxed{\mu_k = \tan\alpha}$

$a = g\sin\alpha + \mu_k g\cos\alpha = g(\sin\alpha + \sin\alpha) = 2g\sin\alpha$

$\cancel{V} = at + V_0 \Rightarrow t = \frac{V_0}{a} = \frac{V_0}{2g\sin\alpha}$

۲۱۴ـ گزینه ۱

$E_1 = K_1 + U_1 = \frac{1}{2}kx^2 = \frac{1}{2}\times 4\times\frac{1}{10} = 2J$

$E_2 = K_2 + U_2 = \frac{1}{2}mv^2 = \frac{1}{2}\times\frac{1}{2}\times v^2 = \frac{1}{4}v^2$

$E_1 = E_2 \Rightarrow 2 = \frac{1}{4}v^2 \Rightarrow \boxed{v = 2\sqrt{2}}$

۲۱۵ـ گزینه ۱

$1 = \frac{Q_A}{Q_B} = \frac{C_A \times 5}{2C_B \times 3} \Rightarrow C_A = \frac{2}{5}C_B = 0.4C_B$

۲۱۶ـ گزینه ۲

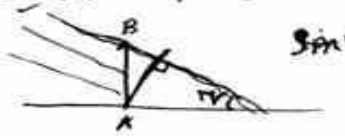
$P_A = \rho_{آب} gh + P_{هوا} = 1000\times 10\times 2 + P_{هوا} = 20000 + P_{هوا}$

$P_0 = P_{هوا} + \rho_{جیوه} hg \Rightarrow 10^5 = P_{هوا} + 13600\times 10\times\frac{10}{100}$

$\Rightarrow P_{هوا} = 10^5 - 2000 \Rightarrow P_A = 20000 + 100000 - 2000 = 118000 = 118.4\,kPa$

۲۱۷ـ گزینه ۴

بلندترین طول سایه مربوط به وقتی است که سیم با سطح زمین بنابراین



گزینه ۱

$\sin 37 = \frac{\text{ارتفاع}}{\text{سایه}} \Rightarrow \text{سایه} = \frac{\text{ارتفاع}}{\sin 37} = \frac{0.6}{0.6} = 1\,m = 100\,cm$

۲۱۸ـ گزینه ۴

$f = \frac{1}{D} = \frac{1}{5} = 0.2\,m \qquad m = \frac{8}{2} = 4$

$\frac{1}{p} + \frac{1}{q} = \frac{1}{f} \Rightarrow \frac{1}{p} + \frac{1}{4p} = \frac{1}{20} \Rightarrow \frac{5}{4p} = \frac{1}{20} \Rightarrow \boxed{p = 25}$

$\Rightarrow q = 4p = 100 \qquad q + p = 125$

۲۱۹ـ گزینه ۳

$m = 5 \qquad q - p = 48 \qquad 5p - p = 48 \Rightarrow \boxed{p = 12}$

$q = 60$

$\frac{1}{p} + \frac{1}{q} = \frac{1}{f} \quad \text{یا} \quad f = \frac{m}{m+1}p = \frac{5}{6}\times 12 = 10$

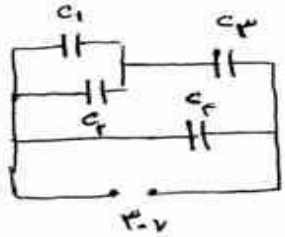
۲۲۰ـ گزینه ۴

$E_1 = E_2 \Rightarrow \frac{1}{d_1^2} = \frac{4}{(r-d_1)^2} \Rightarrow 2d_1 = r - d_1 \Rightarrow \boxed{d_1 = \frac{r}{3}}$

$E_1' = E_2' \Rightarrow \frac{1}{(r-d_2)^2} = \frac{4}{d_2^2} \Rightarrow d_2 = 2(r - d_2) \Rightarrow 3d_2 = 2r \Rightarrow d_2 = \frac{2}{3}r$

$\Rightarrow \frac{d_2}{d_1} = \frac{\frac{2}{3}r}{\frac{r}{3}} = 2$

۲۲۱ـ گزینه (۳)



$C_{12} = 12$

$\begin{cases} C_{123} = \frac{12\times 6}{18} = 4 \\ C_4 = 2 \end{cases}$

با کل در خازن C_1 و C_{123} به نسبت ظرفیت‌ها تقسیم می‌شود.

$C_{\text{معادل}} = \frac{8}{6}$

$\Rightarrow q = CV = \frac{8}{6}\times 30 = 40\,\mu C$

۲۲۲ـ گزینه (۱)

$P = Ri^2 \Rightarrow \frac{R_1 \cancel{\varepsilon^2}}{(R_1+r)^2} = \frac{R_2 \cancel{\varepsilon^2}}{(R_2+r)^2} \Rightarrow R_1(R_2+r)^2 = R_2(R_1+r)^2$

$\Rightarrow R_1R_2^2 + R_1r^2 + \cancel{2R_1R_2r} = R_2R_1^2 + R_2r^2 + \cancel{2R_1R_2r}$

$\Rightarrow r^2(R_2-R_1) = R_1R_2(R_2-R_1) \Rightarrow \boxed{r=\sqrt{R_1R_2}}$

۲۲۳ـ گزینه (۴)

۲۲۴ـ گزینه (۲)

$R_2\uparrow \longrightarrow R_{\text{معادل}}\updownarrow \quad R_{\text{معادل}} = R_1 + \frac{R_2R_3}{R_2+R_3} \Rightarrow$

$\downarrow i_{\text{کل}} = \frac{V}{R_{\text{معادل}}} \longrightarrow V_1 = i_{\text{کل}}R_1\downarrow \longrightarrow V_2\uparrow$

۲۲۵ـ گزینه (۱)

۲۲۶ـ گزینه (۳)

$\varepsilon = -\frac{\Delta\Phi}{\Delta t} \Rightarrow \varepsilon_{\text{شیب نمودار}} = \frac{2-0}{1-3} = -1$

۲۲۷ـ گزینه (۱)

$K = 0.16 - 400x^2 \qquad v^2 = \omega^2(A^2-x^2)$

$K = \frac{1}{2}mv^2 = \frac{1}{2}m\omega^2(A^2-x^2) = 0.16 - 400x^2 \Rightarrow \frac{1}{2}m\omega^2 = 400$

از طرفی $\frac{1}{2}m\omega^2A^2 = 0.16 \Rightarrow A^2 = \frac{0.16}{400} =$

$\Rightarrow A = \frac{0.4}{20} = \frac{4}{200} = \frac{2}{100}\,m = 2\,cm$

۲۲۸ـ گزینه (۳)

$V_{max} = A\omega = 0.06\,\frac{2\pi}{T} = 0.06\times\frac{2\pi}{0.48} = \frac{3}{4}$

$\frac{T}{12} = 0.04 \Rightarrow T = 0.48$

۲۲۹ـ گزینه (۳)

$L = \frac{3}{2}\lambda \Rightarrow \lambda = \frac{2}{3}L = \frac{2}{3}\times\frac{6}{10} = 0.4\,m$

$f = \frac{v}{\lambda} = \frac{240}{4/10} = \frac{2400}{4} = 600$

۲۳۰- گزینه ۴

$v = \frac{\omega}{k} \Rightarrow \omega = 100\pi/2$

$\Delta\phi = k\Delta x \Rightarrow k = \frac{100\pi}{2}$

$a_M = 0.4\,\omega^2 \sin(\omega t + \frac{\pi}{4})$

$a_N = 0.4\,\omega^2 \sin(\omega t + \frac{5\pi}{2})$

$\Rightarrow \frac{a_M}{a_N} = \frac{\sin(\frac{100\pi}{2}\times\frac{1}{100} + \frac{\pi}{4})}{\sin(\frac{100\pi}{2}\times\frac{1}{100} + \frac{5\pi}{2})} = \frac{\sin(\frac{\pi}{2})}{\sin(\frac{11\pi}{4})} = \frac{\sqrt{2}/2}{1/2} = \sqrt{2}$

۲۳۱- گزینه ۴

$\Delta\beta = -40 = 10\log\frac{I_2}{I_1} \Rightarrow -4 = \log\left(\frac{1/r_2^2}{1/r_1^2}\right) = \log\left(\frac{100}{r_2^2}\right)$

$\Rightarrow 10^{-4} = \frac{100}{r_2^2} \Rightarrow r_2^2 = \frac{100}{10^{-4}} \Rightarrow r_2 = 1000$

۲۳۲- گزینه ۱

$x_5 = (2\times5-1)\frac{\lambda D}{2a}$ $\quad x_4 = 8\frac{\lambda_2 D}{2a}$

$x_5 = x_4 \Rightarrow 9\frac{\lambda_1 D}{2a} = 8\frac{\lambda_2 D}{2a} \Rightarrow \lambda_2 = \frac{9}{8}\lambda_1 = \frac{9}{8}\frac{c}{f_1}$

$\Rightarrow \frac{c}{f_2} = \frac{9}{8}\frac{c}{f_1} \Rightarrow f_2 = \frac{8}{9}f_1 = \frac{8}{9}\times 2.5\times10^{14} = \frac{20}{9}\times10^{14} = \frac{2}{9}\times10^{15}$

۲۳۳- گزینه ۲

$hf = hf_0 + K_{max} \Rightarrow 3.5\times10^{15}\times4\times10^{-15} = hf_0 + 12.8\times10^{-19}\times\frac{1}{1.6\times10^{-19}}$

$\Rightarrow hf_0 = 10 - 8 = 2eV$

$hf = hf_0 + eV_0 \Rightarrow 8\times10^{14}\times4\times10^{-15} = 2 + eV_0 \Rightarrow eV_0 = 3.2 - 2 = 1.2\,V$

۲۳۴- گزینه ۴

$E_n = \frac{E_R}{n^2} = 0.85$ $\quad E_{n+1} = \frac{E_R}{(n+1)^2} = \frac{13.6}{(5)^2} = \frac{13.6}{25} = 0.544$

$\Rightarrow n = \left(\frac{E_R}{0.85}\right)^{1/2} = \left(\frac{13.6}{0.85}\right)^{1/2} = 4$

$\Rightarrow \Delta E = 0.85 - 0.544 = 0.306$

۲۳۵- گزینه ۲