

« به نام خداوند رزقین کسان »

پاسخنامه آزمون دوحله یک دوره 36

الپیاد فنییک (1401 - 1402)

کد ۱

دانش پژوهان الپیاد فنییک

دبیرستان بعثت مشهد

سعید خیابانی

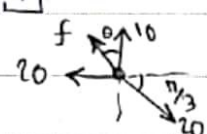
امین محمدزاده

پارسا الپوری

1- 1) $t=0 \rightarrow r > 0, v < 0$
 $E = \frac{1}{2}kr^2 + \frac{1}{2}mv^2 = Cte \rightarrow$ معادله بیضی
 در وقت $r \uparrow \rightarrow v \downarrow$

2- 2) $\omega = \frac{v}{R} \rightarrow R_B < R_A \rightarrow a_B > a_A$

3- 3) $20 = 10 \log \frac{I_A}{I_0} \rightarrow \frac{20}{10} = \log \frac{I_A}{I_0} \rightarrow I \sim r^{-2} \rightarrow \frac{20}{10} = \log \cos^2 30$
 $r = 10 \log \frac{I_B}{I_0} \rightarrow \frac{20}{10} = \log 3 - 2 \log 2 \rightarrow r = 18,8 \text{ dB}$

4- 4)  $\begin{cases} 20 \sin \frac{\pi}{3} = f \cos \theta + 10 \\ 20 \cos \frac{\pi}{3} = f \sin \theta + 20 \end{cases} \rightarrow f = 10\sqrt{5-2\sqrt{3}} \text{ N}$

5- 2) $\rho_{\text{galaxy}} = \frac{\pi \times 10^{11} \times (2 \times 10^{30})}{\pi (\frac{4}{3} \pi (3,1 \times 10^{17})^3) \times 10^9} \sim 10^{-26}$

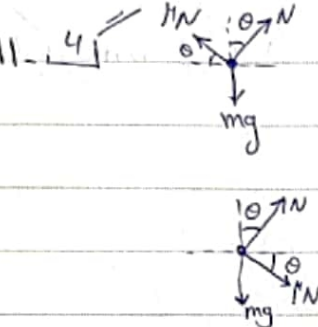
6- 4) $F \sim rv^2 = \frac{v^2}{r} \rightarrow \frac{F_2}{F_1} = \frac{v_1^2 r_1}{v_2^2 r_2} = (\frac{r_1}{r_2})^3$
 $v_1 r_1 = v_2 r_2$

7- 4) $\vec{F} = I \vec{l} \times \vec{B} \rightarrow$ قانون راست دست \rightarrow نیرو و گشتاور را تعیین می کنند

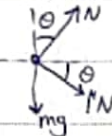
8- 3) $S = (\frac{\pi r^2}{3} (ax(a \sin 60)) \times r) \times 2 + \frac{a^2 \sin 60}{2} \times r = 4,9 \text{ P.V.}$
 $a = r$

9- 1) $W_1 = W_2, Q = W_1 + \Delta U_1, Q' = W_2 + \Delta U_2 \rightarrow Q' - Q = \Delta U_1 - \Delta U_2$
 $\rightarrow \Delta Q = \frac{5}{2} (2 \times 110 - 904) - 1 \times (3 - 0,04) = 10 \text{ J}$

10- 4) $2^{-\frac{2}{6}}$ بعد 2 روز \rightarrow $2^{-\frac{2}{6}} \times 2^{-\frac{2}{2}}$ بعد 6 روز $\rightarrow \frac{1}{16}$
 $2^{-\frac{2}{2}}$ بعد 2 روز $\rightarrow 1 - \frac{1}{16} = \frac{15}{16}$

11. 4) 

$$\left. \begin{aligned} N \sin \theta - N \cos \theta &= m R \omega_1^2 \\ N \cos \theta + N \sin \theta &= mg \end{aligned} \right\} \rightarrow \left(\frac{\omega_2}{\omega_1}\right)^2 = \frac{(\tan \theta + 1)(1 + \tan \theta)}{(\tan \theta - 1)(1 - \tan \theta)}$$



$$\left. \begin{aligned} N \sin \theta + N \cos \theta &= m R \omega_2^2 \\ N \cos \theta - N \sin \theta &= mg \end{aligned} \right\}$$

12. 1) $\frac{C_1}{C_2} = 2$
 $C = \alpha \sqrt{\frac{T}{\lambda}}$
 $T_1 = \frac{Mg}{2}, T_2 = \frac{(m+\Delta m)g}{2}$

$$\left. \right\} \rightarrow \left(\frac{C_1}{C_2}\right)^2 = \frac{T_1}{T_2} = 4 \rightarrow \frac{T_1}{T_2} = \frac{M}{\Delta m + m} = 4$$

$$\rightarrow \Delta m = -\frac{3}{4}M$$

13. 4) $k = \frac{n^2}{(10^3)^2 \times 10^2} \rightarrow n = 3 \times 10^9 \rightarrow C = n(e\hbar u) \rightarrow n = 3 \times 10^9$

14. 3) $\vec{F} = q\vec{v} \times \vec{B}$ و سرعت ثابت است \rightarrow نیروی عمودی و ثابت است و مسیر دایره‌ای می‌شود

15. 3) $\Delta t = \frac{2V}{g}$
 $\Delta t = (N-1)T$

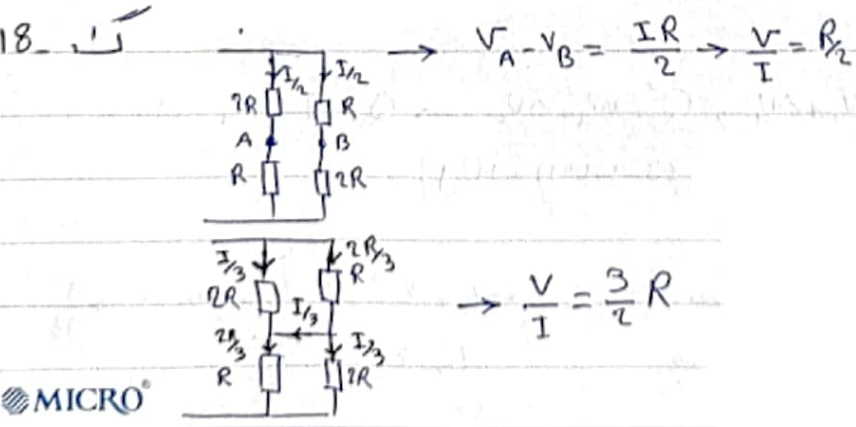
$$\left. \right\} \rightarrow V = \frac{1}{2}g(N-1)T$$

$$\rightarrow W = \frac{1}{2}mv^2 = \frac{1}{4}mg(N-1)^2T^2 \rightarrow P = \frac{1}{4}mg(N-1)^2T \rightarrow P \sim (N-1)^2T$$

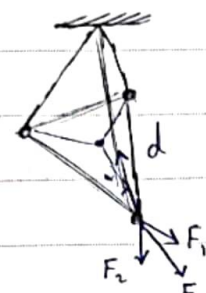
16. 2) $\Delta K = 0 \rightarrow 0 = -(\pi R^2 h)(\rho g h) + \int_0^h g \pi R^2 (h-z) \rho dz + w$

$$\rightarrow w = \frac{1}{2} \pi R^2 h^2 \rho g$$

17. 3) $E = mc^2 \rightarrow \frac{dE}{dt} = P = \dot{m}c^2 \rightarrow Qn = \dot{m}c^2 \rightarrow N = \dot{m}n \rightarrow N = 2 \times 10^{38}$

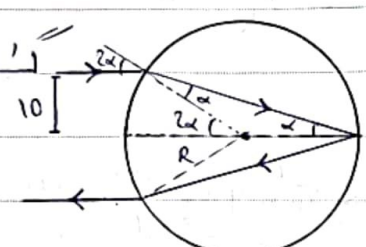


19- $E = kq \left[\left(r - \frac{d}{2} \right)^{-2} - \left(r + \frac{d}{2} \right)^{-2} \right] = \frac{2kq^2}{r^3} \rightarrow E = 2 \times 10^{-25}$

20-  $\vec{F} = \vec{F}_1 + \vec{F}_2 \rightarrow F = \frac{kq^2}{d^2} \sqrt{3}$

$$\left. \begin{aligned} T \sin \alpha &= mg \\ T \cos \alpha &= \frac{kq^2}{d^2} \sqrt{3} \end{aligned} \right\} \rightarrow q^2 = \frac{mgd^3}{k(9d^2 - 3d^2)^{1/2}}$$

21- $\frac{\Delta P}{\Delta h} = -\rho g \rightarrow \text{نسبت در دو نقطه} \rightarrow \frac{P_1}{P_2} = 4$

22-  $\left. \begin{aligned} \sin 2\alpha &= n \sin \alpha \\ R \sin 2\alpha &= 10 \text{ cm} \end{aligned} \right\} \alpha = \frac{\pi}{12} \rightarrow n = 2 \cos\left(\frac{\pi}{12}\right)$

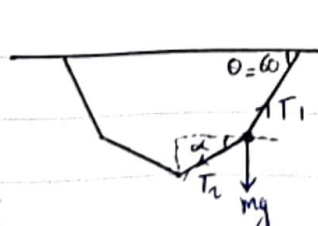
23- از آنجایی که سرعت در t های کوچک با کوچک است پس نیروی مقاومست هوا قابل اغماض می شود. پس در t های کوچک $v = gt$ می شود و در t های بزرگ به سرعت حریص می کند

1Pk- $\left. \begin{aligned} T &= \sqrt{\frac{2h_1}{g}} + \frac{h_1}{300} \\ \frac{h_1}{n_2} &= 0,95 \\ T &= \sqrt{\frac{2h_2}{g}} \end{aligned} \right\} \rightarrow T = \sqrt{\frac{2h_1}{g}} \sqrt{1 + \frac{5}{75}} \rightarrow \sqrt{h_1} = 3,9 \rightarrow h_1 \approx \boxed{15m}$

2Pk- $I_{max} \rightarrow v_{max} \rightarrow v_{\rightarrow} \rightarrow \Sigma F = 0 \rightarrow I l B = mg \rightarrow m = \boxed{15gr}$

3Pk- $\frac{3\pi}{2} = n \left(\frac{2\pi}{60 \text{ day}} - \frac{2\pi}{360 \text{ day}} \right) \rightarrow n = 18 \times 3 = \boxed{54 \text{ day}}$

4Pk- $P_1 V_1 = P V \rightarrow 0 = h^2 + 76h - 76 \times 56 \rightarrow h = \frac{76}{2} = \boxed{38cm}$

5Pk-  $\left. \begin{aligned} 2T \sin \alpha &= mg \rightarrow \alpha = 30^\circ \\ T_1 \cos \theta &= T_2 \cos \alpha \rightarrow 2l \cos \alpha + 2l \cos \theta = 50 \text{ cm} \\ T_1 \sin \theta &= T_2 \sin \alpha + mg \rightarrow l = 18 \text{ cm} \rightarrow L = 18 \times 4 = \boxed{72cm} \end{aligned} \right\}$

$$6Pk. \quad \left. \begin{aligned} P_0 V_0 &= P V \\ P &= P_0 + h \rho g \\ m g + m' g &= (V + V') \rho g \end{aligned} \right\} \rightarrow h = \frac{\rho_0}{\rho g} \left(\frac{V \rho_0}{m + m' - V \rho_0} - 1 \right) = \boxed{14 \text{ cm}}$$

$$7Pk. \quad F = \left(50 \times \frac{10^3}{18} \times 6 \times 10^{23} \times 10 \times 1,6 \times 10^{-19} \right)^2 \times 9 \times 10^9 \times 10^{-4} = 6,4 \times 10^{24}$$

$$\rightarrow \text{طبق تعریف سوال} \rightarrow 0,64 \times 10^{25} \rightarrow n = \boxed{25}$$

$$8Pk. \quad bh = \text{قبل برخورد}$$

$$ah = \text{بعد از برخورد}$$

$$v = \text{سرعت در آیزین نقطه}$$

$$v_{ah} = \frac{1}{2} v_{bh}$$

$$m g h_1 = m g h_2 + \frac{1}{2} m v_{bh}^2$$

$$\rightarrow m g h_2 + \frac{1}{2} m v_{bh}^2 \times 2 = \frac{1}{2} m v_{ah}^2 \rightarrow v^2 = g \frac{h_1 + h_2}{2} \rightarrow H_{\text{Jerry}} = \frac{5h_2 + h_1}{4} = \boxed{18 \text{ dm}}$$