

دبیرستان فرزانهان 5 (فناح) مسعود -

باستقامت المباد فرزند دوره 36 (کد 1)

سحر سادات داودی

مهسا آگاه

آندرانس آموز

آناز ظریف نراد

فاطمه میرکار

هللا موسوی معام

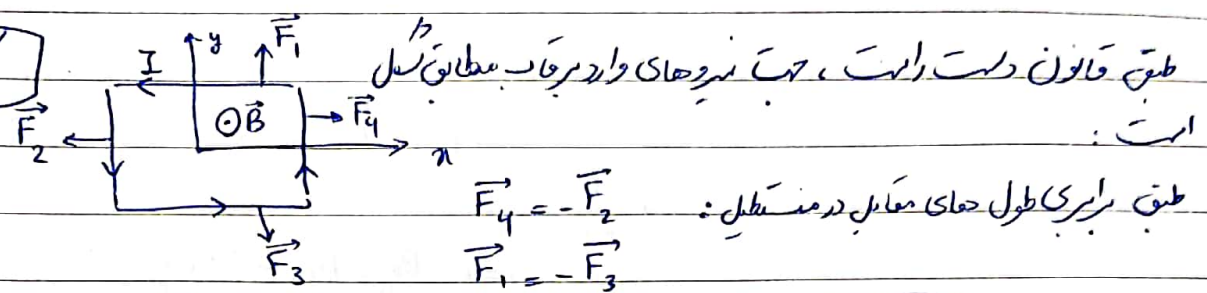
زهرا روزی

6: 4 نمره

$$T = \frac{mV^2}{v} \quad v \propto \sqrt{rT} \quad vr = cte \rightarrow r_1^{3/2} T_1^{1/2} = r_2^{3/2} T_2^{1/2}$$

$$\Rightarrow \frac{T_2}{T_1} = \left(\frac{r_1}{r_2}\right)^3$$

7: 4 نمره



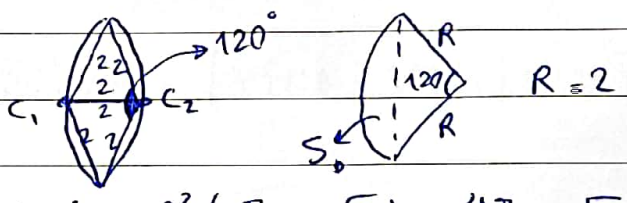
$$\vec{F}_{\text{نتیجه}} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4 = \vec{0}$$

نتیجه صفر

8: 3 نمره

$$W = S \sin \alpha = 2 S_0 P_0 V_0$$

$P_0 V_0$ جدا



$$S_0 = \pi R^2 \times \frac{1}{3} = \frac{R^2}{2} \sin(120) = R^2 \left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right) = \frac{4\pi}{3} - \sqrt{3} = 4,2 - 1,7 = 2,5$$

$$\Rightarrow W = 5 P_0 V_0 \rightarrow \sqrt{3} \text{ نمره}$$

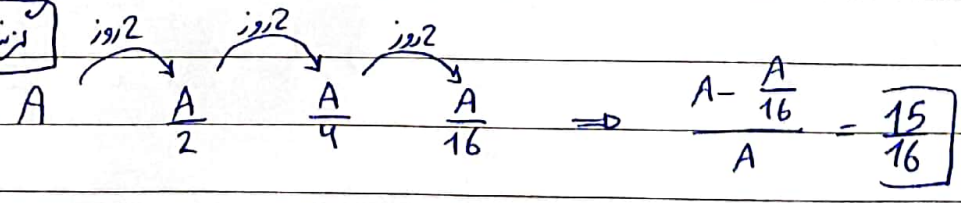
9: 1 نمره

$$Q = \Delta U + P \Delta V \Big|_{AC}^{AB}, n=1=0 \left\{ \begin{aligned} Q &= \frac{5}{2} [P_C(V_C - b) - P_A(V_A - b)] + P_A(V_B - V_A) \\ Q' &= \frac{5}{2} [P_C V_C - P_A V_A] + P_A(V_B - V_A) \end{aligned} \right.$$

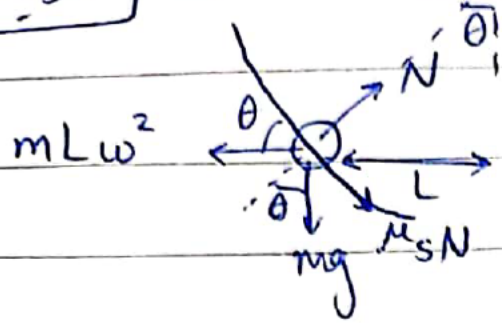
$$Q - Q' = \frac{5}{2} [b(P_A - P_C)] = \frac{5}{2} \times 0.04 \times (-1 \times 10^5) \times 10^{-3} = -10 \text{ J}$$

له تبدیل متریکبه متر مکعب

10: 4 نمره



11: 2 تجزیه if $\omega = \omega_{max}$



$$N = mg \cos \theta + mL \omega^2 \sin \theta$$

$$\mu_s N + mg \sin \theta = mL \omega^2 \cos \theta$$

$$\Rightarrow mL \omega^2 (\cos \theta - \mu_s \sin \theta) = mg (\sin \theta + \mu_s \cos \theta)$$

$$\omega_{max} = \sqrt{\frac{g}{L}} \sqrt{\frac{\tan \theta + \mu_s}{1 - \mu_s \tan \theta}} \quad \omega_{min} = \sqrt{\frac{g}{L}} \sqrt{\frac{\tan \theta - \mu_s}{1 + \mu_s \tan \theta}} \quad \left(\begin{array}{l} \text{Subst. } \mu_s \\ \text{در } \cos \theta \end{array} \right)$$

$$\Rightarrow \frac{\omega_{max}}{\omega_{min}} = \sqrt{\frac{(1 + \mu_s \tan \theta)(\tan \theta + \mu_s)}{(1 - \mu_s \tan \theta)(\tan \theta - \mu_s)}}$$

12: 1 تجزیه

$$v = \sqrt{\frac{T}{\mu}} \quad , \quad L = n \frac{\lambda}{2} \quad f = \frac{v}{\lambda} = \frac{\sqrt{\frac{T}{\mu}}}{\frac{2L}{n}} \quad , \quad T \propto M \rightarrow f \propto n \sqrt{M}$$

$$\frac{f_1}{f_2} = \frac{\sqrt{M}}{2\sqrt{M+\Delta M}} = 1 \rightarrow M = 4(M+\Delta M) \rightarrow \Delta M = M \left(\frac{1-1}{4} \right) = \frac{-3}{4} M$$

$$\boxed{13:4 \text{ زننه}} \quad q_1 = 1C, \quad q_2 = 1C, \quad r = 1m,$$

$$\rightarrow F = 9 \times 10^9 N, \quad F = \frac{\sigma^2}{10^{+4} \text{ cm}^2} \rightarrow 9 \times 10^9 \times 10^5 \text{ dyne} = \frac{\sigma^2}{10^{+4} \text{ cm}^2}$$

$$\Rightarrow \sigma = 1C = 3 \times 10^9 \text{ dyne}^{1/2} \text{ cm} = \boxed{3 \times 10^9 \text{ asu}}$$

Year: month: day:

تاریخ: 3: 14

نیز (کی) معنای جواره نمود بر سطح است و تنها جهت سرعت را مشخص نمی دهد
 اندازهی سرعت ثابت می ماند (دایره) $\Rightarrow R = de \Rightarrow qVB = \frac{mv^2}{R}$

تاریخ: 3: 15

گزینه 2: 16

انرژی اولیه سیستم از سطح واسفرا بالا می‌گردد، در شکل هم (با توجه به اینکه تغییرات در آب اسفرا اجزای است) ارتفاع

انرژی سیستم $U = U_0 + U_1$ است $\leftarrow U_1$ ناشی از سطح آب بالای سطح اسفرا می‌باشد.

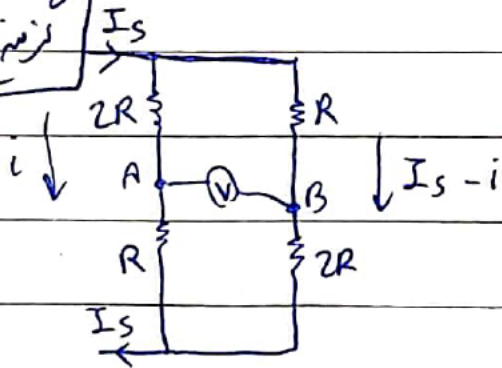
$$W = \Delta U = U - U_0 = U_1 = (\pi R^2 h) g \rho \left(\frac{h}{2}\right) = \frac{1}{2} \pi R^2 \rho g h^2$$

سؤال 3 : 17

$$\dot{E} = \frac{\Delta m c^2}{\Delta t} = \frac{4,5 \times 10^9 \text{ kg} \times 9 \times 10^{16} \text{ m}^2/\text{s}^2}{1 \text{ s}} = 4,5 \times 9 \times 10^{25} \text{ J/s}$$

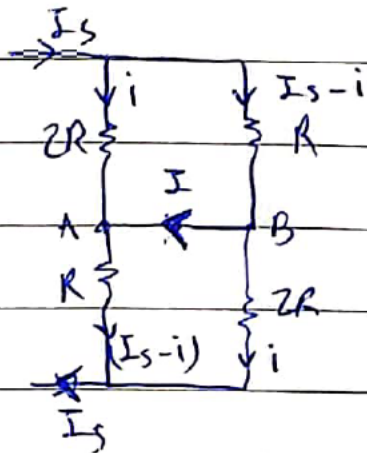
تعداد فوتون ها : $N = \frac{\dot{E}}{Q} = \frac{4,5 \times 9 \times 10^{25}}{2,7 \times 10^6 \times 1,6 \times 10^{-19}} = \frac{1,5}{1,6} \times 10^{38} \rightarrow n_p = \frac{2 \times 1,5}{1,6} = 2 \times 10^{38}$

سؤال 1 : 18



$$3Ri = 3R(I_s - i) \rightarrow i = \frac{I_s}{2}$$

$$V = 2Ri - R(I_s - i) = \frac{RI_s}{2}$$



$$V_A + 2Ri - R(I_s - i) = V_B$$

$$V_A - V_B = 0 = -3i + I_s \rightarrow i = \frac{I_s}{3}$$

$$i + I = I_s - i \Rightarrow I = I_s - 2i = \frac{I_s}{3}$$

$$\Rightarrow \frac{V}{I} = \frac{3}{2} R$$

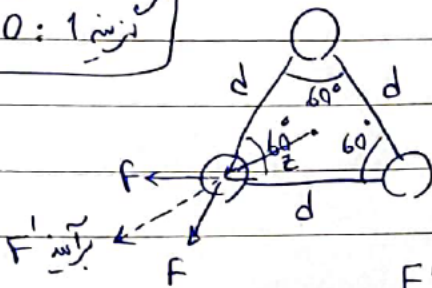
تیزه 2: 19



$$|F| = |-2e E(x) + 2e E(x+d)| = |2ed \frac{dE}{dx}|, \quad E = \frac{kq}{x^2} \rightarrow F = 2ed \times \frac{2kq}{x^3}$$

$$F = \frac{4 \times 1.6 \times 10^{-19} \times 19 \times 10^{-12} \times 9 \times 10^9 \times 2 \times 10^{-12}}{10^{-6}} \text{ N} \approx 2 \times 10^{-25} \Rightarrow n = 25$$

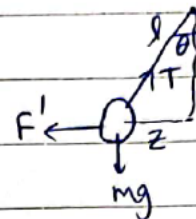
تیزه 1: 20



$$F' = 2F \cos(30^\circ)$$

$$mg = T \cos \theta$$

$$F' = T \sin \theta = mg \tan \theta$$



$$F' = mg \frac{z}{\sqrt{l^2 - z^2}}, \quad 2z \cos(30^\circ) = d \rightarrow z = \frac{d}{\sqrt{3}}$$

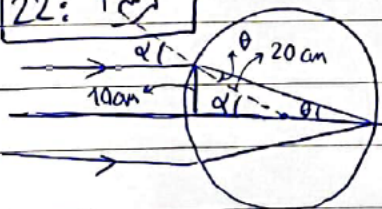
$$\Rightarrow F' = 2F \cos(30^\circ) = \sqrt{3} F = mg \frac{d}{\sqrt{3(l^2 - \frac{d^2}{3})}} \rightarrow F = \frac{mgd}{\sqrt{9l^2 - 3d^2}} = \frac{kq^2}{d^2}$$

$$q = \sqrt{\frac{mgd^3}{k\sqrt{9l^2 - 3d^2}}}$$

تیزه 3: 21

$$\frac{dp}{dh} = -\rho g \rightarrow \frac{\frac{dp}{dh}|_{h=95\text{km}}}{\frac{dp}{dh}|_{h=0}} = \frac{\rho_{15\text{km}}}{\rho_0} = \frac{10/4}{10/1} = \frac{1}{4} = 0.25$$

تیزه 1: 22



$$\sin \alpha = \frac{10}{20} = \frac{1}{2} \rightarrow \alpha = 30^\circ$$

$$2\theta = \alpha \rightarrow \theta = 15^\circ, \quad \sin(30^\circ) = n \sin(15^\circ)$$

$$2 \sin(15^\circ) \cos(15^\circ) = n \sin(15^\circ)$$

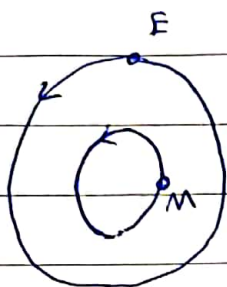
$$\Rightarrow n = 2 \cos\left(\frac{\pi}{12}\right)$$

سؤال 2: 23

$$\text{سرعت } \rightarrow mg = \rho V \rightarrow V = \frac{mg}{\rho}$$

$$t=0 \rightarrow v=0 \rightarrow F=0 \rightarrow a|_{t=0} = g \quad \left(\text{شکل حجم ثابت} \right)$$

$$ILB = mg \rightarrow m = \frac{ILB}{g} = \frac{0.5 \times 0.3 \times 1 \times 10^3}{9.8} \approx 15 \text{ gr} \quad :2$$



$$\omega_E = \frac{2\pi}{360}, \quad \omega_M = \frac{2\pi}{60} \quad :3$$

$$\omega_{M/E} = \omega_M - \omega_E = 2\pi \left(\frac{1}{60} - \frac{1}{360} \right) = \frac{2\pi \times 5}{360}$$

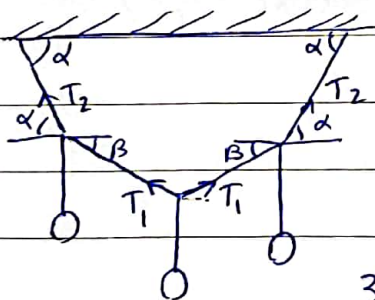
$$\omega_{M/E} (t_2 - t_1) = \frac{3\pi}{2} \rightarrow (t_2 - t_1) = \frac{3}{2} \times \frac{360}{10} = 3 \times 18 = 54 \text{ s} \quad :4$$

طابقه اول $P = P_0 + \rho gh$ $P_0(h_0) = P(h)$ طابقه دوم

$$\Rightarrow P_0 \left(\frac{h_0}{h} - 1 \right) = \rho gh \rightarrow h^2 + \frac{P_0}{\rho g} h - \frac{P_0}{\rho g} h_0 = 0$$

$$\Rightarrow h^2 + 76h - 76 \times 57 = 0 \rightarrow h = \frac{-76 \pm \sqrt{76^2 + 4 \times 76 \times 57}}{2}$$

$$h = 38 \left(-1 + \sqrt{1 + \frac{4 \times 57}{76}} \right) = 38 (-1 + 2) = 38 \text{ cm}$$



$$\left. \begin{aligned} 2T_1 \sin \beta &= mg \\ 2T_2 \sin \alpha &= 3mg \\ T_1 \cos \beta &= T_2 \cos \alpha \end{aligned} \right\} \frac{T_1}{T_2} = \frac{\sin \alpha}{3 \sin \beta} = \frac{\cos \alpha}{\cos \beta} \quad :5$$

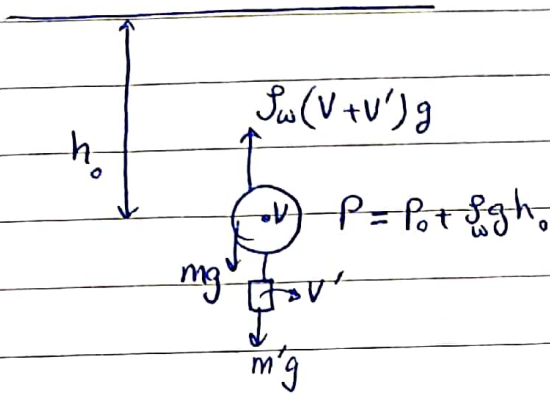
$$3 \cot \alpha = \cot \beta \quad \alpha = 60^\circ \rightarrow \sin \beta = \frac{1}{\sqrt{1 + 9 \cot^2 \alpha}} = \frac{1}{2} \rightarrow \beta = 30^\circ$$

$$50 \text{ cm} = l (2 \cos \alpha + 2 \cos \beta) = 2l \left(\frac{1}{2} + \frac{\sqrt{3}}{2} \right) = l (1 + \sqrt{3})$$

$$\Rightarrow l = \frac{50 \text{ cm}}{1 + \sqrt{3}} \Rightarrow L = 4l = \frac{200 \text{ cm}}{1 + 1.73} = \frac{200}{2.73} \text{ cm} \approx 73 \text{ cm}$$

$\rho_0 = 1,3 \frac{kg}{m^3}$ ρ_0 V_0

$m = \rho_0 V_0$



$PV = \rho_0 V_0$
 $(m + m')g = \rho_w (V + V')g$

$\Rightarrow \rho_0 V_0 + m' = \rho_w \left(\frac{\rho_0 V_0}{\rho_0 + \rho_w g h_0} + \frac{m'}{\rho_s} \right)$

$\Rightarrow \frac{\rho_0 V_0}{\rho_w} + \frac{m'}{\rho_w} - \frac{m'}{\rho_s} = \frac{\rho_0 V_0}{\rho_0 + \rho_w g h_0} \rightarrow \rho_0 + \rho_w g h_0 = \frac{\rho_0 V_0}{V_0 \frac{\rho_0}{\rho_w} + m' \left(\frac{1}{\rho_0} - \frac{1}{\rho_s} \right)}$

$\rho_w g h_0 = \rho_0 \left(\frac{V_0 \left(1 - \frac{\rho_0}{\rho_w} \right) + m' \left(\frac{1}{\rho_s} - \frac{1}{\rho_w} \right)}{V_0 \frac{\rho_0}{\rho_w} + m' \left(\frac{1}{\rho_0} - \frac{1}{\rho_s} \right)} \right)$

$h_0 = \frac{\rho_0}{\rho_w g} \left(\frac{V_0 \left(1 - \frac{\rho_0}{\rho_w} \right) + m' \left(\frac{1}{\rho_s} - \frac{1}{\rho_w} \right)}{V_0 \frac{\rho_0}{\rho_w} + m' \left(\frac{1}{\rho_0} - \frac{1}{\rho_s} \right)} \right) = \frac{10^2}{9,8} \left(\frac{5 \times 10^{-4} \left(1 - \frac{1,3}{1000} \right) + 24 \times 10^{-2} \left(\frac{1}{7900} - \frac{1}{1000} \right)}{5 \times 10^{-4} \left(\frac{1,3}{10^3} \right) + 24 \times 10^{-2} \left(\frac{1}{1000} - \frac{1}{7900} \right)} \right)$

$h_0 \approx \frac{10^2}{9,8} \left(\frac{5 \times 10^{-4} - 2,4 \times 10^{-4} \times 6,9 (7,9)^{-1}}{2,4 \times 10^{-4} \times 6,9 (7,9)^{-1}} \right) = \frac{10^2}{9,8} \left(\frac{5 - 2,4 \times 6,9 / 7,9}{2,4 \times 6,9 / 7,9} \right)$

$h_0 = \frac{10^2}{9,8} \left(\frac{39,5 - 16,56}{16,56} \right) \approx 14 \text{ m}$

$H_2O \text{ مقدار} = \frac{50 \times 10^3}{18} \times 6,02 \times 10^{23} = \frac{30,1 \times 10^{27}}{18} \quad : 7$

$\text{مقدار پروتون} = 10 \times \frac{30,1 \times 10^{27}}{18} = \frac{30,1 \times 10^{28}}{18}$

$q = 1,6 \times 10^{-19} \times \frac{30,1 \times 10^{28}}{18} = \frac{8 \times 30,1 \times 10^8}{9} \text{ C}$

$F = \frac{kq^2}{r^2} = \frac{9 \times 10^9}{10^4} \times \left(\frac{8 \times 30,1 \times 10^8}{9} \right)^2 = 10^5 \times \frac{(8 \times 30,1)^2 \times 10^{16}}{9} \approx 0,64 \times 10^{25}$

$n = 25$

18 - 8

15 - 1