ΘΕΜΑ Α

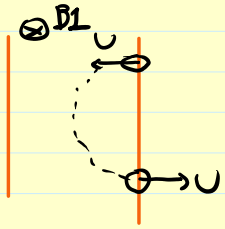
Α1) Β Α2) Β Α3) γ Α4) δ
Α5) α) Σ β) Σ γ) Λ δ) Σ ε) Σ

ΘΕΜΑ Β

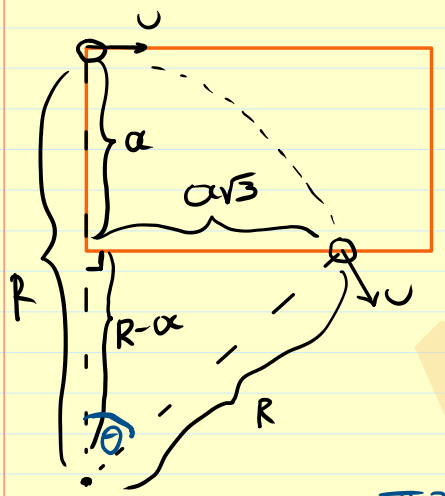
Β1 Α Σωστή απάντηση: (α)

$$\frac{R_1}{R_2} = \frac{\frac{m\cdot v}{B\cdot|q|}}{\frac{m\cdot v}{B_2\cdot|q|}} = \frac{B_2}{B_1} \Rightarrow \boxed{\frac{R_1}{R_2} = \frac{1}{2}}$$

Β Σωστή απάντηση: (γ)



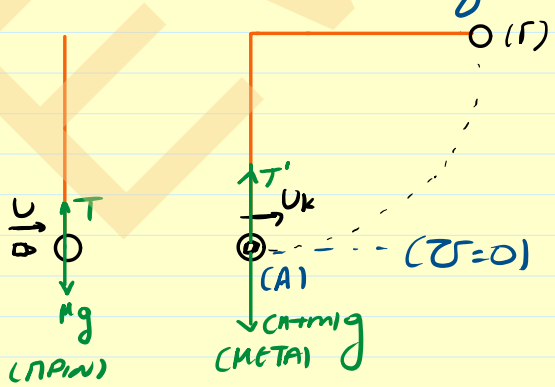
$$T_1 = \frac{2\pi m}{B_2|q|} \quad \text{Ημικύκλιο} \quad \Delta t_2 = \frac{T_1}{2} = \frac{\pi\cdot m}{B_1\cdot|q|} \quad (1)$$



$$R^2 = (R-a)^2 + (a\sqrt{3})^2$$
$$\Rightarrow R^2 = R^2 - 2Ra + a^2 + 3a^2$$
$$\Rightarrow 2R = 4a \Rightarrow R = 2a$$
$$\eta\mu\Theta = \frac{a\sqrt{3}}{R} = \frac{a\sqrt{3}}{2a} = \frac{\sqrt{3}}{2} \rightarrow \Theta = \frac{\pi}{3}\ rad$$
$$\omega = \frac{\Theta}{\Delta t_2} \Rightarrow \frac{2\pi}{T_2} = \frac{\pi/3}{\Delta t_2} \Rightarrow \Delta t_2 = \frac{T_2}{6}$$
$$T_2 = \frac{2\pi m}{B_2|q|} \rightarrow \Delta t_2 = \frac{\pi\cdot m}{3B_2|q|} \quad (2)$$

$$\frac{(1)}{(2)} \Rightarrow \frac{\Delta t_1}{\Delta t_2} = \frac{\frac{\pi\cdot m}{B_1\cdot|q|}}{\frac{\pi\cdot m}{3B_2|q|}} = \frac{3B_2}{B_1} \Rightarrow \boxed{\frac{\Delta t_1}{\Delta t_2} = \frac{3}{2}}$$

Β2 Σωστή απάντηση: (γ)



Α.Δ.Μ.Ε. (Α→Γ)
$$\frac{1}{2}(M+m)\cdot U_K^2 + 0 = (M+m)g\cdot l + 0$$
$$\Rightarrow U_K = \sqrt{2gl} \quad (1)$$

ΠΡΙΝ: $\Sigma F_y = 0 \Rightarrow T = Mg$

ΜΕΤΑ: $\Sigma F_R = T' - (M+m)g$

$$\Rightarrow T' = (M+m)\cdot\frac{U_K^2}{l} + (M+m)g$$

• $T' = 4 \cdot T \Rightarrow (M+m)\cdot \frac{U_{\mu}^2}{\ell} + (M+m)g = 4 \cdot Mg$

$\Rightarrow (M+m)\cdot \frac{(\sqrt{2g\ell})^2}{\ell} + (M+m)\cdot g = 4 \cdot Mg$

$\Rightarrow 2Mg + 2mg + Mg + mg = 4 \cdot Mg$

$\Rightarrow M = 3m$

• Α.Δ.Ο: $m \cdot U = (M+m)\cdot U_K \Rightarrow U_K = \frac{U}{4}$

→ $K_{\text{αλτηρ.}} = \frac{1}{2} m \cdot U^2 = K$

→ $K_{\text{σφαιρ.}} = \frac{1}{2} 4 \cdot m \cdot \frac{U^2}{16} = \frac{K}{4}$

$\Rightarrow Q_{\text{κρ.}} = K - \frac{K}{4} = \frac{3K}{4}$

$\pi = \frac{3K/4}{K} \cdot 100\% \Rightarrow \boxed{\pi = 75\%}$

Β3 Σωστή απάντηση: (β)

$S_1 = U \cdot T = U \cdot \frac{2\pi m_1}{B \cdot |q_2|}$

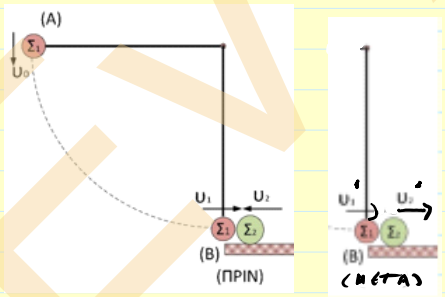
$B_2 = U_x \cdot T = U \cdot \sigma\upsilon\nu 60° \cdot \frac{2\pi m_2}{B \cdot |q_2|}$

$\Rightarrow \frac{B_2}{S_1} = \frac{U \cdot \frac{2\pi m_1}{B \cdot |q_2|}}{\frac{U}{2} \cdot \frac{2\pi m_2}{B \cdot |q_2|}} = \frac{2|q_2| \cdot m_1}{m_2 \cdot |q_1|}$

$\Rightarrow \frac{B_2}{S_1} = 2 \cdot \frac{1}{2} \cdot \frac{|q_1|}{m_1} \cdot \frac{m_1}{|q_1|} \Rightarrow \boxed{\frac{B_2}{S_1} = 1}$

ΘΕΜΑ Γ

Γ1



ΑΔΜΕ(Α→Β): $\frac{1}{2} m_1 U_0^2 + m_1 g \ell = \frac{1}{2} m_1 U_1^2$

$\Rightarrow 36 + 2 \cdot 10 \cdot 1{,}4 = U_1^2$

$\Rightarrow 36 + 28 = U_1^2 \Rightarrow \boxed{U_1 = 8\,m/s}$

Γ2 Α.Δ.Ο: $m_1 U_1 - m_2 U_2 = m_1 U_1' + m_2 U_2'$

$\Rightarrow 9 \cdot 8 - 3 \cdot 6 = 9 U_1' + 3 \cdot 12$

$\Rightarrow 72 - 18 = 9 U_1' + 36$

$\Rightarrow 54 - 36 = 9 U_1' \Rightarrow \boxed{U_1' = \frac{18}{9} = 2\,m/s}$

Γ3 $\pi_{12} = \frac{K_2' - K_2}{K_2} 100\% = \left(\frac{K_2'}{K_2} - 1\right) 100\% = \left(\frac{\frac{1}{2} m_2 u_2'^2}{\frac{1}{2} m_2 u_2^2} - 1\right) 100\%$

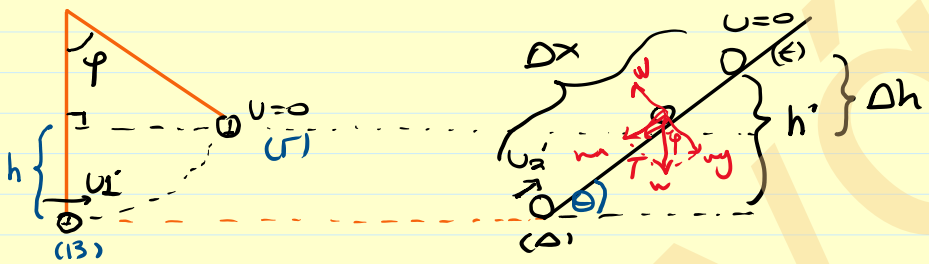
$\Rightarrow \pi_{12} = \left[\left(\frac{u_2'}{u_2}\right)^2 - 1\right] 100\% = \left[\left(\frac{12}{6}\right)^2 - 1\right] 100\% \Rightarrow \boxed{\pi_{12} = 300\%}$

Γ4 $\Sigma F_y = 0 \Rightarrow N = m_2 g \sigma\upsilon\varphi = 24\,N \rightarrow T = \mu N = \frac{3}{4} 24 = 18\,N$

$W_x = m_2 g \eta\mu\varphi = 18\,N$

$\frac{dK}{dt} = -\Sigma F_x u_2' = -(W_x + T) u_2' = -36 \cdot 12 \Rightarrow \boxed{\frac{dK}{dt} = -432\,J/s}$

Γ5



Α.Δ.Μ.Ε. (Β→Γ)

$\frac{1}{2} m_1 u_1'^2 = m_1 g h \Rightarrow h = \frac{u_1'^2}{2g} = 0{,}2\,m$

Θ.Μ.Κ.Ε. (Δ→Ε)

$0 - \frac{1}{2} m_2 u_2'^2 = -W_x \Delta x - T \Delta x \Rightarrow -\frac{1}{2} 3 \cdot 144 = -18 \Delta x - 18 \Delta x$

$\Rightarrow 36 \Delta x = 216 \Rightarrow \Delta x = 6\,m$

$\eta\mu\theta = \frac{h'}{\Delta x} \Rightarrow h' = \eta\mu\theta \cdot \Delta x = 3{,}6\,m$

$\boxed{\Delta h = h' - h = 3{,}4\,m}$

ΘΕΜΑ Δ

Δ1 ΘΜΚΕ (Α→Γ) $\frac{1}{2} m_1 U^2 - 0 = q_1 V_{AΓ} \Rightarrow \frac{1}{2} 10^{-10} \cdot 4 \cdot 10^6 = 10^{-6} V_{AΓ}$

$\Rightarrow \boxed{V_{AΓ} = 200\,V}$

Δ2 $R = \frac{m_1 U}{B \cdot |q_1|} = \frac{10^{-10} \cdot 2 \cdot 10^3}{1 \cdot 10^{-6}} \Rightarrow \boxed{R = 0{,}2\,m}$

$T_1 = \frac{2\pi \cdot m_1}{B \cdot |q_1|} = \frac{2\pi \cdot 10^{-10}}{1 \cdot 10^{-6}} \Rightarrow T_1 = 2\pi \cdot 10^{-4}\,s$

ΕΥΑΥΟΡΙΑ

$\rightarrow \boxed{\Delta t_1 = \frac{T_1}{2} = \pi \cdot 10^{-4} s}$

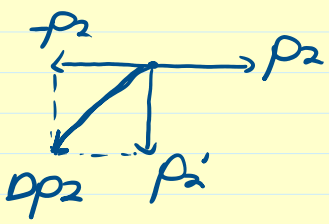
$2R = a \Rightarrow \boxed{a = 0,4m}$

Δ3 $T_2 = \frac{2\pi m_2}{B \cdot |q_2|} \Rightarrow T_2 = \frac{2\pi \cdot 4 \cdot 10^{-10}}{1 \cdot 2 \cdot 10^{-6}} = 4\pi \cdot 10^{-4} s$

$\boxed{\Delta t_2 = \frac{T_2}{4} = \pi \cdot 10^{-4} s}$

$\boxed{W_{F_{L0}} = 0}$ (αφού $\vec{F}_{L0} \perp \vec{v}$)

Δ4 $\Delta\vec{p}_2 = \vec{p}_2' - \vec{p}_2 \Rightarrow \Delta\vec{p}_2 = \vec{p}_2' + (-\vec{p}_2)$

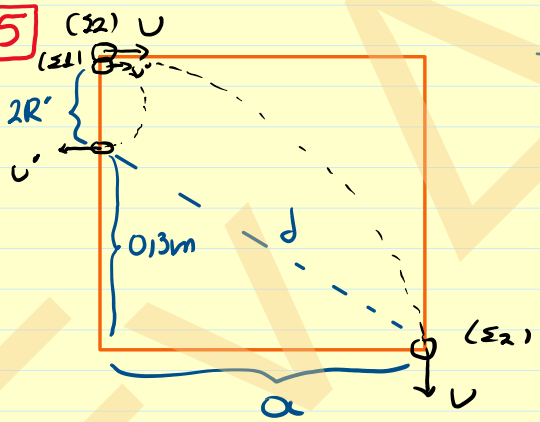


$\Delta p_2 = \sqrt{p_2^2 + p_2'^2} = \sqrt{2p_2^2} = p_2 \cdot \sqrt{2}$

$\Rightarrow \Delta p_2 = m_2 \cdot v \cdot \sqrt{2} = 4 \cdot 10^{-10} \cdot 2 \cdot 10^3 \cdot \sqrt{2}$

$\Rightarrow \boxed{\Delta p_2 = 8 \cdot \sqrt{2} \cdot 10^{-7} \, kg\frac{m}{s}}$

Δ5



Τα σωματίδια εξέρχονται την ίδια χρονική στιγμή από το μαγνητικό πεδίο ($\frac{T_1}{2} = \frac{T_2}{4}$).

$R_1' = \frac{m_1 v / 4}{B \cdot |q_1|} = 0,05m$

$d = \sqrt{0,3^2 + 0,4^2} = \sqrt{0,25} \Rightarrow \boxed{d = 0,5m}$

ΕΝ ΔΥΝΑΜΕΙ