ΘΕΜΑ Α

Α1 γ **Α2** β **Α3** γ **Α4** α

Α5 α) Λ β) Σ γ) Λ δ) Σ ε) Λ

ΘΕΜΑ Β

Β1 Σωστή απάντηση: (α)

→ Ίδια φορά

$S_B - S_A = 2\pi R \Rightarrow U_B \cdot t_1 - U_A \cdot t_1 = 2\pi R \Rightarrow 3U_A t_1 - U_A t_1 = 2\pi R$

$\Rightarrow 2 \cdot U_A \cdot t_1 = 2\pi R \Rightarrow t_1 = \frac{\pi R}{U_A}$ (1)

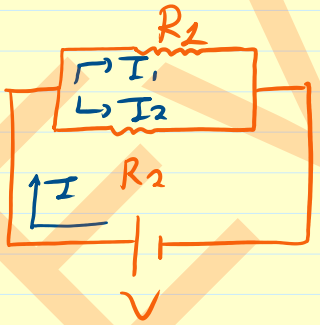
→ Αντίθετη φορά

$S_A + S_B = 2\pi R \Rightarrow U_A \cdot t_2 + U_B \cdot t_2 = 2\pi R \Rightarrow U_A \cdot t_2 + 3U_A \cdot t_2 = 2\pi R$

$\Rightarrow 4U_A \cdot t_2 = 2\pi R \Rightarrow t_2 = \frac{\pi \cdot R}{2U_A}$ (2)

$$\frac{(1)}{(2)} \Rightarrow \frac{t_1}{t_2} = \frac{\frac{\pi \cdot R}{U_A}}{\frac{\pi \cdot R}{2U_A}} \Rightarrow \boxed{\frac{t_1}{t_2} = 2}$$

Β2 Σωστή απάντηση: (γ)



$P_1 = \frac{V^2}{R_1} \Rightarrow P_1 = \frac{V^2}{4R_2}$ (1)

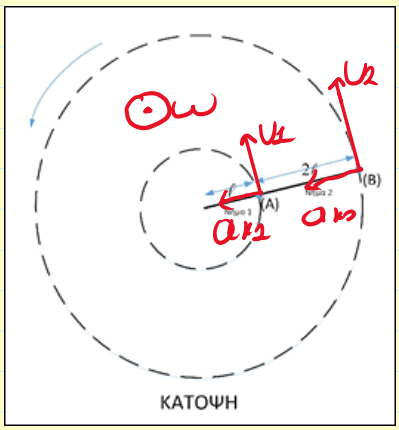
$P_2 = \frac{V^2}{R_2}$ (2)

$$\frac{(2)}{(1)} \Rightarrow \frac{P_2}{P_1} = \frac{\frac{V^2}{R_2}}{\frac{V^2}{4R_2}} = 4 \Rightarrow \boxed{P_2 = 4P_1}$$

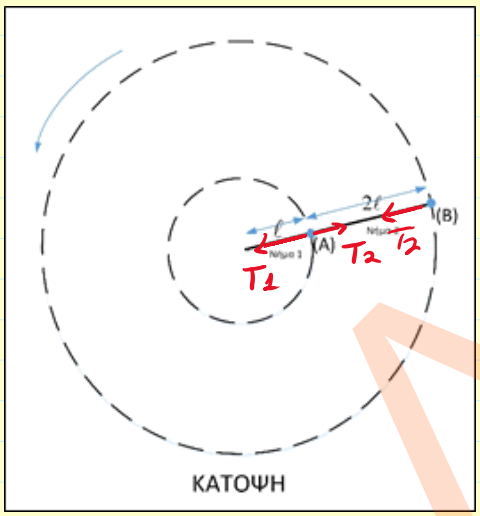
Β3 Α) Σωστή απάντηση: (β)

$$\frac{U_1}{U_2} = \frac{\omega \cdot R_1}{\omega \cdot R_2} = \frac{\ell}{3\ell} \Rightarrow \boxed{\frac{U_1}{U_2} = \frac{1}{3}}$$

Β



Γ Συνισταμένη: (γ)



$$U_2 = 3U_1$$

$$\rightsquigarrow \Sigma F_{R_B} = m \cdot \frac{U_2^2}{3\ell} = T_2 \Rightarrow m \cdot \frac{(3U_1)^2}{3\ell} = T_2$$

$$\Rightarrow T_2 = \frac{3m \cdot U_1^2}{\ell}$$

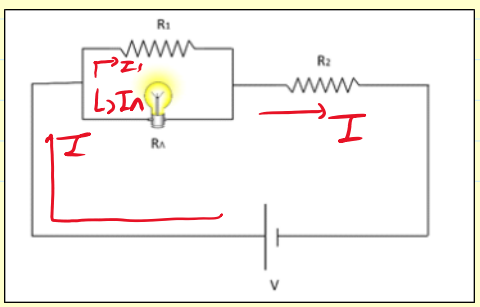
$$\rightsquigarrow \Sigma F_{R_A} = m \cdot \frac{U_1^2}{\ell}$$

Όμως: $\Sigma F_{R_A} = T_1 - T_2 \Rightarrow m \cdot \frac{U_1^2}{\ell} = T_1 - 3\frac{m \cdot U_1^2}{\ell} \Rightarrow T_1 = 4m\frac{U_1^2}{\ell}$

Άρα: $\frac{T_1}{T_2} = \frac{4m\frac{U_1^2}{\ell}}{3m\frac{U_1^2}{\ell}} \Rightarrow \boxed{\frac{T_1}{T_2} = \frac{4}{3}}$

ΘΕΜΑ Γ

Γ1



$$P_K = \frac{V_K^2}{R_A} \Rightarrow R_A = \frac{V_K^2}{P_K} = \frac{12 \cdot 12}{24} \Rightarrow \boxed{R_A = 6\Omega}$$

$$P_K = V_K \cdot I_K \Rightarrow I_K = \frac{P_K}{V_K} \Rightarrow \boxed{I_K = 2A}$$

Γ2 $R_{1,n} = \frac{R_1 \cdot R_n}{R_1 + R_n} = \frac{3 \cdot 6}{3+6} = 2\Omega$

$R_{o1} = R_{1,n} + R_2 = 4\Omega$

$I = \frac{V}{R_{o1}} = \frac{36}{4} \Rightarrow I = 9A$

$\rightsquigarrow V_1 = V_n \Rightarrow I_1 R_1 = I_n R_n \Rightarrow I_1 \cdot 3 = I_n \cdot 6 \Rightarrow I_1 = 2I_n \ (1)$

$I_1 + I_n = I \overset{(1)}{\Rightarrow} 2I_n + I_n = 9 \Rightarrow I_n = 3A$

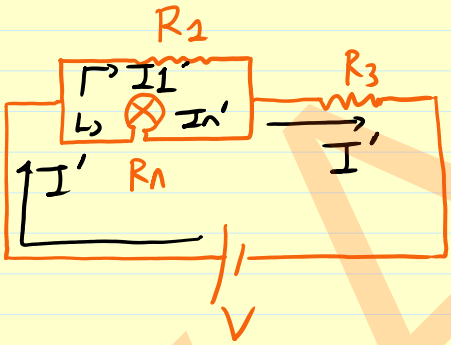
$(1) \Rightarrow \boxed{I_1 = 6A}$

Αφού: $\boxed{I_n = 3A > I_k = 2A}$ → Υπερλειτουργεί

Γ3 $Q_{R_2} = I^2 \cdot R_2 \cdot \Delta t = 9^2 \cdot 2 \cdot 10 = 81 \cdot 2 \cdot 10$

$\Rightarrow \boxed{Q_{R_2} = 1620J}$

Γ4



$I_n' = I_k = 2A$

$V_n' = V_k = 12V \rightarrow V_1' = V_n' = 12V$

$P_2 = \frac{V_1'^2}{R_1} = \frac{12 \cdot 12}{3} \Rightarrow \boxed{P_1 = 48W}$

Γ5 $I_1' = \frac{V_1'}{R_1} = \frac{12}{3} = 4A$

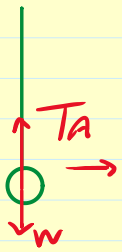
$I' = I_1' + I_n' = 6A$

$V_n' + V_3' = V \Rightarrow V_3' = 36 - 12 = 24V$

$R_3 = \frac{V_3'}{I'} = \frac{24}{6} \Rightarrow \boxed{R_3 = 4\Omega}$

ΘΕΜΑ Δ

Δ1

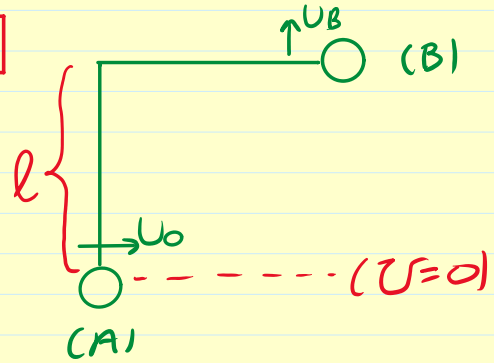


$$\Sigma F_{RA} = m\cdot\frac{U_0^2}{\ell} = 2\cdot\frac{10^2}{1} = 200N$$

$$w = m\cdot g = 20N$$

$$\Sigma F_{RA} = T_A - mg \Rightarrow \boxed{T_A = 220N}$$

Δ2



Α.Δ.Μ.Ε.(Α→Β)

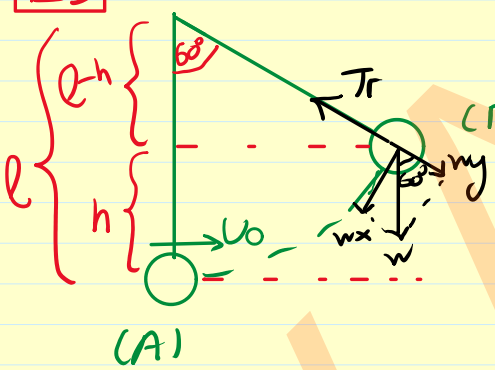
$$K_A + \mathcal{U}_A^{\vec{0}} = K_B + U_B$$

$$\Rightarrow \frac{1}{2}\cdot m\cdot U_0^2 = \frac{1}{2}m\cdot U_B^2 + mg\ell$$

$$\Rightarrow 100 = U_B^2 + 20$$

$$\Rightarrow \boxed{U_B = \sqrt{80} = 4\sqrt{5}\,m/s}$$

Δ3



$$\sim \sigma\upsilon\nu 60^\circ = \frac{\ell - h}{\ell} \Rightarrow \frac{\ell}{2} = \ell - h \Rightarrow h = \frac{\ell}{2}$$

$$\sim, w_y = mg\cdot\sigma\upsilon\nu 60^\circ = 10N$$

Α.Δ.Μ.Ε.(Α→Γ)

$$K_A + \mathcal{U}_A^{\vec{0}} = K_\Gamma + U_\Gamma$$

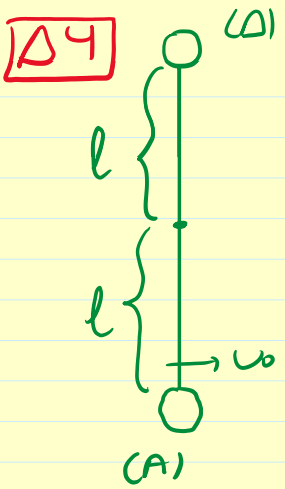
$$\Rightarrow \frac{1}{2}m\cdot U_0^2 = \frac{1}{2}m\cdot U_\Gamma^2 + mg\cdot h$$

$$\Rightarrow 100 = U_\Gamma^2 + 2\cdot 10\cdot\frac{1}{2} \Rightarrow U_\Gamma = \sqrt{90}\,m/s$$

$$\Sigma F_{R\Gamma} = m\cdot\frac{U_\Gamma^2}{\ell} = 2\frac{(\sqrt{90})^2}{1} = 180N$$

$$\Sigma F_{R\Gamma} = T_\Gamma - w_y \Rightarrow \boxed{T_\Gamma = 190N}$$

Δ4



Α.Δ.Μ.Ε. (Α → Δ)

$K_A + U_A^{\not 0} = K_\Delta + U_\Delta$

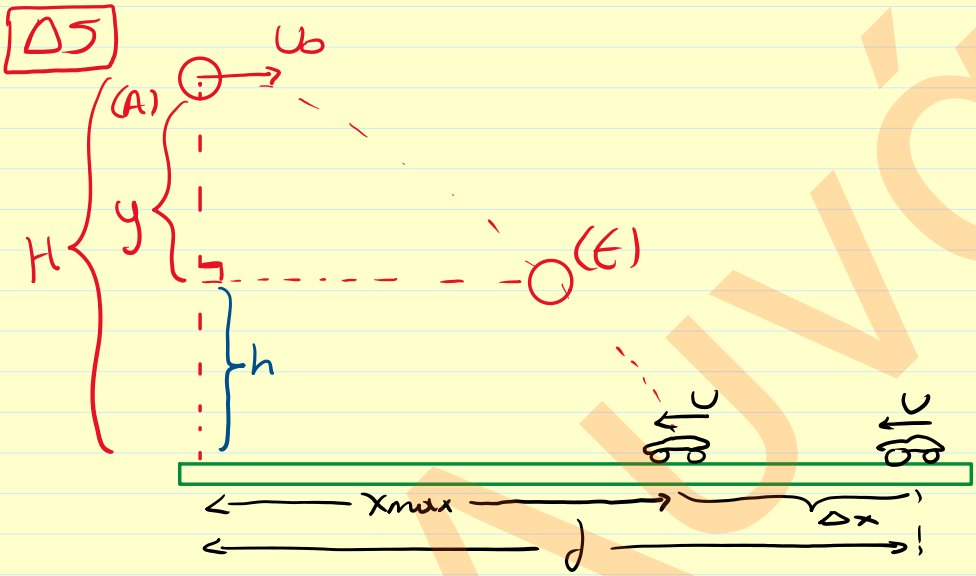
$\Rightarrow \frac{\not 2}{\not 2} m \upsilon_0^2 = \frac{\not 2}{\not 2} m \upsilon_\Delta^2 + \not 2 mg \cdot 2\ell$

$\Rightarrow 100 = \upsilon_\Delta^2 + 40 \Rightarrow \upsilon_\Delta = \sqrt{60}\ m/s$

$\Sigma F_{R_r} = m \frac{\upsilon_r^2}{\ell} = 2 \cdot \frac{(\sqrt{60})^2}{1} = 120N$

$\Sigma F_{R_\Delta} = T_\Delta + W \Rightarrow T_\Delta = 100N > 0 \rightarrow$ Εκτελεί

Δ5



$x_{max} = d - \Delta x = 20m$

$x_{max} = \upsilon_0 \cdot t_{\varepsilon\varsigma} \rightarrow t_{\varepsilon\varsigma} = \frac{20}{10} = 2s$

$\upsilon = \frac{\Delta x}{\Delta t} = \frac{10}{2} \Rightarrow \boxed{\upsilon = 5\ m/s}$

Δ6 $H = \frac{1}{2} g \cdot t_{\varepsilon\varsigma}^2 = \frac{1}{2} \cdot 10 \cdot 2^2 = 20m$

$y = \Delta x \Rightarrow \frac{1}{2} g \cdot t^2 = \upsilon \cdot t \Rightarrow \not 5 t^{\not 2} = \not 5 \cdot t \Rightarrow t = 1s$

$y = \frac{1}{2} \cdot g \cdot t^2 = 5m \rightarrow h = H - y = 15m$

$U = m \cdot g \cdot h = 2 \cdot 10 \cdot 15 \Rightarrow \boxed{U = 300J}$