ΛΥΣΕΙΣ Α' ΛΥΚΕΙΟΥ 21/4/2024

ΘΕΜΑ Α

Α1) α Α2) γ Α3) γ Α4) β

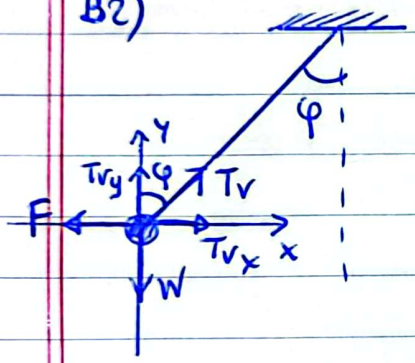
Α5) Σ, Λ, Λ, Λ, Λ

ΘΕΜΑ Β

Β1) • $\Sigma F_x = 0 \Rightarrow F = T \Rightarrow T = 6N$ και $T = \mu N \Rightarrow N = \frac{T}{\mu} = \frac{6}{\frac{3}{4}} = 8N$

• $\Sigma F_y = 0 \Rightarrow N = W \Rightarrow W = 8N$ Σωστό το (β)

Β2)



• $\Sigma F_y = 0 \Rightarrow T_{ry} = W \Rightarrow T_r \cdot 6\sigma\upsilon\varphi = W \Rightarrow$

$\Rightarrow T_r \cdot 0,8 = 100 \Rightarrow T_r = \frac{100}{0,8} \Rightarrow T_r = 125N$

• $\Sigma F_x = 0 \Rightarrow F = T_{rx} \Rightarrow F = T_r \cdot \eta\mu\varphi \Rightarrow$

$\Rightarrow F = 125 \cdot 0,6N \Rightarrow F = 75N$ Σωστό το (β)

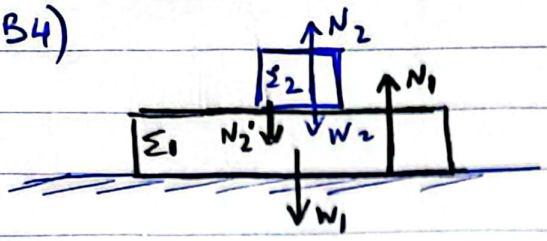
Β3)

• $\frac{1}{2} m u_1^2 - 0 = W_1$ (1)

• $\frac{1}{2} m u_2^2 - 0 = W_2 \Rightarrow \frac{1}{2} m (4u_1)^2 = W_2 \Rightarrow \frac{1}{2} m 16 u_1^2 = W_2$

$\Rightarrow 16 \frac{1}{2} m u_1^2 = W_2 \overset{(1)}{\Rightarrow} 16 W_1 = W_2$ Σωστό το (α)

B4)



A) Το Σ_1 δέχεται: $\vec{N}_2'$ από το Σ_2
$\vec{N}_1$ από το δάπεδο
$\vec{W}_1$ από τη Γη

Το Σ_2 δέχεται: $\vec{N}_2$ από το Σ_1
$\vec{W}_2$ από τη Γη.

B) Από επαφή: $\vec{N}_1, \vec{N}_2, \vec{N}_2'$
Από απόσταση: $\vec{W}_1, \vec{W}_2$

Γ) Ζεύγος δράσης αντίδρασης: $\vec{N}_2 = -\vec{N}_2'$

Δ)

• Για το Σ_1 στον xx' από 2ο Νόμο Newton:

$\Sigma F_x = m_1 a \Rightarrow F - T_s' = m_1 a \Rightarrow F - T_s' = 3ma$ (1)

• Για το Σ_2 στον xx' από 2ο Νόμο Newton:

$\Sigma F_x = m_2 a \Rightarrow T_s = ma$ (2)

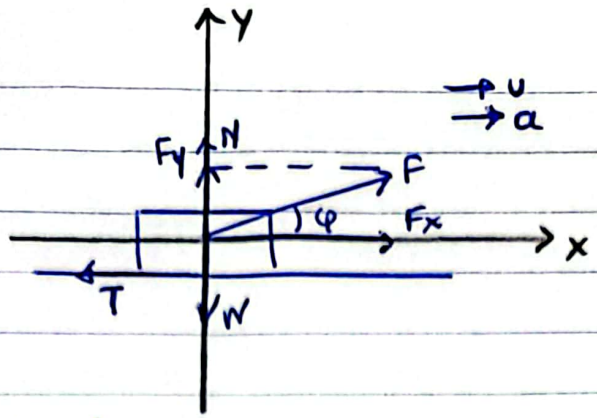
Κατά μέτρο: $T_s = T_s'$, από 3ο Νόμο Newton.

(1) + (2) $\Rightarrow$ $F - T_s + T_s = 3ma + ma \Rightarrow F = 4ma$ (3)

(2) $\overset{(3)}{\Rightarrow}$ $F = 4T_s \Rightarrow T_s = \frac{F}{4}$, κατά μέτρο τα δεξιά.

Ισχύει το (γ)

ΘΕΜΑ Γ



Γ1) $W = mg = 100N$

$F_x = F \cdot \sigma\upsilon\nu\varphi = 100 \cdot 0,6 \Rightarrow F_x = 60N$

$F_y = F \cdot \eta\mu\varphi = 100 \cdot 0,8 \Rightarrow F_y = 80N$

$\Sigma F_y = 0 \Rightarrow N + F_y = W \Rightarrow N = W - F_y = 100N - 80N \Rightarrow N = 20N$

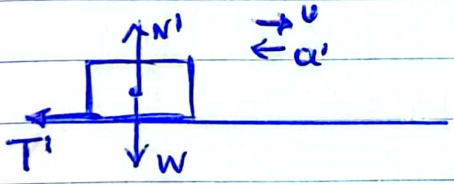
$T = \mu N = 0,5 \cdot 20N \Rightarrow \boxed{T = 10N}$

Γ2) $\Sigma F_x = ma \Rightarrow F_x - T = ma \Rightarrow 60 - 10 = 10 \cdot a \Rightarrow \boxed{a = 5 \frac{m}{s^2}}$

Γ3) $S_1 = \frac{1}{2} a_1 \Delta t_1^2 \Rightarrow \Delta t_1 = \sqrt{\frac{2S_1}{a_1}} = \sqrt{\frac{2 \cdot 10}{5}} = \sqrt{4} \Rightarrow \boxed{\Delta t_1 = 2s}$

$U_1 = a \cdot \Delta t_1 = 5 \cdot 2 \Rightarrow \boxed{U_1 = 10 m/s}$

Γ4)



Μετά την κατάργηση της $\vec{F}$ έχουμε:

$\Sigma F_y = 0 \Rightarrow N' = W \Rightarrow N' = 100N$

$T' = \mu N' = 0,5 \cdot 100N \Rightarrow T' = 50N$

$\Sigma F_x = ma' \Rightarrow T' = ma' \Rightarrow 50 = 10 \cdot a' \Rightarrow a' = 5 m/s^2$ Μέτρο επιβράδυνσης

$U_2 = U_0 - |a'| \cdot \Delta t_2$

$U_2 = 0 \Rightarrow 0 = U_0 - |a'| \cdot \Delta t_2 \Rightarrow \Delta t_2 = \frac{U_0}{|a'|} = \frac{U_1}{|a'|} = \frac{10}{5} \Rightarrow$

$\Rightarrow \boxed{\Delta t_2 = 2 sec}$

Και $\Delta t_2 = t_2 - t_1 \Rightarrow 2s = t_2 - 2s \Rightarrow \boxed{t_2 = 4s}$

$S_2 = U_0 \Delta t_2 - \frac{1}{2} |a'| \Delta t_2^2 = 10 \cdot 2 - \frac{1}{2} 5 \cdot 2^2 = 20 - 10 \Rightarrow S_2 = 10m$

Γ5) $Q_1 = |W_{T_1}| = T \cdot S_1 = 10 \cdot 10 J \Rightarrow Q_1 = 100 J$

$Q_2 = |W_{T_2}| = T' \cdot S_2 = 50 \cdot 10 J \Rightarrow Q_2 = 500 J$

$Q_{ολ} = Q_1 + Q_2 \Rightarrow \boxed{Q_{ολ} = 600 J}$

ΘΕΜΑ Δ

Δ1) Για το υλικό επίπεδο (Α) → (Γ):

$W_x = W \cdot \eta\mu\varphi = 50 \cdot 0,6 \Rightarrow W_x = 30N$

$W_y = W \cdot \sigma\upsilon\nu\varphi = 50 \cdot 0,8 \Rightarrow W_y = 40N$

$\Sigma F_y = 0 \Rightarrow N_1 = W_y \Rightarrow N_1 = 40N$

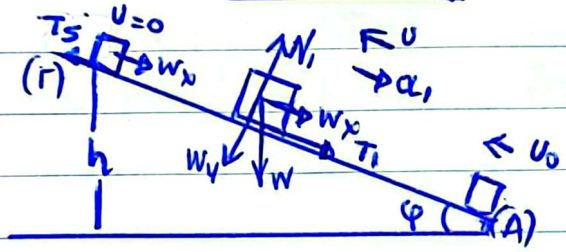
$T_1 = \mu_1 N = \frac{1}{4} \cdot 40N \Rightarrow T_1 = 10N$

$A = \sqrt{T_1^2 + N_1^2} = \sqrt{10^2 + 40^2} = \sqrt{1700} = 10\sqrt{17}N$ (μέτρο)

$\varepsilon\varphi\theta = \frac{N_1}{T_1} = \frac{40}{4} = 4$ (κατεύθυνση)

Δ2) $\Sigma F_x = m a_1 \Rightarrow W_x + T_1 = m a_1 \Rightarrow 30 + 10 = 5 a_1 \Rightarrow$

$\Rightarrow 40 = 5 a_1 \Rightarrow \boxed{a_1 = 8 m/s^2}$ (μέτρο επιβράδυνσης)



Δ3) $(A\Gamma) = S_{stop} = S = \frac{U_0^2}{2|a_1|} = \frac{20^2}{2 \cdot 8} = 25m$

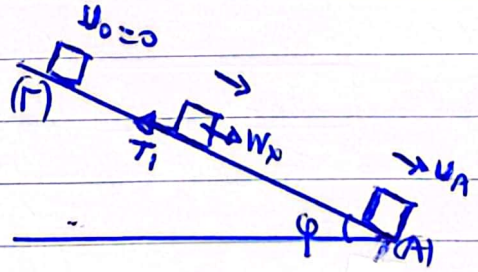
$\eta\mu\varphi = \frac{h}{(A\Gamma)} \Rightarrow h = \eta\mu\varphi \, (A\Gamma) = 0,6 \cdot 25 \Rightarrow h = 15m$

Δ4) α) $W_x = 30N$

$T_{s max} = \mu_s \cdot N_1 = 0,3 \cdot 40N \Rightarrow T_{s max} = 12N$

Επειδή $W_x > T_{s max}$, το σώμα θα επιστρέψει στην βάση του κεκλιμένου επιπέδου.

β)



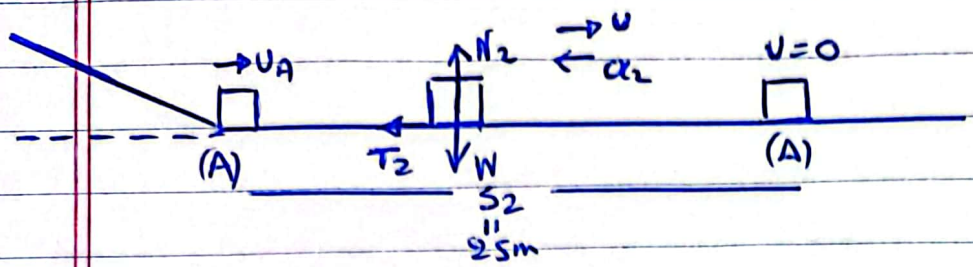
ΘΜΚΕ Γ → Α: $K_{τελ} - K_{αρχ} = W_{W_x} + W_{T_1} + W_{W_y} + W_{N_1}$

$K_A - 0 = +W_x \cdot S - T_1 \cdot S$

$K_A = 30 \cdot 25 - 10 \cdot 25 \Rightarrow$

$\boxed{K_A = 500J}$

Δ5) ΓΙΑ ΤΟ ΟΡΙΖΟΝΤΙΟ ΕΠΙΠΕΔΟ $A \to \Delta$



ΘΜΚΕ: $A \to \Delta$

$$K_{TEA}^{(\Delta)} - K_{ΟΡΧ}^{(A)} = W_{T_2} + W_{N_2} + W_W \Rightarrow$$

($W_{N_2} = 0$, $W_W = 0$)

$$0 - -K_A = -T_2 \cdot S_2 \Rightarrow 500 = T_2 \cdot 25 \Rightarrow$$

$$T_2 = 20N$$

$$\Sigma f_y = 0 \Rightarrow N_2 = W \Rightarrow N_2 = 50N$$

$$T_2 = \mu_2 N_2 \Rightarrow 20 = \mu_2 \cdot 50 \Rightarrow \mu_2 = \frac{2}{5} \Rightarrow \boxed{\mu_2 = 0,4}$$