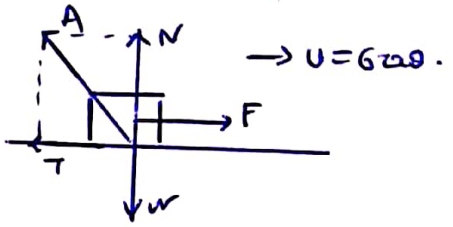
ΛΥΣΕΙΣ ΔΙΑΓΩΝΙΣΜΑΤΟΣ ΦΥΣΙΚΗΣ Α' ΛΥΚΕΙΟΥ
23/4/2023

ΘΕΜΑ Α

Α1) β Α2) γ Α3) δ Α4) γ Α5) Λ, Λ, Σ, Λ, Σ

ΘΕΜΑ Β



Β1)

I) $\Sigma F_x=0 \Rightarrow F=T \Rightarrow T=6N$ και $\Sigma F_y=0 \Rightarrow N=w \Rightarrow N=8N$

$A=F_{\text{διαν}}=\sqrt{N^2+T^2}=\sqrt{8^2+6^2} \Rightarrow A=F_{\text{διαν}}=10N$ ΣΩΣΤΟ το (γ)

II) $T=\mu \cdot N \Rightarrow 6=\mu \cdot 8 \Rightarrow \mu=\frac{6}{8}=\frac{3}{4} \Rightarrow \mu=0,75$ ΣΩΣΤΟ το (γ)

Β2) $\Sigma F_y=0 \Rightarrow N=w \Rightarrow N=mg \Rightarrow N=20N$

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

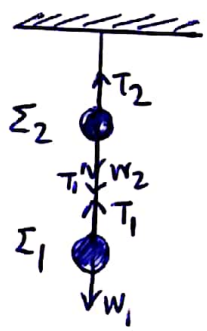
$\Delta x=\frac{1}{2} a \cdot \Delta t^2 \Rightarrow 4=\frac{1}{2} \cdot a \cdot 2^2 \Rightarrow \boxed{a=2 m/s^2}$

$\Sigma F_x=ma \Rightarrow F-T=ma \Rightarrow F-10=2 \cdot 2 \Rightarrow \boxed{F=14N}$

$W_F=+F \cdot \Delta x=14 \cdot 4J \Rightarrow \boxed{W_F=56J}$

$W_T=-T \cdot \Delta x=-10 \cdot 4J \Rightarrow \boxed{W_T=-40J}$

Β3)

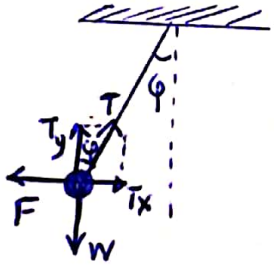


ΣΧΗΜΑ 1

Για το Σ_1: $\Sigma F=0 \Rightarrow T_1=w_1 \Rightarrow \boxed{T_1=50N}$

Για το Σ_2: $\Sigma F=0 \Rightarrow T_2=T_1'+w_2 \Rightarrow T_2=50N+100N \Rightarrow \boxed{T_2=150N}$

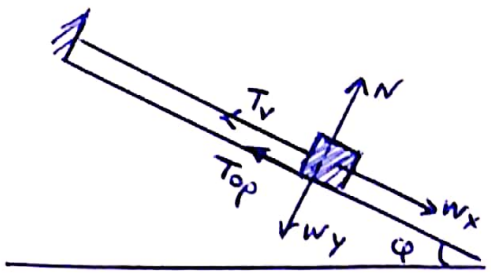
ΣΧΗΜΑ 2



$\Sigma F_y=0 \Rightarrow T_y=w \Rightarrow T \sigma \upsilon \nu \varphi=w \Rightarrow T \cdot 0,8=100 \Rightarrow \boxed{T=125N}$

$\Sigma F_x=0 \Rightarrow T_x=F \Rightarrow T \eta \mu \varphi=F \Rightarrow 125 \cdot 0,6=F \Rightarrow \boxed{F=75N}$

ΣΧΗΜΑ 3

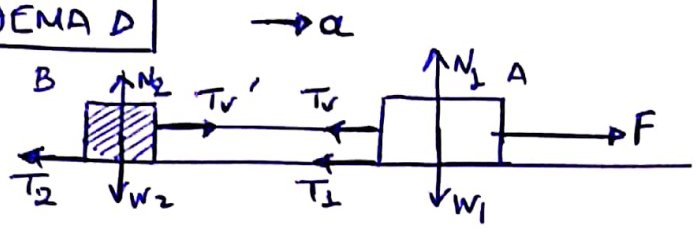


• $\Sigma F_y = 0 \Rightarrow N = W_y \Rightarrow N = W \cdot \sigma\upsilon\nu\varphi \Rightarrow$
$N = 200 \cdot 0,8 \Rightarrow \boxed{N = 160N}$

• $T_{op} = \mu_s \cdot N = 160 \cdot 0,5 \Rightarrow \boxed{T_{op} = 80N}$

• $\Sigma F_x = 0 \Rightarrow W_x = T_v + T_{op} \Rightarrow$
$mg\eta\mu\varphi = T_v + T_{op} \Rightarrow 200 \cdot 0,6 = T_v + 80 \Rightarrow$
$\Rightarrow \boxed{T_v = 40N}$

ΘΕΜΑ Δ



ΣΩΜΑ Α $\Sigma F_y = 0 \Rightarrow N_1 = W_1 \Rightarrow N_1 = m_1 g \Rightarrow N_1 = 30N$
$T_1 = \mu N_1 = 0,5 \cdot 30 \Rightarrow \boxed{T_1 = 15N}$
$\Sigma F_x = m_1 \alpha \Rightarrow F - T_v - T_1 = m_1 \alpha \ (1)$

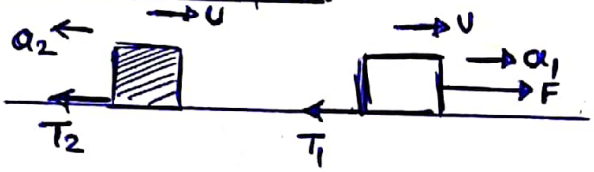
ΣΩΜΑ Β $\Sigma F_y = 0 \Rightarrow N_2 = W_2 \Rightarrow N_2 = m_2 g \Rightarrow N_2 = 10N$
$T_2 = \mu N_2 = 0,5 \cdot 10 \Rightarrow \boxed{T_2 = 5N}$
$\Sigma F_x = m_2 \alpha \Rightarrow T_v' - T_2 = m_2 \alpha \xrightarrow{T_v' = T_v} T_v - T_2 = m_2 \alpha \ (2)$

$(1)+(2) \Rightarrow F - T_v - T_1 + T_v - T_2 = m_1 \alpha + m_2 \alpha \Rightarrow F - T_1 - T_2 = (m_1 + m_2)\alpha \Rightarrow$
$30 - 15 - 5 = (3+1) \cdot \alpha \Rightarrow 10 = 4\alpha \Rightarrow \boxed{\alpha = 2,5 m/s^2}$

Για $t_1 = 4s$: $\upsilon = \alpha \cdot t_1 = 2,5 \cdot 4 \Rightarrow \boxed{\upsilon = 10 m/s}$
$S = \frac{1}{2} \alpha t_1^2 = \frac{1}{2} \cdot 2,5 \cdot 4^2 \Rightarrow S = 20m$

Από την (2) $\Rightarrow T_v - 5 = 1 \cdot 2,5 \Rightarrow \boxed{T_v = 7,5N}$

Όταν κοπεί το νήμα:



ΣΩΜΑ Α $\Sigma F_x = m_1 a_1 \Rightarrow F - T_1 = m_1 a_1 \Rightarrow 30 - 15 = 3a_1 \Rightarrow a_1 = 5 m/s^2$
Επειδή $\Sigma \vec{F_x} \uparrow\uparrow \vec{\upsilon}$ θα εκτελέσει ευθύγραμμη ομαλά επιβραδυνόμενη κίνηση με $\upsilon_{αρχ} = \upsilon = 10 m/s$

Για $\Delta t = t_2 - t_1 = 3s$: $S_1 = \upsilon_{αρχ} \cdot \Delta t + \frac{1}{2} a_1 \Delta t^2 = 10 \cdot 3 + \frac{1}{2} \cdot 5 \cdot 3^2 \Rightarrow$
$S_1 = 30 + 22,5 \Rightarrow S_1 = 52,5m$

ΣΩΜΑ Β $\Sigma F_x = m_2 a_2 \Rightarrow T_2 = m_2 a_2 \Rightarrow 5 = 1 \cdot a_2 \Rightarrow a_2 = 5\,m/s^2$ (ΜΕΤΡΟ ΕΠΙΒΡΑΔΥΝΣΗΣ)

Επειδή $\Sigma\vec{F} \uparrow\downarrow \vec{v}$ θα εκτελέσει ευθύγραμμη ομαλά επιβραδυνόμενη μέχρι να σταματήσει: $t_{stop} = \frac{v_{0x}}{|a_2|} = \frac{10}{5} \Rightarrow t_{stop} = 2s$

$S_{stop} = \frac{v_{0x}^2}{2|a_2|} = \frac{10^2}{2 \cdot 5} = \frac{100}{10} \Rightarrow S_{stop} = 10m$

Το σώμα Β θα έχει σταματήσει να κινείται την χρονική στιγμή $t = t_1 + t_{stop} = 4s + 2s \Rightarrow t = 6s$, ενώ την χρονική στιγμή $t_2 = 7s$ θα είναι ήδη ακίνητο.

Συνεπώς μέχρι την θραύση του νήματος θα διανύσει: $S_2 = S_{stop} = 10m$

ΥΠΟΛΟΓΙΣΜΟΣ ΘΕΡΜΟΤΗΤΩΝ

Για το χρονικό διάστημα $0 - t_1$:

$Q_1 = |W_{T_1}| = T_1 S = 15 \cdot 20\,J \Rightarrow Q_1 = 300\,J$

$Q_2 = |W_{T_2}| = T_2 \cdot S = 5 \cdot 20\,J \Rightarrow Q_2 = 100\,J$

Για το χρονικό διάστημα $t_1 = 4s$ έως $t_2 = 7s$

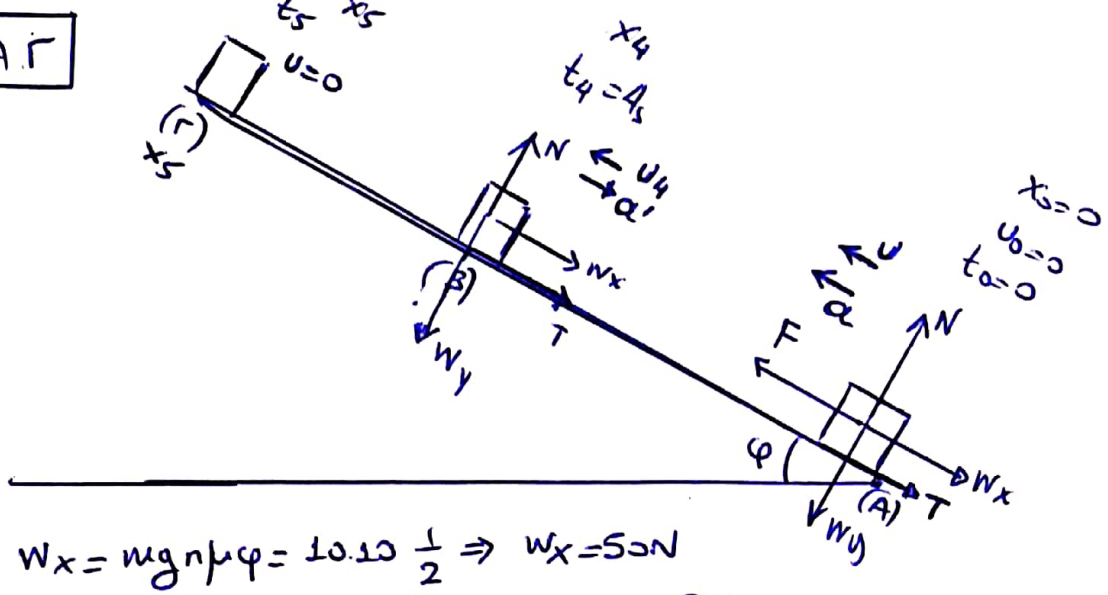
$Q_1' = |W_{T_1}| = T_1 S_1 = 15 \cdot 52{,}5\,J \Rightarrow Q_1' = 787{,}5\,J$

$Q_2' = |W_{T_2}| = T_2 \cdot S_2 = 5 \cdot 10\,J \Rightarrow Q_2' = 50\,J$

ΣΥΝΟΛΙΚΑ: $Q_{ολ} = Q_1 + Q_2 + Q_1' + Q_2' = 300J + 100J + 787{,}5J + 50J \Rightarrow$

$\boxed{Q_{ολ} = 1237{,}5J}$

ΘΕΜΑ Γ



Γ1.) $W_x = mg\eta\mu\varphi = 10\cdot 10\,\frac{1}{2} \Rightarrow W_x = 50N$

$W_y = mg\sigma\upsilon\nu\varphi = 10\cdot 10\,\frac{\sqrt{3}}{2} \Rightarrow W_y = 50\sqrt{3}N$

$\Sigma f_y = 0 \Rightarrow N = W_y \Rightarrow N = 50\sqrt{3}N$

$T = \mu N = \frac{\sqrt{3}}{3}\cdot 50\sqrt{3} \Rightarrow T = 50N$

Γ2) $\Sigma f_x = m\alpha \Rightarrow F - W_x - T = m\alpha \Rightarrow 120 - 50 - 50 = 10\alpha \Rightarrow$

$\Rightarrow 20 = 10\cdot\alpha \Rightarrow \alpha = 2m/s^2$

Γ3) • $\Delta x_1 = \frac{1}{2}\alpha\Delta t_1^2 \Rightarrow \Delta x_1 = \frac{1}{2}\cdot 2\cdot 4^2 \Rightarrow \Delta x_1 = 16m \Rightarrow$

$x_4 - x_0 = 16m \Rightarrow x_4 - 0 = 16m \Rightarrow x_4 = 16m$

• $u_4 = \alpha\cdot\Delta t_1 = 2\cdot 4 \Rightarrow u_4 = 8m/s$

Γ4) $W_W^{A\to B} = W_{W_x}^{A\to B} = -W_x\cdot\Delta x_1 = -50\cdot 16J \Rightarrow W_W^{A\to B} = -800J$

$W_F = F\cdot\Delta x_1 = 120\cdot 16J = 1920J$

Γ5) $\Sigma F_x = ma' \Rightarrow W_x + T = ma' \Rightarrow 50+50 = 10\cdot a' \Rightarrow a' = 10m/s^2$

$\Delta x_2 = S_{stop} = \frac{u_{αρ}^2}{2|a'|} = \frac{u_4^2}{2|a'|} = \frac{8^2}{2\cdot 10} = 3,2m$ (Μέτρο επιβράδυνσης)

και

$\Delta x_2 = x_5 - x_4 \Rightarrow x_5 = \Delta x_2 + x_4 \Rightarrow x_5 = 3,2m + 16m \Rightarrow$

$x_5 = 19,2m$