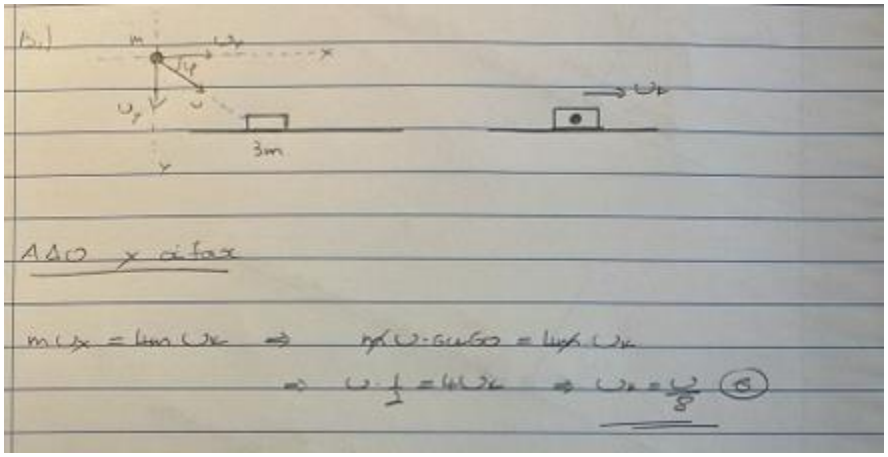
ΘΕΜΑ Α

Α1) α **Α2)** β **Α3)** δ **Α4)** α

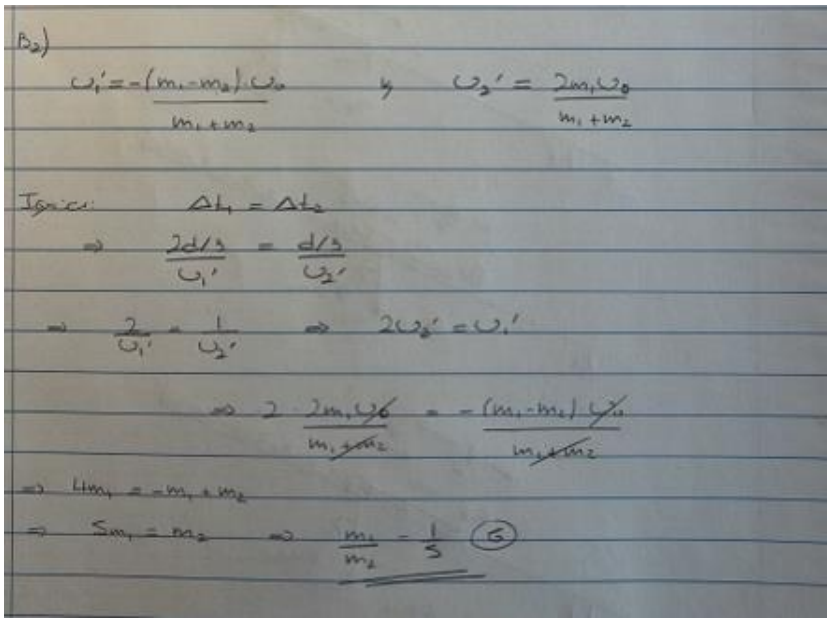
Α5) α. Λ β. Σ γ. Λ δ. Σ ε. Σ

ΘΕΜΑ Β

Β1) β



Β2) β



Β3)

I. (γ)

Ισχύει: $K_{max} = \frac{1}{2} m \upsilon_{max}^2$ και $\upsilon = \frac{\upsilon_{max}}{2}$.

Άρα:

$$K = \frac{1}{2} m \left(\frac{\upsilon_{max}}{2} \right)^2 = \frac{K_{max}}{4} = 2J$$

Είναι: $U = E - K = 6J$

II. (γ)

Έχουμε: $|\alpha| = \frac{\alpha_{max}}{2}$ ή $\omega^2 |x| = \frac{\omega^2 A}{2}$ ή

$$|x| = \frac{A}{2}$$

$K = E - U$ ή $K = E - \frac{1}{2} k \frac{A^2}{4}$ ή

$K = E - \frac{E}{4}$ ή $K = \frac{3E}{4}$ ή $K = 6J$

ΘΕΜΑ Γ

α) i) Είναι $T = 0,2\pi \sec$ και

$\omega = \frac{2\pi}{T} = 10 \, rad / \sec$

$\alpha_{max} = \omega^2 A$ ή $A = \frac{\alpha_{max}}{\omega^2} = 0,04 \, m$

$\upsilon_{max} = \omega A = 0,4 \, m / \sec$

ii) Τη χρονική στιγμή $t = 0$ είναι:

$\alpha = -\alpha_{max}$

Επομένως έχουμε: $x = +A$.

Άρα:

$x = A\eta\mu\varphi_0$ $+A = A\eta\mu\varphi_0$ ή $\eta\mu\varphi_0 = +1$

Άρα: $\varphi_0 = \pi / 2 \, rad$.

β) Είναι:

$F_{\epsilon\pi} - Dx$ ή

$F_{\epsilon\pi} = -m\omega^2 A\eta\mu(\omega t + \varphi_0)$ ή

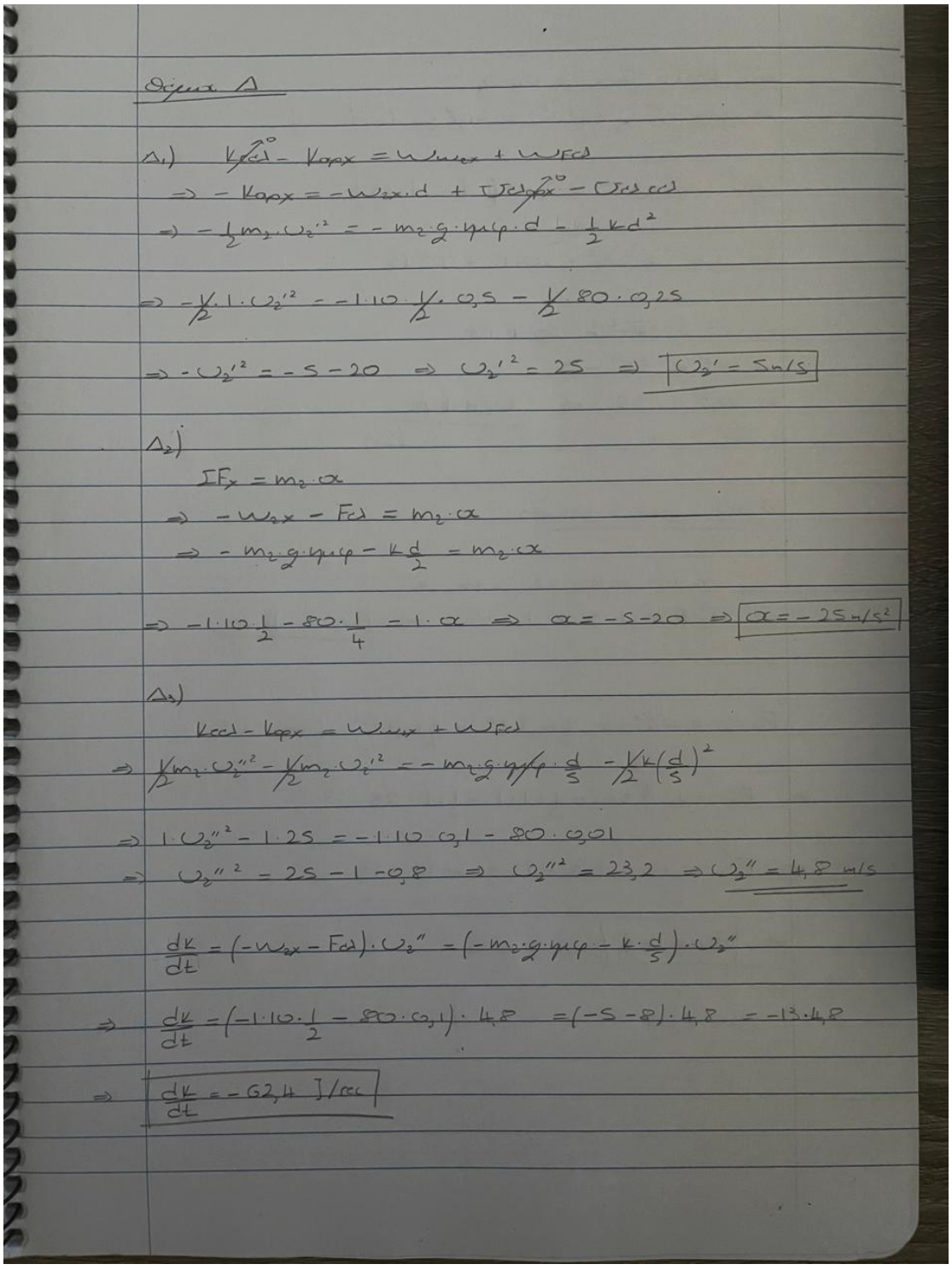
$F_{\epsilon\pi} = -8\eta\mu\left(10t + \frac{\pi}{2}\right)$ (S.I.) (1)

γ) Έχουμε:

$\frac{dp}{dt} = F_{\epsilon\pi} \overset{(1)}{\rightarrow} \frac{dp}{dt} = -8\eta\mu\left(10\frac{\pi}{30} + \frac{\pi}{2}\right) =$

$= -4 \, kg \frac{m}{\sec^2}$

ΘΕΜΑ Δ



Θέμα Δ

Δ1) $K_{τελ}^{0} - K_{αρχ} = W_{w_{2x}} + W_{F_{ελ}}$

$\Rightarrow -K_{αρχ} = -w_{2x} \cdot d + U_{ελ,αρχ}^{0} - U_{ελ,τελ}$

$\Rightarrow -\frac{1}{2} m_2 \cdot v_2'^2 = -m_2 \cdot g \cdot \mu_{κ\varphi} \cdot d + \frac{1}{2} k d^2$

$\Rightarrow -\frac{1}{2} \cdot 1 \cdot v_2'^2 = -1 \cdot 10 \cdot \frac{1}{2} \cdot 0{,}5 + \frac{1}{2} \cdot 80 \cdot 0{,}25$

$\Rightarrow -v_2'^2 = -5 - 20 \Rightarrow v_2'^2 = 25 \Rightarrow \boxed{v_2' = 5\,m/s}$

Δ2)

$\Sigma F_x = m_2 \cdot \alpha$

$\Rightarrow -w_{2x} - F_{ελ} = m_2 \cdot \alpha$

$\Rightarrow -m_2 \cdot g \cdot \mu_{κ\varphi} - k\frac{d}{2} = m_2 \cdot \alpha$

$\Rightarrow -1 \cdot 10 \frac{1}{2} - 80 \cdot \frac{1}{4} = 1 \cdot \alpha \Rightarrow \alpha = -5 - 20 \Rightarrow \boxed{\alpha = -25\,m/s^2}$

Δ3)

$K_{τελ} - K_{αρχ} = W_{w_{2x}} + W_{F_{ελ}}$

$\Rightarrow \frac{1}{2} m_2 \cdot v_2''^2 - \frac{1}{2} m_2 \cdot v_2'^2 = -m_2 \cdot g \cdot \mu_{κ\varphi} \cdot \frac{d}{5} - \frac{1}{2} k \left(\frac{d}{5}\right)^2$

$\Rightarrow 1 \cdot v_2''^2 - 1 \cdot 25 = -1 \cdot 10 \cdot 0{,}1 - 80 \cdot 0{,}01$

$\Rightarrow v_2''^2 = 25 - 1 - 0{,}8 \Rightarrow v_2''^2 = 23{,}2 \Rightarrow \underline{v_2'' = 4{,}8\,m/s}$

$\frac{dK}{dt} = (-w_{2x} - F_{ελ}) \cdot v_2'' = (-m_2 \cdot g \cdot \mu_{κ\varphi} - k \cdot \frac{d}{5}) \cdot v_2''$

$\Rightarrow \frac{dK}{dt} = (-1 \cdot 10 \cdot \frac{1}{2} - 80 \cdot 0{,}1) \cdot 4{,}8 = (-5 - 8) \cdot 4{,}8 = -13 \cdot 4{,}8$

$\Rightarrow \boxed{\frac{dK}{dt} = -62{,}4\ J/sec}$

Δ4) $K_{τελ} - K_{αρχ} = W_{w_1}$

$\Rightarrow \frac{1}{2} m_1 υ_1^2 - \frac{1}{2} m_1 υ_0^2 = -m_1 g (1 - 1 \cdot συνφ)$

$\Rightarrow υ_1^2 - υ_0^2 = -2 \cdot 10 \left(1 - 1 \cdot \frac{\sqrt{3}}{2}\right)$

$\Rightarrow υ_1^2 = υ_0^2 - 20 \cdot 1 + 10 \cdot \sqrt{3}$

$\Rightarrow υ_1^2 = \sqrt{39}^2 - 20 + 17$

$\Rightarrow υ_1^2 = 39 - 3$

$\Rightarrow υ_1^2 = 36 \Rightarrow υ_1 = 6 m/s$

ΑΔΟ για κρούση

$m_1 υ_1 = m_2 υ_2' + m_1 υ_1'$

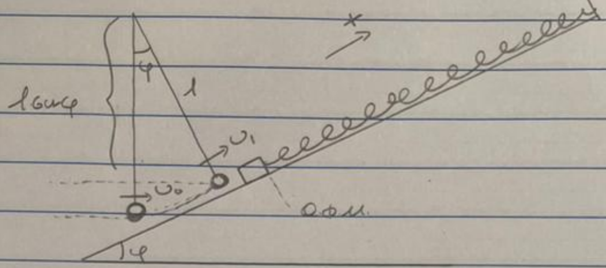
$\Rightarrow 1 \cdot 6 = 1 \cdot 5 + 1 \cdot υ_1' \Rightarrow υ_1' = 1 m/s$

$E_{απ} = K - K' = \frac{1}{2} m_1 υ_1^2 - \frac{1}{2} m_1 υ_1'^2 - \frac{1}{2} m_2 υ_2'^2$

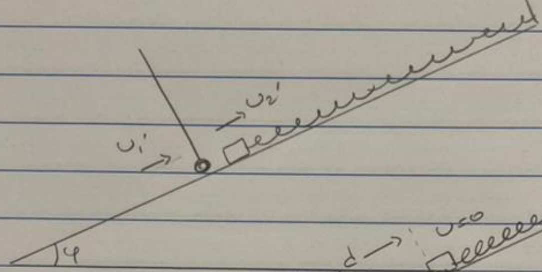
$\Rightarrow E_{απ} = \frac{1}{2} \cdot 1 \cdot 36 - \frac{1}{2} \cdot 1 \cdot 1 - \frac{1}{2} \cdot 1 \cdot 25$

$\Rightarrow E_{απ} = 18 - 0{,}5 - 12{,}5 = 18 - 13$

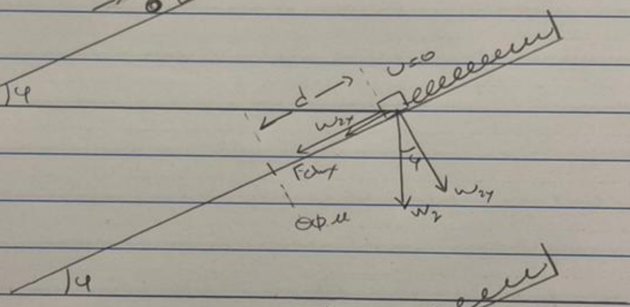
$\Rightarrow \boxed{E_{απ} = 5 J}$



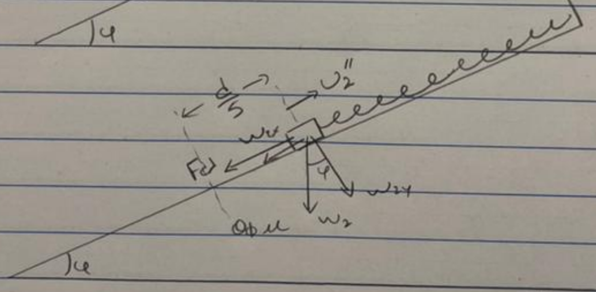
lcosφ
φ
l
x
υ1
υ0
ΘΦΜ
φ



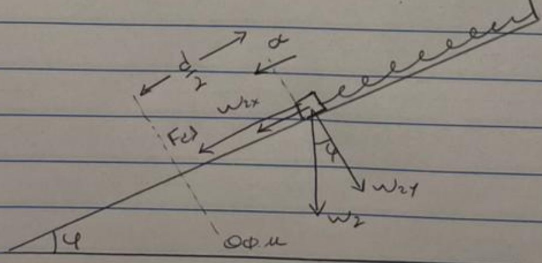
υ2'
υ1'
φ



d
υ=0
w2x
φ
w2y
w2
ΘΦΜ
φ



υ2''
w2x
φ
w2y
w2
ΘΦΜ
φ



d/2
d
w2x
φ
w2y
w2
ΘΦΜ
φ