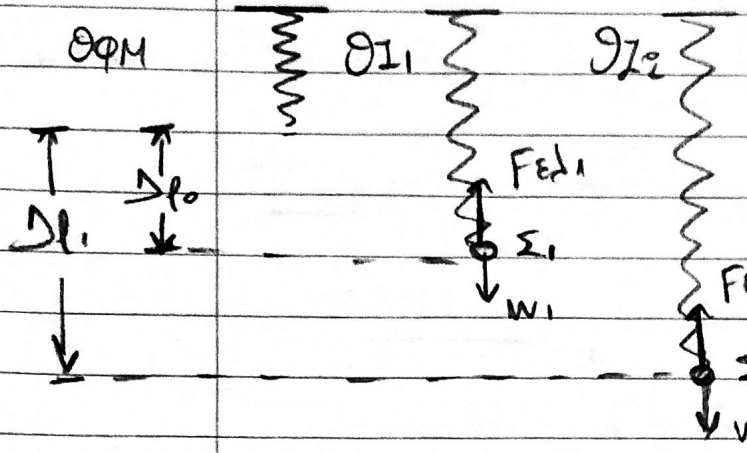
ΘΦΜ



$\Theta_{Σ_1}: \Sigma F = 0 \Rightarrow$

$\Rightarrow w_1 = F_{ελ_1} \Rightarrow$

$\Rightarrow 10 = 100\,\Delta l_0$

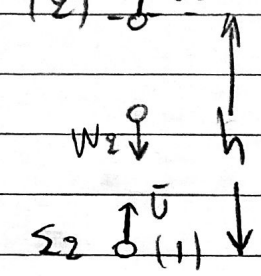
$\Rightarrow \underline{\Delta l_0 = 0{,}1\,m}$

$\Theta_{Σ_{12}}: \Sigma F = 0 \Rightarrow$

$\Rightarrow w_{12} = F_{ελ_2} \Rightarrow$

$\Rightarrow \underline{\Delta l_1 = 0{,}2\,m}$

Κίνηση $Σ_2$



ΘΜΚΕ (1) → (2)

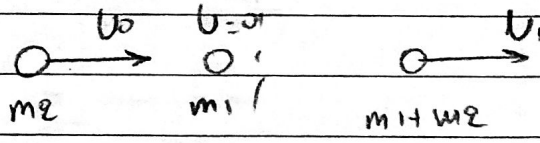
$\Delta K = \Sigma W \Rightarrow$

$\Rightarrow \frac{1}{2} m_2 U_0^2 - \frac{1}{2} m_2 U^2 = W_{w_2} \Rightarrow$

$\Rightarrow \frac{1}{2}(U_0^2 - U^2) = -15 \Rightarrow$

$\Rightarrow U_0^2 - U^2 = -30 \Rightarrow |U_0| = \sqrt{6}\ m/s$

Κρούση $Σ_2 \rightarrow Σ_1 + Σ_2$



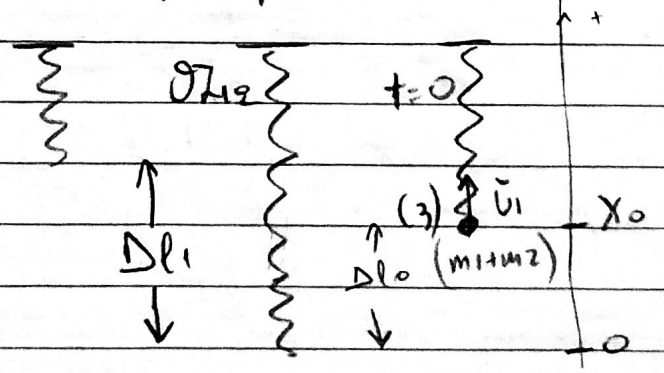
ΑΔΟ: $m_2 U_0 = (m_1+m_2) U_1$

$\Rightarrow U_0 = 2U_1 \Rightarrow$

$\Rightarrow U_1 = 0{,}5\sqrt{6}\ m/s$

Συνθήκη - Ταλάντωση

ΘΦΜ



$X_0 = \Delta l_1 - \Delta l_0 \Rightarrow$

$\Rightarrow \underline{X_0 = 0{,}1\,m}$

Τη χρονική στιγμή $t=0$, $\delta\varepsilon$ $X = X_0 = +0{,}1\,m$ και $U = +0{,}5\sqrt{6}\ m/s$

ΑΔΕΤ

$\frac{1}{2} k A_1^2 = \frac{1}{2} k X_0^2 + \frac{1}{2}(m_1+m_2) U_1^2 \Rightarrow 100 A_1^2 = 1+3$

$\Rightarrow \underline{A_1 = 0{,}2\,m}$

(a)

β) $U=0$ για πρώτη φορά στη θέση $x=+A$, $u>0$

Για $t=0$, $x=+\frac{1}{2}A \Rightarrow \dots \underline{\varphi_0=\pi/6}$!

$\omega=\sqrt{\frac{k}{m_1+m_2}} \Rightarrow \omega=\sqrt{50} \Rightarrow \omega=5\sqrt{2}\ rad/s$

$x=0{,}2\cdot\eta\mu(5\sqrt{2}t+\frac{\pi}{6})$

$U=\sqrt{2}\,\sigma\upsilon\nu(5\sqrt{2}t+\frac{\pi}{6})$

Για $U=0$

$0=\sqrt{2}\,\sigma\upsilon\nu(5\sqrt{2}t+\frac{\pi}{6})$

$\Rightarrow \sigma\upsilon\nu(5\sqrt{2}t+\frac{\pi}{6})=0=\sigma\upsilon\nu\frac{\pi}{2} \Rightarrow$

$\Rightarrow 5\sqrt{2}t+\frac{\pi}{6}=2k\pi+\frac{\pi}{2}$ ή $5\sqrt{2}t+\frac{\pi}{6}=2k\pi-\frac{\pi}{2}$

$5\sqrt{2}t=2k\pi+\frac{\pi}{3}$ ή $5\sqrt{2}t=2k\pi-\frac{2\pi}{3}$

$5\sqrt{2}t=\frac{6k\pi+\pi}{3}$ ή $5\sqrt{2}t=\frac{6k\pi-2\pi}{3}$

$5\sqrt{2}t=\frac{6k+1}{3}\pi$ ή $5\sqrt{2}t=\frac{6k-2}{3}\pi$

$t=\frac{6k+1}{30}\sqrt{2}\cdot\pi$ ή $t=\frac{6k-2}{30}\cdot\sqrt{2}\pi$

$k=0$ $t_1=\frac{\sqrt{2}\pi}{30}s$ $t_2<0$ απορρ.

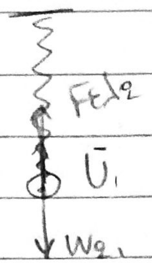
$k=1$ $t_3=\frac{7\sqrt{2}}{30}\pi\ s$ $t_4=\frac{11\sqrt{2}}{30}\pi\ s$

$t_1=\frac{\sqrt{2}}{30}\pi\ s$, τότε θα γίνει $U=0$ για πρώτη φορά και επαληθεύεται με x:

$+A=A\eta\mu(\omega t_1+\varphi_0) \Rightarrow \eta\mu(\omega t_1+\varphi_0)=1 \Rightarrow \eta\mu(5\sqrt{2}\cdot\frac{\sqrt{2}}{30}\pi+\frac{\pi}{6})=1$

$\Rightarrow \eta\mu(\frac{\pi}{3}+\frac{\pi}{6})=1 \Rightarrow \eta\mu\frac{\pi}{2}=1$ Σωστά

γ) $\frac{\Delta p}{\Delta t}$



i) m_1+m_2
αφέσω μετά τη κρούση

$$\frac{d\bar{p}_1}{dt} = \Sigma\bar{F}_1 = (m_1+m_2)\,\bar{α}_1 \quad (1)$$

$$α_1 = -ω^2 A_1 ημφ_0 = -\frac{100}{2}\cdot 0{,}2\cdot\frac{1}{2} \Rightarrow α_1 = -5\ m/s^2$$

$$\frac{d\bar{p}_1}{dt} = -10\ kg\cdot m/s^2$$

ii) Στις ακραίες θέσεις
θετική ή αρνητική
Λόγω της (1) τόσο στο (+) όσο και στο (-)
άκρο $|α(+)| = |α(-)| = |α_2|$

$$\left.\begin{aligned} x &= A_1 ημ(ωt+φ_0) \\ α &= -ω^2 A\, ημ(ωt+φ_0) \end{aligned}\right\} α = -ω^2 x \quad (2) \Rightarrow \bar{α} = -ω^2\bar{x}$$

αντίρροπα μεγέθη

$$(2) \Rightarrow |α_2| = +ω^2 A = 50\cdot 0{,}2 = 10\ m/s^2$$

I) Θετική ακραία θέση
$$α = -ω^2 A = -10\ m/s^2$$
$$\frac{dp_{θετ}}{dt} = -20\ kg\cdot m/s^2$$

II) Αρνητική ακραία θέση
$$α = -ω^2(-A) \Rightarrow α = +10\ m/s^2$$
$$\frac{dp_{αρν}}{dt} = +20\ kg\cdot m/s$$