ΘΕΜΑ Α

Α1. β

Α2. δ

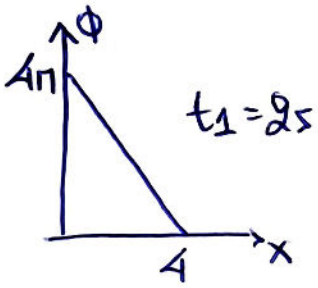
Α3. β

Α4. α

Α5. α.Λ β.Σ γ.Σ δ.Λ ε.Λ

ΘΕΜΑ Β

Β1. (i)



$$U_s = \frac{x}{t} = \frac{4}{2} = 2 m/s$$

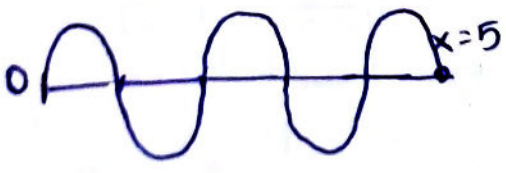
$$\varphi = 2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) \overset{\substack{t_1=2 \\ x=0}}{\Longrightarrow} 4\pi = 2\pi\left(\frac{2}{T} - 0\right) \Rightarrow T = 1s$$

$$f = \frac{1}{T} = 1 Hz$$

$$\lambda = \frac{U}{f} = 2m$$

Την $t_2 = 2,5s$: $U_s = \frac{x}{t_2} \Rightarrow x = 5m$

Άρα το κύμα έχει διαδοθεί σε απόσταση 5m από το Ο, άρα αφού $\lambda = 2m$ έχουμε την $t_2 = 2,5s$ $2,5\lambda$ επομένως και 5 σημεία που θα ~~έχουν~~ βρίσκονται σε ακραία θέση.



Β2. (ii)

$K = hf_1 - \varphi \Rightarrow \varphi = h \cdot f_1$ (1)

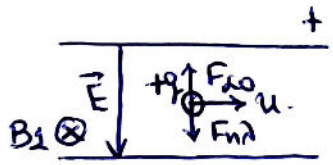
Όταν $f_2 = 3f_1$.

$K_{max} = hf_2 - \varphi \Rightarrow K_{max} = 3hf_1 - hf_1 = 2hf_1$

Επομένως

$eV_0 = 2hf_1 \Rightarrow V_0 = \frac{2hf_1}{e}$

Β3. α)(ii)



$F_{λ1} = F_{20} \Rightarrow E \cdot |q| = B_1 u |q| \Rightarrow u = \frac{E}{B_1}$.

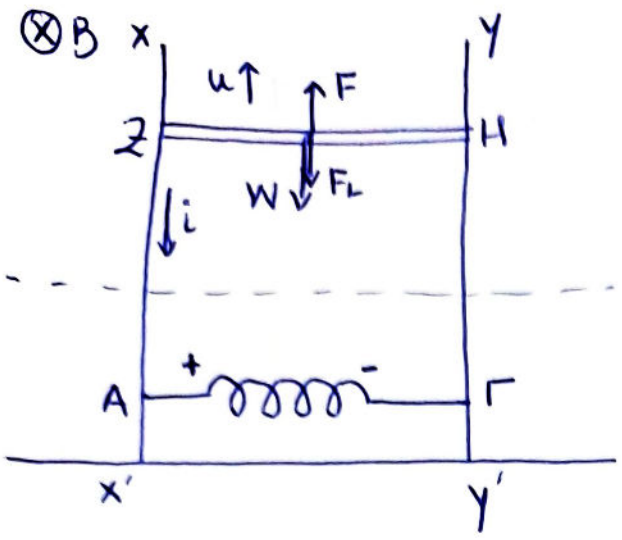
β) (i)

$F_{20} = F_K \Rightarrow B \cdot |q| = m\frac{u^2}{R} \Rightarrow R = \frac{mu}{B|q|}$

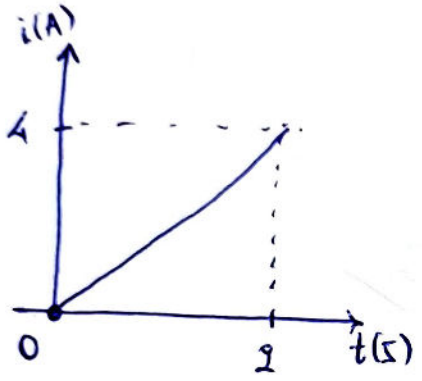
$d = 2R_2 - 2R_1 = 2(R_2 - R_1) = 2\left(\frac{m_2 u}{B_2|q|} - \frac{m_1 u}{B_2|q|}\right) =$

$= 2\frac{\Delta m u}{B_2|q|} \Rightarrow \Delta m = \frac{dB_2|q|}{2 \cdot u} = \frac{dB_1B_2|q|}{2E}$

ΘΕΜΑ Γ



Γ1.



$\frac{\Delta i}{\Delta t} = κλίση = \frac{4}{2} = 2\ A/s$

$q_{επ} = Εμβαδόν\ τριγώνου = \frac{1}{2} \cdot 2 \cdot 4 = 4\ C$

Γ2. Το άκρο Α (+) και το άκρο Γ (-)

$$E_{ΑΥΤ} = \left| -L\frac{\Delta i}{\Delta t} \right| = \frac{1}{2} \cdot 2 = 1V$$

Γ3. 2ος κανόνας Kirchoff:

$$E_{επ} - iR - E_{ΑΥΤ} = 0$$

$$B \cdot u \cdot l - 2 \cdot t \cdot 1 - 1 = 0$$

$u = 2t + 1\ (S.I.)$ ΕΥΘΥΓΡΑΜΜΗ ΟΜΑΛΑ ΕΠΙΤΑΧΥΝΟΜΕΝΗ ΜΕ $u_0 = 1 m/s$ και $a = 2 m/s^2$

Γ4.α) $W = mg = 5N$

$F_L = B \cdot i \cdot l = 4N$

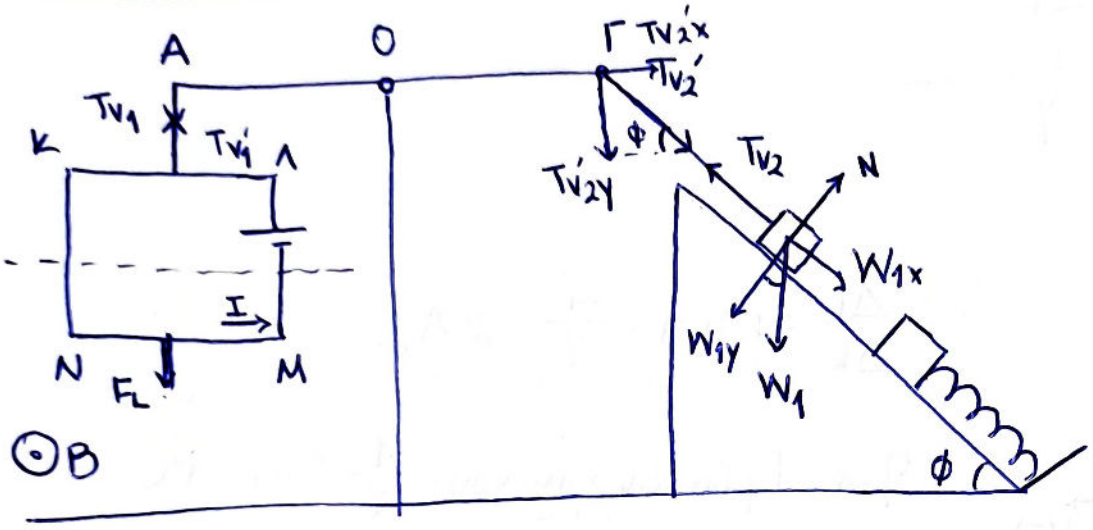
$\Sigma F = m \cdot a \Rightarrow F - F_L - W = m \cdot a \Rightarrow F = 1 + 4 + 5 = 10N.$

β) $P_F = \frac{dW_F}{dt} = \frac{F \cdot dx}{dt} = F \cdot u = 10 \cdot 5 = 50\,W$

$u(2) = 2 \cdot 2 + 1 = 5\,m/s$

γ) $P_2 = E_{AVT} \cdot i = 1 \cdot 4 = 4\,W$

ΘΕΜΑ Δ



Δ1. $I = \frac{E}{R} = \frac{30}{2} = 15\,A$

$F_L = B \cdot I \cdot \ell = B \cdot 15 \cdot 0{,}8$ (1).

$W_1 = m_1 g = 30N$

$W_{1x} = W_1 \cdot \eta\mu 37° = 30 \cdot 0{,}6 = 18N$

$W_{1y} = W_1 \cdot \sigma\upsilon 37° = 30 \cdot 0{,}8 = 24N$

Σ1: $\Sigma F_x = 0 \Rightarrow T_{v2} = W_{1x} = 18N$

$\Sigma F_y = 0 \Rightarrow W_{1y} = N = 24N$

$T_{v2x} = T_{v2} \cdot \sigma\upsilon\phi = 18 \cdot 0{,}8 = 14{,}4N$

$T_{v2y} = T_{v2} \cdot \eta\mu\phi = 18 \cdot 0{,}6 = 10{,}8N$

ΑΓ: $\Sigma \tau_0 = 0 \Rightarrow T_{v1} \cdot \frac{\ell}{2} = T_{v2y} \frac{\ell}{2} \Rightarrow$ **$T_{v1} = T_{v2y} = 10{,}8N$**

Δ2. (1) $F_2 = Tv_1 = B \cdot I \cdot \ell \Rightarrow 18 \cdot 0,6 = B \cdot 15 \cdot 0,8 \Rightarrow$

$$B = \frac{6 \cdot 3 \cdot 6}{5 \cdot 3 \cdot 8} = \frac{36}{40} = \frac{9}{10} = 0,9\,T$$

Δ3. Αρχικά για το S_2:

$$\omega_2 = \sqrt{\frac{k}{m_2}} = \sqrt{\frac{100}{1}} = 10\,rad/s$$

$$d = \frac{9\pi}{100} = A$$

Θ.Ι. $\Rightarrow u_2 = u_{max} = \omega \cdot A = 10 \cdot \frac{9\pi}{100} = 0,9\pi\,m/s$

$$\Delta t = \frac{T}{4} = \frac{2\pi}{4\omega} = \frac{2\pi}{40} = \frac{\pi}{20}\,s$$

$$u_1 = a_1 \cdot \Delta t = 6 \cdot \frac{\pi}{20} = \frac{3\pi}{10} = 0,3\pi\,m/s$$

$$a_1 = \frac{W_{1x}}{m_1} = \frac{18}{3} = 6\,m/s^2$$

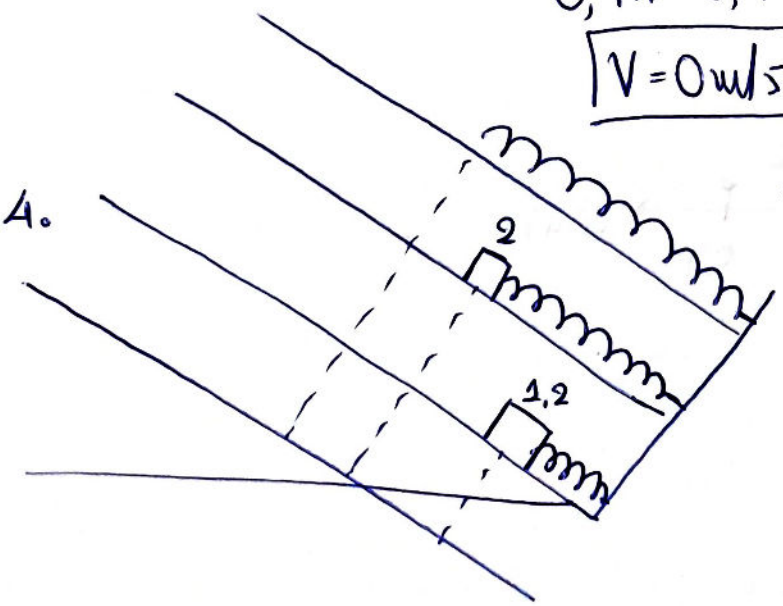
ΑΔΟ: $P_{ΑΡΧ} = P_{ΤΕΛ} \Rightarrow m_1 \cdot u_1 - m_2 u_2 = (m_1 + m_2)V \Rightarrow$

$3 \cdot 0,3\pi - 1 \cdot 0,9\pi = 4V \Rightarrow$

$0,9\pi - 0,9\pi = 4V \Rightarrow$

$$\boxed{V = 0\,m/s}$$

Δ4.



ΑΡΧΙΚΑ

Θ.Ι: $\Sigma F = 0 \Rightarrow$

$k \cdot \Delta l_2 = m_2 g \eta\mu 37° \Rightarrow$

$100\,\Delta l_2 = 10 \cdot 0,6 \Rightarrow$

$\Delta l_2 = 0,06\,m.$

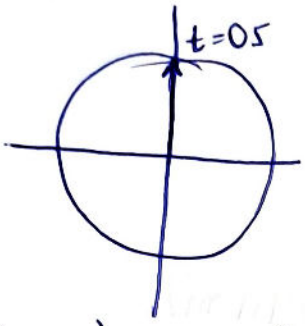
ΝΕΑ Θ.Ι: $\Sigma F = 0 \Rightarrow k \cdot \Delta l_{1,2} = (m_1+m_2) g \eta\mu 37° \Rightarrow$

$100 \Delta l_{1,2} = 40 \cdot 0,6 \Rightarrow \Delta l_{1,2} = \frac{24}{100} = 0,24 m.$

$A = \Delta l_{1,2} - \Delta l_2 = 0,24 - 0,06 = 0,18 m$

$\omega' = \sqrt{\frac{k}{m_1+m_2}} = \sqrt{\frac{100}{4}} = 5 rad/s$

$\varphi_0 = \pi/2$



$x = A\eta\mu(\omega t + \varphi_0) \Rightarrow x = 0,18 \eta\mu(5t + \pi/2)$ (S.I)

Δs. $\Sigma F = -D \cdot x \Rightarrow F_{\epsilon\pi} - W_{1,2x} = -100 \cdot x \Rightarrow F_{\epsilon\pi} = (m_1+m_2) g \eta\mu 37° - 100x$

$F_{\epsilon\pi} = 40 \cdot 0,6 - 100x = 24 - 100x$ (S.I.)

$x = +A = 0,18$ $\quad F_{\epsilon\pi} = 24 - 18 = 6N$

$x = -A = -0,18$ $\quad F_{\epsilon\pi} = 24 + 18 = 42N.$

$x = 0$ $\quad F_{\epsilon\pi} = 24N.$