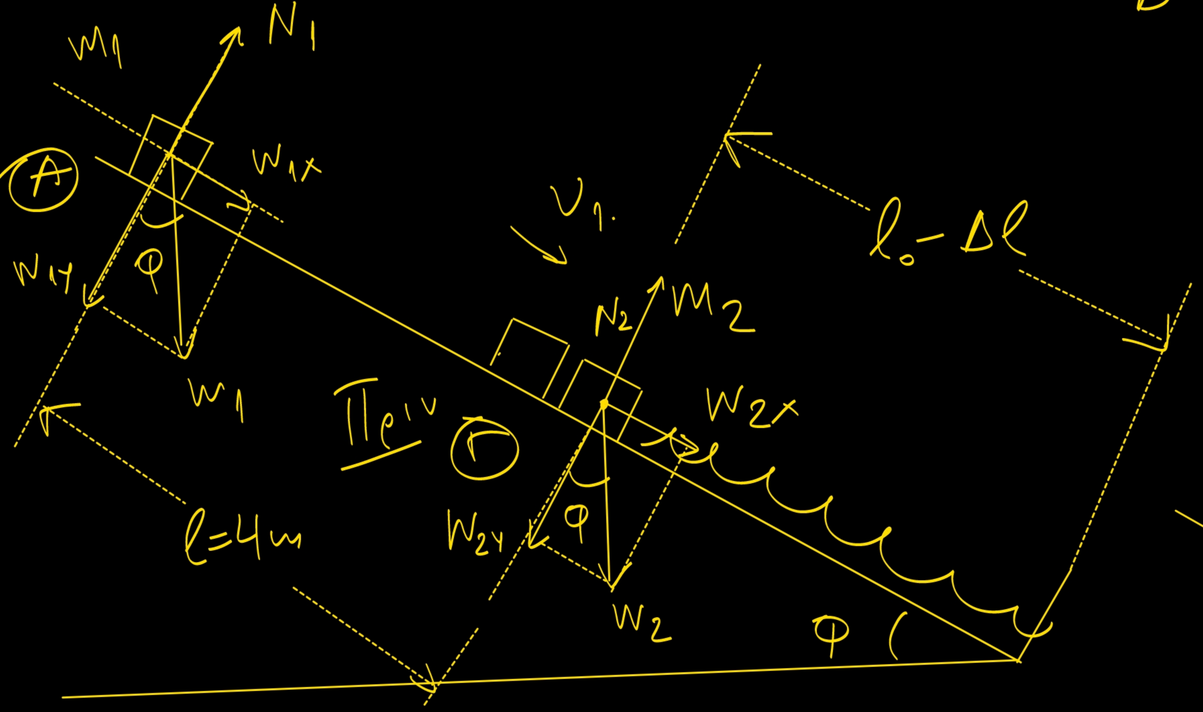
Α 64. S.48 εξ. 182.

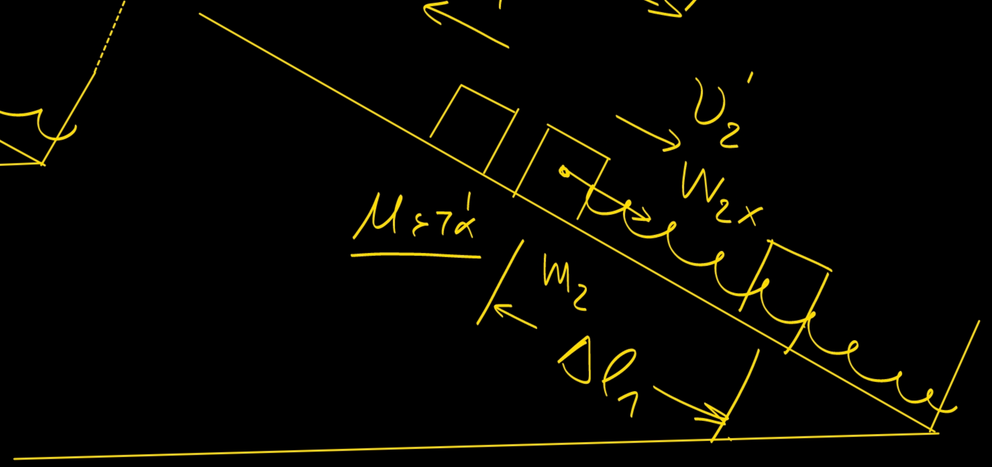


ΘΜΚΕ: Α → Γ:

$$\Delta K = \Sigma W \Rightarrow \frac{1}{2} m_1 v_1^2 - 0 = W_{w_{1x}} \Rightarrow$$

$$\frac{1}{2} m_1 v_1^2 = m_1 g \eta\mu\varphi \cdot l \Rightarrow v_1 = \sqrt{2 g l \eta\mu\varphi} =$$

$$= \sqrt{2 \cdot 10 \cdot 4 \cdot \frac{1}{2}} = \sqrt{40} \ m/s.$$



$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1 \Rightarrow$$

$$v_1' = \frac{m_1 - 3m_1}{m_1 + 3m_1} v_1 \Rightarrow$$

$$v_1' = -\frac{v_1}{2} = -\frac{\sqrt{40}}{2} = -\sqrt{10}\ m/s.$$

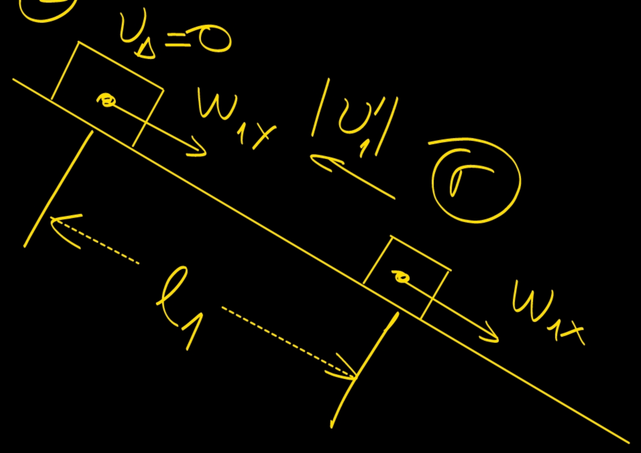
ΘΜΚΕ: Γ → Δ

$$0 - \frac{1}{2} m_1 v_1'^2 = -m_1 g \eta\mu\varphi \cdot \ell_1 \Rightarrow$$

$$\frac{v_1'^2}{2} = g \eta\mu\varphi \cdot \ell_1 \Rightarrow$$

$$\frac{10}{2} = 10 \cdot \frac{1}{2} \cdot \ell_1 \Rightarrow \ell_1 = 1\ m$$

Άρα το m_1 ανεβαίνει πάνω κατά 1m



$$v = v_0 - \alpha t$$

$$0 = |v_1'| - g \eta\mu\varphi t_1 \Rightarrow t_1 = \frac{\sqrt{10}}{5} sec$$

Η μπάλα μπαίνει στη θέση ισορροπίας

m_2, οπότε η επιπλέον συσπείρωση

Δl_1 είναι το πλάτος της ταλάντωσης

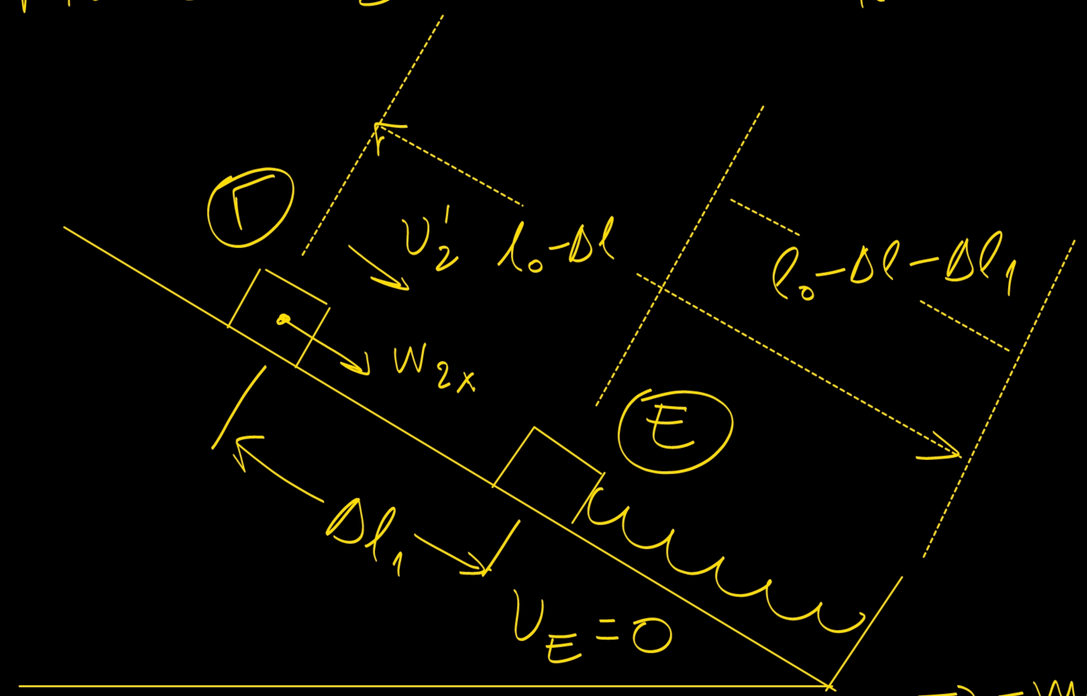
που θα εκτελέσει και $v_2' = v_{max} = \omega A = \omega \Delta l_1$

$$v_2' = \frac{2m_1}{m_1+m_2} v_1 = \frac{2m_1}{m_1+3m_1} v_1 = \frac{\sqrt{40}}{2} \text{ m/s}.$$

$$\omega = \sqrt{\frac{k}{m_2}} = \sqrt{\frac{200}{1}} = 10\sqrt{2} \text{ rad/sec}$$

Άρα: $v_2' = \omega \cdot \Delta l_1 \Rightarrow \frac{\sqrt{40}}{2} = 10\sqrt{2} \cdot \Delta l_1 \Rightarrow \Delta l_1 = \frac{\sqrt{40}}{20\sqrt{2}} = \frac{2 \cdot \sqrt{5} \cdot \sqrt{2}}{2 \cdot 10 \cdot \sqrt{2}} = \frac{\sqrt{5}}{10}$ m.

Για το m_2 από ΘΜΚΕ έχουμε:



Από τη ΘΣ έχουμε:

$$W_{2x}=K\cdot\Delta l \Rightarrow m_2 g\,\eta\mu\varphi = K\cdot\Delta l$$

ΘΜΚΕ: Γ → Ε:

$$0-\frac{1}{2}m_2U_2'^2 = W_{\text{Fελ}(\Gamma\to E)} + W_{W_{2x}(\Gamma\to E)} =$$

$$= U_{\text{ελ},\Gamma} - U_{\text{ελ},E} + W_{2x}\cdot\Delta l_1 \Rightarrow$$

$$-\frac{1}{2}m_2U_2'^2 = \frac{1}{2}K\cdot\Delta l^2 - \frac{1}{2}K\cdot(\Delta l+\Delta l_1)^2 + m_2 g\,\eta\mu\varphi\cdot\Delta l_1$$

$$\Rightarrow -m_2U_2'^2 = K\left(\Delta l^2-(\Delta l+\Delta l_1)^2\right)+2K\cdot\Delta l\cdot\Delta l_1 \Rightarrow$$

$$m_2U_2'^2 = K(\Delta l+\Delta l_1)^2 - K\Delta l^2 - 2K\cdot\Delta l\cdot\Delta l_1 \Rightarrow$$

$$m_2U_2'^2 = \cancel{K\Delta l^2} + 2K\cancel{\cdot\Delta l}\cdot\Delta l_1 + K\cdot\Delta l_1^2 - \cancel{K\cdot\Delta l^2} - \cancel{2K\cdot\Delta l}\cdot\Delta l_1 \Rightarrow$$

$$m_2U_2'^2 = K\cdot\Delta l_1^2$$

Άρα καταλήγουμε στον τύπο:

$$m_2 v_2'^2 = K \cdot \Delta l_1^2 \Rightarrow$$

$$v_2'^2 = \frac{K}{m_2} \cdot \Delta l_1^2 \Rightarrow$$

$$|v_2'| = \sqrt{\frac{K}{m_2}} \cdot \Delta l_1 = v_2' = v_{max}$$

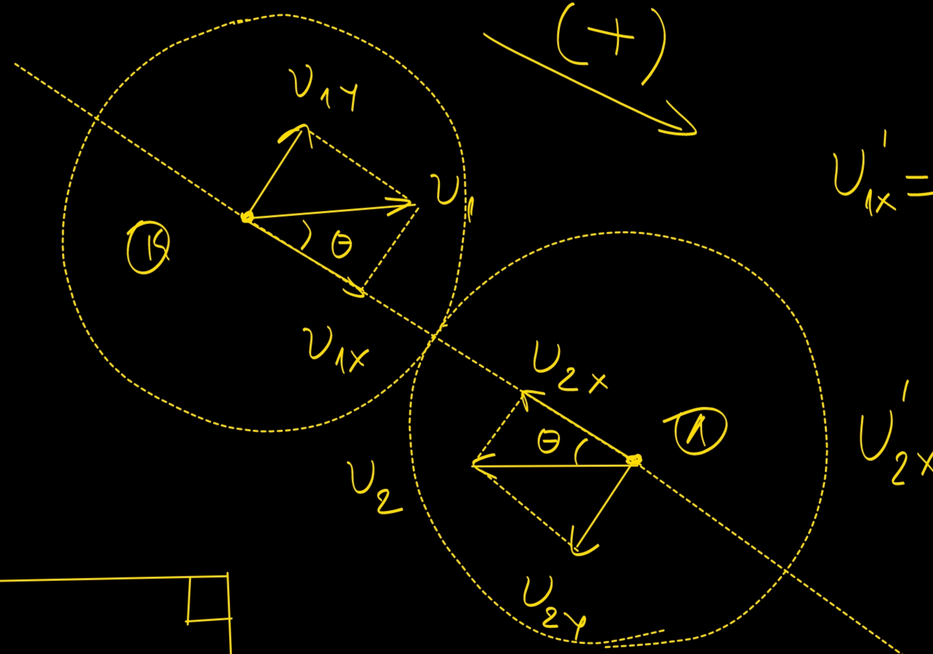
και $\Delta l_1 = \frac{\sqrt{5}}{10}$ m όπως προηγουμένως.

Ασκ. 2.179 (Μαθ)(Παλιό).

$$v_{1x} = v_1 \sigma\upsilon\nu\theta = 5 \cdot 0{,}6 = 3\ m/s.$$

$$|v_{2x}| = v_2 \cdot \sigma\upsilon\nu\theta = 10 \cdot 0{,}6 = 6\ m/s.$$

$$v_{2y} = v_2 \cdot \eta\mu\theta = 10 \cdot 0{,}8 = 8\ m/s$$



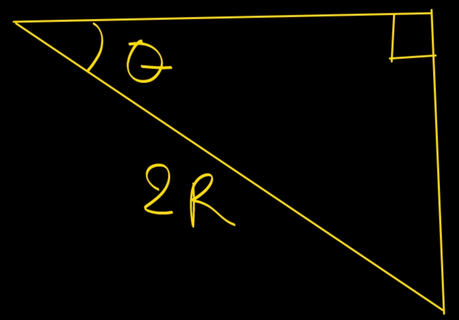
$$v'_{1x} = \frac{m_1 - m_2}{m_1 + m_2} v_{1x} + \frac{2m_2}{m_1 + m_2} v_{2x}$$

$$v'_{2x} = \frac{2m_1}{m_1 + m_2} v_{1x} + \frac{m_2 - m_1}{m_1 + m_2} v_{2x}$$

$\Rightarrow$

$$v'_{1x} = \frac{1-2}{1+2} \cdot 3 + \frac{2 \cdot 2}{1+2} \cdot (-6) = -1 - 8 = -9\ m/s.$$

$$v'_{2x} = \frac{2 \cdot 1}{1+2} \cdot 3 + \frac{2-1}{2+1} \cdot (-6) = 2 - 2 = 0\ m/s.$$



$$\eta\mu\theta = \frac{d}{2R} = \frac{0{,}4}{0{,}5} = 0{,}8$$

και $\sigma\upsilon\nu\theta = 0{,}6$.

$$v'_{2y} = v_{2y} \Rightarrow v'^2_2 = v'^2_{2x} + v'^2_{2y} = v'^2_{2y} \Rightarrow |v'_2| = v_{2y} \Rightarrow |v'_2| = 8\ m/s.$$

β) $K_{2,\text{πριν}} = \frac{1}{2} m_2 v_2^2 = \frac{1}{2} \cdot 2 \cdot 10^2 = 100\ J.$

$K_{2,\text{μετά}} = \frac{1}{2} m_2 v_2'^2 = \frac{1}{2} \cdot 2 \cdot 8^2 = 64\ J.$

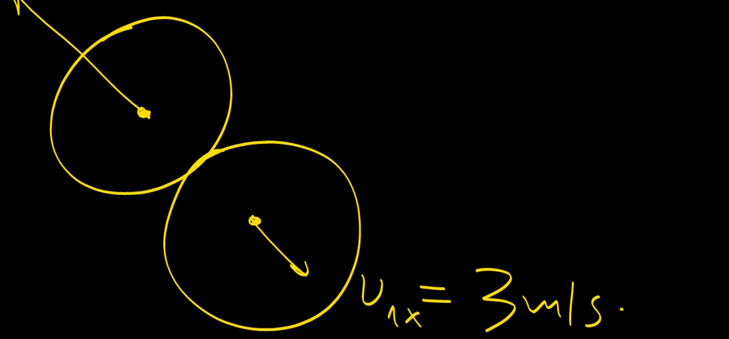
$\text{Ποσοστό μεταβολής} = \frac{\Delta K_2}{K_{2,\text{πριν}}} \cdot 100 =$

$= \frac{K_{2,\text{μετά}} - K_{2,\text{πριν}}}{K_{2,\text{πριν}}} \cdot 100 = \frac{64 - 100}{100} \cdot 100 =$

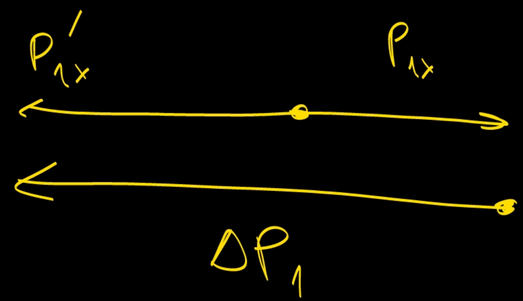
$= -36\ \%$ (μείωση)

γ) $\Delta p_{1y} = p_{1y}' - p_{1y} = m_1 v_{1y}' - m_1 v_{1y} = 0$

$v_{1x}' = -9\ m/s$



$v_{1x} = 3\ m/s.$



$\Delta p_1 = p_{1x} + |p_{1x}'| =$

$= m_1 \cdot v_1 + m_1 \cdot |v_{1x}'| = 3 + 9 = 12\ N \cdot sec$

Ασκ. 2.182 (Μαθ)

α) $\frac{1}{2} m_2 v_2'^2 = \frac{8}{9} \cdot \frac{1}{2} \cdot m_1 v_1^2$

$$v_2' = \frac{2m_1}{m_1 + m_2} v_1 = \frac{4 \cdot 10}{2 + m_2} = \frac{40}{2 + m_2} \ (m/s)$$

$$m_2 \cdot \frac{40^2}{(2+m)^2} = 2 \cdot 10^2 \Rightarrow$$

$$\frac{1600 m_2}{(2+m_2)^2} = 200 \Rightarrow 8m_2 = (2+m_2)^2 \Rightarrow$$

$$8m_2 = 4 + 4m_2 + m_2^2 \Rightarrow$$

$$m_2^2 - 4m_2 + 4 = 0$$