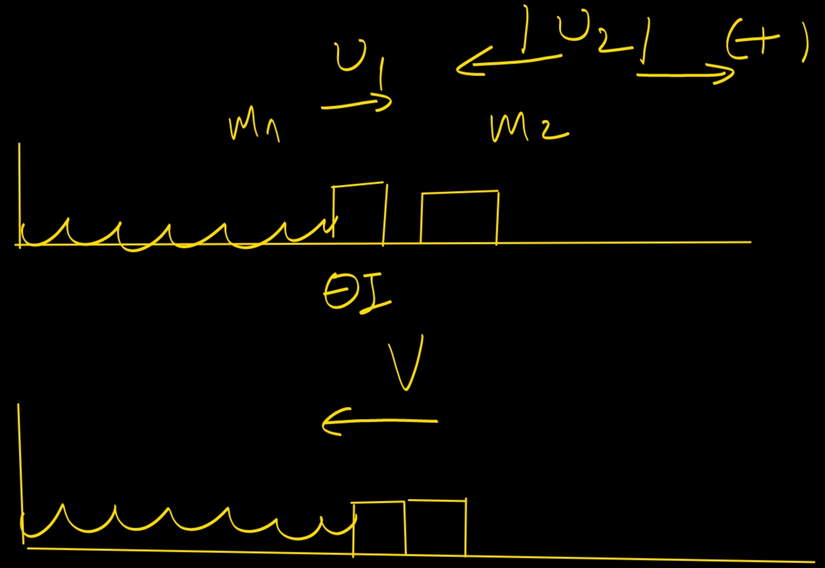
Ασκ. 2.90 σελ. 46.)

α) Πριν την κρούση:

$$\omega_1 = \sqrt{\frac{K}{m_1}}$$

Μετά την κρούση:

$$\omega_2 = \sqrt{\frac{K}{m_1+m_2}}$$



$P_{πριν} = P_{μετά} \Rightarrow$

$$m_1 U_1 + m_2 \cdot (-U_2) = (m_1+m_2)\cdot(-V)$$

Η κρούση γίνεται στη ΘΙ του m_1 όταν έχει: $U_1 = +U_{1,max} = +\omega_1 A_1$

Η κρούση είναι πλαστική επειδή αυξάνεται η περίοδος

$$\frac{3T_1}{4} = 3\cdot\frac{\pi}{20} \Rightarrow$$

$$\frac{T_1}{4} = \frac{\pi}{20} \Rightarrow T_1 = \frac{\pi}{5}\,sec$$

$$\omega_1 = \frac{2\pi}{T_1} = \frac{2\pi}{\frac{\pi}{5}} = 10\,r/s$$

$$T_2 = (11-3)\cdot\frac{\pi}{20} \Rightarrow$$

$$T_2 = \frac{8\pi}{20} = \frac{2\pi}{5}\,sec$$

$$\omega_2 = \frac{2\pi}{T_2} = \frac{2\pi}{\frac{2\pi}{5}} \Rightarrow \omega_2 = 5\,rad/sec$$

$$\frac{\omega_2}{\omega_1} = \frac{\sqrt{\frac{K}{m_1+m_2}}}{\sqrt{\frac{K}{m_1}}} = \sqrt{\frac{m_1}{m_1+m_2}} \Rightarrow$$

$$\frac{5}{10} = \sqrt{\frac{1}{1+m_2}} \Rightarrow$$

$$\frac{1}{1+m_2} = \frac{1}{4} \Rightarrow$$

$$1+m_2 = 4 \Rightarrow m_2 = 3\,kg.$$

β) Έστω ότι το m_1 ξεκινά από τη θέση $+A_1$

$x_1(0) = +A_1 \Rightarrow \varphi_0 = \frac{\pi}{2}\,rad$

Άρα: $x_1(t) = A_1 \sigma\upsilon\nu(\omega_1 t + \varphi_0) \Rightarrow$

$$x_1(t) = 0{,}1\,\sigma\upsilon\nu\left(10t + \frac{\pi}{2}\right)\ (SI)$$

$$\frac{\Delta K_1}{\Delta t} = \Sigma F_1 \cdot v_1 = m_1 a_1 v_1 = -m_1 \omega_1^2 x_1 v_1$$

$$x_1\left(\frac{\pi}{40}\right) = 0{,}1\,\sigma\upsilon\nu\left(\frac{10\pi}{40} + \frac{\pi}{2}\right) = 0{,}1\,\sigma\upsilon\nu\left(\frac{\pi}{2} + \frac{\pi}{4}\right) = 0{,}1\,\sigma\upsilon\nu\frac{\pi}{4} =$$

$$= 0{,}1\frac{\sqrt{2}}{2}$$

$$v_1(t) = -\sigma\upsilon\nu\left(10t + \frac{\pi}{2}\right) \Rightarrow v_1\left(\frac{\pi}{40}\right) = -\sigma\upsilon\nu\left(\frac{\pi}{4} + \frac{\pi}{2}\right) = -\eta\mu\frac{\pi}{4} = -\frac{\sqrt{2}}{2}\,m/s.$$

Αρα: $\frac{\Delta K_1}{\Delta t} = -m_1 \omega_1^2 x_1 v_1 = -1 \cdot 100 \cdot 0,1 \frac{\sqrt{2}}{2} \cdot \left(-\frac{\sqrt{2}}{2}\right) = 10 \cdot \frac{2}{4} = 5 J/sec.$

γ) Η μεγίστη γίνεται στη ΘΙ

άρα $V = v_{2,max} = \omega_2 A_2 =$

$= 5 \cdot 0,2 = 1 m/s.$

$P_1 = m_1 v_1 = m_1 v_{1,max} =$

$= m_1 \omega_1 A_1 = 1 \cdot 10 \cdot 0,1 \Rightarrow$

$P_1 = 1 kg \cdot m/s.$