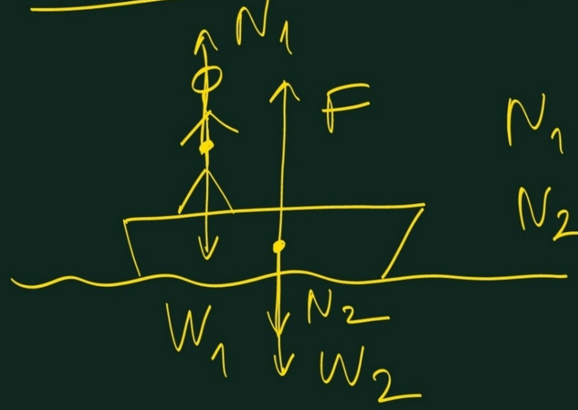
Ερ. 3



F = δύναμη από το νερό στη βάρκα (άνωση)

N_1 = δύναμη από τον άνθρωπο στη βάρκα
N_2 = " " " στον άνθρωπο. } εσωτερικές

W_1, W_2, F εξωτερικές.

$W_1 = N_1$ (ισορροπία)

$N_1 = N_2$ ($3^{ος}$ ΝΝ)

$F = N_2 + W_2$ (ισορροπία)

Άρα: $F = W_1 + W_2$.

216 Km/h = 60 m/s.

Αθ. 2 σελ. 65.

$$F = \frac{\Delta p}{\Delta t} = \frac{0 - mv}{\Delta t} = \frac{-10^5 \cdot 60}{120} =$$

$$= -0{,}5 \cdot 10^5 = -5 \cdot 10^4 \, N$$

ή $|\vec{F}| = 5 \cdot 10^4 \, N$.

Ασκ. 3

$U = 24\ m/s$

$m = 0,5\ kg$

$$F = \frac{\Delta p}{\Delta t} = \frac{m \cdot U}{\Delta t} = \frac{0,5 \cdot 24}{0,03} = \frac{12}{0,03} = \frac{1200}{3} = 400N$$

Ασκ. 4

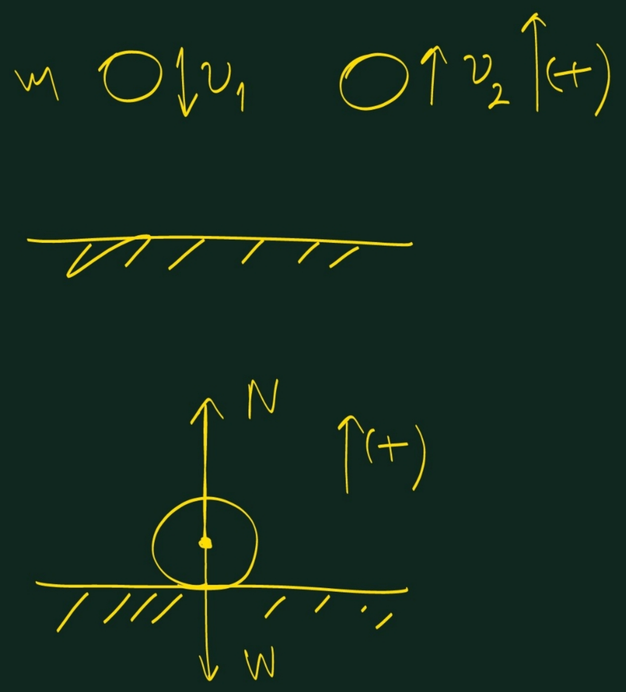
Έχουμε ελεύθερη πτώση

$$\Sigma F = \frac{\Delta p}{\Delta t} = mg = 900N$$

$W = mg = \Sigma F$

$U = gt \Rightarrow U = 10\ m/s$

Ασκ. 5 σελ. 65.)



A. $P_{τελ} = +mv_2$

$P_{αρχ} = m \cdot (-v_1) = -mv_1$

$\Delta p = P_{τελ} - P_{αρχ} = mv_2 - (-mv_1) = m(v_1 + v_2) \Rightarrow$

$\Delta p = 0,5 \cdot (30+10) = 20\ kg \cdot \frac{m}{s}$

B. $\Sigma F = \frac{\Delta p}{\Delta t} \Rightarrow N - W = \frac{\Delta p}{\Delta t} \Rightarrow$

$N = mg + \frac{m(v_1+v_2)}{\Delta t} \Rightarrow N = 0,5 \cdot 10 + \frac{20}{0,25} \Rightarrow$

$N = 5 + 80 \Rightarrow N = 85N$ (μέση δύναμη από το έδαφος)

Αθλ. 6

$$v = 90\,km/h = \frac{90.000\,m}{3.600\,sec} = \frac{900}{36} = 25\,m/s.$$

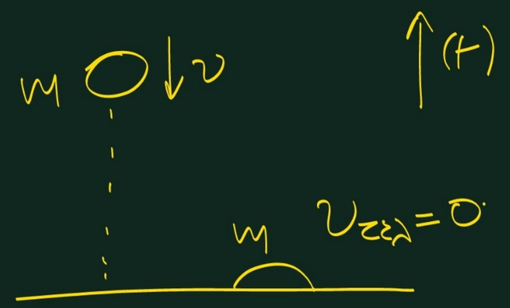
A. $p_{αρχ} = 0$

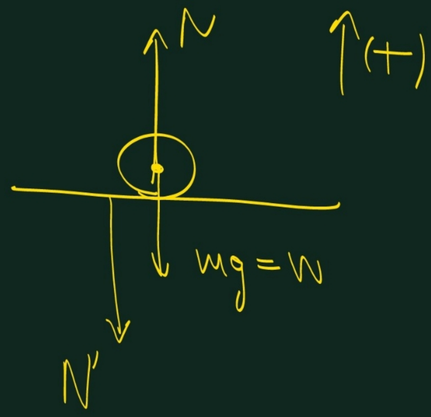
$$p_{τελ} = mv = 1600 \cdot 25 = 40.000\ kg \cdot m/s.$$

$$\Delta p = p_{τελ} - p_{αρχ} = 4 \cdot 10^4\ kg \cdot m/s.$$

B. $$\Sigma F = \frac{\Delta p}{\Delta t} = \frac{4 \cdot 10^4}{5} = 0{,}8 \cdot 10^4 = 8 \cdot 10^3\ N.$$

Ασκ. 7 σελ. 65





Α. Για κάθε σταγόνα:

$$\Delta p = p_{τελ} - p_{αρχ} = 0 - (-mυ) = mυ \Rightarrow$$

$$\Delta p = 3 \cdot 10^{-5} \cdot 17 = 51 \cdot 10^{-5} = 5{,}1 \cdot 10^{-4}\ kg \cdot m/s.$$

Β. Σε 1 sec πέφτουν 500 σταγόνες.

Σε Δt; πέφτει 1 σταγόνα.

$$\frac{1}{\Delta t} = \frac{500}{1} \Rightarrow \Delta t = \frac{1}{500}\ sec.$$

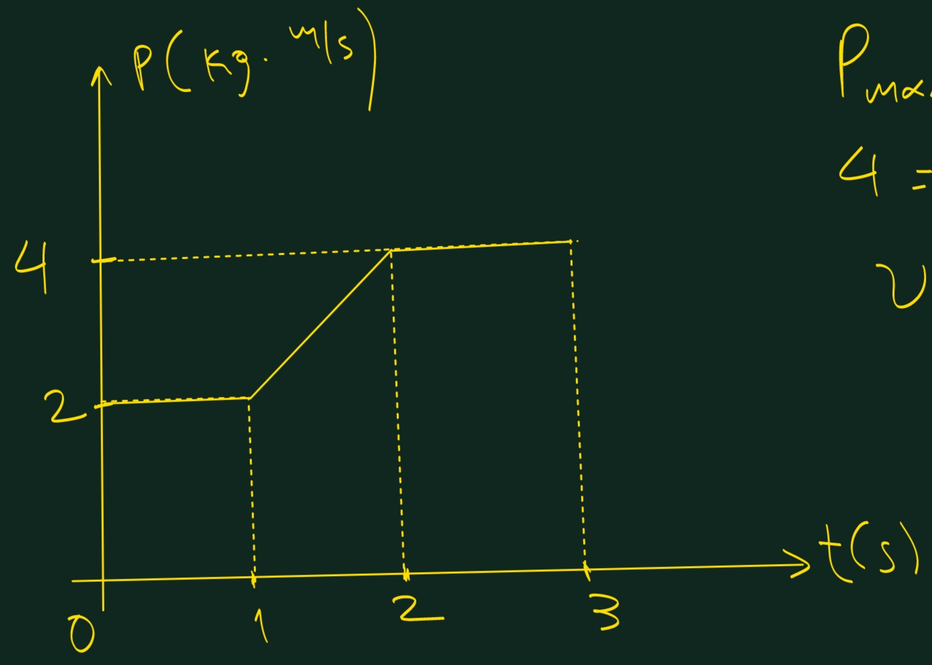
$$\Sigma F = \frac{\Delta p}{\Delta t} \Rightarrow N - W = \frac{mυ}{\Delta t} \Rightarrow N = mg + \frac{mυ}{\Delta t} = 3 \cdot 10^{-5} \cdot 10 + \frac{5{,}1 \cdot 10^{-4}}{\frac{1}{500}} =$$

$$= 3 \cdot 10^{-4} + 5 \cdot 5{,}1 \cdot 10^{2} \cdot 10^{-4} = 3 \cdot 10^{-4} + 2550 \cdot 10^{-4}\ (N) \Rightarrow$$

$N = 2553 \cdot 10^{-4} N \Rightarrow$

$N = 0{,}2553\ N$

Ασκ. 8 σελ. 66



Α. $p_{min} = m v_{min} \Rightarrow$

$2 = 1 \cdot v_{min} \Rightarrow$

$v_{min} = 2\ m/s.$

$p_{max} = m \cdot v_{max} \Rightarrow$

$4 = 1 \cdot v_{max} \Rightarrow$

$v_{max} = 4\ m/s.$

Β. Από $0 \to 1$ sec:

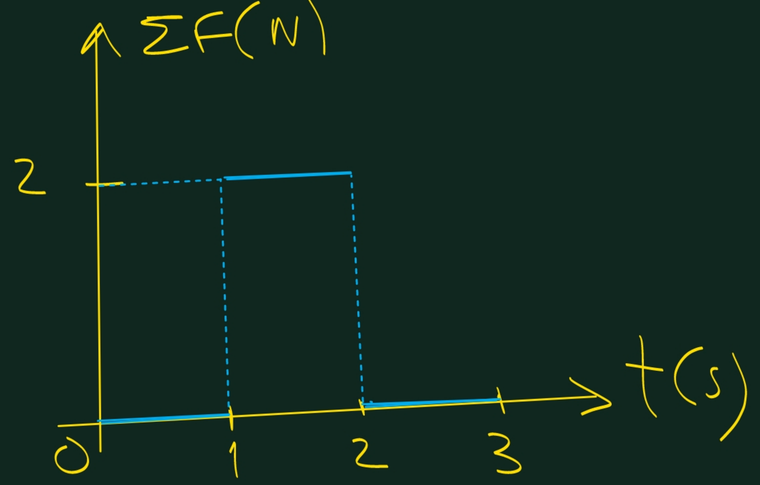
$$\Sigma F = \frac{\Delta p}{\Delta t} = \frac{2-2}{1-0} = 0N$$

Από $1 \to 2$ sec

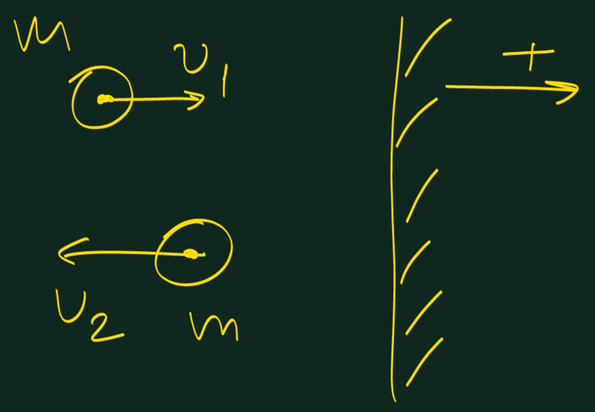
$$\Sigma F = \frac{\Delta p}{\Delta t} = \frac{4-2}{2-1} = 2N$$

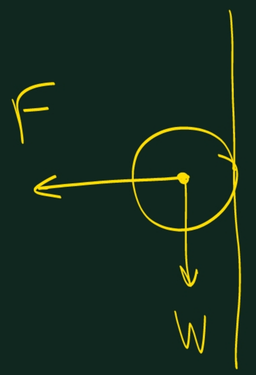
Από $2 \to 3$ sec

$$\Sigma F = \frac{\Delta p}{\Delta t} = \frac{4-4}{3-2} = 0N$$



Άσκ. 10





Α. $p_{πριν} = mv_1 = 0,1 \cdot 10 = 1\ kg \cdot m/s.$

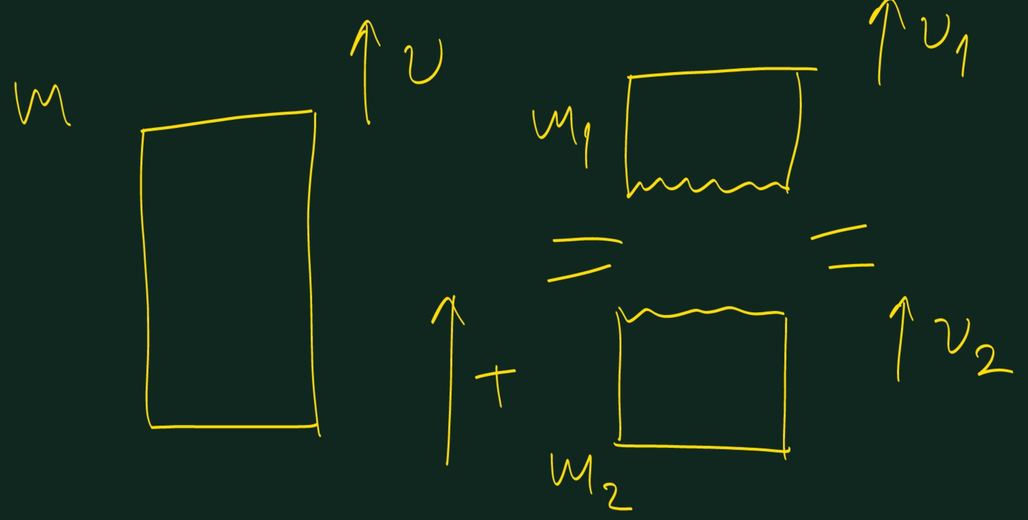
$p_{μετά} = -mv_2 = -0,1 \cdot 8 = -0,8\ kg \cdot m/s.$

Β. $\Delta p = p_{μετά} - p_{πριν} = -0,8 - 1 = -1,8\ kg \cdot m/s.$

Γ. $\Sigma F_x = \frac{\Delta p}{\Delta t} \Rightarrow -F = \frac{\Delta p}{\Delta t} \Rightarrow -F = \frac{-1,8}{0,1} \Rightarrow$

$F = 18\ N.$

Ασκ. 14



$m = 1000\,kg$ $\quad m_2 = 200\,kg$

$\upsilon = 500\,m/s$ $\quad \upsilon_2 = ;$

$m_1 = 800\,kg$

$\upsilon_1 = 1000\,m/s$

$P_{πριν} = mυ$

$P_{μετά} = m_1\upsilon_1 + m_2\upsilon_2$

$P_{πριν} = P_{μετά}$ επειδή η έκρηξη είναι ακαριαία ($\Delta t \simeq 0$), οπ και το σύστημα δεν είναι μονωμένο λόγω των βαρών των σωμάτων.

$mυ = m_1\upsilon_1 + m_2\upsilon_2 \Rightarrow$

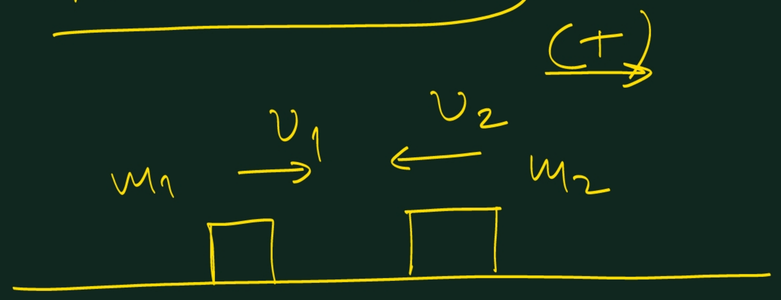
$1000 \cdot 500 = 800 \cdot 1000 + 200 \cdot \upsilon_2 \Rightarrow$

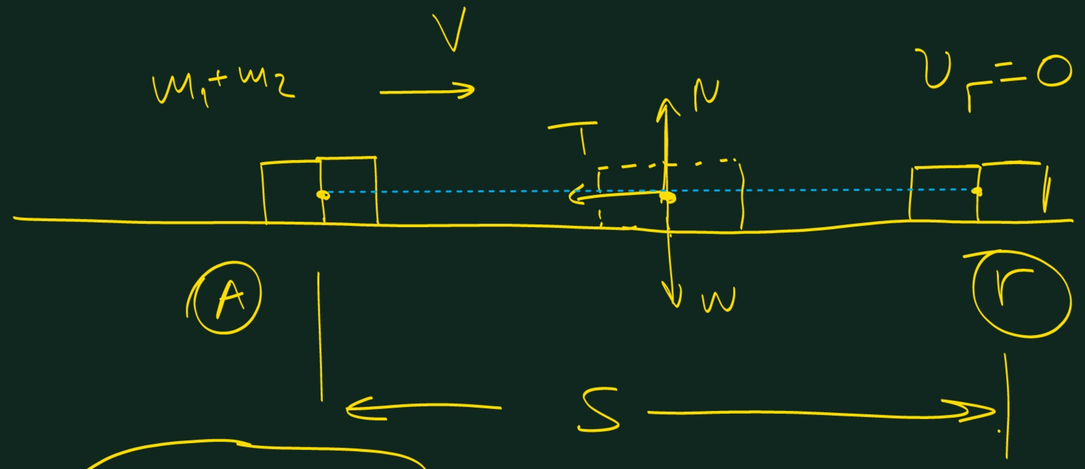
$500000 = 800000 + 200\upsilon_2 \Rightarrow$

$200\upsilon_2 = -300000 \Rightarrow \upsilon_2 = -1500\,m/s$

Άρα: $|\vec{\upsilon}_2| = 1500\,m/s$ και φορά προς τα κάτω.

Ασκ. 17 σελ. 67





Α. $P_{πριν} = P_{μετά} \Rightarrow$

$m_1v_1 - m_2v_2 = (m_1+m_2)V \Rightarrow$

$0,4 \cdot 20 - 0,6 \cdot 5 = (0,4+0,6) \cdot V \Rightarrow$

$8 - 3 = V \Rightarrow V = 5\ m/s$.

$v_1 = 0$

Β. $K_{πριν} = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 = \frac{1}{2} \cdot 0,4 \cdot 20^2 + \frac{1}{2} \cdot 0,6 \cdot 5^2$

$= 0,2 \cdot 400 + 0,3 \cdot 25 = 87,5\ J$.

$K_{μετά} = \frac{1}{2}(m_1+m_2)V^2 = \frac{1}{2} \cdot 1 \cdot 5^2 = 12,5\ Joule$

Άρα η απώλεια ενέργειας είναι:

$Q = K_{πριν} - K_{μετά} = 75\ J$.

Γ. $T = \mu N$

$\Sigma F_y = 0 \Rightarrow N = W = (m_1+m_2)g$

ΘΜΚΕ: Α → Γ: $\Delta K = \Sigma W \Rightarrow K_Γ - K_A = \cancel{W_w}^{0} + W_T + \cancel{W_N}^{0} \Rightarrow$

$(\vec{w}, \vec{N} \perp \Delta\vec{x})$

$0 - \frac{1}{2}(m_1+m_2)V^2 = -T \cdot S \Rightarrow$