

**Έργο**

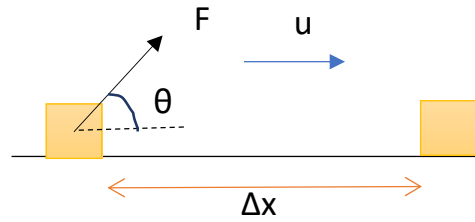
$$W_F = F \cdot x \cdot \cos\theta$$

$W_F$  : έργο της δύναμης  $F$  (J – Joule)

$F$  : δύναμη (N)

$\Delta x$  : μετατόπιση (m)

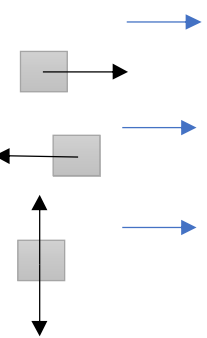
$\theta$  : γωνία ανάμεσα στη δύναμη και τη μετατόπιση (ταχύτητα –  $u$ )



$W_F = + F \cdot \Delta x$  , όταν  $\vec{F} \parallel \vec{u}$  ,  $\theta = 0^\circ$  ( $F$  ομόρροπη της  $u, x$ )

$W_F = - F \cdot \Delta x$  , όταν  $\vec{F} \nabla \vec{u}$  ,  $\theta = 180^\circ$  ( $F$  αντίρροπη της  $u, x$ )

$W_F = 0$  , όταν  $\vec{F} \perp \vec{u}$  ,  $\theta = 90^\circ$  ( $F$  κάθετη της  $u, x$ )

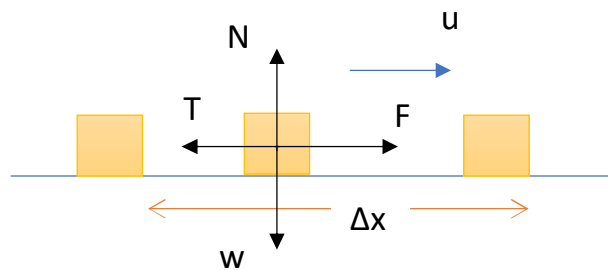


$$W_F = + F \cdot \Delta x$$

$$W_T = - T \cdot \Delta x$$

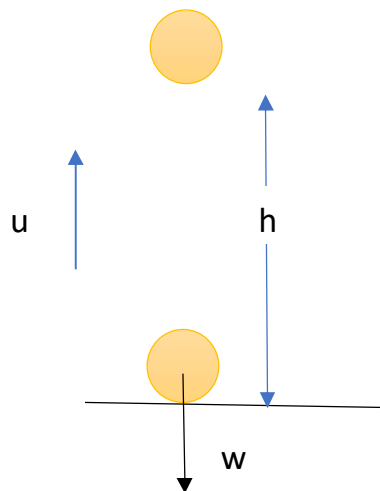
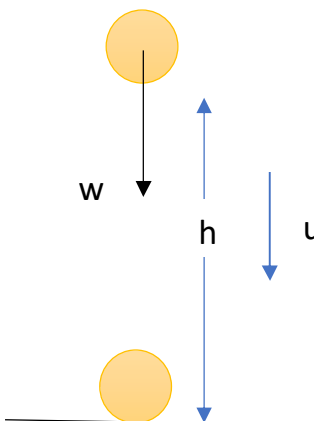
$$W_w = W_N = 0$$

$$w = m \cdot g, \quad T = \mu \cdot N$$



$$W_w = + w \cdot h = + 7 \cdot 10 = +70 \text{ J}$$

$$W_w = - w \cdot h = - 7 \cdot 10 = -70 \text{ J}$$



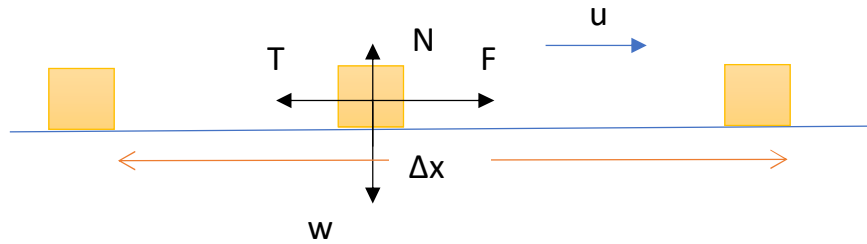
$$F = 15 \text{ N}, N = 40 \text{ N}$$

$$m = 4 \text{ kg}$$

$$\mu = 0,2$$

$$\Delta x = 7 \text{ m}$$

$$g = 10 \text{ m/s}^2$$



Να υπολογιστούν τα έργα των δυνάμεων, καθώς και το ολικό έργο..

$$w = m \cdot g = 4 \cdot 10 = 40 \text{ N}$$

$$T = \mu \cdot N = 0,2 \cdot 40 = 8 \text{ N}$$

$$W_F = +F \cdot \Delta x = +15 \cdot 7 = +105 \text{ J}$$

$$W_T = -T \cdot \Delta x = -8 \cdot 7 = -56 \text{ J}$$

$$W_w = W_N = 0 \text{ J}$$

$$W_{ολ} = W_F + W_T + W_w + W_N = +105 - 56 + 0 + 0 = +49 \text{ J}$$

$$F_1 = 20 \text{ N}, N = 32 \text{ N}$$

$$F_2 = 8 \text{ N}$$

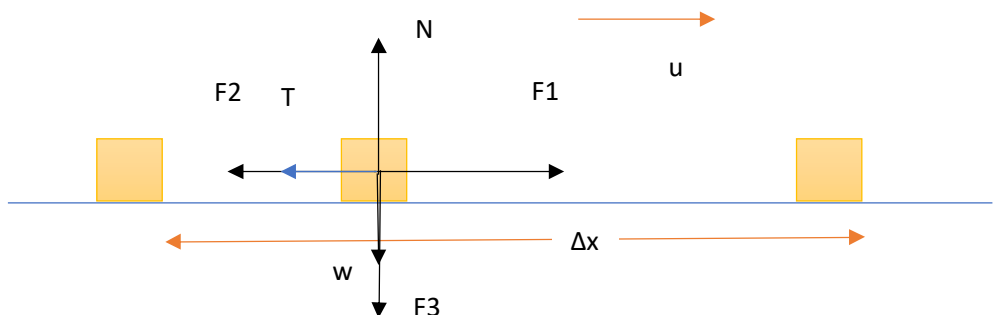
$$F_3 = 12 \text{ N}$$

$$m = 2 \text{ kg}$$

$$\mu = 0,3$$

$$\Delta x = 5 \text{ m}$$

$$g = 10 \text{ m/s}^2$$



Να υπολογιστούν τα έργα των δυνάμεων, καθώς και το ολικό έργο.

$$w = m \cdot g = 2 \cdot 10 = 20 \text{ N}$$

$$T = \mu \cdot N = 0,3 \cdot 32 = 9,6 \text{ N}$$

$$W_{F_1} = +F_1 \cdot \Delta x = +20 \cdot 5 = +100 \text{ J}$$

$$W_{F_2} = -F_2 \cdot \Delta x = -8 \cdot 5 = -40 \text{ J}$$

$$W_T = -T \cdot \Delta x = -9,6 \cdot 5 = -48 \text{ J}$$

$$W_w = W_N = W_{F_3} = 0 \text{ J}$$

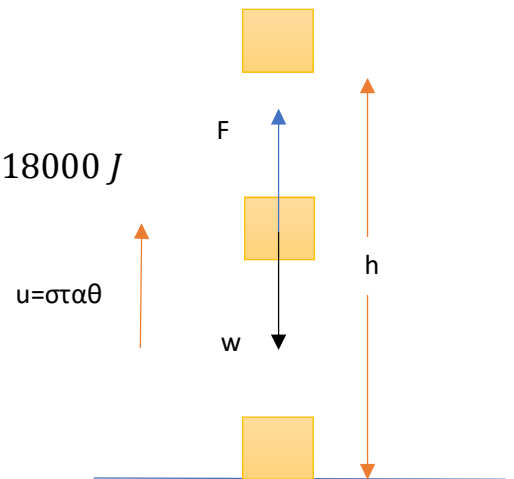
$$W_{ολ} = W_{F_1} + W_{F_2} + W_{F_3} + W_T + W_w + W_N = +100 - 40 + 0 - 48 + 0 + 0 = +12 \text{ J}$$

**1/σελ.112**

$$w = m \cdot g = 150 \cdot 10 = 1500 \text{ N}$$

$$W_w = -w \cdot h = -1500 \cdot 12 = -18000 \text{ J}$$

$$W_{o\lambda} = 0 \Leftrightarrow W_F + W_w = 0 \Leftrightarrow W_F - 18000 = 0 \Leftrightarrow W_F = +18000 \text{ J}$$



**3/σελ.112**

$$m = 250 \text{ kg}$$

$$h = 2,3 \text{ m}$$

$$g = 10 \text{ m/s}^2$$

a)  $w = m \cdot g = 250 \cdot 10 = 2500 \text{ N}$

$$W_w = -w \cdot h = -2500 \cdot 2,3 = -5750 \text{ J}$$

$$W_{o\lambda} = 0 \Leftrightarrow W_F + W_w = 0 \Leftrightarrow W_F - 5750 = 0 \Leftrightarrow W_F = +5750 \text{ J}$$

b)  $W_F = 0 \text{ J}$

c)  $W_w = +w \cdot h = +2500 \cdot 2,3 = +5750 \text{ J}$

$$W_{o\lambda} = 0 \Leftrightarrow W_F + W_w = 0 \Leftrightarrow W_F + 5750 = 0 \Leftrightarrow W_F = -5750 \text{ J}$$