

Activitats. Conservació de la quantitat de moviment

1) Coet 2300t. $\frac{1000\text{kg}}{1\text{t}} = 2,3 \cdot 10^6 \text{ kg}$
 $F = 3 \cdot 10^7 \text{ N}$

a)  b) $F_{\text{for}} = F_{\text{ext}} - P = 3 \cdot 10^7 - 2,3 \cdot 10^6 \cdot 9,8$
 $[F_{\text{for}} = 7,46 \cdot 10^6 \text{ N}]$
 c) $F_{\text{TOT}} = m \cdot a$
 $a = \frac{F_{\text{TOT}}}{m} = \frac{7,46 \cdot 10^6 \text{ N}}{2,3 \cdot 10^6 \text{ kg}} = [3,24 \text{ m/s}^2]$

2) $M_{\text{He}} = 4,003 \text{ u} \cdot \frac{1,66 \cdot 10^{-27} \text{ kg}}{1 \text{ u}} = 6,64 \cdot 10^{-27} \text{ kg He}$
 $M_{\text{Cu}} = 273,058 \text{ u} \cdot \frac{1,66 \cdot 10^{-27} \text{ kg}}{1 \text{ u}} = 4,03 \cdot 10^{-25} \text{ kg Cu}$
 $\frac{r_{\text{Cu}}}{r_{\text{He}}} = 0$
 $M_{\text{He}} v_{\text{He}} + M_{\text{Cu}} v_{\text{Cu}} = 0$
 $v_{\text{Cu}} = \frac{M_{\text{He}} \cdot v_{\text{He}}}{M_{\text{Cu}}} = \frac{6,64 \cdot 10^{-27} \cdot 5 \cdot 10^6}{4,03 \cdot 10^{-25}} = [8,23 \cdot 10^4 \text{ m/s}]$

3) $M_{\text{He}} = 4,003 \text{ u} \cdot \frac{1,66 \cdot 10^{-27} \text{ kg}}{1 \text{ u}} = 6,64 \cdot 10^{-27} \text{ kg He}$
 $M_{\text{Po}} = 216,051 \text{ u} \cdot \frac{1,66 \cdot 10^{-27} \text{ kg}}{1 \text{ u}} = 3,58 \cdot 10^{-25} \text{ kg Po}$
 $\frac{r_{\text{Po}}}{r_{\text{He}}} = 0$
 $M_{\text{He}} v_{\text{He}} + M_{\text{Po}} v_{\text{Po}} = 0$
 $v_{\text{Po}} = -\frac{M_{\text{He}} v_{\text{He}}}{M_{\text{Po}}} = -\frac{6,64 \cdot 10^{-27} \cdot 7,75 \cdot 10^7}{3,58 \cdot 10^{-25}}$
 $v_{\text{Po}} = [-3,24 \cdot 10^5 \text{ m/s}]$

4) $m_A v_A + m_B v_B = m_A v_A' + m_B v_B'$
 eix X $\begin{cases} m_A v_{Ax} + m_B v_{Bx} = m_A v_{Ax}' + m_B v_{Bx}' \\ m_A v_{Ay} + m_B v_{By} = m_A v_{Ay}' + m_B v_{By}' \end{cases}$
 eix Y $\begin{cases} m_A v_{Ax} + m_B v_{Bx} = m_A v_{Ax}' + m_B v_{Bx}' \\ m_A v_{Ay} + m_B v_{By} = m_A v_{Ay}' + m_B v_{By}' \end{cases}$
 $\begin{cases} 5 \cdot 5 + m_B \cdot 3 = 5 \cdot 2,2 + m_B \cdot 10 \\ 5 \cdot (-6) + m_B \cdot 4 = 5 \cdot 2 + m_B v_{By}' \end{cases}$
 $\begin{cases} 25 + 3m_B = 11 + 10m_B \rightarrow 14 = 7m_B \rightarrow [m_B = 2 \text{ kg}] \\ -30 + 4m_B = 10 + m_B v_{By}' \end{cases}$
 $8 - 2v_{By}' = 40$
 $v_{By}' = \frac{40 - 8}{-2} = [-16 \text{ m/s}]$

5) a) $\vec{P}_{\text{TOT}} = \vec{P}_{\text{INICIAL}} = \vec{P}_{\text{FINAL}}$
 $m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$
 $m_1 v_1 = m_1 v_2'$
 $[v_1 = v_2']$
 les boles tenen mateixa massa
 $m_1 = m_2 = m$

6) $F = 15 \text{ N}$
 $m = 10 \text{ kg}$
 $v = 30 \text{ m/s}$
 $I = F \cdot \Delta t = \Delta p$
 $F = \frac{\Delta p}{\Delta t}; \Delta t = \frac{\Delta p}{F} = \frac{m \cdot v}{F} = \frac{10 \text{ kg} \cdot 30 \text{ m/s}}{15 \text{ N}} = [20 \text{ s}]$

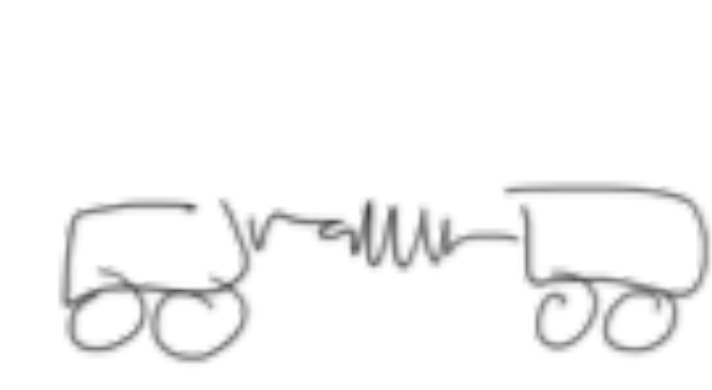
7) a) $\vec{P}_0 = 0$
 $m_1 = 50 \text{ g} \cdot \frac{1 \text{ kg}}{10^3 \text{ g}} = 0,05 \text{ kg}$
 $v_1 = 30 \text{ m/s}$
 $\Delta t = 60 \text{ ms} \cdot \frac{1 \text{ s}}{10^3 \text{ ms}} = 0,06 \text{ s}$
 $F = \frac{\Delta p}{\Delta t} = \frac{m(v_2 - v_1)}{\Delta t} = \frac{0,05 \cdot (-30 - 30)}{0,06} = [-25 \text{ N}]$

c) $\vec{P}_0 = 0$
 $F = \frac{\Delta p}{\Delta t} = \frac{m(v_2 - v_1)}{\Delta t} = \frac{0,05 \cdot (-30 - 30)}{0,06}$
 $[F = -50 \text{ N}]$

d) xoc igual i 10% perd energia

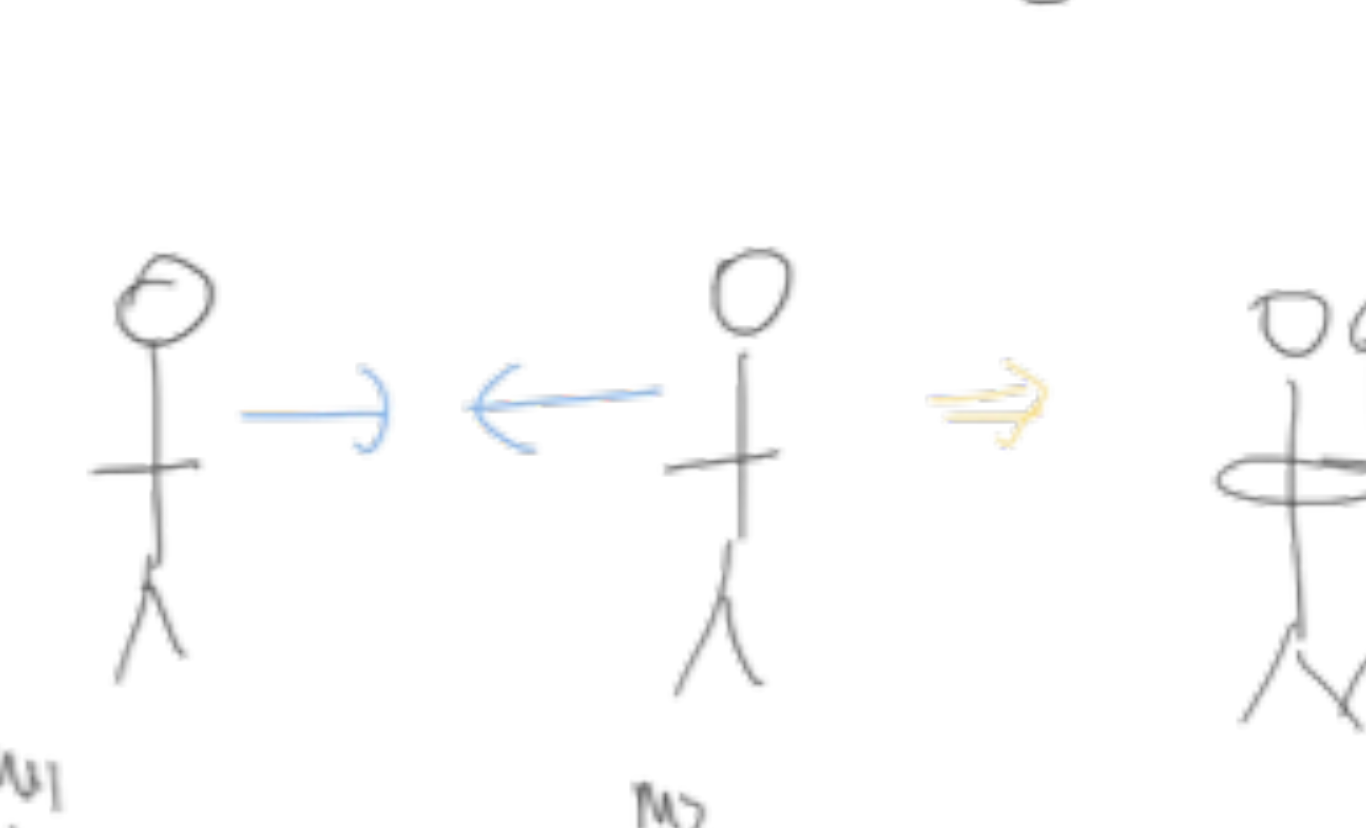
$v_f = -\left(v_0 - \frac{1}{10} v_0\right) = -\frac{9}{10} v_0 = -\frac{9}{10} \cdot 30 = -27 \text{ m/s}$

$F = \frac{\Delta p}{\Delta t} = \frac{m(v_2 - v_1)}{\Delta t} = \frac{0,05 \cdot (-27 - 30)}{0,06} = [-47,5 \text{ N}]$

9) 
 $m_2 = 2m_1$
 $(m_1 + m_2)v = m_1 v_1 + m_2 v_2$
 $(m_1 + 2m_1)v = m_1 v_1 + 2m_1 v_2$
 $3m_1 v = m_1(v_1 + 2v_2)$
 $3v = v_1 + 2v_2$
 $[v_1 = -2v_2]$

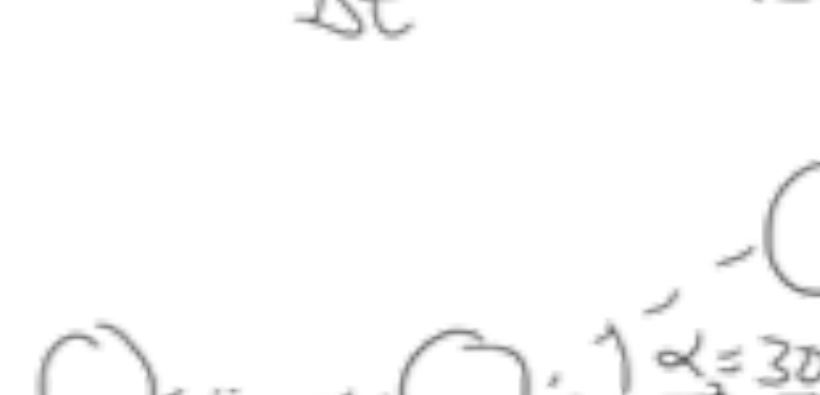
10) $\vec{P}_0 = 10 \vec{e} \text{ kg} \cdot \text{m/s}$
 $\vec{P}_f = 7 \vec{e} + 12 \vec{e} \text{ kg} \cdot \text{m/s}$
 $\Delta \vec{p} = \vec{P}_f - \vec{P}_0 = (7 \vec{e} + 12 \vec{e}) - 10 \vec{e}$
 $[\Delta \vec{p} = 7 \vec{e} + 2 \vec{e} \text{ kg} \cdot \text{m/s}]$
 $\vec{F} = \frac{\Delta \vec{p}}{\Delta t} = \frac{7 \vec{e} + 2 \vec{e} \text{ (kg} \cdot \text{m/s)}}{1 \cdot 10^{-3} \text{ s}} = [7000 \vec{e} + 2000 \vec{e} \text{ N}]$
 $|\vec{F}| = \sqrt{(7000)^2 + (2000)^2} = [7280 \text{ N}]$

11) $m = 900 \text{ g} \cdot \frac{1 \text{ kg}}{10^3 \text{ g}} = 0,9 \text{ kg}$
 $\Delta y = 300 \text{ m}$
 $v = \frac{80 \text{ km}}{\text{h}} \cdot \frac{10^3 \text{ m}}{1 \text{ km}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} = 22,22 \text{ m/s}$
 $m_1 = 600 \text{ g} \cdot \frac{1 \text{ kg}}{10^3 \text{ g}} = 0,6 \text{ kg}$
 $v_1 = \frac{100 \text{ km}}{\text{h}} \cdot \frac{10^3 \text{ m}}{1 \text{ km}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} = 27,77 \text{ m/s}$
 $m_2 = 0,9 - 0,6 = 0,3 \text{ kg}$
 $v_2 = \frac{m v - (m_1 v_1)}{m_2} = \frac{0,9 \cdot 22,22 - (0,6 \cdot 27,77)}{0,3}$
 $v_2 = 11,11 \text{ m/s}$
 $\frac{11,11 \text{ m}}{\text{s}} \cdot \frac{3600 \text{ s}}{1 \text{ h}} \cdot \frac{1 \text{ km}}{10^3 \text{ m}} = [40 \text{ km/h (+) va cap amunt!}]$

12) 
 a) mateixa velocitat $v_1 = v_2$
 mateixa massa $m_1 = m_2$
 $m_1 v_1 - m_1 v_1 = 2m_1 v$
 $0 = 2m_1 v$
 $[v = 0 \text{ m/s}]$
 Quedarien aturats!

b) $v = 0,1 \text{ m/s} \rightarrow$ això només pot passar si les manes dels patinadors són diferents!

13) $t = 0,02 \text{ s}$
 $\vec{F} = \frac{\Delta \vec{p}}{\Delta t} = \frac{m \vec{v} - m \vec{v}_0}{\Delta t} = \frac{m(\vec{v} - \vec{v}_0)}{\Delta t} = \frac{0,8 \cdot (28 - 5)}{0,02} = [920 \text{ N}]$

14) 
 $v_1 = 2 \text{ m/s}$
 $v_2 = 0 \text{ m/s}$
 manes iguals! (m)
 $\vec{P}_{\text{INICIAL}} = \vec{P}_{\text{TOT}}$
 $\vec{P} + \vec{P}_2 = \vec{P}_1' + \vec{P}_2'$
 $\begin{cases} P_x = P_1' \cos \alpha_1 + P_2' \cos \alpha_2 \\ P_y = P_1' \sin \alpha_1 + P_2' \sin \alpha_2 \end{cases}$
 $\begin{cases} 0 = P_1' \sin \alpha_1 + P_2' \sin \alpha_2 \\ 2 = P_1' \cos \alpha_1 + P_2' \cos \alpha_2 \end{cases}$
 $\begin{cases} 0 = v_1' \sin \alpha_1 + v_2' \sin \alpha_2 \\ 2 = v_1' \cos \alpha_1 + v_2' \cos \alpha_2 \end{cases}$
 dividim
 $\begin{cases} 0 = v_1' \sin \alpha_1 + v_2' \sin \alpha_2 \\ 2 = v_1' \cos \alpha_1 + v_2' \cos \alpha_2 \end{cases}$
 $\text{tg} \alpha_1 = \frac{-\sin 30^\circ}{2 - \cos 30^\circ}$
 $\alpha_1 = -\arctg 0,44 = [-23,79^\circ]$
 $v_1' = \frac{-v_2' \sin \alpha_2}{\sin \alpha_1} = \frac{-\sin 30^\circ}{\sin (-23,79)} = [1,24 \text{ m/s}]$

b) $\Delta \vec{v}_1 = \vec{v}_1' - \vec{v}_1 = (v_1' \cos \alpha_1 \vec{e} + v_1' \sin \alpha_1 \vec{j}) - v_1 \vec{e}$
 $\Delta \vec{v}_1 = (v_1' \cos \alpha_1 - v_1) \vec{e} + v_1' \sin \alpha_1 \vec{j}$
 $\Delta \vec{v}_1 = \left(-\frac{\sqrt{3}}{2} \vec{e} - \frac{1}{2} \vec{j}\right) \text{ m/s}$
 $|\Delta \vec{v}_1| = \sqrt{\left(-\frac{\sqrt{3}}{2}\right)^2 + \left(-\frac{1}{2}\right)^2} = [1 \text{ m/s}]$
 $\Delta \vec{v}_2 = \vec{v}_2' - \vec{v}_2 = (v_2' \cos \alpha_2 \vec{e} + v_2' \sin \alpha_2 \vec{j}) - 0$
 $\Delta \vec{v}_2 = \left(\frac{\sqrt{3}}{2} \vec{e} + \frac{1}{2} \vec{j}\right) \text{ m/s}$
 $|\Delta \vec{v}_2| = \sqrt{\left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{2}\right)^2} = [1 \text{ m/s}]$

15) $\vec{F} = 20 \vec{e} - 15 \vec{j} + 60 \vec{e}$
 $\Delta t = 35 \text{ s}$
 $v = 12 \vec{e} - 20 \vec{j} - 30 \vec{e}$
 $v_0 = ?$
 $F = m \cdot a$
 $a = \frac{\Delta v}{\Delta t} = \frac{v - v_0}{\Delta t}$
 $F = m \cdot \frac{(v - v_0)}{\Delta t} = m \frac{\Delta v}{\Delta t}$
 $\Delta v = \frac{F \cdot \Delta t}{m} = \frac{(20 \vec{e} - 15 \vec{j} + 60 \vec{e}) \cdot 35 \text{ s}}{5 \text{ kg}}$
 $\Delta v = 140 \vec{e} - 215 \vec{j} + 420 \vec{e} \text{ m/s}$
 $\Delta v = v - v_0; v_0 = v - \Delta v = (12 \vec{e} + 20 \vec{j} - 30 \vec{e}) - (140 \vec{e} - 215 \vec{j} + 420 \vec{e})$
 $[v_0 = -128 \vec{e} + 125 \vec{j} - 450 \vec{e}]$