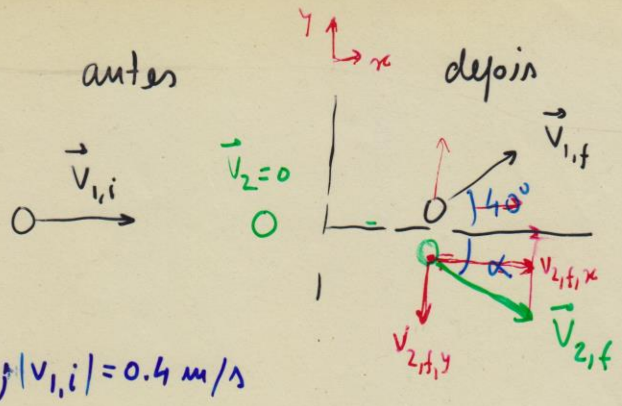
(6)



$m_1 = 0.2\ Kg$

$m_2 = 0.3\ Kg$

$|V_{1,f}| = 0.2\ m/s\ ;\ |V_{1,i}| = 0.4\ m/s$

a) **CONSERVAÇÃO DE MOMENTO LINEAR**

$$\vec{P}_{1,i} + \vec{P}_{2,i} = \vec{P}_{1,f} + \vec{P}_{2,f}$$

$$m_1 \vec{V}_{1i} + 0 = m_1 \vec{V}_{1f} + m_2 \vec{V}_{2f}$$

$\underline{\underline{xx}}$ $\quad 0.2 \times 0.4 = 0.2 \times 0.2 \cos 40 + 0.3 \times V_{2,f} \cos\alpha$

$\underline{\underline{yy}}$ $\quad 0 = 0.2 \times 0.2 \operatorname{sen} 40 + 0.3 \times V_{2,f} \operatorname{sen}\alpha$

$$\Leftrightarrow \quad V_{2,f} = \frac{0.165}{\cos\alpha}$$

$$0 = 0.026 + 0.3\,\frac{0.165}{\cos\alpha}\cdot\operatorname{sen}\alpha \Leftrightarrow Tg\,\alpha = -0.52 \Leftrightarrow \alpha = -27.5°$$

$$e \quad V_{2,f} = \frac{0.165}{\cos(-27.5)} = 0.19\ m/s$$

6 cont.

b) PARA m_1:

$$\Delta\vec{V}_1 = \vec{V}_{1f} - \vec{V}_{1i} = \left(\ 0.2\cos 40\,\hat{i} + 0.2\sin 40\,\hat{j}\right) - 0.4\,\hat{i}$$

$$= -0.25\,\hat{i} + 0.13\,\hat{j} \quad (m/s)$$

$$\Delta\vec{P}_1 = \vec{P}_{1f} - \vec{P}_{1i} = m_1(\Delta\vec{V}_1) = 0.2\left(-0.25\,\hat{i} + 0.13\,\hat{j}\right)$$

$$= -0.05\,\hat{i} + 0.026\,\hat{j} \left(\frac{kg\ m}{s}\right)$$

O MESMO P/ m_2:

$$\Delta\vec{V}_2 = 0.17\,\hat{i} - 0.09\,\hat{j} \quad \left(\frac{m}{s}\right)$$

$$\Delta\vec{P}_2 = 0.05\,\hat{i} - 0.026\,\hat{j} \left(\frac{kg\ m}{s}\right)$$

COMPARE!

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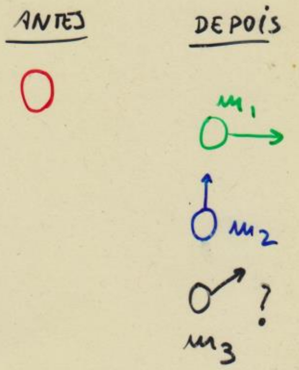
$$m_T = m_1 + m_2 + m_3 = 17\times10^{-27} + 8\times10^{-27} + 12\times10^{-27} = 37\times10^{-27}\ \text{Kg}$$

$v_i = 0$ m/s (NÚCLEO INICIALMENTE EM REPOUSO)

a) CONSERVAÇÃO DE MOMENTO LINEAR



$$\vec{P}_i = \vec{P}_f$$

xx: $0 = m_1 v_{1x} + m_2 \underset{0}{v_{2x}} + m_3 v_{3x}$

yy: $0 = m_1 \underset{0}{v_{1y}} + m_2 v_{2y} + m_3 v_{3y}$

$$\Leftrightarrow \quad v_{3x} = \frac{-m_1 v_{1x}}{m_3} = -\frac{17\times10^{-27}\times 6.0\times10^{6}}{12\times10^{-27}} = -8.5\times10^{6}\ \text{m/s}$$

$$v_{3y} = \frac{-m_2 v_{2y}}{m_3} = -\frac{8\times10^{-27}\times 8\times10^{6}}{12\times10^{-27}} = -5.3\times10^{6}\ \text{m/s}$$

$$|\vec{v}_3| = 1\times10^{7}\ \text{m/s}$$

$$\vec{P}_3 = m_3\vec{v}_3 = 12\times10^{-27}\left(-8.5\times10^{6}\,\hat{i} - 5.3\times10^{6}\,\hat{j}\right)$$

$$= 1.02\times10^{-19}\,\hat{i} - 6.36\times10^{-20}\,\hat{j} \quad \left(\frac{\text{kg m}}{\text{s}}\right)$$

b) $\Delta E_c = E_{cf} - \underset{0}{E_{ci}} = \frac{1}{2}\left(m_1 v_1^2 + m_2 v_2^2 + m_3 v_3^2\right)$

$$\Leftrightarrow \Delta E_c = \frac{1}{2}\left(17\times10^{-27}\times(6.0\times10^{6})^2 + 8\times10^{-27}(8\times10^{6})^2 + 12\times10^{-27}(1\times10^{7})^2\right)$$

$$\Leftrightarrow \Delta E_c = 1.16\times10^{-12}\ (\text{J})$$

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$m_b = 20\,g$; $V_i \equiv V_b$

$m_B = 980\,g$

mola comprime 10 cm ; $K = 1000\ (N/m)$

COLISÃO PERFEITAMENTE INELÁSTICA

$$m_b V_b + m_B \underset{0}{\underset{\parallel}{V_B}} = (m_B + m_b)\, V_{B+b}$$

MOLA

$$E_T = \frac{1}{2} K A^2 = \frac{1}{2} \times 1000 \times 0.1^2 = 5\,J$$

CONSERVAÇÃO DE ENERGIA NA MOLA (COM BLOCO E BALA)

$$E_c = E_p \Leftrightarrow \frac{1}{2}(m_B + m_b)\, V_{B+b}^2 = 5\,J$$

E_c ↓ NA POSIÇÃO DE EQUIL

E_p ↓ NA POSIÇÃO EXTREMA ($x = A$)

$\Leftrightarrow$

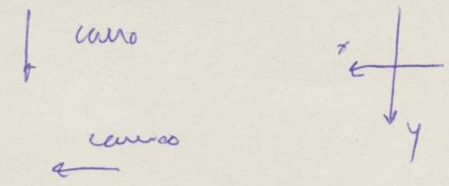
b) $V_b = 158\ m/s$

a) $V_{B+b} = 3.16\ m/s$

c) $\Delta E_c = \frac{1}{2}(m_b + m_B)\, V_{B+b}^2 - \frac{1}{2} m_b V_b^2$

$\Leftrightarrow \Delta E_c = -245\ (J)$

(25)



colisão perfeitamente inelástica

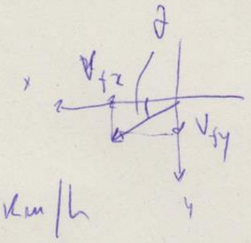
a) $\vec{P}_i = \vec{P}_f$

$$xx \quad M_c V_{ci} = (m_c + M_c) V_{fx} \qquad V_{fx} = \frac{M_c V_{ci}}{m_c + M_c} = \frac{7500 \times \cancel{18{,}06}\ 65}{7500+1100}$$

$$yy \quad m_c v_{ci} = (m_c + M_c) V_{fy} \qquad V_{fy} = \frac{m_c v_{ci}}{m_c + M_c} = \frac{1100 \times \cancel{18{,}06}\ 93}{7500+1100}$$

$V_{fx} = 56{,}7$ Km/h

$V_{fy} = 11{,}9$ Km/h



$$|\vec{V}| = \sqrt{56{,}7^2 + 11.9^2} = 58 \text{ Km/h}$$

$$\theta = Tg^{-1}\left(\frac{V_{fy}}{V_{fx}}\right) = 11.9^\circ \qquad SW$$

b) $$\Delta E_c = \left(\frac{1}{2} m_c v_{ci}^2 + \frac{1}{2} M_c V_{ci}^2\right) - \frac{1}{2}(M_c + m_c) V_f^2$$

$$= \left(\frac{1}{2} 1100 \times 30.6^2 + \frac{1}{2} 7500 \times 18{,}06^2\right) - \frac{1}{2}(7500+1100)\, 16.1^2$$

$$= 1.1 \times 10^6 \text{ J}$$