Problema 1

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- $\vec{P}_1 = m_1 V_0 \hat{i} = \frac{m}{4} V_0 \hat{i}$
- $\vec{P}_2 = m_2 V_0 \hat{j}$
- $\vec{P}_3 = m_3 V_0 \hat{u}$, con $\hat{u}$ una dirección que balancee $\vec{P}_1 + \vec{P}_2$

$$\vec{P}_1 + \vec{P}_2 + \vec{P}_3 = \vec{0} \Rightarrow \vec{P}_3 = -(\vec{P}_1 + \vec{P}_2)$$

$$|\vec{P}_3| = \sqrt{|\vec{P}_1|^2 + |\vec{P}_2|^2} = V_0 \sqrt{\left(\frac{m}{4}\right)^2 + m_2^2}$$

$$m_3 = \sqrt{\left(\frac{m}{4}\right)^2 + m_2^2}$$

$$m_1 + m_2 + m_3 = m \Rightarrow \frac{m}{4} + m_2 + m_3 = m \Rightarrow m_2 + m_3 = \frac{3m}{4}$$

$$\frac{3m}{4} - m_2 = \sqrt{\left(\frac{m}{4}\right)^2 + m_2^2} \Rightarrow \left(\frac{3m}{4} - m_2\right)^2 = \left(\frac{m}{4}\right)^2 + m_2^2$$

$$\frac{9m^2}{16} - \frac{3m}{2} m_2 + m_2^2 = \frac{m^2}{16} + m_2^2 \Rightarrow \frac{9m^2}{16} - \frac{m^2}{16} - \frac{m^2}{16} = \frac{3m}{2} m_2 \Rightarrow \frac{8m^2}{16} = \frac{3m}{2} m_2 \Rightarrow m_2 = \frac{8m^2/16}{(3m/2)} = \frac{8m}{16} \cdot \frac{2}{3} = \frac{m}{3}$$

$$m_3 = \frac{3m}{4} - \frac{m}{3} = \frac{9m - 4m}{12} = \frac{5m}{12}$$

R:

$$\boxed{m_1 = \frac{m}{4} \quad m_2 = \frac{m}{3} \quad m_3 = \frac{5m}{12}}$$

Problema 2

Javier Joaquín

$m_{bala} = 0{,}04 \text{ kg}$
$m_m = 20 \text{ kg}$

$$(m_{bala} + m_m) V = m_{bala} V_0 \Rightarrow V = \frac{0{,}04 \times 300}{20 + 0{,}04} = \frac{12}{20{,}04} \approx 0{,}599 \text{ m/s}$$

$$N = (20 + 0{,}04)\, g \approx 20{,}04 \times 9{,}81 = 196{,}8 \text{ N}$$

$$f_{fr} = \mu N = 0{,}1 \times 196{,}8 = 19{,}68 \text{ N}$$

$$K = \frac{1}{2}(20{,}04) V^2 = 0{,}5 \times 20{,}04 \times (0{,}599)^2 \approx 3{,}60 \text{ J}$$

$$W_{fr} = -f_{fr} d = -K \Rightarrow d = \frac{K}{f_{fr}} = \frac{3{,}60}{19{,}68} \approx \boxed{0{,}183 \text{ m}}$$

Problema 3

$$\frac{1}{2} M V_i^2 = MgH \Rightarrow V_i = \sqrt{2gH}$$

$$(M + m) V_f = M V_i \Rightarrow V_f = \frac{M\sqrt{2gH}}{\cancel{M} + 1{,}5M} = \frac{\sqrt{2gH}}{2{,}5} = \frac{2}{5}\sqrt{2gH}$$

$$\frac{1}{2}(M + m) V_f^2 = (M+m) g h \Rightarrow h = \frac{V_f^2}{2g} = \frac{\left(\frac{2}{5}\sqrt{2gH}\right)^2}{2g} = \frac{\frac{4}{25} 2gh}{2g} = \frac{8}{50} H = \boxed{\frac{4}{25} H}$$

$$K_i = \frac{1}{2} M V_i^2 = MgH$$

$$K_f = \frac{1}{2}(M+m) V_f^2 = \frac{1}{2}\, 2{,}5 \left(\frac{2}{5}\sqrt{2gH}\right)^2 = 1{,}25 M \times \frac{4}{25} 2gH = \frac{1{,}25 \times 4 \times 2}{25} MgH = \frac{10}{25} MgH = \frac{2}{5} MgH$$

$$\Delta E = K_i - K_f = MgH - \frac{2}{5} MgH = \boxed{\frac{3}{5} MgH}$$

R:

Altura máxima: $h = \frac{4}{25} H$

Energía perdida: $\Delta E = \frac{3}{5} MgH$

Problema 4

Javier Joaquín

$\frac{1}{2} m v_0^2 = mgL \Rightarrow V_0 = \sqrt{2gL}$

MASA 1: $m$, Velocidad inicial $u_1 = +V_0$

MASA 2: $M = 2m$, Velocidad inicial $u_2 = -V_{0x}$

$$V_1 = \frac{m-M}{m+M} u_1 + \frac{2M}{m+M} u_2$$

$$V_2 = \frac{2m}{m+M} u_1 + \frac{M-m}{m+M} u_2$$

$$-V_0 = \frac{m-2m}{3m} V_0 + \frac{2\cdot 2m}{3m}(-V_{0x}) = -\frac{1}{3}V_0 - \frac{4}{3}V_{0x}$$

$$-V_0 + \frac{1}{3}V_0 = -\frac{4}{3}V_{0x} \Rightarrow -\frac{2}{3}V_0 = -\frac{4}{3}V_{0x} \Rightarrow V_{0x} = \frac{1}{2}V_0 = \frac{1}{2}\boxed{\sqrt{2gL}}$$

$$V_2 = \frac{2m}{3m}V_0 + \frac{2m-m}{3m}(-V_{0x}) = \frac{2}{3}V_0 + \frac{1}{3}\left(-\frac{1}{2}V_0\right) = \frac{2}{3}V_0 - \frac{1}{6}V_0 = \frac{4}{6}V_0 - \frac{1}{6}V_0 = \frac{3}{6}V_0 = \frac{1}{2}V_0 = \boxed{\frac{1}{2}\sqrt{2gL}}$$

R:

a) $V_0 = \sqrt{2gL}$

b) Velocidad de m tras el choque: $V_2 = \frac{1}{2}\sqrt{2gL}$