ALUNO = JORGE NAMI HARBES
FÍSICA 2021.1 - SIST. DE INFORMAÇÃO
LISTA EXERCÍCIOS CAP. 9 - CENTRO DE MASSA
E MOMENTO LINEAR

1- $m_1 = 2$ kg xy_1 $(-1,2m, 0,5m)$

$m_2 = 4$ kg xy_2 $(0,6m, -0,75m)$

$m_3 = 3$ kg xy_3 (x, y)

$M = 9$ kg xy $(-0,5m, -0,7m)$

$$\frac{m_1 xy_1 + m_2 xy_2 + m_3 xy_3}{m_1 + m_2 + m_3} = xy$$

$$\frac{(-2,4, 1) + (2,4, -3) + (3x, 3y)}{9} = (-0,5, -0,7)$$

$(-2,4, 1) + (2,4, -3) + (3x, 3y) = (-4,5, -6,3)$

$-2,4 + 2,4 + 3x = -4,5$

u) $\boxed{x = -1,5}$

$1 - 3 + 3y = -6,3$

$3y = -6,3 + 2 = -4,3$

b) $\boxed{y = -1,43}$

$$9 - \quad m_1 = 0,5 \, kg \quad xy_1 (0,0)$$

$$M_2 = 1,5 \, kg \quad xy_2 (1,2) m$$

$$\frac{xy_1 \, m_1 + xy_2 \, m_2}{M} = (x,y)$$

$$\frac{(0,0) + (1,5,3)}{2} = (x,y)$$

$$(x,y) = (0,75, 1,5)$$

$$\vec{F_R} = \vec{F_o} + \vec{F_N} = 2\hat{\imath} + 3\hat{\jmath} - 3\hat{\imath} - 2\hat{\jmath}$$

$$\vec{F_R} = -\hat{\imath} + \hat{\jmath} \quad \sqrt{}$$

$$\vec{F_{Rx}} = m \cdot a \implies a_x = \frac{-1}{2} = -0,5 \, m/s^2$$

$$\vec{F_{Ry}} = m \cdot a \implies a_y = \frac{1}{2} = 0,5 \, m/s^2$$

$$S_x = \cancel{S_{0_x}}^{0} + \cancel{V_o t}^{0} + \frac{a t^2}{2}$$

$$S_x = 0 - \frac{0,5(4)^2}{2} = \boxed{-4 \, m}$$

$$S_y = \cancel{S_{0_y}}^{0} + \cancel{V_o t}^{0} + \frac{a t^2}{2} = $$

$$S_y = 0 + \frac{0,5(4)^2}{2} = \boxed{4 \, m}$$

27 - $m = 1,2 \, kg$ $V_1 = 25 \, m/s$ $V_2 = 10 \, m/s$

a) $\vec{I} = \Delta \vec{P}$

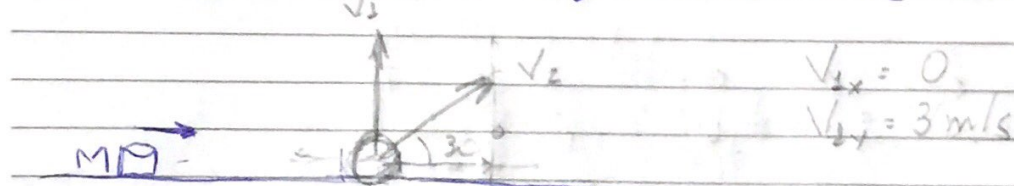$\vec{I} = \vec{P_f} - \vec{P_i} = m \cdot \vec{v_f} - m \cdot \vec{v_0}$

$\vec{I} = 1,2 (10 - (-25)) = 35 \cdot 1,2$

$I = \boxed{42 \, N \cdot s}$

b) $\Delta t = 0,02 \, s$

$\vec{F} = \dfrac{\Delta \vec{P}}{\Delta t} = \dfrac{42}{0,02} = \boxed{2100 \, N}$

42 - $M = 4 \, kg$, $m_1 = 2 \, kg$ $m_2 = 2 \, kg$
$V_0 = ?$ $V_1 = 3 \, m/s$ $V_2 = 5 \, m/s$

$V_{1x} = 0$
$V_{1y} = 3 \, m/s$

$V_{2y} = 5 \cdot \frac{1}{2} = 2,5$
$M \cdot \vec{V_0} = m_1 \cdot \vec{V_1} + m_2 \cdot \vec{V_2}$ $V_{2x} = 5 \cdot \frac{\sqrt{3}}{2} = 2,5 \sqrt{3}$

$M V_{0x} + M V_{0y} = m_1 \cdot V_{1y} + m_2 \cdot V_{2y} + m_2 V_{2x}$

$M V_{0x} = m_2 \cdot V_{2x}$ $M V_{0y} = 2 \cdot 3 + 2 \cdot 2,5$
$2 V_{0x} = 2,5 \sqrt{3}$ $4 V_{0y} = 2 (3 + 2,5)$
$V_{0x} = 1,25 \sqrt{3}$ $V_{0y} = \dfrac{5,5}{2} = 2,75$

$V_0^2 = V_{0x}^2 + V_{0y}^2 = 4,6875 + 7,5625$
$V_0^2 = 12,25$

$\boxed{V_0 = 3,5 \, m/s}$

50 - $m_1 = 5,2g$ $V_1 = 672$ m/s

$m_2 = 700y$ $V_2 = 0$

$V_{f_1} = 428$ m/s

w) $V_{f_2} = ?$

$$m_1 \cdot \vec{V_1} + m_2 \cdot \vec{V_2} = m_1 \cdot \vec{V_{f_1}} + m_2 \cdot \vec{V_{f_2}}$$

$0,0052 \cdot 672 = 0,0052 \cdot 428 + 0,7 \cdot V_{f_2}$

$0,7 V_{f_2} = 244 \cdot 0,0052$

$$V_{f_2} \approx 1,8125 \text{ m/s}$$

b) $CM = \dfrac{m_1 \cdot 0 + m_2 \cdot 672}{M} =$

$\dfrac{0,7 \cdot 672}{0,7052} \approx 667,04$

$V = \dfrac{\Delta S}{\Delta t} = \dfrac{672 - 667,04}{1} \approx 4,955 \text{ m/s}$

61- $\quad m_1 = 340 g \qquad V_1 = 1,2 m/s \qquad V_{f_1} = 0,66 m/s$

$\qquad m_2 = ? \qquad\qquad V_2 = 0 m/s \qquad V_{f_2} = ?$

$\qquad\qquad\qquad\qquad V_{CM} = ?$

$$K_0 = K_f \Rightarrow \frac{1}{2} m_1 \cdot V_1^2 + \frac{1}{2} m_2 \cdot \overset{0}{\cancel{V_2^2}} = \frac{1}{2} m_1 \cdot V_{f_0}^2 + \frac{1}{2} m_2 \cdot V_{f_2}^2$$

$$\frac{1}{2} \cdot (0,34) \cdot (1,2)^2 = \frac{1}{2} (0,34) \cdot (0,66)^2 + \frac{1}{2} m_2 \cdot V_{f_2}^2$$

$$0,4896 = 0,148104 + m_2 \cdot V_{f_2}^2$$

$$0,341496 = m_2 \cdot V_{f_2}^2$$

$$m_1 \cdot V_1 + m_2 \cdot \overset{0}{\cancel{V_2}} = m_1 \cdot V_{f_1} + m_2 \cdot V_{f_2}$$

$$0,34 \cdot 1,2 = 0,34 \cdot 0,66 + m_2 \cdot V_{f_2}$$

$$0,1836 = m_2 \cdot V_{f_2}$$

$$0,341496 = \underbrace{m_2 \cdot V_{f_2}} \cdot V_{f_2}$$

$$\boxed{V_{f_2} = 1,86 m/s}$$

$$m_2 = \frac{0,1836}{1,86} \approx 0,0982 kg \approx \boxed{98,7 g}$$

c) $CM = \dfrac{x_1 m_1 + x_2 m_2}{M} = \dfrac{1,2 \cdot 0,0982}{0,4382} \approx 0,267$

$$V_{CM} = \frac{\Delta S}{\Delta t} = \frac{1,2 - 0,267}{1} \approx \boxed{0,93 m/s}$$

68 - $h = 2,5m$ $m_2 = 2m_1$ $\mu_k = 0,5$

a) Bloco 1:

$$m \cdot g \cdot h = \frac{1}{2} m \cdot V^2$$

$$9,8 \cdot 2,5 = \frac{1}{2} \cdot V^2 \Rightarrow V = 7 m/s$$

$$K_0 = K_F$$

$$\frac{1}{2} m \cdot V^2 = \frac{1}{2} 2m \cdot V_f^2$$

$$V_f^2 = \frac{49}{2} \Rightarrow V_f = \frac{7\sqrt{2}}{2}$$

$$\frac{1}{2} m V^2 = F \cdot d = \mu \cdot N \cdot d = \mu \cdot m \cdot g \cdot d$$

$$\frac{1}{2} m V^2 = \mu \cdot 2m \cdot g \cdot d$$

$$\frac{49}{2} = \frac{1}{2} \cdot 2 \cdot 9,8 \cdot d \Rightarrow \boxed{d = 2,5m}$$

b) $\frac{1}{2} m \cdot V^2 = F \cdot d$

$$\frac{1}{2} m \cdot (7)^2 = \mu \cdot 3m \cdot g \cdot d$$

$$\frac{49}{2} = \frac{1}{2} \cdot 3 \cdot 9,8 \cdot d$$

$$d \approx 1,67m$$