Guilherme Esdras Silva de Souza

Movimento em duas e três dimensões

3ª Lista Física

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1 - a) $S = S_0 + v_0 t + \frac{at^2}{2}$ $\Big\}$ $\Delta S = v_0 t + \frac{at^2}{2}$ $\rightarrow y = v_0 t + \frac{gt^2}{2}$

$t_{10} = ?$

$a = g = 9,8$

$\hookrightarrow y = \frac{gt^2}{2} \Rightarrow 45 = \frac{9,8t^2}{2} \Rightarrow 9,8t^2 = 90 \Rightarrow t^2 = \sqrt{\frac{90}{9,8}} \Rightarrow \boxed{t^2 = 3,03\,s}$

b) $v = \frac{\Delta x}{\Delta t} \Rightarrow \Delta x = v \cdot \Delta t \Rightarrow \Delta x = 250\,m/s \cdot 3,03\,s$

$x = ?$

$\hookrightarrow \boxed{757,5\,m}$

b) $v_y^2 = v_{y0}^{2=0} + 2 \cdot a \cdot \Delta h$

$v_y = ?$

$\hookrightarrow v_y^2 = 2 \cdot 9,8\,m/s^2 \cdot 45\,m \rightarrow v_y = \sqrt{882\,m^2/s^2} \Rightarrow \boxed{v_y = 29,7\,m/s}$

2 - Por ordem de pulo: C → B → A

Por ordem de Velocidade Escalar: $\boxed{V_A > V_B > V_C}$

3 -

a) $S_y = S_{y0} + vt + a\frac{t^2}{2}$ $\Big\}$ $S_y - S_{y0} = -g\frac{t^2}{2}$

$\hookrightarrow S_y - S_{y0} = -9,8 \cdot \frac{0,19^2}{2} \Rightarrow S_y - S_{y0} \cong -9,8 \cdot 0,0180 \rightarrow \boxed{PQ = 0,177\,m \cong 17,7\,cm}$

b) $S_x = S_{x0} + v \cdot t$

$S_x - S_{x0} = 10 \cdot 0,19 \rightarrow \boxed{S_x - S_{x0} = 1,9\,m}$

4- $v_0 = \frac{25\,m}{1,5\,s \cdot \cos(60°)} = 33,3\,m/s$

$$y - y_0 = (v_0 \sin\theta)\,t - \frac{1}{2} g t^2$$

a) $h = 0 + 33,3\,m/s \cdot \sin(60°)\cdot 1,5\,s - \frac{1}{2}\left(9,8\,m/s^2\right)(1,5\,s)^2$

$$h = 32,28\,m$$

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b) $v_x = v_{0x} \cdot (\cos\theta_0) = 33\,m/s \cdot \cos(60°) = 16,67\,m/s$

$v_y = 33,3\,m/s \cdot \sin(60°) - 9,8\,m/s^2 \cdot 1,5\,s = 14,17\,m/s$

$|\vec{v}| = \sqrt{(v_x)^2 + (v_y)^2} = \sqrt{(16,67\,m/s)^2 + (14,17\,m/s)^2} = 21,87\,m/s$

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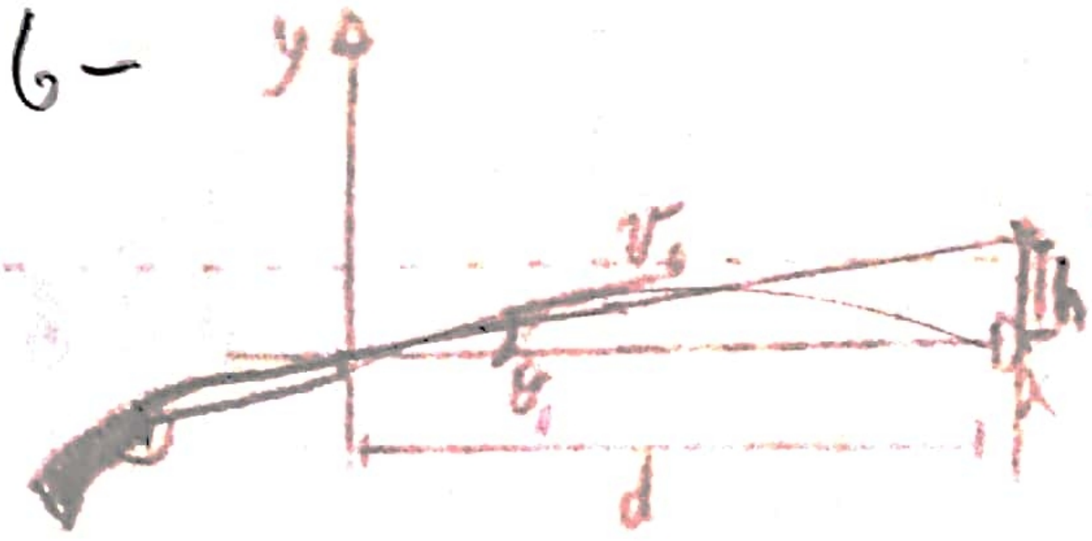
c) $\theta = \text{arctg} = \frac{\sin\theta}{\cos\theta} \Rightarrow \frac{v_y}{v_x} = \frac{14,2}{16,7} = 40,4°$

5-

$v_0 = 5 \cdot (v_0 \cdot \cos\theta) \rightarrow \cos\theta = \frac{1}{5} \rightarrow \theta = \arccos\left(\frac{1}{5}\right) = 78,46°$

6-



Movimento in X:

$x = x_0 + v_{x0} t$

$d = v_0 \cdot \cos\theta \cdot t$

$t = \frac{d}{v_0 \cdot \cos\theta}$

Movimento em y:

$y - y_0 = v_{y0} t - \frac{1}{2} g t^2$

$0 = v_0 \sin\theta_0 - \frac{gt}{2}$

$t = \frac{2 v_0 \sin\theta_0}{g}$

$\frac{d}{v_0 \cos\theta_0} = \frac{2 v_0 \sin\theta_0}{g} \Rightarrow d = \frac{v_0^2 (2 \cos\theta_1 \cdot \sin\theta)}{g} \Rightarrow d = \frac{v^2 \cdot \sin 2\theta_0}{g} \Rightarrow \sin 2\theta = \frac{dg}{v_0^2}$

$\rightarrow \sin 2\theta = \frac{45,7\,m \cdot 9,8\,m/s^2}{460\,m/s^2} \simeq 2,1165 \cdot 10^{-3} \Rightarrow \theta = \frac{\arcsin(2,1165 \cdot 10^{-3})}{2} = 0,0606°$

$tg(\theta_1) = \frac{h}{d} \rightarrow h = d \cdot tg(\theta_1) \rightarrow h = 45,7\,m \cdot tg\,0,0606° \rightarrow h = 0,0484\,m \rightarrow h = 4,84\,cm$

7 - $v_{1y}^2 = v_{0y} - 2g\Delta y$

$6{,}1\,m/s^2 = v_{0y}^2 - 2 \cdot 9{,}8\,m/s^2 \cdot 9{,}1\,m$

$v_{0y} = 14{,}7\,m/s$

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a) $v_{2y}^2 = v_{0y}^2 - 2g\Delta y \Rightarrow 0 = (14{,}7\,m/s)^2 - 2 \cdot 9{,}8\,m/s^2 \cdot h_{máx} \Rightarrow \boxed{h_{máx} = 11\,m}$

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b)

$R = v_{0x} \cdot t$

$S = S_0 + v_0 t + \frac{at^2}{2}$ $\Big\}$ $0 = \frac{11 - 9{,}8\,t^2}{2} \rightarrow t = 1{,}5\,s \rightarrow t_{tot} = 3\,s$

$R = 7{,}6\,m/s : 3 \simeq \boxed{2{,}3\,m}$

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c) $|\vec{v}| = \sqrt{(7{,}6\,m/s)^2 + (-14{,}7\,m/s)^2} = \boxed{17\,m/s}$

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d) $\theta = arctg\left(\frac{v_{3y}}{v_{3x}}\right) = arctg\left(\frac{14{,}7\,m}{7{,}6\,m}\right) = \boxed{-63^\circ}$

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8 - $y = x\,tg\theta_0 - \frac{gx^2}{2v_0^2 \cos^2\theta_0}$

$\frac{1}{2} \cdot \frac{gx^2}{v_0^2} \cdot tg^2\theta_0 - x\,tg\theta_0 + y + \frac{1}{2} \cdot \frac{gx^2}{v_0^2} = 0$

$c = \frac{1}{2} \cdot \frac{gx^2}{v_0^2} = \frac{1}{2} \cdot 9{,}8\,m/s^2 \cdot \frac{(50\,m)^2}{25\,m/s^2} = 19{,}6\,m$

$c \cdot tg^2\theta_0 - x\,tg\theta_0 + y + c = 0$

$tg\theta_0 = \frac{x \pm \sqrt{x^2 - 4(y+c)c}}{2c} = \frac{50\,m \pm \sqrt{((50\,m)^2 - 4(3{,}44\,m + 19{,}6\,m) \cdot 19{,}6)}}{39{,}2\,m}$

$tg\theta_0 = 1{,}99$ } Menor ângulo: $\theta_0 = 31^\circ$

$tg\theta_0 = 0{,}605$ } Maior ângulo: $\theta_1 = 63^\circ$

9 - a) $x_f = x_0 + v_x t$

↳ $v_x = v_0 \cdot \cos\theta \Rightarrow 290 \cdot \cos 30° \Rightarrow 251{,}19\ Km/h$

$\div 3{,}6$

↳ $69{,}76\ m/s$

→ $z_{01} = 69{,}76t \rightarrow \boxed{t = 10{,}03\ s}$

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b) $y_f = y_0 + v_{y_0} t - g\frac{t^2}{2}$

↳ $v_{y_0} = v_0 \sin\theta \Rightarrow v_{y_0} = 290 \cdot \sin 30° \Rightarrow 145\ Km/h$

$\div 3{,}6$

↳ $40{,}28\ m/s$

→ $0 = h - 40{,}28 \cdot t - 9{,}8\frac{t^2}{2}$

↳ $-h = -40{,}28 \cdot 10{,}03 - 4{,}9 \cdot (10{,}03)^2 \rightarrow h = 403{,}986 + 492{,}944$

↳ $\boxed{h = 896{,}9\ m}$

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10 - a) $\vec{v} = \frac{\Delta \vec{x}}{\Delta t} \rightarrow \Delta \vec{x} = \vec{v} \cdot \Delta t \rightarrow \Delta \vec{x} = 2{,}00\ m/s \cdot 0{,}8\ s = \boxed{1{,}60\ m}$

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b) $S = S_0 + v_0 t + \frac{at^2}{2} \rightarrow S = 10 - 9{,}8\ m/s^2 \frac{(10{,}1)^2}{2} = \boxed{6{,}86\ m}$

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c) $S = S_0 + v_0 t + \frac{at^2}{2} \rightarrow 0 = 10 - 9{,}8\ m/s^2 \cdot \frac{t^2}{2} = 1{,}43\ s$

$\vec{v} = \frac{\Delta \vec{x}}{\Delta t} \rightarrow \Delta \vec{x} = \vec{v} \cdot \Delta t \rightarrow \Delta \vec{x} = 2{,}00\ m/s \cdot 1{,}43\ s = \boxed{2{,}86\ m}$