Problemas

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Ejercicio No.1

A person jumps from a fourth-story window 15.0 m above a firefighter's safety net. The survivor stretches the net 1.0 m before coming to rest, Fig. 46. (*a*) What was the average deceleration experienced by the survivor when she was slowed to rest by the net? (*b*) What would you do to make it "safer" (that is, to generate a smaller deceleration): would you stiffen or loosen the net? Explain.

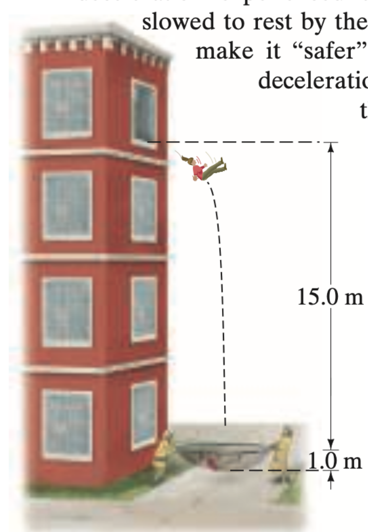

Figure 1: Representación Gráfica Del Problema

Formulas De Aceleración ($a = -g$)

$y = y_0 + v_0 t - \frac{1}{2} g \ t^2$

$v^2 = v_0^2 - 2g\left(y - y_0\right)$

$v = v_0 - gt$

Solución

1. Se calcula las velocidades a que actúan en la red

$v^2 = 0 - 2g\left(0 - 15m\right)$

$v^2 = 0 - 2g\left(0 - 15m\right)$ $v^2 = 2\left(9.81\ \frac{m}{s^2}\right)\left(15m\right)$

1.1. Eliminamos el cuadrado con una raíz

$v^2 = \sqrt{2\left(9.81\ \frac{m}{s^2}\right)\left(15m\right)}$

$v = 17.15\ \frac{m}{s}$

2. Despejamos aceleración para obtener la velocidad promedio

$v^2 = v_0^2 - 2g\left(y - y_0\right)$

$2a\left(y - y_0\right) = v^2 - v_0^2$

$2a = \frac{v^2 - v_0^2}{y - y_0}$

3. Se identifica(Busca) cuanto vale la velocidad inicial (v_0)

$v_0 = 17.15\ \frac{m}{s}$

$v = 0\ \frac{m}{s}$ $v^2 = 0 - 2g\left(0 - 15m\right)$

$y_0 = 1m$

$y = 0$

4. Sustituimos

$a = \frac{\left(0\ \frac{m}{s^2}\right) - \left(17.15\ \frac{m}{s^2}\right)}{2(0 - 1m)}$

$a = 147\ \frac{m}{s^2}$

Se concluye que se desacelera $a = 147\ \frac{m}{s^2}$

Ejercicio No.2

A person driving her car at 45 km/h approaches an intersection just as the traffic light turns yellow. She knows that the yellow light lasts only 2.0 s before turning to red, and she is 28 m away from the near side of the intersection (Fig. 51). Should she try to stop, or should she speed up to cross the intersection before the light turns red? The intersection is 15 m wide. Her car's maximum deceleration is $-5.8\,\mathrm{m/s^2}$, whereas it can accelerate from 45 km/h to 65 km/h in 6.0 s. Ignore the length of her car and her reaction time.

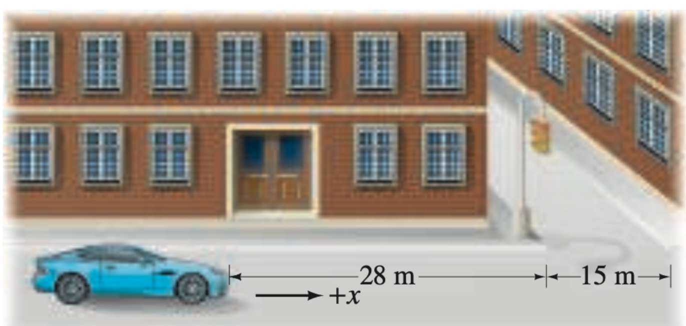

Figure 2: Representación Gráfica Del Problema

Solución

Situación No.1

$v_0 = 12.5\ \frac{m}{s}$

$a = -5.8\ \frac{m}{s^2}$

$v^2 = v_0^2 + 2a\left(x - x_0\right) \rightarrow\ Horizontal$

$2a\left(x - x_0\right) = v^2 - v_0^2$

$x - x_0 = \frac{v^2 - v_0^2}{2a}$

$x - x_0 = \frac{\left(12.5\ \frac{m}{s}\right)^2}{-2\left(5.8\ \frac{m}{s}\right)}$

$x - x_0 = 13.40m$

Situación No.2

Se calcula la velocidad del carro para ver si, logra pasar a tiempo

$a = \frac{v - v_0}{t}$

$45\ \frac{Km}{h}$

$a = \frac{18.05 - 12.5\ \frac{m}{s}}{6s}$

$a = 0.925\ \frac{m}{s^2}$

El tiempo que dispone sera $= \frac{v - v_0}{t}$

$t = 2\ Seg$

$x = x_0 + v_0 t + \frac{1}{2} at2 \quad \therefore \mathit{Movimiento\ de\ aceleración\ total}$

$x = \left(12.5\ \frac{m}{2}\right)(2s) + \frac{1}{2}\left(0.925\ \frac{m}{s}\right)(2s)$

$x = 26.85\ m$

Se concluye qeu al conductor del coche se detenga , ya que puede avanzar $26.85\ m$ y el trayecto es de $43m$, dado a esas sircustancias no es conveniente.

Ejercicio No.3

(II) Extreme-sports enthusiasts have been known to jump off the top of El Capitan, a sheer granite cliff of height 910 m in Yosemite National Park. Assume a jumper runs horizontally off the top of El Capitan with speed 5.0 m/s and enjoys a freefall until she is 150 m above the valley floor, at which time she opens her parachute (Fig. 41). (*a*) How long is the jumper in freefall? Ignore air resistance. (*b*) It is important to be as far away from the cliff as possible before opening the parachute. How far from the cliff is this jumper when she opens her chute?

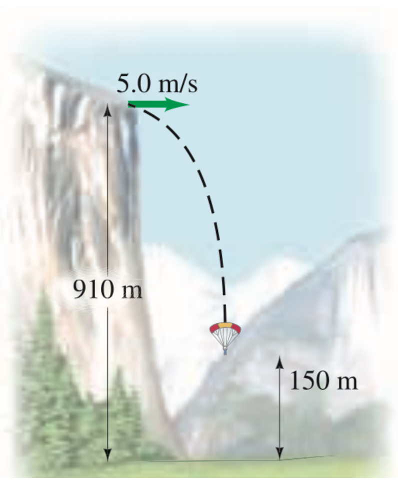

Figure 3: Representación Gráfica Del Problema

(a) *Dirección* y

$vx_0 = \frac{x}{t}$

$x = vx_0 t$

$y = y_0 + v_0 t - \frac{1}{2} g t2$

$150m = 910m + \frac{1}{2} g t2$

$\frac{1}{2} g t = 910m + 150m$

$t^2 = \frac{2(760m)}{9-81\ \frac{m}{s^2}}$

$t^2 = \sqrt{\frac{2(760m)}{9-81\ \frac{m}{s^2}}}$

$t = 12.44\ seg$

$(b)\ \ En\ x$

$x = v_0 t$

$x = \left(5\ \frac{m}{s}\right)(12.44\ seg)$

$x = 62.2\ m$

Se concluye que el paracaidista duro 12.45 seg en la caída libre y hasta los 62.2 m alejado del acantilado.