Answer on Question #70771-Physics-Other

A 60 kg daredevil physicist attaches a bungee cord with a force constant of 15.5 N/m to his waist and jumps off a bridge that is 100 m above the water. The unstretched length of the bungee cord is 8.0 m.

a. Calculate his speed when he is half way down.

b Does he hit the water? Calculate how far he jumps.

Solution

a.

$$\frac{mgh}{2} = \frac{mv^2}{2} + \frac{k}{2}\left(\frac{h}{2} - x\right)^2$$

$$v = \sqrt{gh - \frac{k}{m}\left(\frac{h}{2} - x\right)^2} = \sqrt{(9.81)100 - \frac{15.5}{60}(50-8)^2} = 22.9\frac{m}{s}.$$

b. At the water:

$$mgh = \frac{mv^2}{2} + \frac{k}{2}(h-x)^2$$

$$mgh = 60(9.81)100 = 58860\,J.$$

$$\frac{k}{2}(h-x)^2 = \frac{15.5}{2}(100-8)^2 = 65596\,J > 58860\,J.$$

Thus event at zero speed daredevil physicist cannot hit the water.