Work and Energy Worked Example

- A spring with an unstretched length of 40 cm and a k value of 120 n/cm is used to lift a ½ kilogram box from a height of 20 cm to a height of 30 cm. If the box starts at rest, what would you expect the final velocity to be?

$PE_{sp} = W_{sp} = \frac{1}{2} k \Delta x^2$

$\Delta x_i = (0.4 - 0.2) = 0.2\,m$

$\Delta x_f = (0.4 - 0.3) = 0.1\,m$

$x_{nat} = 0.4\,m$

$KE_i^{\,0} + PE_i + W_{i\to f}^{\,0} = KE_f + PE_f$

$PE_{g_i} = mgh_i$

$PE_{g_f} = mgh_f$

$k = 120 \frac{N}{cm} = 12{,}000 \frac{N}{m}$

$mgh_i + \frac{1}{2} k \Delta x_i^2 = \frac{1}{2} m v_f^2 + mgh_f + \frac{1}{2} k \Delta x_f^2$

$(0.5)(9.81)(0.2) + \frac{1}{2}(12000)(0.2)^2 = \frac{1}{2}(0.5) v_f^2 + (0.5)(9.81)(0.3) + \frac{1}{2}(12{,}000)(0.1)^2$

$v_f = 8.37\ m/s$