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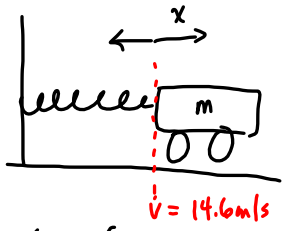
14. $k = 235\ N/m$



- 50J of work was done to stretch spring
- frictionless

Since 50J of was done in stretching the spring, the max elastic potential energy of the spring-cart system is 50J

$W = \Delta E_e$

$50J = E_{e_2} - E_{e_1}$ ($E_{e_1} = 0$)

$E_{e_2} = 50J$

a) $E_{total} = E'_{total}$

(stretched) (equilibrium)

$E_k + E_e = E'_k + E'_e$ ($E_k = 0$, $E'_e = 0$)

$50J = \frac{1}{2}kx^2 = \frac{1}{2}mv^2$

b) $E_e = \frac{1}{2}kx^2$

$50J = \frac{1}{2}\left(235\frac{N}{m}\right)x^2$

$\frac{100J}{235N/m} = x^2$

$x = \pm 0.652\ m$

$50J = \frac{1}{2}m(14.6m/s)^2$

$100J = m(14.6m/s)^2$

$m = \frac{100J}{(14.6m/s)^2}$

$m = 0.469\ kg$

c) Total energy = 50.0J

$E_{total} = E_k + E_e$

$E_{total} = \frac{1}{2}mv^2 + \frac{1}{2}kx^2$

$50.0J = \frac{1}{2}(0.469kg)(5.00m/s)^2 + \frac{1}{2}\left(235\frac{N}{m}\right)x^2$

$50.0J = 5.86J + \frac{1}{2}\left(235\frac{N}{m}\right)x^2$

$44.1J = \frac{1}{2}\left(235\frac{N}{m}\right)x^2$

$\frac{88.2J}{235N/m} = x^2$

$x = \pm 0.613\ m$

the cart will be 61.3cm on either side of the equilibrium when going 5.00m/s.