1. Use $\vec{F}\Delta t = \Delta\vec{P}$, suppose the man of the cars: $m_1 > m_2$ (man of A, man of B)

(a) $\begin{cases} Ft = m_1 v_1 = P_1 \\ Ft = m_2 v_2 = P_2 \end{cases} \Rightarrow P_1 = P_2$

$\begin{cases} E_{k1} = \frac{1}{2} m_1 v_1^2 = \frac{1}{2} m_1 \left(\frac{Ft}{m_1}\right)^2 = \frac{(Ft)^2}{2m_1} \\ E_{k2} = \frac{1}{2} m_2 v_2^2 = \frac{1}{2} m_2 \left(\frac{Ft}{m_2}\right)^2 = \frac{(Ft)^2}{2m_2} \end{cases} \Rightarrow E_{k1} < E_{k2}$

$\begin{cases} v_1 = \frac{Ft}{m_1} \\ v_2 = \frac{Ft}{m_2} \end{cases} \Rightarrow v_1 < v_2$

So the lighter one has more kinetic energy. they have the same momentum and the lighter one goes faster

(b) use $\vec{F} \cdot d\vec{l} = dE_k$

$\begin{cases} FS = \frac{1}{2} m_1 v_1^2 \\ FS = \frac{1}{2} m_2 v_2^2 \end{cases} \Rightarrow E_{k1} = E_{k2}$

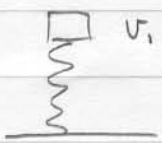
$\begin{cases} P_1 = m_1 v_1 = m_1 \sqrt{\frac{2FS}{m_1}} = \sqrt{2FSm_1} \\ P_2 = m_2 v_2 = m_2 \sqrt{\frac{2FS}{m_2}} = \sqrt{2FSm_2} \end{cases} \Rightarrow P_1 > P_2$

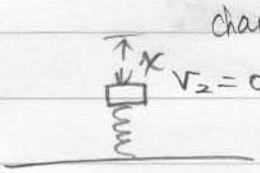
$\begin{cases} v_1 = \sqrt{\frac{2FS}{m_1}} \\ v_2 = \sqrt{\frac{2FS}{m_2}} \end{cases} \Rightarrow v_1 < v_2$

So they have equal kinetic energy. the lighter one goes faster and the heavier has larger momentum.

2. $m = 0.23\,kg$, $v_0 = 1.5\,m/s$, $h = 1.5\,m$, $k = 550\,N/m$

x: the length change of string





(a) According to energy conservation.

$E_k' = E_k + mgh$

$\frac{1}{2} m v_1^2 = \frac{1}{2} m v_0^2 + mgh \Rightarrow v_1 = \sqrt{v_0^2 + 2gh} = \sqrt{1.5^2 + 2 \times 9.8 \times 1.5}$

$= 5.6\,m/s$