## Answer on Question \#57063, Physics / Other

If there were a speed limit for this train as it traveled through a city, but not a weight limit, what mass must be added to the train to slow it down to $5 \mathrm{~m} / \mathrm{s}$ while at the same time keeping the momentum the same as in the second part?

Answer in units of kg.

## Solution:

Momentum is defined to be the mass of an object multiplied by the velocity of the object.

$$
p=m v
$$

The conservation of momentum states that, within some problem domain, the amount of momentum remains constant.

Thus,

$$
\begin{gathered}
p_{1}=p_{2} \\
m v_{1}=\left(m+m_{x}\right) v_{2} \\
m v_{1}=m v_{2}+m_{x} v_{2} \\
m_{x} v_{2}=m\left(v_{1}-v_{2}\right) \\
m_{x}=\frac{m\left(v_{1}-v_{2}\right)}{v_{2}}
\end{gathered}
$$

where $v_{2}=5 \mathrm{~m} / \mathrm{s}$,
$m=$ initial mass of train,
$v_{1}=$ velocity of train from the second part of question.

Answer: $m_{x}=\frac{m\left(v_{1}-v_{2}\right)}{v_{2}}$.

