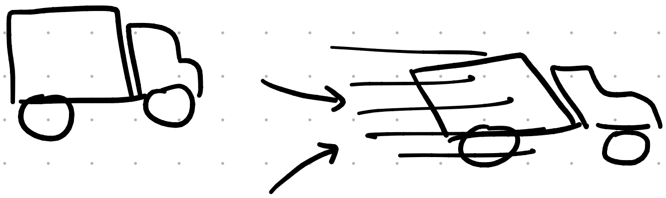
Mechanics 1:

MOMENTUM -AND- IMPULSE

high momentum
heavy but slow truck



INSANELY high momentum

=D
light but fast bullet
high momentum

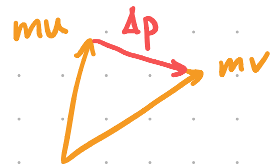
vector

momentum, p

$\rightarrow v\,ms^{-1}$

$m\,kg$

$p = mv$
$= [kg\,ms^{-1}]$
$= [Ns^{-1}]$



impulse $= F \times t$ (force F applied for t seconds)

vector

$= ma \times t = m\left(\frac{v-u}{t}\right)t = m(v-u) = mv - mu = \Delta p$ (change momentum)

When force is applied over a period of time, the velocity change results in momentum change $\Rightarrow$ Impulse $= F \times t = \Delta p$

Ex 1A

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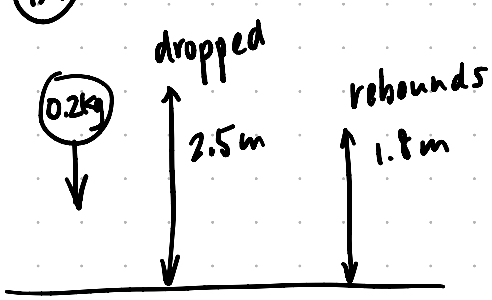


$v^2 = u^2 + 2as$

$v = \sqrt{2(9.81)(2.5)} = 7\,ms^{-1}$ max down velocity

$v^2 = u^2 + 2as$

$u = \sqrt{0 - 2(-9.81)(1.8)} = 5.94\,ms^{-1}$ initial up velocity

$I = m(v-u) = 0.2 \times (\underbrace{7 + 5.94}_{\text{velocity direction changed.}}) = 2.59\,Ns$

(principle of)

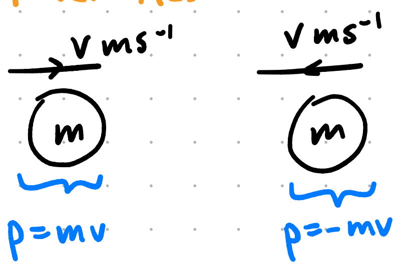
Conservation of Momentum (aka PCOM)

In a closed system: total momentum before = total momentum after

$\underbrace{\Sigma mv = \Sigma mu}$

do not forget the direction of velocities

if something external is making stuff faster/slower, this doesn't apply.



(taking → as +ve)

$\underline{\Sigma p = 0\ Ns}$ they cancel.

Remember to consider momentum and impulse as vectors