Elastic collision

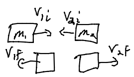
- KE is conserved during collision
- an ideal scenario in real life most collisions are inelastic
  - some energy is lost

loses energy with each bounce

at microscopic level, elastic collisions are common

maximally inelastic collision is one which loses the most energy but conserves momentum

elastic collisions

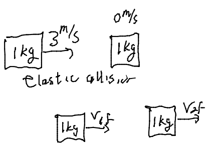


$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$

$\frac{1}{2} m_1 v_{1i}^2 + \frac{1}{2} m_2 v_{2i}^2 = \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2$

2 equations – solve for 2 unknowns (v_{1f} & v_{2f})

e.g.



momentum: $(\cancel{1kg})(3 m/s) + (\cancel{1kg})\cancel{0} = \cancel{1kg}\, v_{1f} + \cancel{1kg}\, v_{2f}$

KE: $\cancel{\frac{1}{2}(1kg)}(3 m/s)^2 + \cancel{\frac{1}{2}(1kg)}0^2 = \cancel{\frac{1}{2}(1kg)} v_{1f}^2 + \cancel{\frac{1}{2}(1kg)} v_{2f}^2$

$3 = v_{1f} + v_{2f} \rightarrow v_{2f} = 3 - v_{1f}$

$9 = v_{1f}^2 + v_{2f}^2$

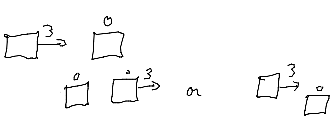
$9 = v_{1f}^2 + (3 - v_{1f})^2$

$\cancel{9} = v_{1f}^2 + \cancel{9} - 6v_{1f} + v_{1f}^2$

$0 = 2v_{1f}^2 - 6v_{1f}$

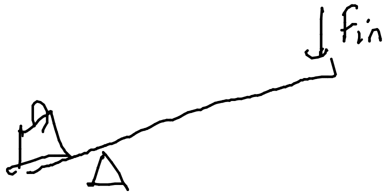
$= 2v_{1f}(v_{1f} - 3)$

either $v_{1f} = 0$, $v_{2f} = 3$ or $v_{1f} = 3$, $v_{2f} = 0$

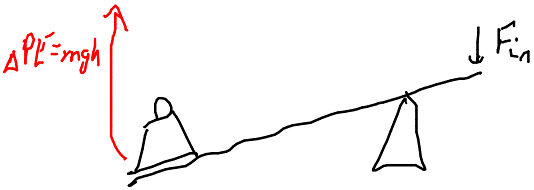


block 1 misses block 2.

Simple Machines



I can use less force to lift the weight, if I move my end of the lever ~~the~~ a greater distance.



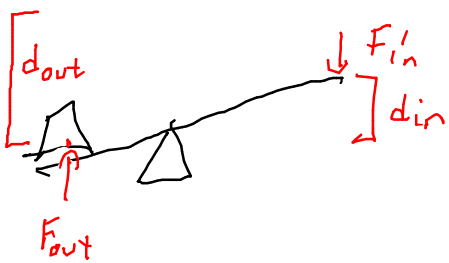
I do work

$W = F_{in} \Delta x$

apply more force over less distance

mass gains potential energy

$mgh = F_{in} \Delta x$



$$\boxed{F_{out} d_{out} = F_{in} d_{in}}$$

If F_{out} & d_{out} are given

(e.g. "Lift the box up those stairs")

then if you decrease d_{in}, you increase F_{in}

" " " increase d_{in}, you decrease F_{in}

need less force