- The momentum of an object is the product of its mass & velocity. $\vec{p} = m\vec{v}$
- Momentum is a vector, it has magnitude & direction.
- Impulse is the average Force multiplied by the time during which it acts. $\text{Impulse} = F\Delta t$
- Impulse exerted on something is equal to the change in momentum it produces. $\Delta p = F\Delta t$
- Conservation of momentum states that momentum is conserved if there is no net external force. $p_o = p_f$
- Inelastic collision, momentum is conserved but Kinetic energy is not conserved.
- Perfectly inelastic collision is when the objects stick together.
- Elastic collision is when momentum and Kinetic energy is conserved.

momentum is measured in $\frac{kg\,m}{s}$

True or false

Impulses are smaller when bounces take place.

$\Delta p = F \Delta t$ False

$m = 1.0\,kg \quad V_0 = 1\,m/s$

O → | sad ball

$V_f = 0$

$\Delta p = p_f - p_0$

$= 0 - (1\,kg)(1\,m/s)$

$= -1\,kg\,m/s$

O → | happy ball

$V_0 = 1\,m/s$

$V_f = -1\,m/s$

$\Delta p = p_f - p_0$

$= (1\,kg)(-1\,m/s) - (1\,kg)(1\,m/s)$

$= -2\,kg\,m/s$

True or false

Airbags increases the time of a passengers impact during a collision

$\Delta p = F \Delta t$ True

A 2.5 kg ball strikes a wall with a velocity of 5 m/s to the right & bounces back with a velocity of 3 m/s to the left. If the duration of the collision was 0.25 sec, what is the average force the wall exerted on the ball? $\Delta p = F \Delta t \quad F = \frac{\Delta p}{\Delta t}$

$\Delta p = p_f - p_0 = (2.5\,kg)(-3\,m/s) - (2.5\,kg)(5\,m/s) = -20\,kg\,m/s$

$F = \frac{-20\,kg\,m/s}{0.25\,sec} = -80\,N$

O → |

True or false

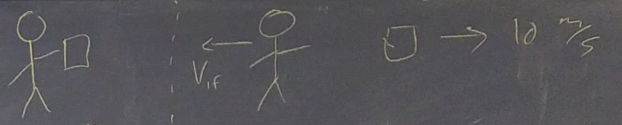
If a net force acts on a system, the system's momentum will change.

True

If net external force acting on system is zero, then the total momentum is zero.

False

A 80 kg astronaut throws a 5 kg tank to the right with a velocity of 10 m/s, what is the final velocity of the astronaut



$P_o = 0$ kg m/s

at rest

astronaut & tank will have equal & opposite momentum. $P_f = 0 = m_1 V_{1f} + m_2 V_{2f}$

$0 = (80\text{kg}) V_{1f} + (5\text{kg})(10\ \text{m/s})$

$0 = (80\text{kg}) V_{1f} + 50\ \text{kg m/s}$

$-50\ \text{kg m/s} = (80\text{kg}) V_{1f}$

$V_{1f} = \frac{-50\ \text{kg m/s}}{80\ \text{kg}} = -0.625\ \text{m/s}$

$V_{1f} = 0.625$ m/s to the left

If superman is at rest in free space and throws an asteroid that has more mass than superman, then which moves faster?

Superman