Conservation of Momentum

Really starts with Newton's Third Law

- equal and opposite forces during a collision
- equal and opposite impulses
- equal and opposite changes in momenta ($\Delta\vec{p}_A = -\Delta\vec{p}_B$)
- total momentum is the same before & after a collision (neglecting friction)

$$\Rightarrow \vec{p}_{total} = \vec{p}'_{total}$$

$\Rightarrow$ mvp chart to organize info

Elastic Collision

Kinetic energy is conserved during an elastic collision:

$$E_{k_{total}} = E'_{k_{total}}$$

$E_k = \frac{1}{2}mv^2$ $\quad E_{k_A} + E_{k_B} = E'_{k_A} + E'_{k_B}$

Collisions can have varying degrees of "elasticity". An perfectly inelastic collision occurs when the objects stick together.

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Apply the Lof Cons of Mom. in order to find the velocity of steel ball after the collision.

+ orig dir of bill ball

	BEFORE		AFTER	
	Bill Ball	Steel Ball	Bill Ball	Steel Ball
m	0.250kg	0.800kg	0.250kg	0.800kg
v	+5.00m/s	0	-2.62m/s	v
p	1.25 kg·m/s	0	-0.655 kg·m/s	(0.800kg)v

$\vec{P}_{total}$ $\vec{P}'_{total}$

$$\vec{P}_{total} = \vec{P}'_{total}$$

$$1.25\,kg\,m/s + 0 = -0.655\,kg\,m/s + (0.800kg)v$$

$$1.905\,kg\,m/s = (0.800kg)v$$

$$v = +2.38\,m/s$$

$$\vec{v} = 2.38\,m/s \text{ [in the original dir of bill ball]}$$

To see if the collision is elastic:

$$E_{k\,bill} = \tfrac{1}{2}(0.250kg)\left(5.00\tfrac{m}{s}\right)^2 = 3.125J$$

$$E_{k\,steel} = 0$$

$E_{k\,total} = 3.125J$ / $3.12\,J$

$$E'_{k\,bill} = \tfrac{1}{2}(0.250kg)\left(-2.62\tfrac{m}{s}\right)^2 = 0.85805\,J$$

$$E'_{k\,steel} = \tfrac{1}{2}(0.800kg)\left(2.38125\tfrac{m}{s}\right)^2 = 2.26814\,J$$

$E'_{k\,total} =$ $3.126\,J$ / $3.13J$

Since the E_k totals are the same before and after the collision, the collision is ELASTIC!

TO DO

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