Conservation of Momentum:

Really due to Newton's Third Law:

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

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

$\Rightarrow$ mvp chart to organize info

Elastic Collisions

A collision is <u>elastic</u> if Kinetic energy is conserved:

$E_K = \frac{1}{2}mv^2$ $E_{K_{total}} = E'_{K_{total}}$

$$E_{K_A} + E_{K_B} = E'_{K_A} + E'_{K_B}$$

Not every collision is an elastic collision. There are varying degrees of elasticity. A perfectly inelastic collision occurs when the two objects stick together.

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We need to find the velocity of the steel ball after the collision in order to find the $E_{k_{total}}$ and $E'_{k_{total}}$.

Apply the L of Cons. of Mom.:

+ original dir of bill ball

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

$p = mv$

Before: $\vec{p}_{total}$; After: $\vec{p}\,'_{total}$

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

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

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

$$v \doteq +2.38\,\frac{m}{s}$$

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

We need to find the Kinetic Energies:

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

$$E_{k_{steel}} = 0\,J$$

$E_{k_{total}} = 3.125\,J$ (3.12 J)

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

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

$E'_{k_{total}}$ 3.126 J (3.13 J)

The collision was <u>ELASTIC</u> since

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

TO DO

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