Elastic Collisions

* In every collision (neglecting friction), momentum is conserved due to Newton's Third Law:

If the objects experience equal but opposite forces during a collision, they also experience equal but opposite impulses which means they have equal but opposite changes in momenta (ie one object's loss is the other's gain)

* Kinetic energy may or may not be conserved in a collision. If it is conserved => ELASTIC COLLISION

To see if a collision is elastic, you must know all the velocities ⇒ use conservation of momentum to find a missing velocity.

Dec 6-9:00 AM

MP|320

	BEFORE		AFTER	
	BBall	SBall	BBall	SBall
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 (mv)	+1.25 kg·m/s +	0	−0.655 kg·m/s +	(0.800 kg)v
	p_{total}		p'_{total}	

\+ original dir of BBall
− opposite dir of BBall initially

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

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

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

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

$$\vec{v} = 2.38\,m/s\ [\text{in the original direction of the BBall}]$$

To see if an elastic collision:

BEFORE

BBall: $E_k = \frac{1}{2}mv^2 = \frac{1}{2}(0.250\,kg)(5.00\,m/s)^2 = 3.125\,J$

SBall: $E_k = 0$

Total: 3.125 J

AFTER

BBall: $E_k = \frac{1}{2}mv^2 = \frac{1}{2}(0.250\,kg)(2.62\,m/s)^2 = 0.85805\,J$

SBall: $E_k = \frac{1}{2}mv^2 = \frac{1}{2}(0.800\,kg)(2.38\,m/s)^2 = 2.26576\,J$

Total: 3.124 J

Since $E_{k\,total} \approx E'_{k\,total}$, the collision was elastic.

TO DO:

① PP|322

② Review: p277|23-39
p328|20-23

TEST - Thurs, Dec 9th

Chapter 6 - Work, Energy + Power

- $W = F_{\parallel}\Delta d$
- $W = F\Delta d\cos\theta$
- W = area under a F-d graph
- when no work is done
- Kinetic energy: $E_k = \frac{1}{2}mv^2$
- Gravitational Potential Energy: $E_g = mgh$
- Elastic Potential Energy: $E_e = \frac{1}{2}kx^2$ (Hooke's Law $F_a = kx$)
- Work-Energy Theorem: $W = \Delta E$
- Power: $P = \frac{W}{\Delta t}$
- Efficiency $= \frac{E_O}{E_I} \times 100\%$

Chapter 7 - Conservation of Energy + Momentum

- Law of Conservation of Mechanical Energy:

single object or cart/spring system

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

$$E_g + E_k + E_e = E_g' + E_k' + E_e'$$

BEFORE = AFTER

(neglecting friction/air resist)

- Law of Conservation of Momentum

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

(in an isolated system)

$$\vec{P}_A + \vec{P}_B = \vec{P}_A' + \vec{P}_B'$$

(BEFORE) (AFTER)

* use mvp chart to organize info
* momentum is a vector (dir is impt)

- Elastic Collisions => Kinetic Energy is conserved.