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.

MP|320

	BEFORE B	BEFORE S	AFTER B	AFTER S
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

$\vec{p}_{total}$ (before), $\vec{p}\,'_{total}$ (after)

\+ the original direction of the bill. ball.
− opp. the original direction of the bill. ball

$$\vec{p}_{total} = \vec{p}\,'_{total}$$
$$\vec{p}_B + \vec{p}_S = \vec{p}\,'_B + \vec{p}\,'_S$$
$$+1.25\,kg\cdot m/s + 0 = -0.655\,kg\cdot m/s + (0.800\,kg)v$$
$$1.905\,kg\cdot m/s = (0.800\,kg)v$$
$$v \doteq +2.38\,m/s$$
$$\vec{v} = 2.38\,m/s\ [\text{in the original direction of the billiard}]$$

To see if ELASTIC:

BEFORE:

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

Steel Ball: $E_k = 0$

Total: 3.125 J

AFTER

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

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

Total: 3.124 J

Since $E_{k\,total} = E'_{k\,total}$, the collision is: ELASTIC

TO DO

1. PP|322
2. Review: p277|23-39 (Chapt 6)
   p328|20-23 (Chapt 7)

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: $E_k = \frac{1}{2} m v^2$
- Gravitational Potential Energy: $E_g = mgh$
- Elastic Potential Energy: $E_e = \frac{1}{2} k x^2$ (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 resis)

- Law of Conservation of Momentum

2 objects

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

$$\vec{p}_A + \vec{p}_B = \vec{p}\,'_A + \vec{p}\,'_B$$

(BEFORE) (AFTER)

(in an isolated system)

* use mvp chart to organize info

* momentum is a vector (dir is impt)

Dec 6-9:29 AM