PP|317

27.

+ north

	Before: cannon+ball	After: cannon	After: ball
m		1385 kg	58.5 kg
v	0	V	+49.8 m/s
P	0	(1385 kg)V	2913.3 kg·m/s

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

Law of Conservation of Momentum

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

$0 = (1385\,kg)V + 2913.3\,kg\cdot m/s$

$-2913.3\,kg\cdot m/s = (1385\,kg)V$

$V = -2.10\,m/s$

$\vec{V} = 2.10\,m/s$ [south]

recoil velocity of the cannon

Elastic Collisions

This is a special type of collision. An elastic collision occurs when the total kinetic energy before the collision is the same as the total kinetic energy after the collision.

* Not all collisions are elastic!!
* All collisions obey the Law of Conservation of Momentum (neglecting friction)

MP 13.2 0

+ forward

	Before		After	
	Bill	Steel	Bill	Steel
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

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

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

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

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

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

$$\vec{v} = 2.38\ m/s\ [forward]$$

or [in the original direction of the billiard ball]

E_K (before)

$E_K(Bill) = \frac{1}{2}(0.250\ kg)(5.00\ m/s)^2 = 3.125\ J$ 3.12 J

$E_K(Steel) = 0$

$E_K(total) = 3.125\ J$

E'_K (after)

$E'_K(Bill) = \frac{1}{2}(0.250\ kg)(2.62\ m/s)^2 = 0.85805\ J$

$E'_K(Steel) = \frac{1}{2}(0.800\ kg)(2.38\ m/s)^2 = 2.26576\ J$

$E'_K(total) = 3.12\ J$

Since $E_{K(total)} = E'_{K(total)}$

the collision was elastic.

TO DO: ① PP 13.2 2

② HW Probe from §7-1