Conservation of Mechanical Energy

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

(before) (after)

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

TRUE..... if there are no non-conservative forces (friction/air resist)

If there is a non-conservative force then that force does negative work which reduces to TOTAL energy.

So it is really just the work-energy theorem

$$W = \Delta E_{total}$$

Conservation of Momentum (§7-3)

Recall Newton's Third Law:

$$\vec{F}_A = -\vec{F}_B$$

$$\vec{F}_A \Delta t = -\vec{F}_B \Delta t$$

$$\Delta\vec{p}_A = -\Delta\vec{p}_B$$

(one objects loss in momentum is equal to the other's gain in momentum)

$$m_A \Delta\vec{v}_A = -m_B \Delta\vec{v}_B$$

$$m_A(\vec{v}_A' - \vec{v}_A) = -m_B(\vec{v}_B' - \vec{v}_B)$$

$$m_A\vec{v}_A' - m\vec{v}_A = -m_B\vec{v}_B' + m_B\vec{v}_B$$

$$-\left(-m_A\vec{v}_A - m_B\vec{v}_B = -m_A\vec{v}_A' - m_B\vec{v}_B'\right)$$

$$m_A\vec{v}_A + m_B\vec{v}_B = m_A\vec{v}_A' + m_B\vec{v}_B'$$

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

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

LAW OF CONSERVATION OF MOMENTUM!

- applies to ALL collisions (neglect friction)

MP|313

car 1 = +

	BEFORE		AFTER
	car 1	car 2	car (1+2)
m	1.75×10^4 kg	2.00×10^4 kg	3.75×10^4 kg
v	+5.45 m/s	0	v
p	+95375 kg·m/s	0	$(3.75\times10^4\text{kg})v$

$p = mv \Leftarrow$ (p)

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

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

$$+95375\ \text{kg·m/s} + 0 = (3.75\times10^4\text{kg})v$$

$$v = +2.54\ \text{m/s}$$

write your final answer as a vector!

$\rightarrow \vec{v} = 2.54$ m/s [in the original direction of car 1]

MP|316 - RECOIL

+ forward

	BEFORE: You + canoe	AFTER: you	AFTER: canoe
m	180kg	65kg	115kg
v	0	+0.75m/s	v
p	0	+48.75 kg·m/s	(115kg)v

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

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

$$0 = +48.75\,kg\cdot m/s + (115kg)v$$

$$-48.75\,kg\cdot m/s = (115kg)v$$

$$v = -0.424\,\frac{m}{s}$$

velocity of canoe (+ friend) $\longrightarrow \vec{V} = 0.424\,\frac{m}{s}$ [backwards]

TO DO

1. PP|315
2. PP|317