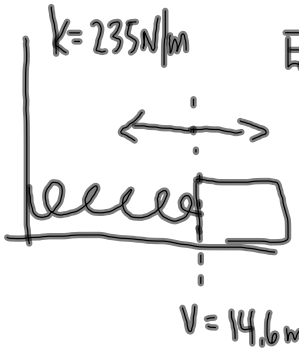
MP | 296 (from HW)

14.



a) (stretched) (eq)

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

$E_e + E_k = E'_e + E'_k$

$50.0\,J + 0 = 0 + \frac{1}{2}mv^2$

$50.0\,J = \frac{1}{2}m(14.6\,m/s)^2$

$\frac{2(50.0\,J)}{(14.6\,m/s)^2} = m$

$m = 0.469\,kg$

b) $E_e = \frac{1}{2}kx^2$

$\frac{2E_e}{k} = x^2$

$x^2 = \frac{2(50.0\,J)}{235\,N/m}$

$x = \pm 0.652\,m$

The amplitude is 65.2 cm

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

(fully stretched) (partial stretch)

$E_e = E'_e + E'_k$

$50.0\,J = \frac{1}{2}kx^2 + \frac{1}{2}mv^2$

$50.0\,J = \frac{1}{2}(235\,N/m)x^2 + \frac{1}{2}(0.469\,kg)(5.00\,m/s)^2$

$50.0\,J = \frac{1}{2}(235\,N/m)x^2 + 5.86\,J$

$44.1\,J = \frac{1}{2}(235\,N/m)x^2$

$\frac{2(44.1\,J)}{235\,N/m} = x^2$

$x = \pm 0.613\,m$

Dec 3-9:03 AM

§ 7-3 Conservation of Momentum

Recall Newton's Third Law:

$$\vec{F}_A = -\vec{F}_B$$ (B on A ← A on B)

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

$$\boxed{\Delta \vec{p}_A = -\Delta \vec{p}_B}$$ (one object's loss in momentum is the other's gain)

$$\vec{p}_A' - \vec{p}_A = -(p_B' - p_B)$$

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

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

← In an isolated system

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

Recall: $\vec{p} = m\vec{v}$

Law of Conservation of Momentum

(applies in all collision when we neglect friction)

Dec 3-9:26 AM

MP|313

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

+ east
− west

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

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

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

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

$$\vec{v} = 2.54\ \text{m/s [east]}$$

MP|316

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

+ forward
- backwards

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

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

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

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

$$v = -0.42\,m/s$$

$\vec{v}$: 0.42 m/s [backwards]

TO DO

① PP|315

② PP|317

Dec 3-9:47 AM