

Principles of Physics: Problem Set #6

Coupled Systems & Momentum Conservation

$$\vec{F}_{total} = \sum \vec{F} = M\vec{a} \quad ; \quad \sum F_x = Ma_x \quad ; \quad \sum F_y = Ma_y \quad ; \quad \vec{F}_{1 \text{ on } 2} = -\vec{F}_{2 \text{ on } 1}$$

$$\text{for } \vec{a} = \text{constant} : \quad v = v_o + at, \quad x = x_o + v_o t + \frac{1}{2} at^2$$

$$\vec{p} = m\vec{v} \quad \dots \text{ for a collision} : \quad \vec{p}_{tot}^{before} = \vec{p}_{tot}^{after}$$

Due: Wednesday Oct. 3 in class

Notes: 1) Open lab this week ... come work on your lab paper! Lab papers are due Monday Oct. 8.
2) No class on Friday, so this problem set is due on Wed. ... study session Tues. 6:30-9:30.

Reading assignment:

for Mon, Ch 4 (pp 71-77) [Momentum and momentum conservation]

for Wed, Ch 4 (pp 77-79) [Introduction to circular motion]

Problem assignment:

(WARNING - The problem naming/numbering scheme in the text is confusing, so ALWAYS double check whether a problem is guided review (**GR**), skill building (**SB**), **Synthesis**, etc.)

CHAPTER 4

GR-18a (pg 84 ... 2 car collision version I)

GR-18b (pg 84 ... 2 car collision version II)

SB-15 (pg 86 ... scale in an elevator)

SB-17 (pg 87 ... system of boxes)

SB-20 (pg 87 ... relations between force, velocity, and acceleration)

Bonus. A hockey puck (mass = 200.0 g) sliding due north with speed 1.0 m/s is struck by a bb-pellet (mass = 1.0 g) travelling due east at 30.0 m/s. The pellet imbeds itself into the puck on impact.

- a) Draw two clear figures showing the "before" and "after" states for this collision.
- b) Determine the total momentum in the x -direction and y -direction before the collision.
- c) Use momentum conservation to determine the x and y components of the final velocity of the combined puck-bb system (mass = 201.0 g). By what angle is the puck deflected from its original path? [Partial answer: deflection angle = 8.5° E of N]