Momentum Conservation

Momentum and the Newtons second law:

$$\vec{p} = m \cdot \vec{v}$$

$$\vec{F}_{net} = m \cdot \vec{a} = \frac{\Delta \vec{p}}{\Delta t}$$

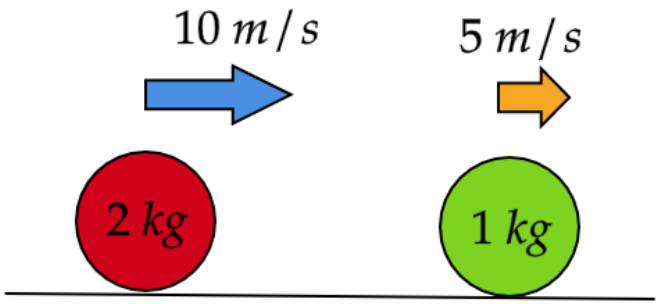
No external forces:

$$\vec{F}_{net} = 0$$

$$\Delta \vec{p} = \vec{p}_{final} - \vec{p}_{initial} = 0$$

Momentum of a system of two bodies:

$$\vec{p}_{tot} = \vec{p}_1 + \vec{p}_2$$



Homework 13

Problem 1.
A fox is chasing a small rabbit. The momentum of the fox is equal to the momentum of the rabbit. Will the fox catch the rabbit?

Problem 2.
An 80 kg jogger runs with a constant acceleration of 0.2 m/s^2 for 10 seconds. How did his momentum change during this time?

Problem 3.
A $10\ kg$ ball moving on a horizontal plane at a speed of $10\ \frac{m}{s}$ hits a $5\ kg$ ball that was at rest before the collision. After the collision, the smaller ball starts moving at a speed of $10\ \frac{m}{s}$. Find the velocity of the heavy ball after the collision — neglect friction.

Problem 4* (bonus problem).
On the next page!

Homework 13

Problem 4* (bonus problem).
An astronaut of mass $100\ kg$ approaches a spaceship of mass $50{,}000\ kg$ by pulling a cable attached to the ship. The distance between the astronaut and the ship is $100\ m$, and they both are initially at rest. What distance will the astronaut and the ship have traveled by their meeting time? The mass of the cable is negligible.

Hint: *How are the velocities of the astronaut and the ship related at every moment in time?*