

Momentum and Impulse

Momentum and the Newtons second law:

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



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

Impulse is a product of force and time:

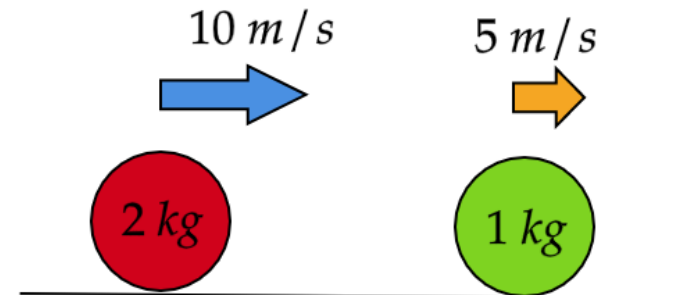
$$\vec{J} = \vec{F} \cdot \Delta t$$



$$\Delta \vec{p} = \vec{J}$$

Momentum of a system of two bodies:

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



Homework 14

Problem 1.

A rubber ball of mass $10g$ is dropped down from the top of a 180-meter building. The ball hits the ground and bounces up with the same speed. Find the force applied by the ball to the ground if the collision time was 0.01 seconds.

Problem 2.

A soccer ball with a mass of $400g$ moves at a speed of $25 \frac{m}{s}$. If the ball hits the goalkeeper's chest, it bounces back with the same speed, and the collision time is $0.025 s$. If the goalkeeper catches the ball, the speed of the ball becomes zero in $0.04 s$. Find the force applied by the ball to the goalkeeper in both cases.

Problem 3* (bonus problem).

A block is initially at rest on a horizontal plane. The block is being pushed horizontally with force F , and after time Δt , this force disappears. What is the friction force acting on this block if it stops in $3\Delta t$ after force F disappears?