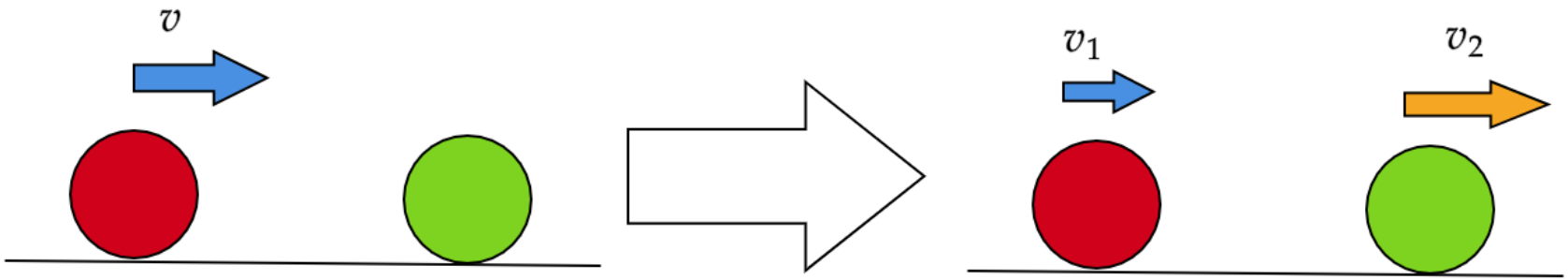
Kinetic Energy

Kinetic energy is a scalar quantity:

$$E_{kin} = \frac{m\,v^2}{2} \longrightarrow [E_{kin}] = J = kg \cdot \frac{m^2}{s^2}$$

In a completely elastic collision, the kinetic energy is conserved:



$$E_{kin} = E'_{kin} \longrightarrow \frac{m\,v^2}{2} = \frac{m\,v_1^2}{2} + \frac{m\,v_2^2}{2}$$

Homework 15

Problem 1.
In class, we discussed completely elastic collisions. Now consider an inelastic collision, where the two balls of equal mass stick together after the collision. Before the collision, the first ball was moving with a speed of $5\frac{m}{s}$, and the second ball was at rest. What is the final velocity of the balls after the collision? What are the total kinetic energies before and after the collision?

Problem 2.
Calculate the kinetic energy of a falling stone with a mass of $10\ kg$ after 3 seconds of falling.

Problem 3.
A runner moves with speed $\mathrm{v} = 4\frac{m}{s}$ and has momentum $p = 250\ kg \cdot \frac{m}{s}$.
Find the kinetic energy of the runner. Derive a general formula for kinetic energy in terms of v and p.

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

Homework 15

Problem 4* (bonus problem).
2025 identical balls are at rest, placed on a straight line with an interval of $1\ m$ between the neighboring balls (see the figure below). 2026-th ball (the same as others) comes from the left with a speed of $1\frac{m}{s}$. Assuming that all collisions are completely elastic, answer the following questions. How much time will pass between the first collision in this system and the last collision? How will all the balls move after the last collision? The size of the balls is much smaller than the distance between them.