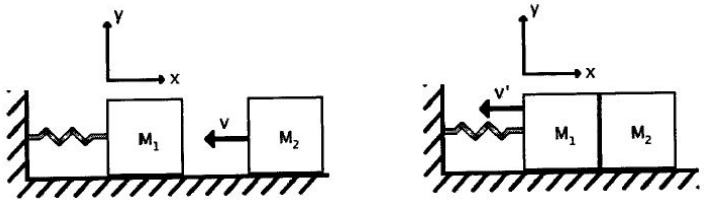
FP19

A mass m_1 sits on a frictionless surface and is attached to one end of a spring with spring constant k. The other end of the spring is attached to the wall. The mass and the spring are initially at rest.



A second mass m_2 comes sliding in which velocity $-v\hat{x}$, hits the first mass m_1 at time $t = 0$, and sticks to it. This includes oscillations in the spring, which can then be measured. This in turn can be used to determine the mass m_2 of the impinging object.

a) (3 points) What is the velocity $\vec{v}'$ of the two masses immediately after the collision? Express your answer in terms of v, m_1, and m_2.

b) (3 points) Find an expression from m_2 in terms of m_1, k and the angular frequency ω_0 of the observed oscillations.

A function which describes the position for the two masses for all time following the collision is $x = Asin(\omega_0 t) + Bcos(\omega_0 t)$ where A and B are unknown constants, $t = 0$ is the time of the collision, and $x = 0$ is the equilibrium position of the spring.

c) (4 points) What are the values of A and B? Express your answer in terms of ω_0, m_1, m_2 and v.