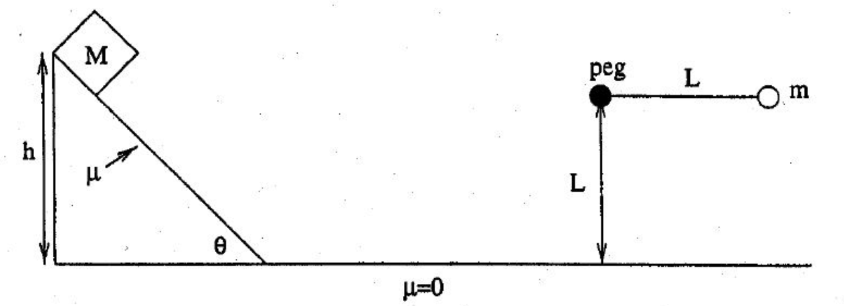
QP22

A large mass M is released from rest at the top of an inclined plane of angle θ and frictionless coefficient μ. At the same time, a pendulum consisting of a small mass m and massless string of length L is released at height L (horizontally).

The large mass slides down the incline and smoothly onto the table, continues across the frictionless table, and collides with the pendulum's mass just as the pendulum has reached the bottom of its swing and is approaching the large mass. The two masses stick together after the collision.



a) (1 point) Assuming the mass M is released at a height h, what is its velocity v_M when it reaches the flat part of the table?

Assume for the rest of the problem that $v_M = \sqrt{gh}$.

b) (2 points) What is the velocity v_C of the combined object immediately after the collision? For what initial height h of the mass M will the combined mass come to rest immediately after the collision?

c) (2 points) Consider the case $M = 2m$. What must the initial height h have been in order for the pendulum of the combined mass to go "over the top" in the counterclockwise direction?