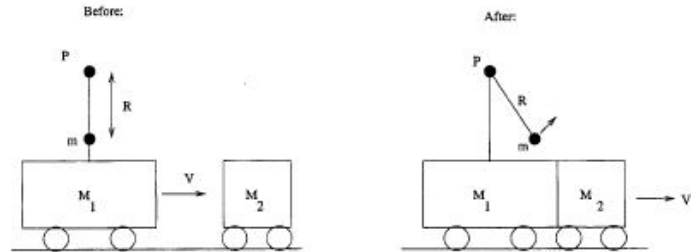**QP31**

A cart of mass M_1 has a pole on it from which a ball of mass $m \ll M_1, M_2$ hangs from a thin string of negligible mass and length R attached at a point P, as shown in the figure. The cart and ball have initial velocity V (the ball is initially at rest with respect to the cart). The cart crashes into another cart of mass M_2 and sticks to it. All surfaces are frictionless, and you may ignore the mass of the wheels.

a) (2 points) Find the velocity of the two carts V' after the collision.

b) (2 points) Find the smallest initial velocity V so that the ball will complete a circle around the point P after the collision.

c) (2 points) Now, instead of the two carts sticking together, assume an elastic collision and find the smallest initial velocity V so that the ball will complete a circle around the point P after the collision.