Two blocks with masses $m_1 = 2\ kg$ and $m_2 = 3\ kg$ hang on either side of a pulley as shown below. Block m_1 is on an incline ($\theta = 30°$) and is attached to a spring of constant $40\ N/m$. The system is released from rest with the spring at its equilibrium position.

a. Applying conservation of energy, what is the maximum extension, D, of the spring?

b. What is the speed of the mass m_2 when the extension is 0.5 m?
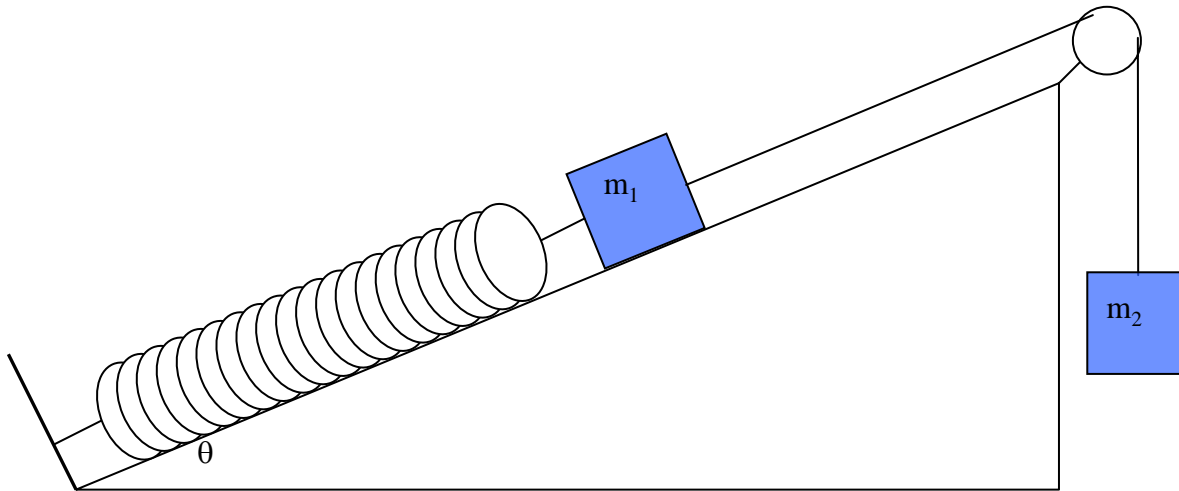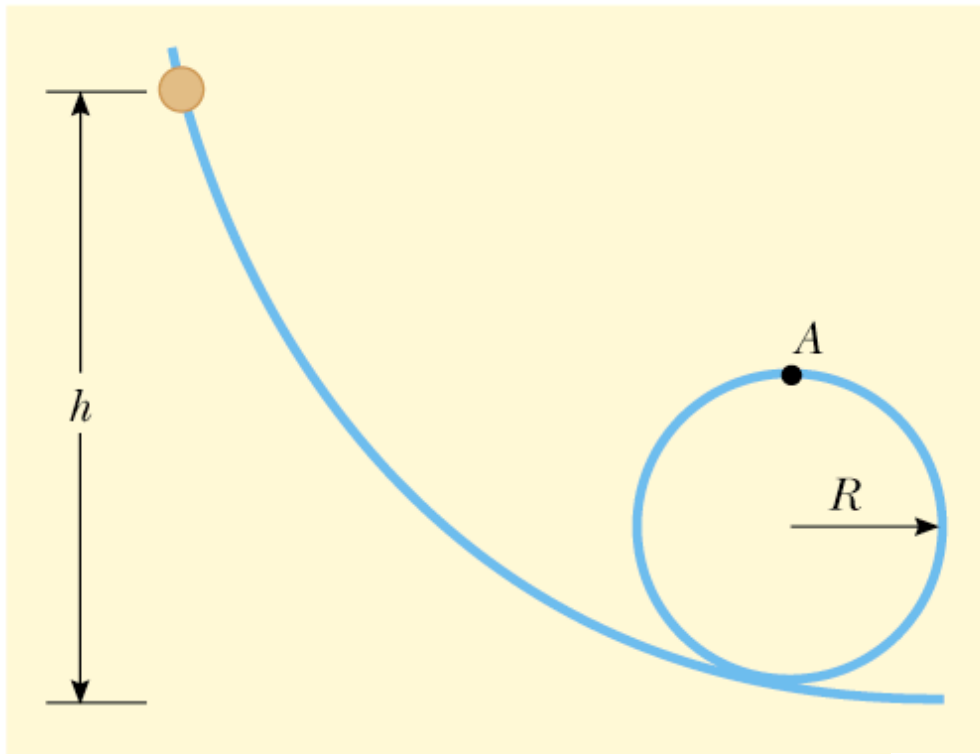
A bead slides without friction around a loop-the-loop track as shown above. If the bead is released from a height h=3.5R, what is the speed of the bead at point A? What is the normal force at A if the bead has mass 5g?
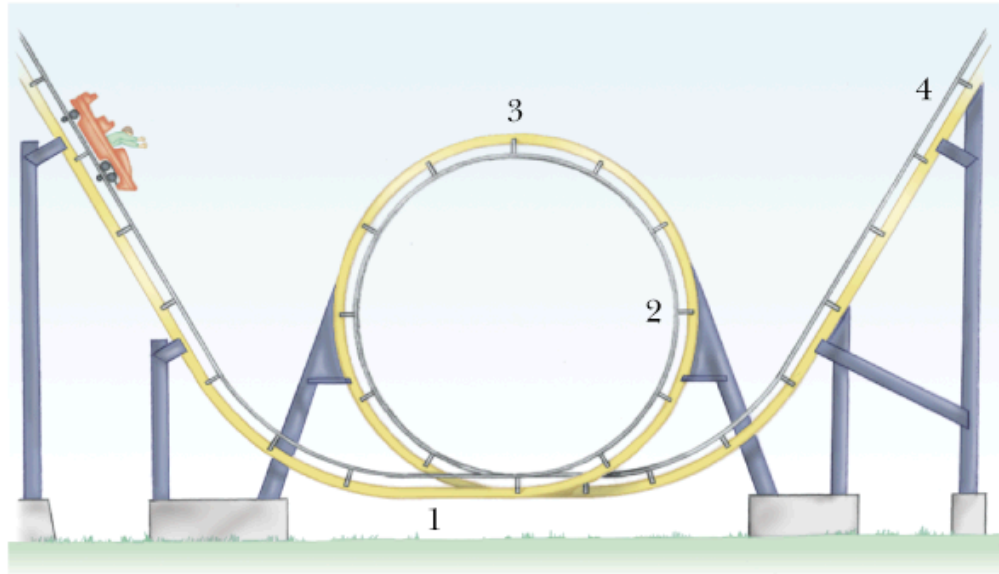
Consider a roller coaster car (with negligible friction) going around a loop of radius 20m. The car barely makes it around the top of the loop, and at the top the riders feel weightless. What is the speed of the roller coaster at the top of the loop? What is the speed of the roller coaster at points 1 and 2? What is the difference in heights between positions 1 and 4 if the speed at 4 is 10m/s?