1. (30) Sphere C and block A are both moving to the left with a velocity \( v_i \), when the block is suddenly stopped by the wall. Determine the smallest velocity \( v_o \) for which the sphere C will swing in a full circle about the pivot B if
(a) BC is a slender rod of negligible mass,
(b) BC is a rope.

2. (40) A 20-kg block B is suspended from a 2-m cord attached to a 30-kg cart A, which may roll freely on a frictionless horizontal track. If the system is released from rest in the position shown, determine the velocities of A and B as B passes directly under A.

3. (30) The figure shows \( n \) spheres of equal masses \( m \) suspended in a line by wires of equal length so that the spheres are almost touching each other. If sphere 1 is released from the dashed position and strikes sphere 2 with a velocity \( v_i \), write an expression for the velocity \( v_n \) of the \( n \)th sphere immediately after being struck by the one adjacent to it. The common coefficient of restitution is \( e \).

**Useful equations**

Work and energy: \( T_i + U_{1\rightarrow2} = T_2 \)

Work of a spring force: \( U_{1\rightarrow2} = \frac{1}{2} kx_1^2 - \frac{1}{2} kx_2^2 \)

Conservation of energy: \( T_i + V_i = T_2 + V_2 \)

Impulse and momentum: \( m\vec{v}_1 + \int_{t_1}^{t_2} \vec{F} \, dt = m\vec{v}_2 \)

Coefficient of restitution: \( e = \frac{v'_b - v'_d}{v_d - v_b} \)