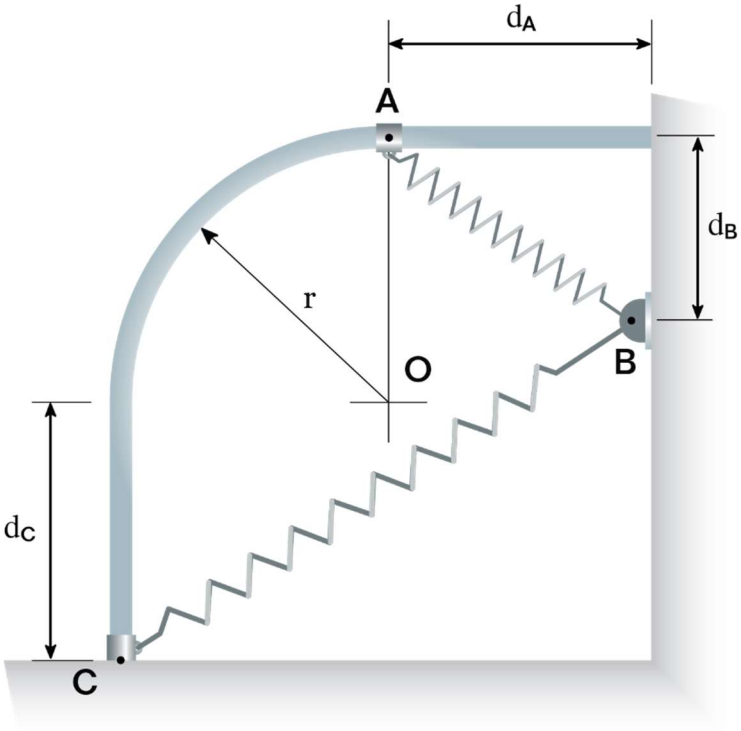
21-P-WE-AG-031



A m-kg collar is attached to a curved corner and a spring fixed at point B. The collar starts off at rest from point C. The spring has a stiffness of k kN/m and an unstretched length of X meters. If $d_c = d_c$ meters, $d_b = d_b$ meters, $d_a = d_a$ meters, and $r = r$ meters, then how fast is the collar going when it reaches point A?

Neglect friction and assume the assembly is horizontal

ANSWER:

First, we write down the initial and final states of the system:

$$v_i = 0, s_i = \sqrt{(d_a + r)^2 + (r - d_b + d_c)^2} - X$$

$$v_f = ?, s_f = X - \sqrt{(d_a)^2 + (d_b)^2}$$

Then, we write down the conservation of energy equation and rearrange to solve for v_f.

$$\frac{1}{2}mv_i^2 - \frac{1}{2}ks_i^2 = \frac{1}{2}mv_f^2 + \frac{1}{2}ks_f^2$$

$$ks_i^2 = mv_f^2 + ks_f^2 \rightarrow v_f = \sqrt{\frac{k(s_i^2 - s_f^2)}{m}}$$