13.73 A thin circular rod is supported in a *vertical plane* by a bracket at A. Attached to the bracket and loosely wound around the rod is a spring of constant $k = 40$ N/m and undeformed length equal to the arc of circle AB. A 200 g collar is unattached to the spring and can slide without friction along the rod. Knowing that the collar is released from rest when $\theta = 30°$, determine (*a*) the velocity of the collar as it passes through point B, (*b*) the force exerted by the rod on the collar as it passes through B.

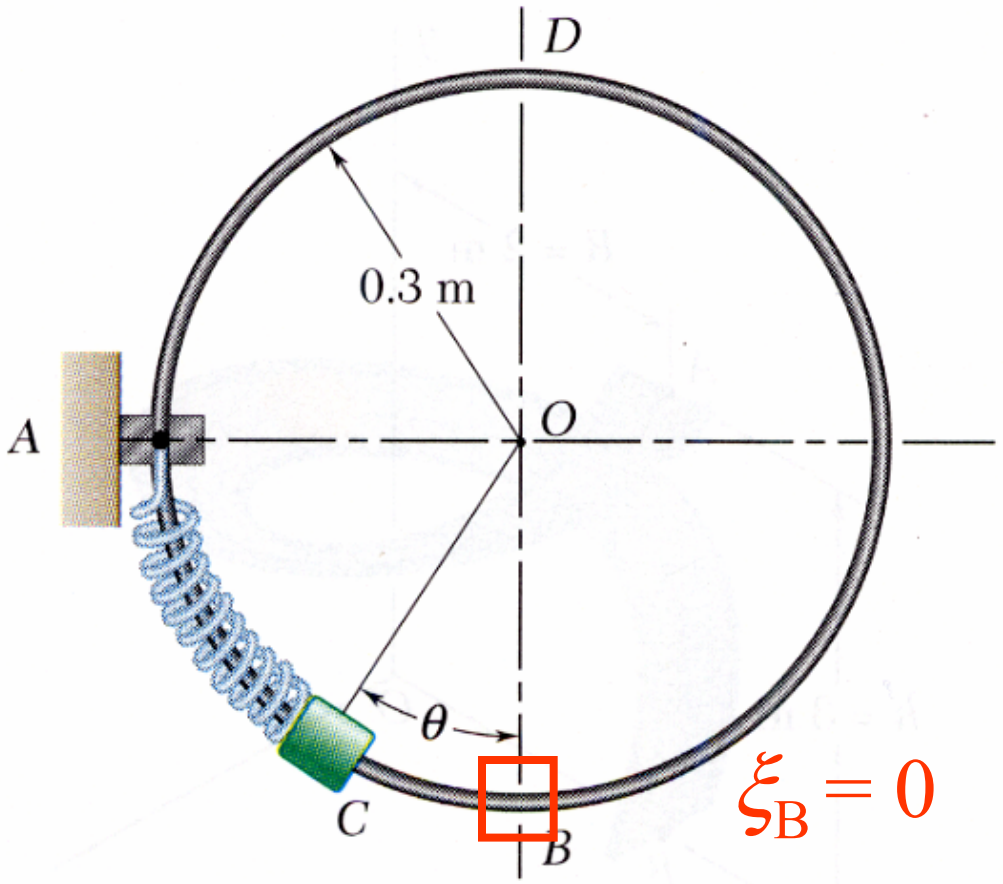
$$T_C + V_C = T_B + V_B$$

$$T_C = 0$$

$$V_C = {}^1/_2 k \xi_C^2 + mgy_C$$

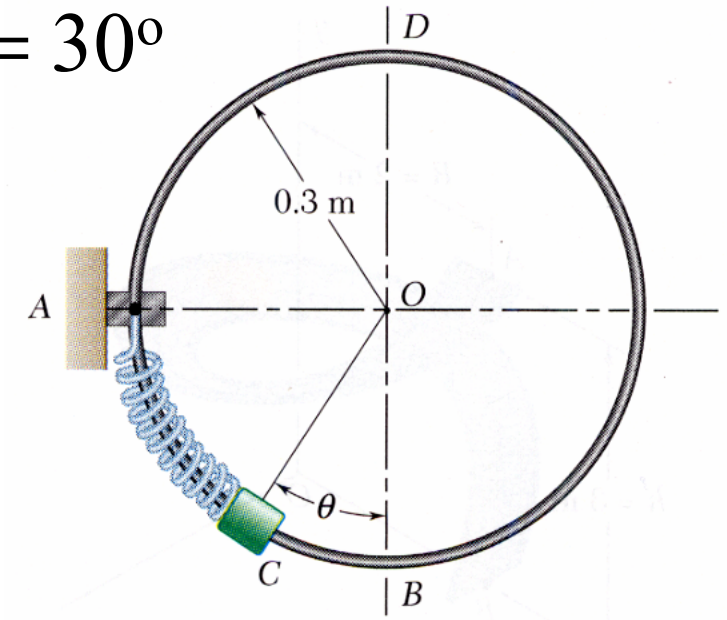
$$T_B = {}^1/_2 v_B^2$$

$$V_B = {}^1/_2 k \xi_B^2 + mgy_B$$



$\xi_B = 0$

$\theta_B = 30^o$



$$T_C + V_C = T_B + V_B$$

$$T_C = 0$$

$$V_C = {}^1/_2\, k\, \xi_C^{\,2} + mgy_C$$

$$= {}^1/_2\,(40\text{N/m})[(0.3\text{ m})\ 30^o/180^o\pi]^2$$

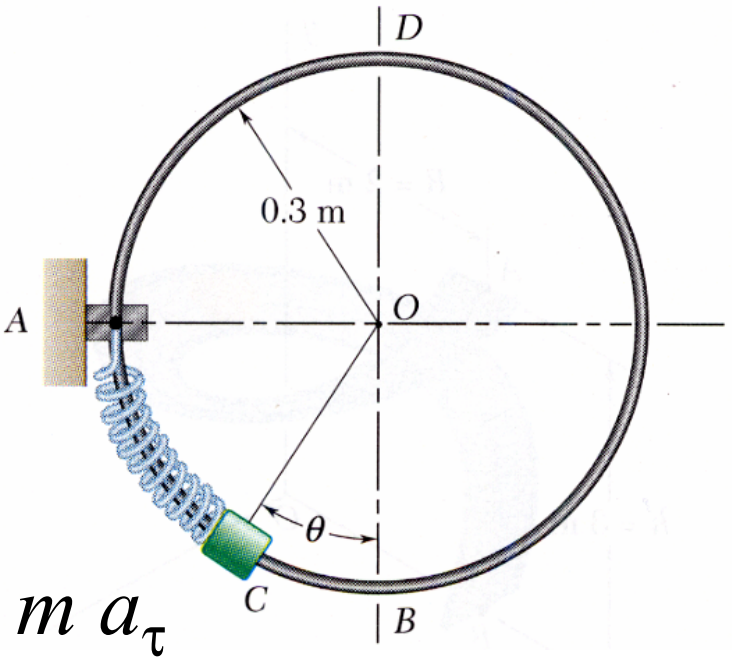
$$+(0.2\text{Kg})(9.81\text{ m/s}^2)[(0.3\text{m})(1-\cos 30^o)]$$

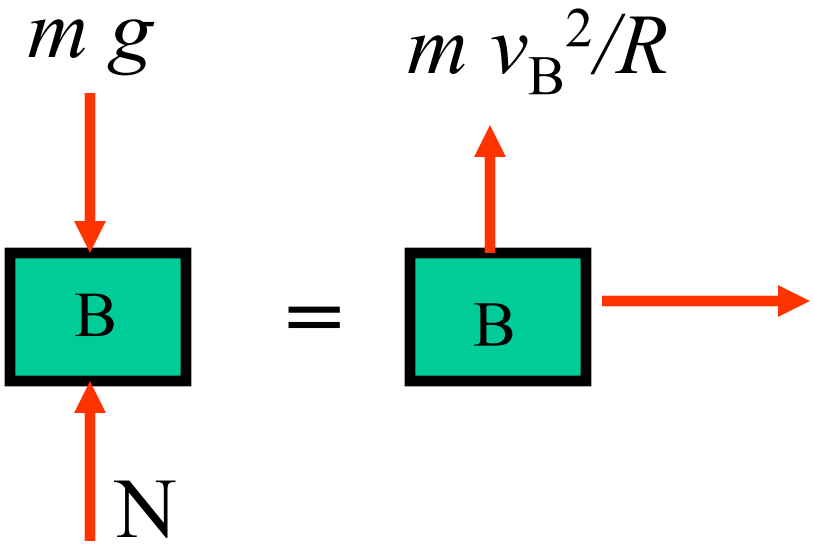
$$T_B = {}^1/_2\, m\, v_B^{\,2}$$

$$v_B = 2.39\text{ m/s}$$

$$V_B = {}^1/_2\, k\, \xi_B^{\,2} + mgy_B = 0$$

13.73 A thin circular rod is supported in a *vertical plane* by a bracket at A. Attached to the bracket and loosely wound around the rod is a spring of constant $k = 40$ N/m and undeformed length equal to the arc of circle AB. A 200 g collar is unattached to the spring and can slide without friction along the rod. Knowing that the collar is released from rest when $\theta = 30°$, determine (*a*) the velocity of the collar as it passes through point B, (*b*) the force exerted by the rod on the collar as it passes through B.





$$N - m\,g = m\,v_B^2/R$$

$$N = m\,v_B^2/R + m\,g = 0.2(2.39^2/0.3 + 9.81) = 5.78 \text{ N}$$