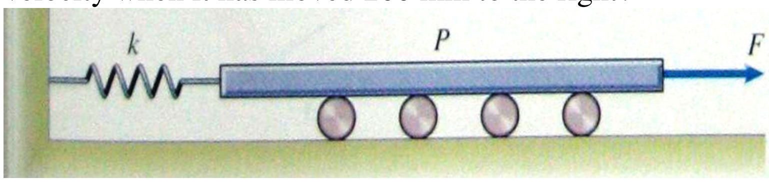
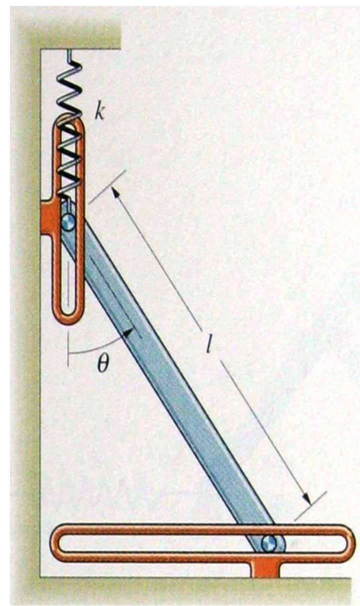
EGBE261: Biomechanics 2
Homework from Chapter 8: Energy and Momentum in Rigid-Body Dynamics

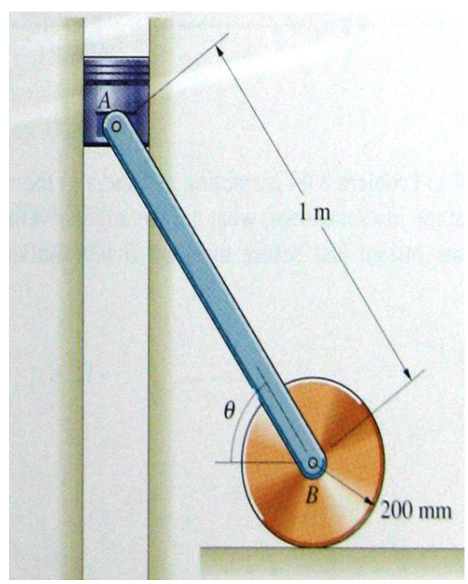
8.24. The 22-kg platen P rests on four roller bearings. The roller bearings can be modeled as 1-kg homogeneous cylinders with 30-mm radii. The platen is stationary and the spring (k = 00 N/m) is unstretched when a constant horizontal force F = 100 N is applied as shown. What is the platen's velocity when it has moved 200 mm to the right?



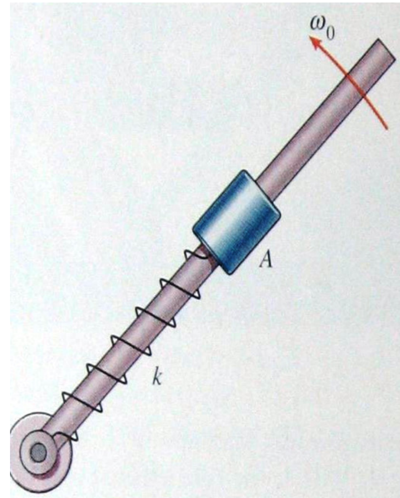
8.38. The spring attached to the slender bar of mass m is unstretched when θ = 0. If the bar falls from rest in the vertical position, what is its angular velocity as a function of θ? Friction is negligible.



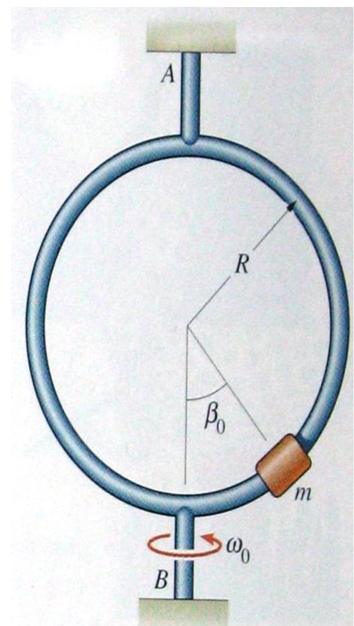
8.40. The 4-kg slender bar is pinned to a 2-kg slider at A and to a 4-kg homogenous cylindrical disk at B. Neglect the friction force on the slider and assume that the disk rolls. If the system is released from rest with θ=60°, what is the bar's angular velocity when θ = 0?



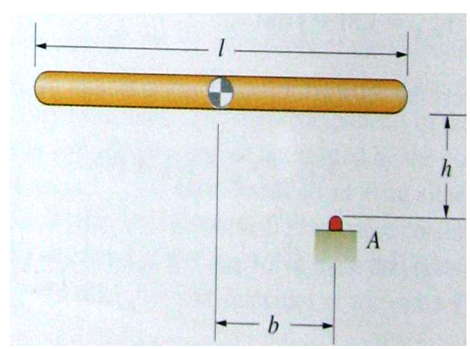
8.60. The 2-kg bar is 1 m in length. It rotates in the horizontal plane about the smooth pin. The 6-kg collar A slides on the smooth bar. The unstretched length of the spring is 0.2 m, and its spring constant is $k = 10$ N/m. At the instant shown, the angular velocity of the bar is $\omega_0 = 2$ rad/s, the distance from the pin to the collar is $r = 0.6$ m, and the radial velocity of the collar is zero. Use conservation of angular momentum to determine the bar's angular velocity when the distance from the pin to the collar is $r = 0.8$ m. Neglect the moment of inertia of the collar about its center of mass.



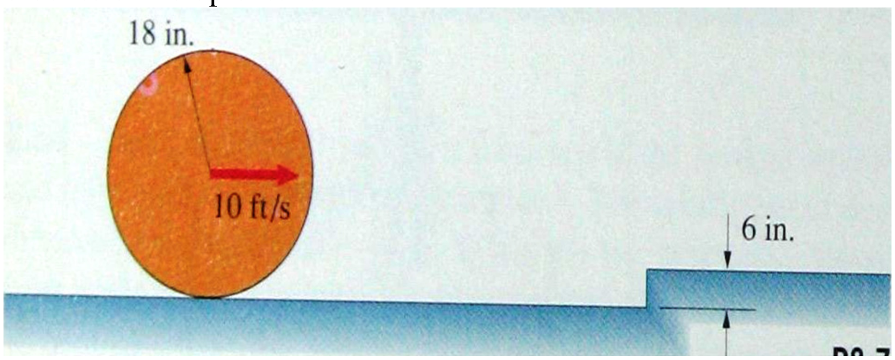
8.63. The circular bar is welded to the vertical shafts, which can rotate freely in bearings at A and B. Let I be the moment of inertia of the circular bar and shafts about the vertical axis. The circular bar has an initial angular velocity ω_0 and the mass m is released in the position shown with no velocity relative to the bar. Determine the angular velocity of the circular bar as a function of the angle β between the vertical and the position of the mass. Neglect the moment of inertia of the mass about its center of mass.



8.66. The slender bar of mass $m = 2$ kg and length $l = 1$ m falls from rest in the position shown and hits the smooth projection at A. The coefficient of restitution is $e = 0.4$. $b = 350$ mm and $h = 200$ mm. What is the bar's angular velocity after the impact?



8.80. A wheel that can be modeled as a 1-slug homogeneous cylindrical disk rolls on a horizontal surface toward a 6-in step. If the wheel remains in contact with the step and does not slip while rolling up onto it, what is the minimum velocity the wheel must have rolloing toward the step in order to climb up onto it?



8.93. Each slender bar is 48 in long and weighs 20 lb. Bar A is released in the horizontal position shown. The bars are smooth and the coefficient of restitution of their impact is e = 0.8. Determine the angle through which B swings afterward.