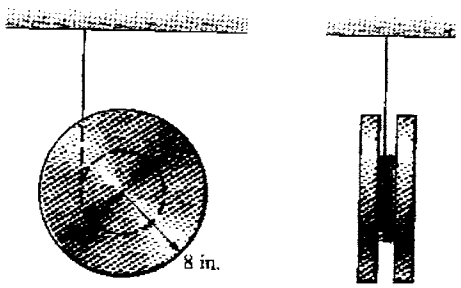
ME230 HW 6

1

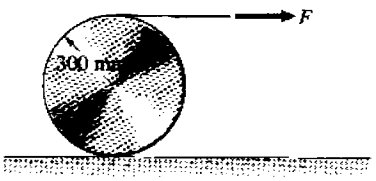
The stepped disk weighs 40 lb and its mass moment of inertia is $I = 0.2$ slug-ft^2. If it is released from rest, how long does it take the center of the disk to fall 3 feet? (Assume that the string remains vertical.)



2

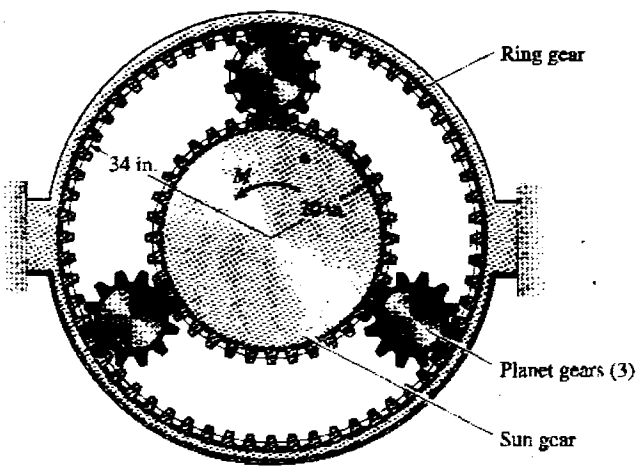
The 100-kg cylindrical disk is at rest when the force F is applied to a cord wrapped around it. The static and kinetic coefficients of friction between the disk and the surface equal 0.2. Determine the angular acceleration of the disk if (a) $F = 500$ N; (b) $F = 1000$ N.

Strategy: First solve the problem by assuming that the disk does not slip, but rolls on the surface. Determine the friction force and find out whether it exceeds the product of the friction coefficient and the normal force. If it does, you must rework the problem assuming that the disk slips.



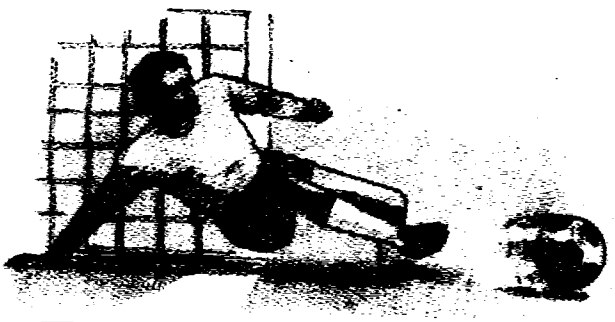
5

The ring gear is fixed. The mass and mass moment of inertia of the sun gear are $m_S = 22$ slugs, $I_S = 4400$ slug-ft^2. The mass and mass moment of inertia of each planet gear are $m_P = 2.7$ slugs, $I_P = 65$ slug-ft^2. If a couple $M = 600$ ft-lb is applied to the sun gear, what is the resulting angular acceleration of the planet gears, and what tangential force is exerted on the sun gear by each planet gear?



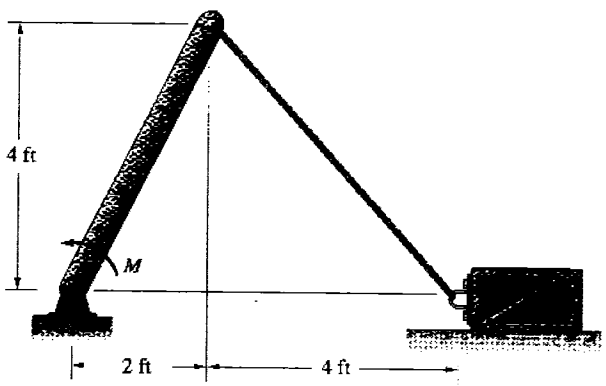
2.

A soccer player kicks the ball to a teammate 20 ft away. The ball leaves his foot moving parallel to the ground at 20 ft/s with no initial angular velocity. The coefficient of kinetic friction between the ball and the grass is $\mu_k = 0.4$. How long does it take the ball to reach his teammate? (The ball is 28 in. in circumference and weighs 14 oz. Estimate its mass moment of inertia by using the equation for a thin spherical shell: $I = \frac{2}{3}mR^2$.)



4

The slender bar weighs 20 lb and the crate weighs 80 lb. The surface the crate rests on is smooth. If the system is stationary at the instant shown, what couple M will cause the crate to accelerate to the left at 4 ft/s^2 at that instant?



6

The 18-kg ladder is held in equilibrium in the position shown by the force F. Model the ladder as a slender bar and neglect friction.

(a) What are the axial force, shear force, and bending moment at the ladder's midpoint?

(b) If the force F is suddenly removed, what are the axial force, shear force, and bending moment at the ladder's midpoint at that instant?