1. In the mechanism shown, each of the two wheels has a mass of 30 kg and a centroidal radius of gyration of 100 mm. Each link OB has a mass of 10 kg and may be treated as a slender bar. The 7-kg collar at B slides on the fixed vertical shaft with negligible friction. The spring has a stiffness $k = 30$ kN/m and is contacted by the bottom of the collar when the links reach the horizontal position. If the collar is released from rest at the position $\theta = 45°$ and if friction is sufficient to prevent the wheels from slipping, determine (*a*) the velocity v_B of the collar as it first strikes the spring and (*b*) the maximum deformation x of the spring.

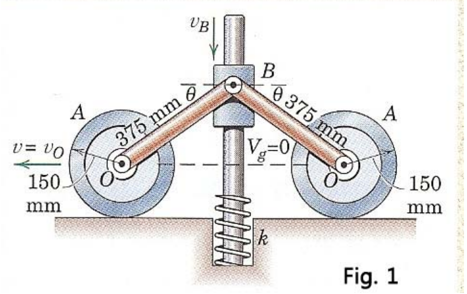

Fig. 1

2. A facility for testing the performance of motorized golf carts consists of an endless belt where the angle θ can be adjusted. The cart of mass m is slowly brought up to its rated ground speed v with the braking torque M on the upper pulley constantly adjusted so that the cart remains in a fixed position A on the test stand. With no cart on the belt, a torque M_0 is required on the pulley to overcome friction and turn the pulleys regardless of speed. Friction is sufficient to prevent the wheels from slipping on the belt. Determine an expression for the power P absorbed by the braking torque M. Do the static friction forces between the wheels and the belt do work?

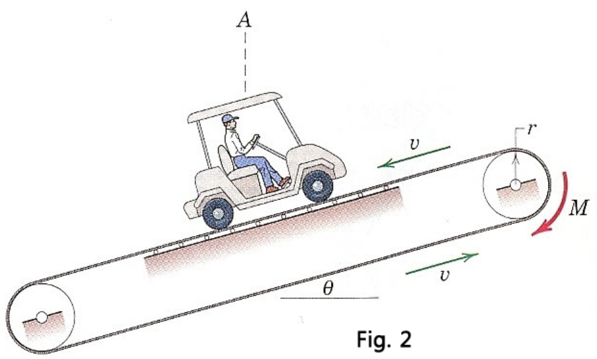

Fig. 2

3. Motive power for the experimental 10-Mg bus comes from the energy stored in a rotating flywheel which it carries. The flywheel has a mass of 1500 kg and a radius of gyration of 500 mm and is brought up to a maximum speed of 4000 rev/min. If the bus starts from rest and acquires a speed of 72 km/h at the top of a hill 20 m above the starting position, compute the reduced speed N of the flywheel. Assume that 10 percent of the energy taken from the flywheel is lost. Neglect the rotational energy of the wheels of the bus.

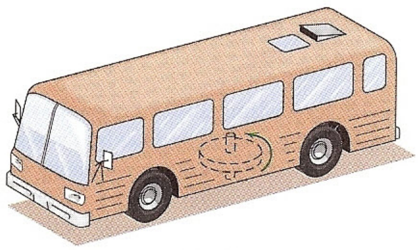

Fig. 3

4. The 15-lb wheel with radius of gyration of 4 in. about its center O is constrained by the band which is secured at A and wraps around the wheel and ends at point B. The band weighs 0.8 lb per foot of length. If the wheel is released from rest in the position shown with a steady 4-lb force applied to the band at B, calculate the velocity of the center O of the wheel when it has rolled 10 in. down the incline.

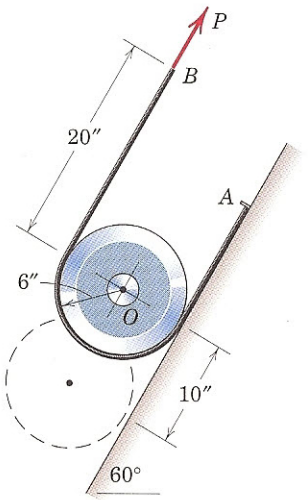

Fig. 4

5. The 200-mm-radius brake drum is attached to a larger flywheel that is not shown. The total mass moment of inertia of the flywheel and drum is 19 kg · m^2 and the coefficient of kinetic friction between the drum and the brake shoe is 0.35. Knowing that the initial angular velocity of the flywheel is 360 rpm counterclockwise, determine the vertical force **P** that must be applied to the pedal *C* if the system is to stop in 100 revolutions.

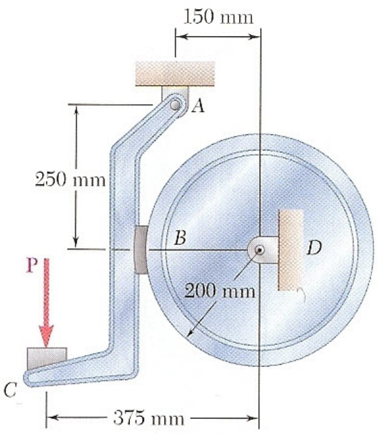

Fig. 5

6. A uniform sphere of radius *r* is placed at corner *A* and is given a slight clockwise motion. Assuming that the corner is sharp and becomes slightly embedded in the sphere, so that the coefficient of static friction at *A* is very large, determine (*a*) the angle *β* through which the sphere will have rotated when it loses contact with the corner, (*b*) the corresponding velocity of the center of the sphere.

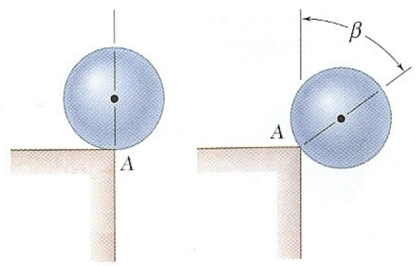

Fig. 6