Rotational and Rolling Motion:

1. A solid cylinder (m=0.500kg, r=0.15m, I= ½mr2) and a hollow cylinder (m=0.500kg, r=0.15m, I=mr2) are released from rest from the top of an inclined plane. The plane is 2.00m long and is angled at 15o. Find the speed of each cylinder at the bottom of the incline.

2. A 4.0kg mass is attached to a string and is swung in a horizontal circular path, r=0.400m, at 2.1m/s. The string is then pulled such that the radius decreases to 0.200m. Find the new speed of the mass.

3. A satellite is in elliptical orbit around a planet. At the nearest point, r=8.8x107m, the satellite has a speed of 6580m/s. What is the speed of the satellite at the farthest point, r2=1.10x108m.

4. A solid sphere rolls down an incline without slipping. The incline is angled at 23.0o and the coefficient of static friction is 0.38.

A. Find the acceleration of the sphere.

B. The angle of the slope is increased to the point that the sphere begins slipping. Find θ.

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5. A bicycle and rider, m=75.0kg, is at rest on level ground. The coefficient of static friction between the wheel and the ground is 0.750. The radius of the wheel is 45.0cm, and the radius of the drive gear at the rear wheel is 8.0cm. The rider starts to accelerate the bicycle by pedaling. You may assume that 75% of the weight is over the rear wheel. The rear wheel can be thought of as a ring with mass of 1.20kg.

A. What is the maximum angular acceleration before the tire slips?

B. What is the maximum linear acceleration of the chain before the tire slips?

C. What is the forward acceleration of the bicycle?

D. If the radius of the cog at the pedals is 16.0cm, is 270g and I=mr2, and the crank arm is 30.0cm long and of negligible mass, what is the maximum force that can be applied to the pedal without slipping?

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