

Phy 113: Physics of Sports

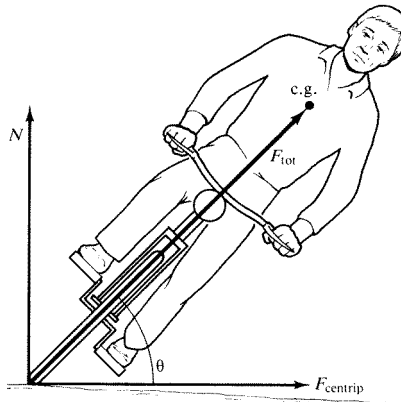
Homework Problems

Set #10: Due Monday, December 1, 2008

Note: Students are encouraged to work together and discuss the problems. However, each student must arrive at her/his own final answers. Show all your work. Simply copied homework will result in zero.

1. (15 points) The current world record for the men's hammer throwing was set by Yuriy Sedykh in 1986. In the hammer throwing competition, a 16-lbs steel ball attached at the end of a 4-foot wire is wound around and thrown. If the steel ball is revolving uniformly in a horizontal circle and the ball makes 2.5 revolutions in a second: (a) What is the centripetal acceleration? (b) What is the moment of Inertia (rotational mass) of the ball about the center of the rotation? (Ignore the size of the ball.) (c) What is the angular momentum of the ball about the center of the rotation?

2. (10 points) When cyclists round a curve, they instinctively lean into the turn to keep from falling over. The ideal angle at which to lean is one for which the total force of the ground on the person goes through the center of the gravity, as shown in the figure below. Find the angle θ for a curve of 10 m radius taken at 6 m/s?



3. (10 points) A slider thrown by Joba Chamberlain spins at a rate of 1700 rpm. (a) What is the angular momentum of the slider? (b) If it takes 0.02 s for him to spin the ball from rest when he pitches, what is the torque he applies to the ball? A baseball is 0.14 kg in mass and 9.25 inches in circumference.

4. (10 points) Sarah Hughes, a 2002 winter Olympic gold medalist in figure skating and Long Island native, starts her spin at an initial angular velocity of 2.5 spins (rotations) per second while keeping her arms and legs stretched out. Moments later she pulls her arms and legs inward tightly making herself spin rapidly at a rate of 6.0 spins per second. If we assume, there is no friction and her initial moment of inertia (rotational inertia) was 1.5 kg m^2 , what is her final moment of inertia?

5. (10 points) Guo Jingjing, a 2008 Beijing Olympic gold medalist, can reduce her rotational inertia by a factor of about 2.5 when changing from the straight position to the tuck position. If she makes three rotations in 1.4 s when in the tuck position, what is her angular speed (rev/s) when in the straight position?