How Fast Can It Spin?
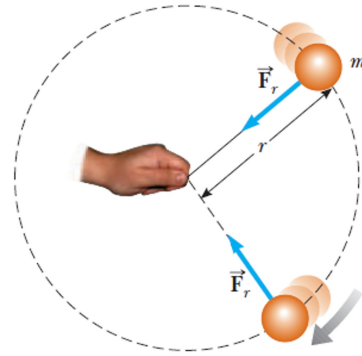
A puck of mass 0.5 kg is attached to the end of a cord 1.5 m long. The puck moves in a horizontal circle as shown. If the cord can withstand a maximum tension of 50 N, what is the maximum speed at which the puck can move before the cord breaks? Assume the string remains horizontal during the motion.

The Conical Pendulum

A small ball of mass (m) is suspended from a string of length (L). The ball revolves with constant speed (v) in a horizontal circle of radius (r) as shown. Find an expression for v.
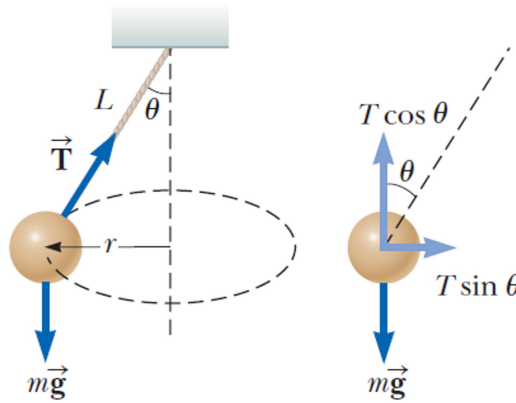
What Is the Maximum Speed of the Car?

A car of mass m moving on a flat, horizontal road negotiates a curve of radius r as shown. If the coefficient of static friction between the tires and dry pavement is μ_s, find the maximum speed the car can have and still make the turn successfully.

The Banked Roadway

A civil engineer wishes to redesign the horizontal curved roadway in such a way that a car will not have to rely on friction to round the curve without skidding. Such a ramp is usually banked, which means that the roadway is tilted toward the inside of the curve. At what angle should the curve be banked?
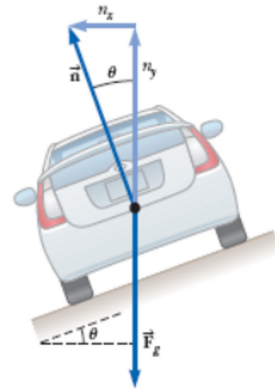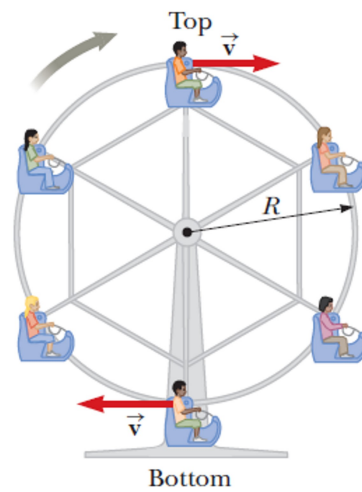
Riding the Ferris Wheel

A child of mass (m) rides on a Ferris wheel as shown. The child moves in a vertical circle of radius (r) at a constant speed (v).

- o Determine the force exerted by the seat on the child at the bottom of the ride. Express your answer in terms of the weight of the child, mg.
- o Determine the force exerted by the seat on the child at the top of the ride.
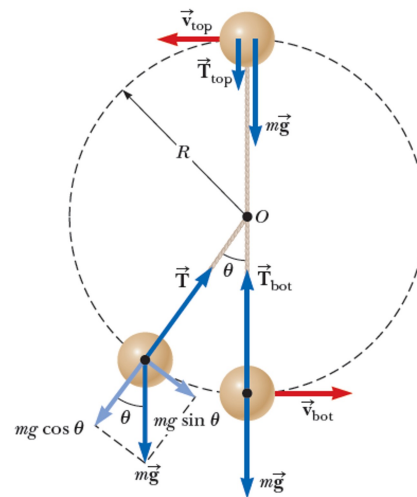
Keep Your Eye on the Ball

A small sphere of mass (m) is attached to the end of a cord of length (R) and set into motion in a vertical circle about a fixed point O as shown. Determine:

- the tangential acceleration of the sphere,
- the tension in the cord at any instant when the speed of the sphere is (v) and the cord makes an angle θ with the vertical.

In the stunt of riding a bicycle in a loop – the – loop, assuming that the loop is a circle with radius $r = 2.7\ m$, what is the least speed v that the bicycle could have at the top of the loop to remain in contact with it there?

(a)
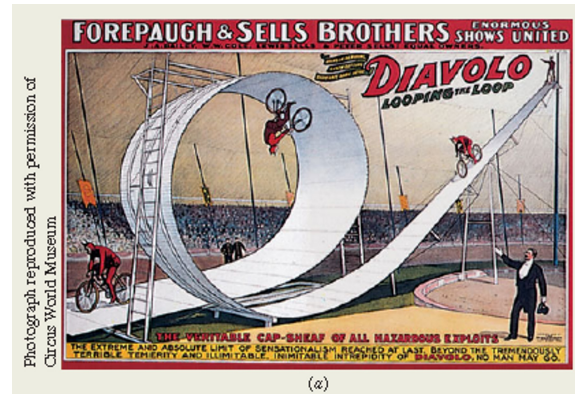
Satellite

Consider a satellite of mass m moving in a circular orbit around the Earth at a constant speed v and at an altitude h above the Earth's surface, as shown. Determine the speed of the satellite in terms of G, h, R_E (the radius of the Earth) and M_E (the mass of the Earth).