Phys 2010 (NSCC), Spring 2007
Problem Set #5

1. An athlete swings a 5.00 kg ball horizontally on the end of a rope. The ball moves in a circle of radius 0.800 m such that it makes one revolution every 1.20 s.
   Find the speed of the ball.

2. In Problem 1, find the centripetal acceleration of the ball and the tension in the rope.

3. Tarzan (who has a mass of 150 kg) tries to cross a river by swinging from a 9–m long vine. His speed at the bottom of the swing is $7.0\frac{m}{s}$. Find the tension in the vine at this point.

4. A car of mass 1000 kg is travelling over the top of a hill at a speed of $20.0\frac{m}{s}$. The hill has a radius of curvature of 120 m.

What is the normal force of the road on the car? What is the maximum speed the car can have at the top of this hill for it to stay in contact with the road? (It loses contact if the normal force is zero at the top of the hill.)

5. Phobos, a satellite of Mars, has an orbital period of 0.3189 days and an orbital radius of 9.377×10^6 m.

From these data (and the equations we found in class relating orbital period and radius) find the mass of Mars.

6. If a satellite orbiting the earth has an orbital period of one day, what is the radius of its orbit? How large is this compared with the radius of the earth?

Such a satellite would stay over the same point on the earth's equator; it is called a geostationary satellite.

7. A shopper in a supermarket pushes a cart with a force of 35 N directed at an angle of 25° downward from the horizontal. Find the work done by the shopper as she moves down a 50.0-m length of aisle.

50 m

25°

35 N
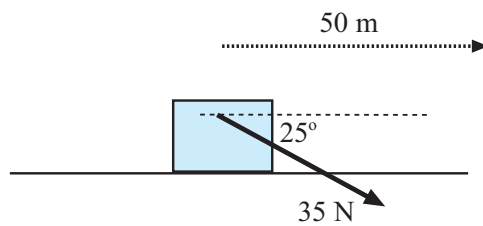
8. A 7.00-kg bowling ball moves at $3.00 \frac{m}{s}$. How fast does a 2.45 g Ping-Pong ball move so that the two balls have the same kinetic energy?