# Physics 113 - Fall 2012 - workshop module 5
Work, energy, gravitation,

1. A car is stopped by a constant friction force that is independent of the car's speed. By what factor is the stopping distance changed if the car's initial speed is doubled?

2. A block of mass M=5 kg is released from rest and slides down a frictionless ramp of height h above the floor. The ramp makes an angle of 30 degrees with the horizontal. At the bottom of the track the block slides along the horizontal floor, around a vertical loop (loop-the-loop). The loop in the track has a radius of 0.2 meters. As the block passes the top of the loop, it never loses contact with the track. Once past the loop, the block encounters a region in the track where there is a rough surface (friction). μ_k between the block and the track in this region is 0.15.

(a) What is the minimum value for h, the starting height of the block above the floor?
(b) Assuming the value of h in part (a), what is the speed of the block at the bottom of the ramp?
(c) How far does the block travel along the part of the track with friction before it comes to a stop?
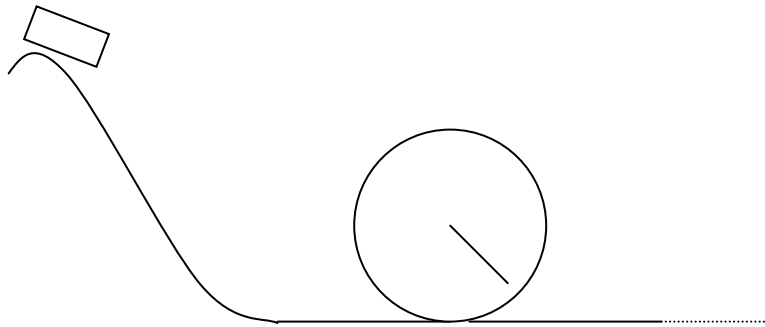
3. Crazy Jumpers Incorporated wants to test the elasticity of a new bungee cord without endangering anyone's life. While the clients are busy jumping from a bridge (using the older cords), the owner (M = 100 kg) is attached to a 10 meter length of the new cord and slowly lowered until he is hanging motionlessly. At that time it is noted that the cord has stretched to a new length of 20 meters.

Make a FBD for the owner as he dangles (motionlessly) from the bungee cord.

Using Newton's 2nd Law, determine the spring constant for this bungee cord.

Now that the spring constant of the new cord is known, the owner (who recently completed a physics course) performs a few quick calculations and then decides to do a trial jump using a 40 m length (unstretched) of the new cord. He jumps from the 90m tall bridge as his assistants (who unfortunately never learned physics) watch with

a mixture of fascination and morbid curiosity. Your goal in this problem is to recreate the owner's calculations to determine whether it was safe for him to jump.

4. Consider a 2 kg mass stacked on top of a 7 kg mass as shown below. The two masses are attached to a spring (which is attached to the wall) and can move back and forth on a frictionless surface. The coefficient of static friction between the bottom surface of the top mass and the top surface of the bottom mass is 0.45. The spring constant is 200 N/m.

    a) What is the maximum amplitude of the simple harmonic motion (maximum amount the spring is compressed and stretched) of the system shown below such that the top mass does not slip during the oscillation?

    b) In a system that undergoes this limiting motion: What is the total energy of the system?