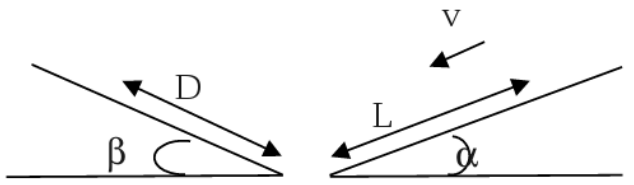
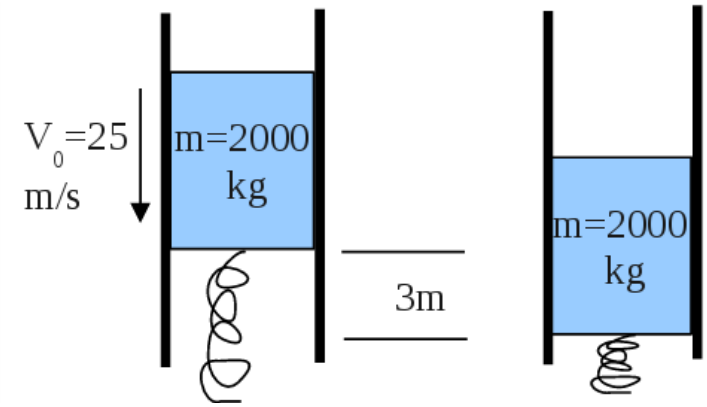
Physics 1210
Homework 6 Written-out Problems

1.
You work for WYDOT and are tasked with creating a runaway ramp program for generally calculating how long a runaway ramp needs to be given an initial truck speed and angle downhill. As seen in the diagram, the truck will have an initial velocity (v) at a downhill angle (α) when it is realized the breaks are out. After traveling a further distance downhill (L) it will enter the sanded ramp with a coefficient of rolling friction μ_r and start uphill at angle β. Find D, the distance it travels uphill before stopping as a function of everything else.



2.
You are a designing the safety system for the elevators in McIntyre Hall which consist of a safety clamp that applies friction to the wall of the elevator shaft and a spring at the bottom of the shaft in the event of a cable failure. Together these need to stop a m=2000 kg elevator over a distance of 3 m where the initial velocity of the elevator, just before it starts compressing the spring, is 20 m/s. The friction clamp applies a constant force of 17000 N. Assume the clamp engages when the spring is touched by the elevator and stays engaged forever. The below diagram shows this initial setup and the elevator when it is instantaneously still after traveling the full 3m it has room to travel in while compressing the spring.



a) What does the spring constant need to be?
b) How far back up the shaft does the elevator 'bounce' above the lowest point?
c) After that, the elevator slides back down again. What is its speed just before it contacts the spring again?
d) What is the distance of compression this time for the spring? How much energy is stored in the spring then?