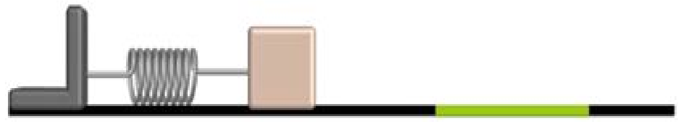
PAL Problem Set 19 for Phys 5A
(Springs)

Always explain your answers and show your work.

Problem 1 - A mass ($m = 10\ kg$) rests on an initially frictionless table and is accelerated by a spring with spring constant $k = 4,100\ N/m$, reaching a speed of $3.7\ m/s$ when it leaves the spring. The floor is frictionless except for a rough patch. This rough patch has a coefficient of kinetic friction of $\mu_k = 0.45$.



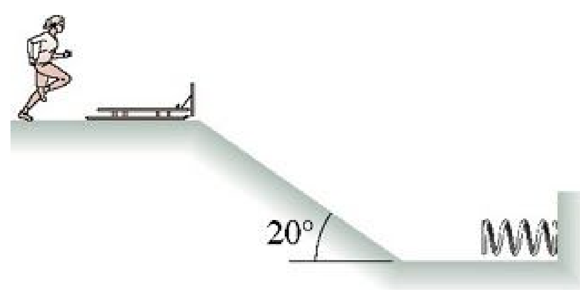
A. How far was the spring initially compressed?

B. The mass is measured to leave the rough spot with a final speed $v_f = 2\ m/s$. How much energy did the mass lose to friction as it traveled across the rough patch?

C. Where did the "lost" energy go?

D. How long was the rough patch?

Problem 2 - A new event has been proposed for the Winter Olympics. An athlete will sprint d meters, starting from rest, then leap onto a bobsled of mass m_s. The person and bobsled will then slide down a ice-covered ramp of length l, sloped at θ degrees, and into a spring with a carefully calibrated spring constant k. The athlete who compresses the spring the farthest wins the gold medal. Lisa, whose mass is m_L, has been training for this event. She can reach a maximum speed of v_{max} in the sprint.



A. Find an expression for the speed of the sled right after Lisa jumps on it (let's call it v_1).

B. Find an expression for the spring compression (Δx) as a function of the information given. [Hint: Your expression should contain contain v_1]