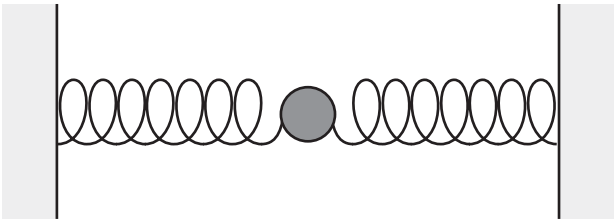
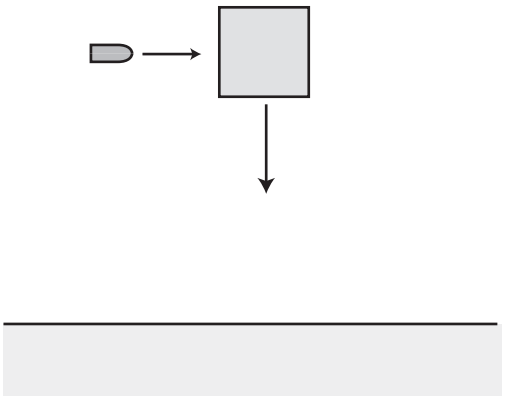
Midterm 2

There are 3 problems worth 33 points each. You must show your work and justify your answer to receive full credit.

1. A ball of mass 0.18 kg is attached to two identical springs with unstretched length 0.12 m. (Neglect the size of the ball.) The springs are attached to opposite walls that are 0.32 m apart. The block is released from rest in a position where the springs are horizontal, as shown below. The ball is observed to fall a vertical distance of 0.028 m before coming momentarily to rest and going back up. **Find the spring constant of the springs.**



2. A bullet of mass 5.4×10^{-3} kg is travelling horizontally at 440 m/s when it hits a wooden block of mass 0.55 kg that is falling straight down at a speed of 12 m/s. They collide at a height of 1.8 m above the ground, and the bullet becomes embedded in the block. The bullet and the block then fall to the ground together. **Find the speed with which the block and bullet hit the ground.**



3. A block of mass 0.23 kg is placed on a ramp that has length 0.50 m, height 0.25 m, and mass 1.2 kg. The ramp is on a horizontal table, and all surfaces are frictionless. The block is initially launched up the ramp with a speed of 0.21 m/s with the ramp at rest. **Find the maximum height reached by the block.** (Note that the ramp also moves!)