This lesson would be great for an AP Physics C Mechanics class, or an AP physics 1 class with advanced students. It requires a very coherent understanding of springs and kinematics and conservation of energy. I don't believe I could've done this lab when I was in AP Physics 1 as it is kinda complicated with multiple steps of applying knowledge from several units. Physics C mechanics students would enjoy.

I don't need to submit any equipment as you already have everything!

Calculations
Finding K for one rubber band:

$PE_i = \frac{1}{2}kx^2$	plug in your initial displacement for x
$KE_f = \frac{1}{2}mv^2$	plug in mass of pencil, and your velocity calculation
PE_i=KE_f	conservation of energy
$k = \frac{mv^2}{x_{disp}^2}$	Rearrange for k

Compare the relationsip between the individual K values of the rubber bands and the combined values in parallel and in series. You should notice the rubber bands in parallel are equivalent to being added together, while the ones in series are equivalent to the sum of the inverse of each band.

Using kinematics to determine exit velocity

Vi	
Vf	0m/st
x	yes
a	-9.8 m/s^2
t	

No t formula
$v_i^2 = v_f^2 + 2ah$

$v_i = 2(-9.8)h$

$k = \frac{m(19.6h)^2}{x_{disp}^2}$

$k = \frac{m(19.6h)^2}{x_{disp}^2} = \frac{384.16mh^2}{x_{disp}^2}$

Post Lab Questions

1. How does the behavior of rubber bands in parallel differ from those in series when a weight is applied? Describe the difference in terms of displacement and constant K

When rubber bands are in parallel, each band shares the load, so the displacement would be less for the same applied force compared to a single band. The spring constant follows this rule K=K1+K2

In contrast, when they are in series the load is distributed across the entire stretch of both bands, and there is more displacement for the same force, so it would have the following behavior:
1/k=1/k1+1/k2

2. Based on your height measurements, which configuration had the highest launch height if they were to be at the same displacement? Does this match your conclusion in response to Student B?
   I had calculation error but it should be the configuration in parallel

3. How does conservation of energy take place in this lab?

Conservation of energy is demonstrated in this lab as the initial spring potential energy (½ kx^2) is directly responsible for the exit velocity(1/2mv^2)and the final height.

4. If you were to double the number of rubber bands in paralell, what would happen to the height?
   It would just be 2k