**Stretching Our Knowledge**

Last year you learned about how a spring stretches which the elasticity is called the k value. The k value represents the force divided by distance which would be Newtons per meter. This means that it takes a certain force to stretch the spring a certain distance. Now we will use this information to investigate how springs work together.   
  
**Safety and equipment issues:**

Avoid swinging the meter sticks around. There is some danger with dropping masses to toes and feet and the masses chip off which changes their mass. Avoid stretching the spring too much. As you move around the room, avoid colliding with the poles used as the spring support system.

**Procedures:**

1. Collect these materials for your group.
   * **One set of slotted masses**
   * **Two mass hangers**
   * **Two springs of the same color (May need other springs and equipment for later in the investigation)**
   * **Support system as demonstrated by the teacher**
   * **Meter stick**
   * **Masking tape**
   * **String**
   * **Scissors**
   * **Level (optional)**
2. Set up the support system and select one spring to calculate the k value. Recall, you need to put an initial mass to stretch the spring as a starting point and you will need to convert your masses to kilograms then into weight (Newtons). The lengths will need to be in meters to get the k value in the units of Newtons per meter. 1000 grams = 1 kilogram, weight = mass times acceleration due to gravity (i.e. g = 9.8 meters per second per second), 100 centimeters = 1 meter. Record the data below.

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| --- | --- |
| **Mass** | **Length** |
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|  |  |
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1. Show your calculation for the k value.
2. Explain what would happen to the k value if you connected two springs with this k value?
3. Connect two springs with the same k value (same color) and calculate the new k value in Newtons/meter.

|  |  |
| --- | --- |
| **Mass** | **Length** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

1. Was your predication correct? If not, why do you think the k value was different than what you predicted?

Check with your teacher to see which of the following scenarios your group will do next. Recall, you need to put an initial mass to stretch the spring as a starting point. Have the teacher circle the scenario(s) your group is completing.  
  
I. Hang two springs of the same k value parallel to each other and determine the new k value of the system. You may need to tape the mass hanger to the connecting pole to avoid slippage. (Don’t forget to predict first).

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II. Hang two springs of the same k value and hook them together so that a right triangle is formed at where they are hooked. Determine the new k value of the system (Don’t forget to predict first).

III. Connect two springs of the same k value in series (in line). Determine the new k value of the system (Don’t forget to predict first).

IV. Hang two springs of different k values parallel. Use one of your springs and get a different color spring. Determine the k value of the new spring. Calculate the amount of mass to hang from each spring so that they are stretched to equal lengths (You may need to tape the mass hanger to the connecting pole to avoid slippage and don’t forget to predict first).

V. Connect two springs of different k values in series. Use one of your springs and get a different color spring. Determine the k value of the new spring (Don’t forget to predict first).

1. Check with other groups that had the same scenarios to see if the results are the same. Be prepared to share your results with the class.
2. Do you see a pattern connecting the springs in series, parallel, or at an angle?