NAME_____

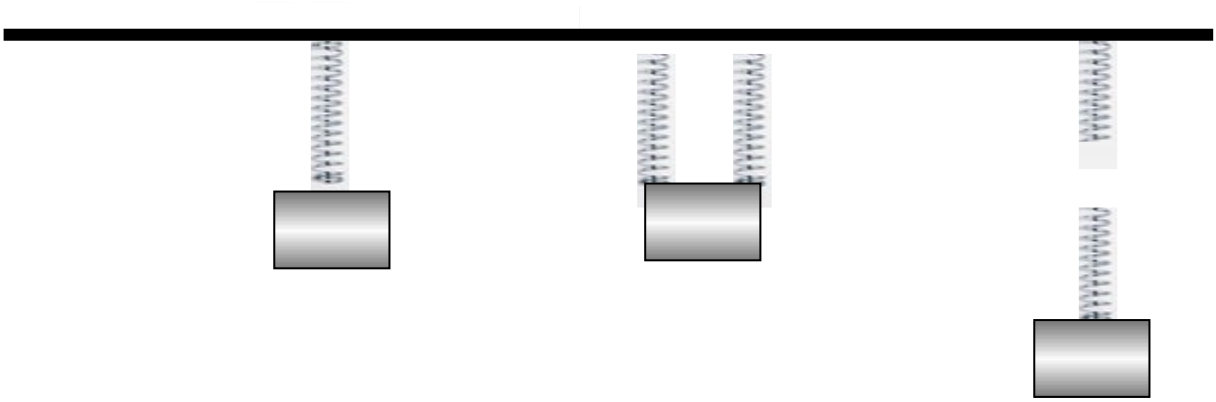
HOOKE'S LAW

LAB INTRODUCTION:

When an external force is applied to a solid object, that object may be bent or twisted out of shape. The ability of an object to return to its original form and shape when the external force is removed is called elasticity. The Englishman, Robert Hooke (1635-1703), discovered that when an elastic object such as a spring is stretched by a force, the amount of elongation or stretch of the spring is directly proportional to the force that produces it. Hooke called the force acting on the body the **stress** and the elongation or deformation of that body the **strain**. He then stated his law as follows: As long as the elastic limit of a body is not exceeded, the strain produced is proportional to the stress causing it. All true elastic objects behave according to this law. Indeed, whether or not an object conforms to this law is proof positive as to whether the object is elastic or not.

In this investigation you will vary the force (weight) applied to a spiral spring and note its elongation, thus verifying Hooke's law. You will also test two springs in series (one below the other) and two springs in parallel (side by side).

DIAGRAM: **parallel** **series**



OBJECTIVES:

-to investigate the relationship between the stress and strain on a spiral spring.

-to compare the elastic properties of different materials.

MATERIALS:

Spiral springs, meter stick, various masses.

PROCEDURES:

1. Set up the apparatus with the spring and meter stick. Note the position with no load on the spring.

2. Be careful not to exceed the elastic limit of the spring. Add various masses ('stress') to the spring and note the amount of elongation ('strain'). Record all data in the provided table.

3. Repeat for the two springs in parallel

4. Repeat for the springs in series.

Recall, 1 g = 0.001 kg = 0.098 N

SPRING		PARALLEL SPRINGS		SERIES SPRINGS	
Force (N)	**Stretch (m)**	**Force (N)**	**Stretch (m)**	**Force (N)**	**Stretch (m)**

CALCULATIONS:
Plot a graph of Force (y-axis) vs Stretch (x-axis) with each line on one set of axes.

Find the slope (with units) of each spring arrangement from your graph by choosing points ON YOUR BEST-FIT LINE. SHOW ALL CALCULATIONS AND **SHOW THE DATA POINTS USED ON EACH GRAPH**. Recall, **SLOPE = Δ FORCE / Δ STRETCH**

What does the slope represent?

Is the k (spring constant) value larger or smaller than before for series springs? Is the k value directly or indirectly related to the stiffness of the spring? (Answer in sentences...)

Is the k (spring constant) value larger or smaller than before for parallel springs? Is the k value directly or indirectly related to the stiffness of the spring?

Which of the following equations do you think would govern the parallel spring arrangements?

Note: The arrangement that had the largest spring constant (slope) would be the 2nd equation while the smallest spring constant would be the 1st equation.

$$k_{tot} = k_1 * k_2 / (k_1 + k_2)$$

or

$$k_{tot} = k_1 + k_2$$