Honors Physics Lab
HOOKE'S LAW for SPRINGS - Mr. Ward

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Name Period

CAUTION: Be careful with the mass hangers and masses. <u>You should not drop the hangers and masses on the table</u>. This damages the hangers and the table. Place a notebook or textbook under the hanging masses and make your measurements from the top surface of the book.

PROCEDURE:

1. <u>For each of the two springs</u> (brass and steel) complete all steps below.
2. Hang the spring by loosening one of the clamp thumbscrews until you can lift the small tab out of the hole on the bar. Put the tab through the loop on the end of the spring and re-tighten the clamp so the tab is in the hole. This should allow the spring to hang straight down.
3. Place a flat bottom 50 g hanger on the spring. DO NOT pull the mass down and release it to make the mass bounce up and down. This is a later lab.
4. Raise the clamp to the top of the pole.
5. Hold a meterstick vertically next to the spring, lightly touching the hanger, with the 100 cm end on the table.
6. Tape the top of the meterstick to the clamp.
7. Add 50-100 g of mass until the coils of the spring are open.
8. We will ignore the mass of the hanger and the added initial mass. (This is legal to do since all we care about is the <u>change</u> of mass compared to the change in length of the spring. The initial mass and the initial position are arbitrary. The hanger and initial mass are needed to open the coils of the spring.)
9. **Record all positions to the nearest millimeter, which is 0.1 cm. Example: x = 45.2 cm**
10. With the hanger and the initial mass on the spring, RECORD the mass as **0 g** and RECORD the starting x value as the position of the bottom of the hanger.
11. Add 50 g to the hanger. RECORD the mass as 50 g and RECORD the new x value. (For better accuracy, rotate the masses so equal heights of slot are opposite each other if you are using the flat bottom hanger.)
12. Add 50 g more. RECORD the mass as 100 g and RECORD the new x value.
13. Continue adding 50 g and RECORDING both mass and x until you reach a mass of 500 g <u>or</u> until the spring touches the surface. <u>Do not</u> exceed 500 g. <u>Do not</u> stretch the spring beyond this length.

CALCULATIONS:

14. Calculate the weight of the masses used in Newtons and RECORD in the RESULTS table.
15. <u>Subtract the starting position from each of the original x values</u> and RECORD the new values in the Δx column in meters.

16. Using Excel, enter the Forces in column A and the Δx values in columns B and C. Remember that (0,0) is also a valid data point.
17. Select all the data and make an x-y graph. Draw the slope and select all three options.
18. You will notice that we plotted the Force (independent variable) on the x-axis and the masses (dependent variable) on the y-axis. This looks correct but the spring constant is usually plotted the reverse. We could go to the trouble of switching the axes, but a simpler way is to take the reciprocal of the slope shown.
19. Show me the graph before you delete it.
20. The slope (actually the reciprocal of the slope) of the line is **k**, the spring constant. That is **k = DF/Dx**

DATA TABLE for Hooke's Law

mass (g)	**x position (cm)** brass spring	**mass (g)**	**x position (cm)** steel spring
0		0	
50		50	
100		70	
150		90	
200		110	
250		130	
300		150	
350		170	
400		190	
450		210	
500		230	

RESULTS TABLE:

weight (N)	**D x (m)** brass spring	**weight (N)**	**D x (m)** steel spring
0	0	0	0

Spring constants calculated (show proper units):

k_{brass} = ____________________ k_{steel} = ____________________

What did you learn?