

Science Coursework – Practical Write Up

Rationale

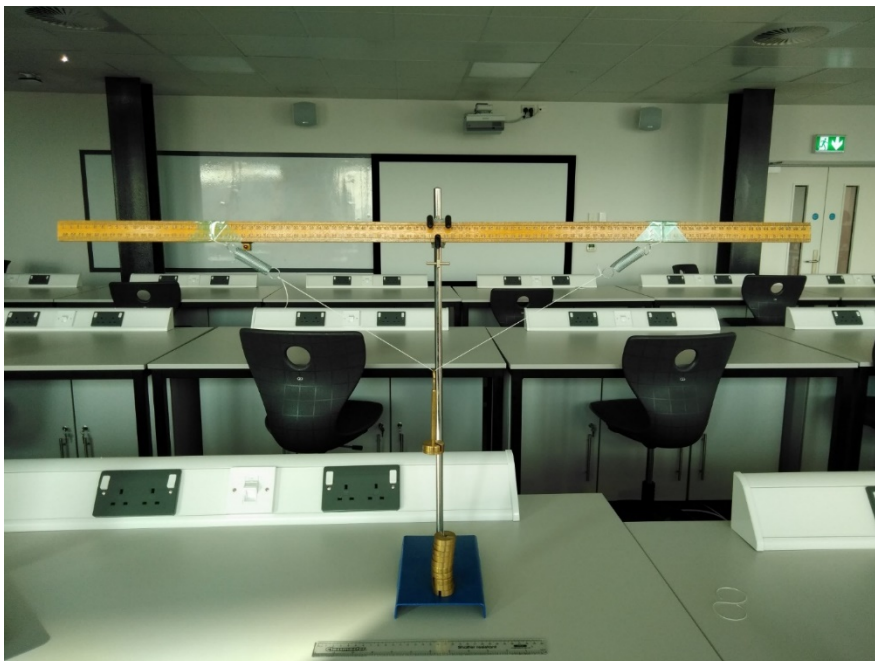
The reason for the Science practical is to investigate the length of a spring when mass is applied to it. This was to investigate whether or not the spring obeyed Hooke's Law. I compared the length of the springs when I applied different amounts of mass onto the springs as well as the angle of the string in which the mass was hanging on. Using my measurements I was able to see whether the springs obeyed Hooke's law.

Apparatus Set Up

The equipment you will need to complete this experiment consists of;

- 1 Meter ruler
- 2 Identical Springs with a ring end on each end
- String
- 30cm ruler
- Mass holder and individual Masses (enough for 500g Total Mass)
- A Clamp stand
- Protractor
- Pen/Paper

Step 1: Set up the above equipment as shown in the photo below:



Notes on setup: Ensure that your ruler is attached to your clamp stand exactly in the middle of the ruler (50cm as it is a 100cm ruler). Ensure your springs are attached to your ruler exactly the same distance apart from the centre of the ruler. E.g. 25 cm away (one spring at 25cm, one spring at 75cm) Ensure your mass holder is set up directly in the middle of the string.

You then need to create a table as shown below to enter your values into.

	Reading 1			Reading 2					
Mass (g)	L1 (mm)	L2 (mm)	Angle	L1 (mm)	L2 (mm)	Angle	L mean	Θ mean	$\frac{M}{\cos(\frac{\Theta_{\text{mean}}}{2})}$

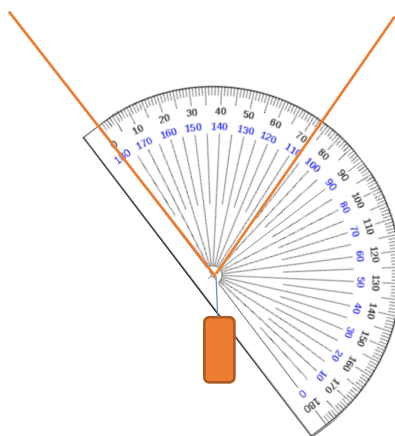
This table consists of Mass, L1 (1st spring length), L2 (2nd spring length) Angle (angle of the string when weight is applied), L mean (mean angle of L1 and L2 for both readings), Theta mean (mean of the angles) and $\frac{M}{\cos(\frac{\Theta_{\text{mean}}}{2})}$ which is a calculation to determine the length of the string drop (from the ruler to the top of the weight holder).

Method

After you have ensured that your equipment is set up accurately, First add a 50g weight to the mass holder. This will make the total weight 100g which is the first reading to take.

Then proceed to measure the length of spring 1 and 2 ensuring the weight has calmed to a still state. Measure the length of the spring with the 30cm ruler from the outer edges of the spring. Record the length of the springs in the table in their respective column.

Measure the angle of the string using the protractor. To do this line up one of the strings to the bottom line on the protractor and the middle of the protractor to the point at which the mass holder is resting on the string as shown below.

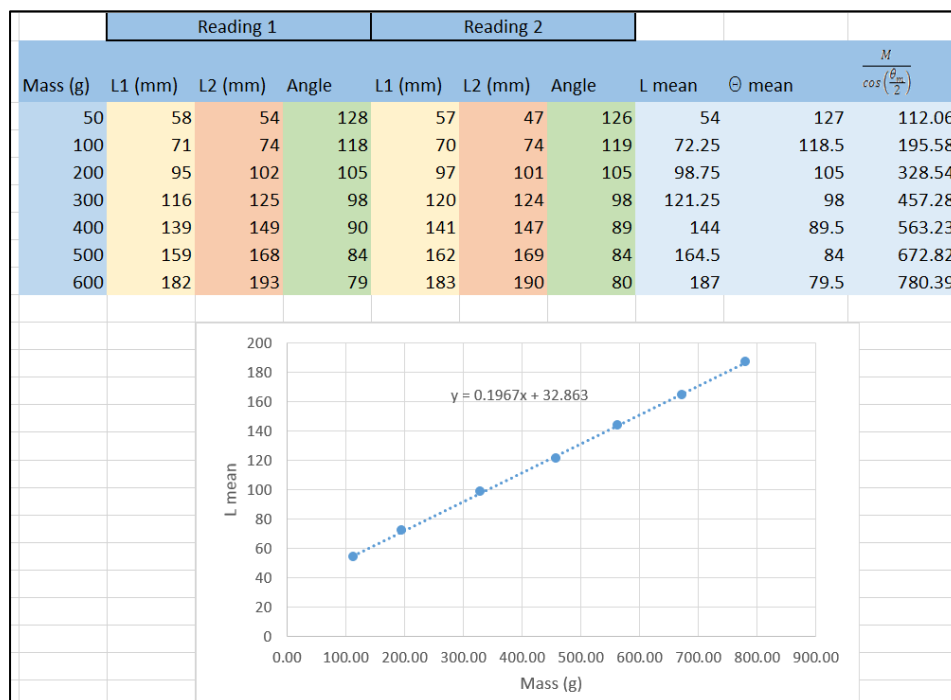


Repeat the above steps for 200g or weight, 300g, 400g, 500g and finally 600g. Ensure your results are written down on your table.

Results

For the results, you need to do a calculation for the mean angles and mean lengths. This gives you

the Length mean and the angle mean which is inputted into the table. Using the equation $\frac{M}{\cos\left(\frac{\theta_m}{2}\right)}$ will allow you to find the mean mass acting downwards. Using this formula allows you to create a graph in excel which I have done below. This helps to visualise what is happening as the graph is not good at representing trends. In order to reduce the chances of inaccuracies I ensured that the weights were still and not moving before I measured the length of the springs and the angles. You can use excel to calculate all means to ensure that the results are correct.



Uncertainty Length	Uncertainty	$\frac{M}{\cos\left(\frac{\theta_m}{2}\right)}$
1.85		0.79
1.38		0.84
1.01		0.95
0.82		1.02
0.69		1.12
0.61		1.19
0.53		1.26

Conclusion

In conclusion, I strongly believe that my experiment has been a success and the results are accurate. This can be backed up by the graph that shows that proves hooke's law. The results are in a straight line and the line of best fit touches all of my readings that I gathered during the experiment. The trend my graph shows is that as the weight increases, the length of the springs increase proportionally. I used the equation $y=mx+c$ as my graph is a straight line. The results of my equation are $y=0.1967x + 32.863$. Some of the results in my graph are not directly in the centre of the line of best fit. This means that the test has systematic errors causing the results to not fully fit the line of best fit. In order to complete the test to a higher standard again I would ensure that I used a smaller increment of weight to further increase the accuracy of my test.

As you can see from my table there are relatively low levels of uncertainty (less than 2%) meaning that my results are accurate.

