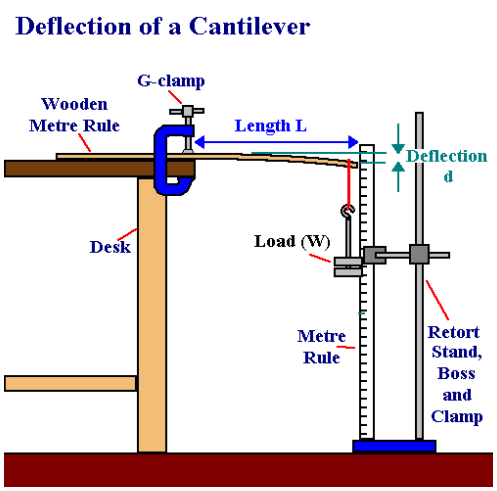
Science 1 Investigating the deflection of a cantilever.

Plan

In my experiment, I am investigating the deflection of a cantilever. Before we start our experiment, we have to gather the necessary equipment and apparatus together in order to start and complete our experiment. We will need the following:-

- 1m ruler (x2).
- 2x G- clamps.
- One piece of string.
- Masking tape and sticky tape.
- 2 blocks of wood.
- And finally 1k in 100g weights (100x10).

Here is a diagram of our experiment.



The meaning of deflection is the movement of a structure or a part of a structure when it is bearing a load.

Once we have collected all the equipment needed to carry out the experiment, we need to first put it together and set it up. We do this by taking one of the 1m rulers and clamping it onto the end of the desk with a G- clamp. We also put some wood in-between the ruler and G- clamp, the reason for this is because we don't want the ruler and table being indented by the clamp. We found out that this could be the best thing to vary. The reasons for this is because we could choose whether to have the ruler further away from the desk and have it bend more or have it closer in to the desk and make it less bendy. Once we had done that, then we took another 1m ruler and taped it onto a retort stand. Then, finally we took one piece of ordinary string and tied it onto the 1m ruler then taped it so it would stay in one position throughout the whole experiment. The reason, we did this is so we could hang our weights onto the end of the string and take our measurements with out the string slipping or falling off.

Before we took any measurements we had to take a few safety precautions, the reason for this is because if we add a certain amount of weight to the ruler then it could reach its elastic limit and snap, so we had to wear some safety goggles just in case shards of wood came into contact with our eyes. Once we had all of our experiment set up and gone through some safety aspects then we were able to take some measurements and record some results. The way, we measured the pivotal force of a cantilever is by first taking the spring, putting it on the end of the piece of string. We then added one of the 1g weights on the end and measured how far its goes down the ruler on the retort stand. We then noticed that the ruler kept moving so we took a second G- clamp and clamped the back of the ruler from stopping it from doing this. After we had recorded our results from the first weight, we then added a second 1g weight and did exactly the same thing and recorded our results. We repeated this ten times. After about the third recording that we did I was able to predict what would happen

<u>Results</u>

Here are all the results that we recorded when measuring the deflection of a cantilever.

Force (N)	Ruler measurement (cm)	Deflection (cm)
1	79.5	0.9
2	78.8	1.6
3	77.9	2.5
4	77.1	3.3
5	76.4	4
6	75.3	5.1
7	74.4	6
8	73.6	6.8
9	72.7	7.7
10	71.9	8.5

Force (N)	Ruler measurement (cm)	Deflection(cm)
1	79.4	0.8
2	78.6	1.6
3	77.8	2.4
4	76.9	3.3
5	76.6	3.6
6	75.3	4.9
7	74.4	5.8
8	73.6	6.6
9	72.7	7.5
10	71.9	8.3

Force (N)	Ruler measurement (cm)	Deflection (cm)
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5	76.1	4.1
6	75.2	5
7	74.4	5.8
8	73.6	6.6
9	72.4	7.8
10	71.9	8.3

	Average
Force (N)	Deflection(cm)
1	0.8
2	1.6
3	2.5
4	3.3
5	3.9
6	4.7
7	5.9
8	6.7
9	7.7
10	8.4

Conclusion and Analysis

When drawing my graph I noticed that the line was very straight. I think that the reason for this is because we added the same amount of weight each time, but if we were to add different amounts of weight then the graph would fluctuate. For example we added 1g weights ten tines but if we were to change that and instead add 1g weight then a 5g weight and then a 4g weight then the graph would fluctuate a lot. My results show that the deflection in cm is directly proportional to the force of Newton's applied i.e. 1g weights. We find that with increase in force in Newton's there is a similar increase in the deflection of the ruler in approximately 0.8cm/g of weight. These results are as expected. The graph shows a straight line and there is ~0.8 cm increase in deflection. The change in length (cm) is proportional to the amount of force applied. The Law of the elastic limit and elasticity has got something to do with this experiment as defined by Hooke's law. If we had continued our experiment by increasing the force, we should expect to find a point would have been reached where the ruler could no longer withstand the force applied and we may then have seen that the elastic limit had been reached and the ruler could have snapped. Here are my results to show that.

Evaluation

In my experiment the improvements that I could have made are as follows:-

By starting off I could first of all put the piece of string on the end of the ruler at different points to see how far the ruler goes is down the other ruler with one weight on the end to try to vary our experiment. So that was one way that we could have started our experiment. Once I had done and completed our experiment we drew up a graph of our results, once I had finished plotting the points on the graph I saw that on our line of best fit there were not that many anomalies witch was very good. The reason for this is because it shows that we did our experiment very well and accurately. But I also noticed that we had some anomalies results these are the dots that are not in direct contact with the line of best fit.