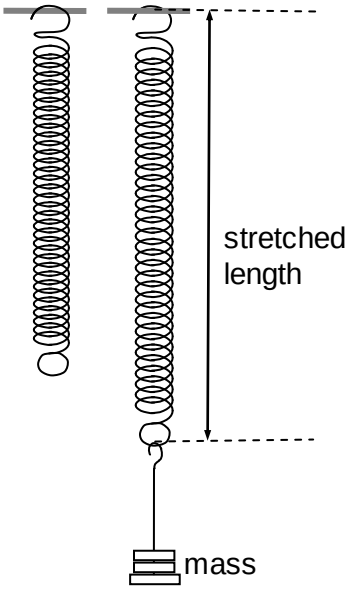
Name: _____

Hooke's Law Experiment

Aim
To find the relationship between the extension of a spring and the mass used to cause the extension. To use the relationship to find the spring constant of the spring on the basis of Hooke's Law for springs.

Equipment
Spring, 50 g masses, metre ruler, retort stand, clamp and boss head, electronic balance.



Theory
Theory states that $\mathbf{F_s = kx}$
where k is the spring constant of the spring (Nm^{-1})
x is the spring extension (m)
and F_s is the spring force (N)

Method
Measure the length of the spring using valid accuracy improving techniques.
For different masses, hung on the end of the spring, measure the full extension of the stretched spring.

Data Results
- Record **all** measurements in an appropriately labelled results table (including units & correct significant figures)

- For each mass calculate the Weight force it exerts on the spring, **W** = mg (use acceleration due to gravity of $9.8ms^{-2}$). Assume the Weight force is equal to the restoring spring Force, $\mathbf{F_s}$ (obeys Newton's 1st Law).
- Plot and draw a graph of **force on the spring, $\mathbf{F_s}$,** against **extension of the spring, x**.

Analysis & Conclusion (Answer guided questions)

Discussion
- For each of the accuracy improving techniques you used, explain **why** it was necessary and **how** measurement accuracy was improved.
- Your explanations must be **particular** to the measurements they relate to, **not** just general statements.

Independent variable (goes on x axis)***:*** _____

Dependent variable (goes on y axis)***:*** _____

Control variables:

- _____
- _____

Results (table & graph): Attach to sheet here!

Analysis & Conclusion:

1. Calculate the **gradient** of the line on your F_s vs x graph. Show your working on your graph

   gradient:_____

   gradient unit _____

2. a) State the **equation** of the mathematical relationship between x and F_s.
   Hint: use y=mx +c and your linear graph

   _____

   _____

   b) Rearrange your equation to make the spring Force (F_s) the subject.

   F_s =

3. If the mass attached to a spring was 340 g, calculate the **extension** (x) of the spring in meters. Show full working on how you obtained your answer

   _____

   _____

   _____

   _____

   _____

4. Determine the **spring constant** (k) of the spring.
   Hint: compare your equation in question 2b) to $F_s = Kx$
   Show your working and state the correct units.

   _____

   _____

   _____

Discussion:

- What steps did you take to ensure accurate results?

_____

_____

_____

- For each of the accuracy improving techniques you used, explain **why** it was necessary and **how** measurement accuracy was improved. Your explanations must be **particular** to the measurements they relate to, **not** just general statements.

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Variables & Results Table	**A**	**M**	**E**
1. Variables defined			
2. Variable measurements correctly recorded plus units given			
3. Well labelled with appropriate Significant figures			
4. Accuracy improving technique(s) used			
Analysis			
5. Graph axis labelled, unit, scales, well plotted points, appropriate LBF			
6. Gradient calculated			
7. Gradient unit given			
Conclusion			
8. Relationship equation stated			
9. Question 3 calculations correct with full working shown			
10. Spring constant value & unit calculated			
Discussion			
11. Accuracy improving technique justified			
Grade reached:	**A**	**M**	**E**