Hooke's law

The purpose of the experiment:-

1-Investigate Hooke's law and

2- find the value of the helical spring constant.

Used equipment's :-

A helical spring

a readingindicator,

a grading ruler

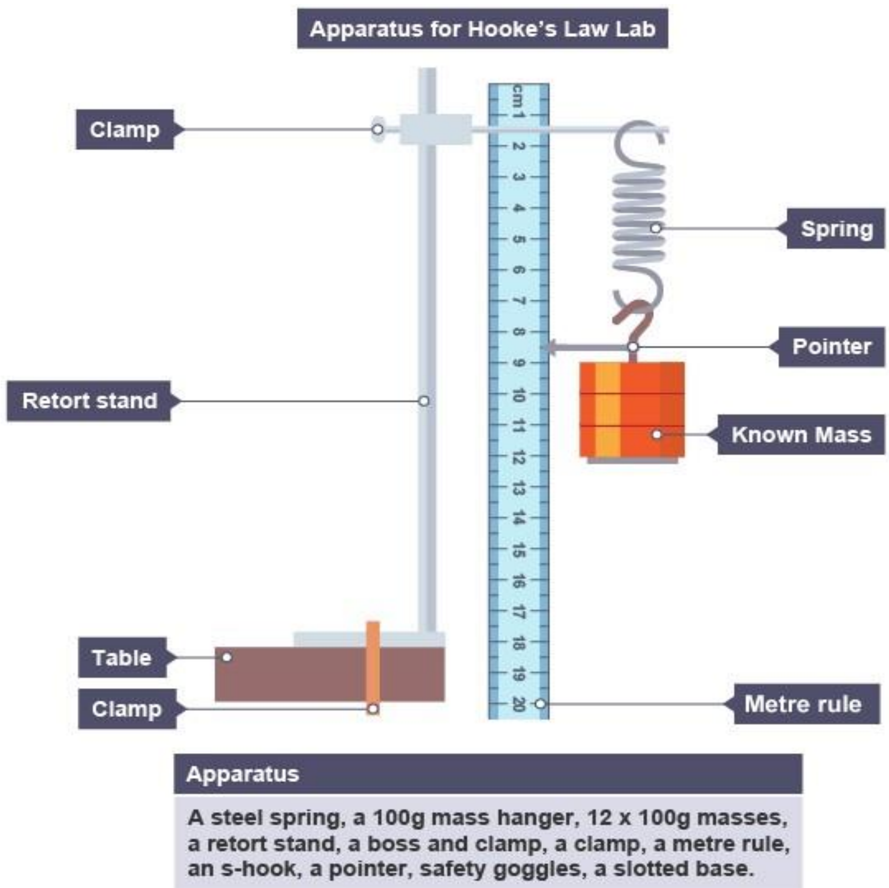
weights,

a portable stand,

a stopwatch,

a stand with a holder,

a metric ruler (or measuring tape).



Theory :-

The scientist Robert Hooke noticed that when a force is applied perpendicularly to a body, there is a relationship between stress and strain.

Stress is defined as the ratio of the perpendicular force acting on the cross-sectional area of the body.
As for **strain**, it represents the ratio between the change in body length to the original length.

Hooke's Law states that the amount of elongation or contraction that occurs in a spring is directly proportional to the value of the applied force, provided that it does not exceed the proportionality limit.
(The ratio between stress and strain is a constant quantity called the modulus of elasticity.) that is

$$Y = \frac{F/A}{\Delta L/L_\circ} \quad \cdots\cdots (1)$$

Where:
F = is the vertical force acting on the spring.
A = is the cross-sectional area of the spring.
$L_\circ$ = is the original length of the spring.
ΔL = is the difference in the length of the spring.

As for the spring constant (K), it is defined as the force required to elongate or compress the spring, and its units are (N/m) and is given by the equation:

$$\boldsymbol{K = F\backslash \Delta L = Mg/\Delta L}$$

Where The elastic constant is a constant quantity for a single spring, that depends on its dimensions, the type of material, and the amount of force applied to it within the limits of proportionality.

The work

1- Set up apparatus as shown in the drawing.
2- Connect the universal suspension hook and indicator to the lower end of the spring. The pointer should only touch the base of the meter.
3- Read the indicator value from the meter base. Record this length in a suitable table. This is the initial length of the spring when the mass is zero.
4- Add a mass of 20 g to the spring and record it.
5- Read the new position of the pointer on the meter base. which represents the new extended length of the spring. Record this length in the table.

6- Calculate the stretching force = weight of masses: W = mg. 7- Calculate: extension = stretched length – original length.

8- Repeat the procedure by adding 20g masses Record the new stretched length by reading the position of the pointer on the meter rule. Subtract the original length from the new stretched length to calculate each extension.

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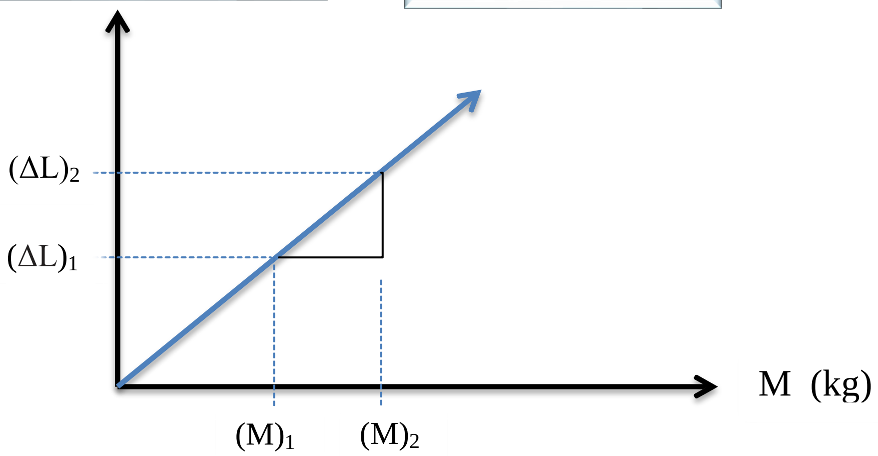
Trial	Masses M (kg)	The force resulting from the suspended weight $F = M * g$ (N)	The original length of the spring $L_{\circ}$ (m)	
			The new length of the spring L (m)	**The amount of elongation** $\Delta L = L - L_{\circ}$ (m)
1				
2				
3				
4				
5				

$$K = \frac{F}{\Delta L} = \frac{Mg}{\Delta L}$$

$$K = \frac{g}{slope}$$



$$\text{Slope} = \frac{\Delta(\Delta L)}{\Delta(M)} , = \frac{\Delta L_2 - \Delta L_1}{M_2 - M_1}$$

ΔL (m)

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