University of Hillah

Department of Anesthesia Techniques

The first stage

Medical physics laboratory

Experiment. Hooks' low

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Aim of the Experiment:

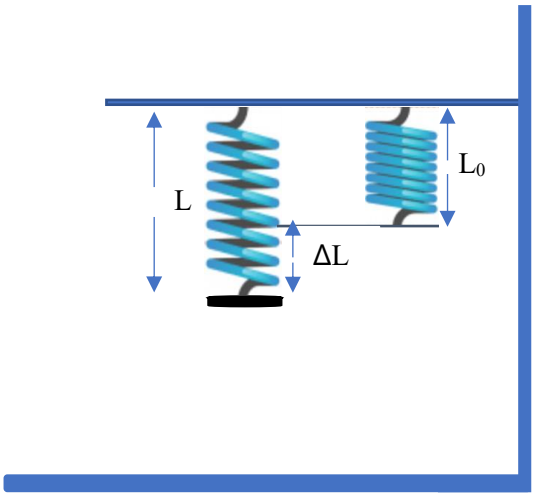
1. Experimentally verify Hooke's Law
2. Determine the spring constant (k)

Tools Used in the Experiment:

1. Spring
2. Set of standard masses
3. Meter scale
4. Stand

Procedure

- ***Attach a spring vertically to a retort stand using a clamp.***
- ***Measure the natural length of the spring without any weights attached.***
- ***Add masses to the spring and measure the extension for each weight.***
- ***Record the applied force and the extension for each weight.***
- ***Plot a graph of force vs. extension and determine the slope which represents the spring constant k.***



Mass (g)	L_0 (cm)	L (cm)	$\Delta L = L - L_0$ (cm)
20			
40			
60			
80			
100			

m (g)

$$Slope = \frac{\Delta y}{\Delta x} = \frac{\Delta m}{\Delta L}$$

$$K = Slope * g\left(\frac{N}{m}\right)$$

ΔL (cm)

k : The spring constant

m : Mass

L : Length of spring with a mass

L_0 : Length of spring without mass

ΔL : The change in length of spring.

Theory :

Hooke's Law states that the force exerted by a spring is directly proportional to the extension or compression of the spring from its equilibrium position. Mathematically, this can be expressed as:

$F = -kL$ ……1

Where:

F : is the restoring force exerted by the spring

K: is the spring constant (a measure of the spring's stiffness)

*) The unit of the spring constant (k) is Newtons per meter (N/m) in the International System of Units (SI). This unit reflects the force required to stretch or compress a spring by one meter.

*) The negative sign indicates that the restoring force acts in the opposite direction to the displacement.

Consider a mass (m) hanging from a spring:

When a mass (m) is attached to a spring, it stretches the spring by a distance L. At this point, the spring exerts an upward restoring force (F) equal to the weight of the mass.

So, we can write:

$F = mg$ 2

Substituting this into Hooke's Law:

$mg = -kL$

Ignoring the negative sign (which indicates the direction of the force), we get:

$mg = kL$

Rearranging the equation to solve for the spring constant (k):

$k = mg/L$

Therefore, the spring constant (k) is equal to the weight of the mass (mg) divided by the extension of the spring (L).