

Elastic Deformation

Elasticity:

Materials bodies which get stretched on the application of a force and regain its original length and shapes on the removal of the deforming force are called elastic bodies. This property of the material bodies is known as elasticity.

Length of the body before applying the stretching force is called un-stretched length.

Length of the body after applying the stretched force is called the stretched length.

Difference between the stretched and the un-stretched length of the body is known as extension.

Hooke's Law:

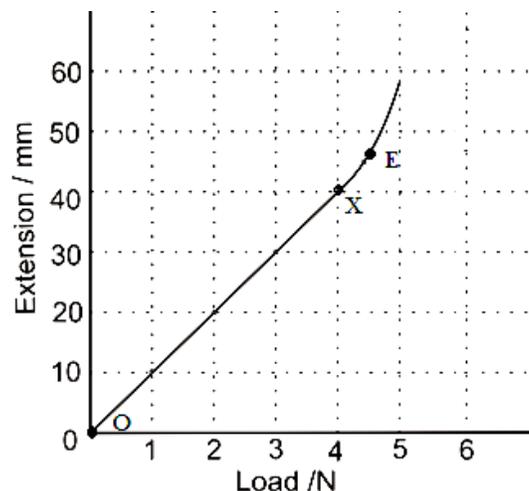
Extension – load/Force

- Extension is a change in length when a force is applied. Difference b/w stretched & un-stretched length of a body is known as extension.
- More load more extension.
- Less load less extension.
- Extension = New Length – Original Length
- $F \propto x$

The table below shows how the extension of s spring varies with force applied (load).

Load/N	0	1	2	3	4	5
Extension	0	10	20	20	40	58

The extension – load graph shown below is plotted the information given on the table.



- OX is the region where Hooke's law is obeyed, that is extension is directly proportional to the stretching force.
- X is the point of limit of proportionality. (The point beyond which the extension of an object is no longer proportional the load producing it is called limit of proportionality.)

- E is its elastic limit. Up to E, the spring behaves elastically and returns to its original length when the load is removed. Beyond E the spring will not regain its original length when the stretching force is removed and the spring is left permanently stretched when the load is removed.

Spring constant of spring can be calculate by using formula:

$$\text{Force} = \text{spring constant} \times \text{extension} (F = Ke)$$

Spring constant of this spring is:

$$K = F/e = 2 / 20 = 0.1 \text{ N/mm}$$

Questions

Q1. A spring of original length 3.0 cm is extended to a total length of 5.0 cm by a force of 8.0 N.

- a) Calculate the spring constant of the spring.**

- b) Assuming the limit of proportionality of the spring has not been reached; calculate the force needed extend it to a total length of 6.0 cm.**

Q2. To verify Hooke's law of elasticity which states that the force required to stretch an elastic material is directly proportional to the distance of extension.

- a) Plot on a graph:**

Load (x)	0	10g	20g	30g	40g	50g
Extension (y)	0	6.3	11.5	16.3	21.5	26.7

- b) Find the spring constant.**

- c) State the possible errors in this experiment.**
