

Hooke's Law

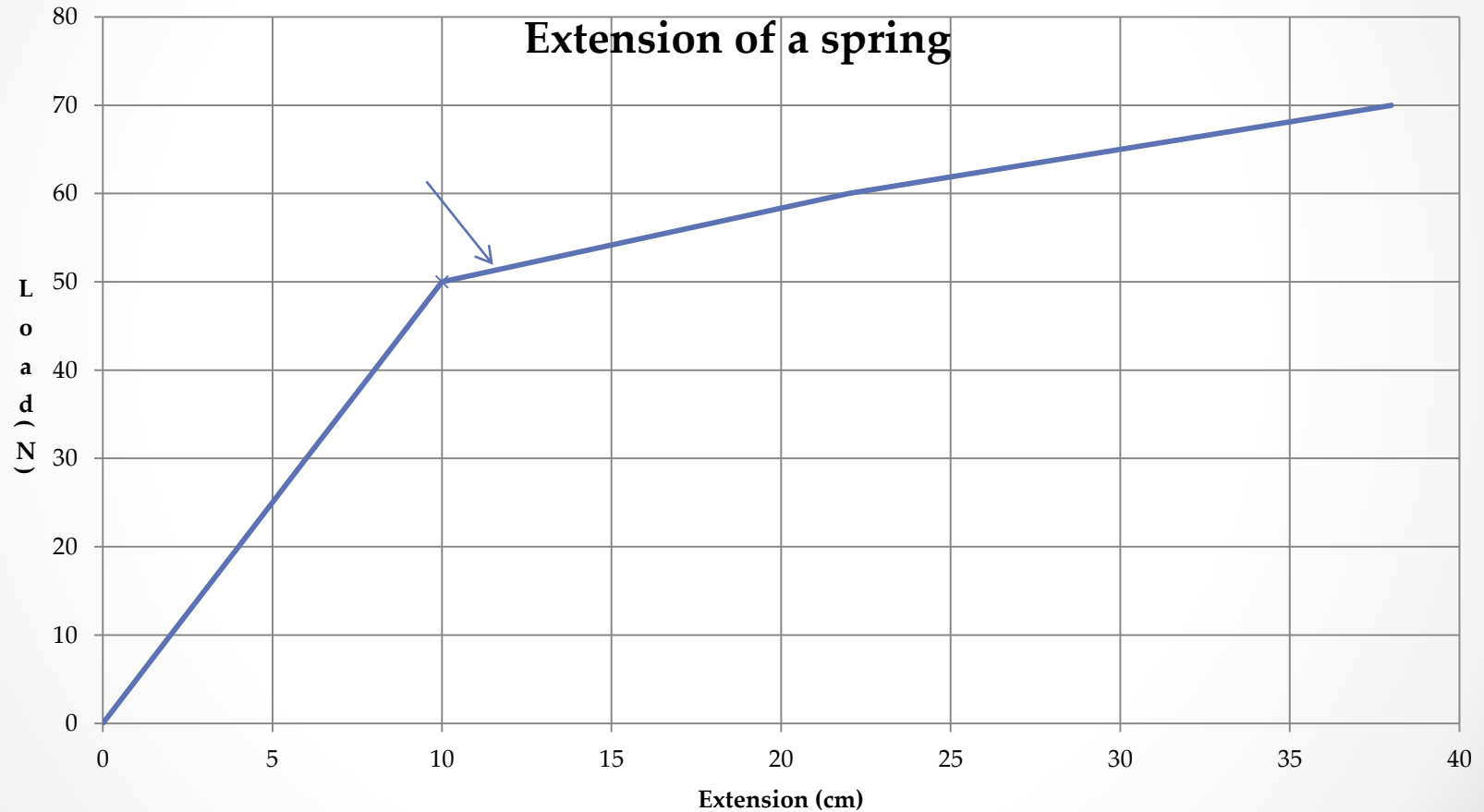
- Robert Hooke investigated springs and found that the distance a spring stretched (extension) of a spring was proportional to the force (load) stretching it. Doubling the force doubled the extension, tripling it, tripled the extension.
- However there comes a point where further loading of the spring will cause a permanent extension and the spring will not return to its original shape. This point is called the elastic limit of the spring.
- Once the elastic limit is reached increasing the load will produce greater extension than before.



Types of Deformation

- Hooke's law applies to elastic objects, that is objects that when stretched/deformed, return to their original shape after being released. Objects which remain deformed are termed plastic, e.g plasticine.

Example



The graph above shows the extension of a spring as weight is added. Why is added force causing greater extension after the point depicted by the arrow?

Equations:

- Formally stated Hooke's law is:

Extension Stretching force

$$L = k \times F$$

Where L = length extended

k = Constant of proportionality

F = stretching force

K the Constant of proportionality

- Stronger materials such as Aluminium or iron will stretch less than softer materials such as rubber or putty under the same force. So a constant of proportionality is used to relate the elastic properties of each material. The value of k is specific to each material. e.g rubber might have a constant of proportionality of 0.7 so placing one newton force on a rubber object will cause $1\text{ N} \times 0.07 = 0.07\text{ m}$ of extension, while steel might have a constant of proportionality of 0.00002 so 1 N stretching force = $1\text{ N} \times 0.00002 = 0.000002\text{ m}$ of extension.