Hook’s law

- Can be described as the relationship between the force F (unit Newton) exerted by the body and the displacement X (unit meter).
- This law studies the expansion of elastic objects such as (SPRING) and the direct proportional to the forces that produced from the spring . This force is equal to the amount of the force exerted on the spring but in the opposite direction, that means the spring always tries to remain in equilibrium.

The general formula of the law

FORCE = –SPEING * DICPLACEMENT (extension)

F (Newton) = $-K$ (n/m) • x (m)
$F = m \bullet g$

From the formula we can see the negative sign on the right side of the equation because the restoring force F (unit Newton) that produce from inside the spring is always in the opposite direction of the displacement and this force is always returning the spring to steady state(equilibrium) after removing the force that was affecting on the spring(when the spring stretched to the right, it's pulls back to the left). K is constant and this constant is specific for each spring, that means the value of this constant is change according to the type of the materials (spring) and it is measured in Newton per meter (n/m).
Extra:

$F = m \bullet g$, where

m is mass of the object (Kg), g is acceleration of the gravity(m/s^2), X (displacement) = $L - l$, L is the original length, l is the length of the spring after elongated or starched

Examples

Example 1
A = 500g mass stretches a spring 20 cm. What is the spring constant?
Answer of the example:
M = 500 g, x = 20 cm, we need the constant = K
To start solving the question we have first to write the original formula of the Hook's Low: $F = -K \bullet X$. We have the mass of the object we can get the force from it (we have to convert the unite from gram to kilogram by dividing on 1000), g = 9.81 m/s^2 or we can write it as (g = 10 m/s^2). $F = mg$ >> F= 0.5•10= 5 N. Now we have the force restoring, so we need only to compensate the force in the Hook's Low. This what we looking for: $K = -F/X$ (negative sign only means opposite direction). K = (5/0.2) = 25 N/m.

Example 2
How long will a force of 4 ×10^2 N elongated a spring with spring constant 5×10^3 N/m?
Answer of the example:
$X = -F/X$ (negative sign only means opposite direction). X = (4×10^2)/(5×10^3) = 80 m. This what we looking for.