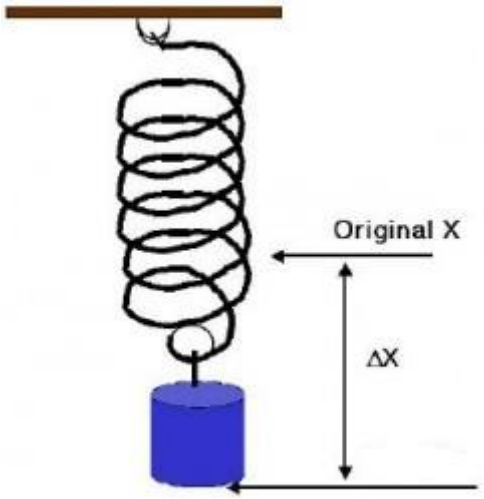
Answer on Question#39501, Physics, Mechanics

A force of 15 N stretched a spring to a total length of 30cm. An additional force of 10 N stretched the force spring 5 cm further. Find the natural length of the spring.

Solution:

Consider a force F stretches the spring so that it displaces the equilibrium position by x.



Hooke's Law is a law that shows the relationship between the forces applied to a spring and its elasticity. The relationship is best explained by the equation F=-kx. F is force applied to the spring this can be either the strain or stress that acts upon the spring. x is the displacement of the spring with negative value demonstrating that the displacement of the spring when it is stretched. K is the spring constant and details how stiff the spring is.

Since we know that a 10 N force stretches the spring 5 cm, the spring constant is

$$k = \frac{F}{x_2} = \frac{10}{0.05} = 200 \text{ N/m}.$$

Use this value of *k* to find the first extension:

$$x_1 = \frac{F}{k} = \frac{15}{200} = 0.075 \text{ m} = 7.5 \text{ cm}.$$

This caused the spring to stretch to 30 cm, so the natural length is

$$l = x - x_1 = 30 - 7.5 = 22.5 \text{ cm}.$$

Answer. l = 22.5 cm.