Answer on Question #58117, Physics / Mechanics | Relativity |

10 If a force of 80N extends a spring of natural length 8m by 0.4m what will be the length of the spring when the applied force is 100N

0.3m

0.5m

1.0m

2.0m

Solution:

First of all we need to find the spring constant (from Hooke's law):

$$F_1 = kx_1$$

F_1- applied force in the first case, x_1- extension.

$$k = \frac{F_1}{x_1} = \frac{80\text{ N}}{0.4\text{ m}} = 200\ \frac{\text{N}}{\text{m}}$$

So, the length of the spring in the second case will be greater its natural length:

$$x_2 = \frac{F_2}{k} = \frac{100\text{ N}}{200\text{ N/m}} = 0.5\text{ m}$$

And the total length in second case:

$$l = l_0 + x_2 = 8 + 0.5 = 8.5\text{ m}$$

Answer: extension = 0.5 m;

total length when the applied force is 100N = 8.5 m .

11 A wire of cross-sectional area of $6\times10^{-5}m^2$ and length 50cm stretches by 0.2mm under a load of 3000N. Calculate the Young's modulus for the wire

$8\times10^{10}Nm^{-2}$

$1.25\times10^{11}Nm^{-2}$

$2.5\times10^{11}Nm^{-2}$

$5\times10^{11}Nm^{-2}$

Solution:

Young's modulus E, is

$$E = \frac{F/A}{\Delta L/L}$$

where

E is the Young's modulus (modulus of elasticity)

F is the force exerted on an object under tension;

A is the actual cross-sectional area through which the force is applied;

ΔL is the amount by which the length of the object changes;

L is the original length of the object.

Hence,

$$E = \frac{3000/6\cdot10^{-5}}{0.2\cdot10^{-3}/0.5} = 1.25\cdot10^{11}\ \mathrm{Nm}^{-2}$$

Answer: $1.25\cdot10^{11}\ \mathrm{Nm}^{-2}$