Q1. If a force of 80N extends a spring of natural lenght 8m by 0.4m what will be the lenght of the spring when applied force is 100n.

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

$$k = \frac{F_1}{x_1}$$

F_1 – applied force in the 1-st case. x_1 – displacement.

So, the length of the spring in the 2-nd case will be greater its natural length:

$$x_2 = \frac{F_2}{k} = \frac{F_2}{\frac{F_1}{x_1}} = \frac{F_2 x_1}{F_1}$$

And the total length in 2-nd case:

$$l = l_0 + \frac{F_2 x_1}{F_1}$$

$$l = 8m + \frac{100N * 0.4m}{80N} = 8.5m$$

Answer: $l = 8.5m$