Answer on Question #37370

Physics – Mechanics | Kinematics | Dynamics

Question:

THE TENSION IN A WIRE 80CM LONG IS 5KGWT. WHAT CHANGE MUST BE DONE IN ORDER TO RAISE THE PITCH BY ONE OCTAVE ,IF THE TENSION IS INCREASED TO 7.2KGWT. ?

Solution:

Frequency:

$$f = \frac{1}{2L_1}\sqrt{\frac{F}{\rho S}},$$

where $L_1 = 0.8\ m$, F is a tension force, ρ is a wire density and S is a wire cross-section area. While we raise pitch by one octave, frequency is doubled, we can change length of a wire:

$$\frac{f_2}{f_1} = 2 = \frac{L_2}{L_1}\sqrt{\frac{F_2}{F_1}} \Rightarrow L_2 = 2L_1\sqrt{\frac{F_1}{F_2}} = 2 \cdot 0.8 \cdot \sqrt{\frac{5}{7.2}} = 1.3\ m$$

Answer:

New length should be equal $1.3\ m$.