Answer on Question #72495-Physics-Other

A wire 0.8m long of total mass 40g is stretched between two points, and a pipe 1.5m long and closed at one end is placed nearly. The speed of sound in air is 350m/sec. What should be the tension in the wire in order for the 6th harmonic of the wire to be in resonance with the 2nd overtone of the pipe?

Solution

For the wire:

$$f = \frac{n}{2L}\sqrt{\frac{T}{\mu}} = \frac{n}{2L}\sqrt{\frac{T}{\frac{m}{L}}}$$

For the pipe:

$$f = n'\frac{v}{4l}$$

In our case:

$$n = 6, n' = 3.$$

Thus,

$$\frac{6}{2(0.8)}\sqrt{\frac{T}{\frac{0.04}{0.8}}} = 3\frac{350}{4(1.5)}$$

$$3.75\sqrt{\frac{T}{0.05}} = 175$$

$$T = 0.05\left(\frac{175}{3.75}\right)^2 = 109 \ N.$$

Answer: 109 N.