	Physics 210: Unquiz08	Name: ____________

A wire has a length of 2 m and a total mass of 0.01 kg. What tension must the wire be under in order to produce a fundamental mode of f=100 Hz when (a) two fixed boundaries exist and (b) one fixed and 1 free boundary exists.

An open organ pipe has a length of 2 meters. What is the lowest mode of resonance that will happen in this pipe. You may assume the speed of sound is 343 m/s.

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A wire has a length of 2 m and a total mass of 0.01 kg. What tension must the wire be under in order to produce a fundamental mode of f=100 Hz when (a) two fixed boundaries exist and (b) one fixed and 1 free boundary exists.

2 fixed bc:

$$\frac{1}{2}\lambda_1 = L \Rightarrow \lambda_1 = 2L : f_1 \lambda_1 = v = \sqrt{\frac{T}{\mu}}$$

$$\text{Require}: f_1 = 100\,\text{Hz}. \Rightarrow (200L)^2 = \frac{T}{\mu} \Rightarrow T = (200 \times 2)^2 \mu = 400^2 \left(\frac{.01}{2}\right) = 800\,\text{N}$$

1 fixed, 1 free bc:

$$\frac{1}{4}\lambda_1 = L \Rightarrow \lambda_1 = 4L : f_1 \lambda_1 = v = \sqrt{\frac{T}{\mu}}$$

$$\text{Require}: f_1 = 100\,\text{Hz} \Rightarrow (400L)^2 = \frac{T}{\mu} \Rightarrow T = (400 \times 2)^2 \left(\frac{.01}{2}\right) = 3200\,\text{N}$$

An open organ pipe has a length of 2 meters. What is the lowest mode of resonance that will happen in this pipe? If the organ pipe was a closed organ pipe, what would be the lowest mode in this pipe? You may assume the speed of sound is 343 m/s.

$$\text{open} \Rightarrow \frac{1}{2}\lambda_1^o = L \Rightarrow \lambda_1^o = 2L : f_1^o \lambda_1^o = v \Rightarrow f_1^o = \frac{v}{\lambda_1^o} = \frac{343}{2 \times 2} = \frac{343}{4} = 85.75\,\text{Hz}$$

Remember: an open organ pipe has both ends open and

$$f_n^o = n f_1^o ; n = 1,2,3,\ldots$$

$$\text{closed} \Rightarrow \frac{1}{4}\lambda_1 = L \Rightarrow \lambda_1 = 4L : f_1^c \lambda_1^c = v \Rightarrow f_1^c = \frac{v}{\lambda_1^c} = \frac{343}{4 \times 2} = \frac{343}{8} = 42.875\,\text{Hz}$$

Remember: a closed organ pipe has 1 end open, one end closed and

$$f_n^c = n f_1^c ; n = 1,3,5,\ldots$$