	Phy210:Unquiz 08	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 two fixed boundaries exist.

Suppose a spring-mass system has a frequency of 1 Hz. How large must the spring constant be to produce this frequency with a 10 kg mass?

How long must a simple pendulum be at the surface of the earth to produce a frequency of 1 Hz?

	Phy210:Unquiz 08	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.

$$2\,\text{fixed BC}: f_1^f \lambda_1^f = v : \frac{1}{2}\lambda_1^f = L \Rightarrow \lambda_1^f = 2L : \Rightarrow f_1^f = \frac{v}{\lambda_1^f} = \frac{v}{2L}$$

$$2\,\text{free BC}: f_1^u \lambda_1^u = v : \frac{1}{4}\lambda_1^u = L \Rightarrow \lambda_1^u = 4L \Rightarrow f_1^u = \frac{v}{4L}$$

$$v = \sqrt{\frac{T}{\mu}} \Rightarrow v^2 \mu = T$$

$$\text{fixed}: [2L f_1^f]^2 = \frac{T}{\mu} \Rightarrow T = [2L f_1^f]^2 \mu = [2x2x100]^2 x0.005 = 800\,N \text{ (hang an 80 kg mass)}$$

$$\text{free}: [4L f_1^u]^2 = \frac{T}{\mu} \Rightarrow T = [4L F_1^u]^2 \mu = [4x2x100]^2 x\, 0.005 = 3200\,N \text{ (hang a 320 kg mass)}$$

Suppose a spring-mass system has a frequency of 1 Hz. How large must the spring constant be to produce this frequency with a 10 kg mass?

$$\omega = \sqrt{\frac{k}{m}} = 2\pi f \Rightarrow k = [2\pi]^2 m = 395\,N$$

How long must a simple pendulum be at the surface of the earth to produce a frequency of 1 Hz?

$$\omega = \sqrt{\frac{g}{L}} = 2\pi f \Rightarrow g = [2\pi f]^2 L \Rightarrow L = \frac{g}{[2\pi f]^2} = \frac{9.8}{[2\pi]^2} = 0.248\,m$$