Name:

14.3 Natural Frequency and Resonance

Question: How do we make and control waves?

1 Setting up the experiment

There are no questions to answer in Part 1.

2 Waves on the vibrating string

Table 1: Frequency, harmonic, and wavelength data

Harmonic #	Frequency (Hz)	Wavelength (m)	Frequency times wavelength
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

3 Analyzing the data

a. In one or two sentences, describe how the frequencies of the different harmonic patterns are related to each other.

b. Why is the word *fundamental* chosen as another name for the first harmonic?

c. Give an equation relating frequency (f) and wavelength (λ) that best describes your observations.

d. If the frequency increases by a factor of two, what happens to the wavelength?

e. Propose a meaning for the number you get by multiplying frequency and wavelength.

4 Frequency and energy

Table 2: Frequency vs. amplitude data

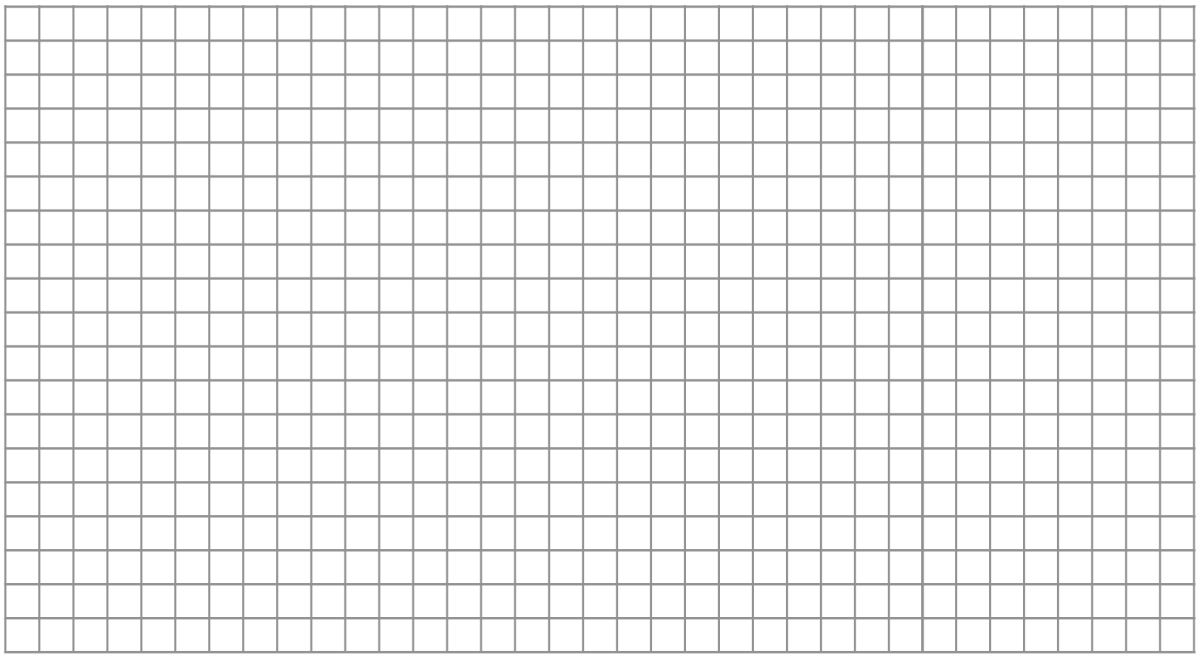
Harmonic #	Frequency (Hz)	Amplitude (cm)

5 Interpreting the data

a. Make a graph showing how the amplitude changes with frequency.

Title: _____

y label: _____



x label: _____

b. What happens to the amplitude of the waves as their frequency increases?

_____

_____

_____

_____

_____

_____

c. How does the energy of a wave depend on its frequency? For a given frequency, the amplitude of a wave depends on energy. More energy means larger amplitude. Assume the wiggler supplies the same amount of energy to each wave, independent of frequency. Use your observations of amplitude and frequency to propose a relationship between frequency and energy.

d. Suppose you had two waves of different frequencies but the same amplitude. Which has more energy, the lower-frequency wave or the higher-frequency one?