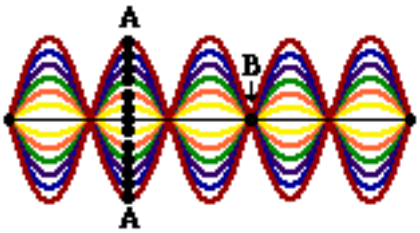
STANDING WAVE PATTERN

A standing wave pattern is a vibrational pattern created within a medium when the vibrational frequency of the source causes reflected waves from one end of the medium to interfere with incident waves from the source. This interference occurs in such a manner that specific points along the medium appear to be standing still (point B). Such points are known as nodes. There are also points along the medium that vibrate back and forth between points of large positive displacement and points of large negative displacement. These points are known as **antinodes (Point A).** Because the observed wave pattern is characterized by points that appear to be standing still, the pattern is often called a *standing wave pattern*. Such patterns are only created within the medium at specific frequencies of vibration. These frequencies are known as harmonic frequencies, or merely **harmonics**. At any frequency other than a harmonic frequency, the interference of reflected and incident waves leads to a resulting disturbance of the medium that is irregular and non-repeating.



Length of string = _____

Harmonic #	Pattern	# of Nodes	# of Antinodes	Frequency (Hz)	Wavelength (m)	Velocity (m/s)
1st						
2nd						
3rd						
4th						
5th						
6th						
nth						

For standing wave patterns, there is a clear mathematical relationship between the length of a string and the wavelength of the wave that creates the pattern. The mathematical relationship simply emerges from the inspection of the pattern and the understanding that each loop in the pattern is equivalent to one-half of a wavelength. The general equation that describes this length-wavelength relationship for any harmonic is:

$$\text{n th Harmonic:} \qquad L = \frac{n}{2}\lambda$$

Problems

1. The positions along the medium that appear to be stationary are known as _____. They are points of no displacement.

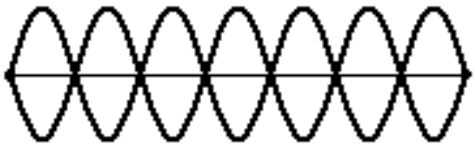
2. The positions along the medium that are undergoing rapid motion between a maximum positive and maximum negative displacement are known as _____.

3. The number of nodes in the standing wave shown in the diagram below is _____.

    a. What kind of interference is occurring at these points? _____

4. The number of antinodes in the standing wave shown in the diagram below is _____.

    a. What kind of interference is occurring at these points? _____



---

5. Suppose that a string is 1.2 meters long and vibrates in the first, second and third harmonic standing wave patterns. Determine the wavelength of the waves for each of the three patterns.

6. The string at the right is 6.0 meters long and is vibrating as the third harmonic. The string vibrates up and down with 45 complete vibrational cycles in 10 seconds. Determine the frequency, period, wavelength and speed for this wave.