Experiments with One-Dimensional Standing Waves

One person (recorder) reads the procedure out loud to all three. The other two (person #1 & #2) hold the spring at either end and carry out the procedures. All three must come up with an answer to the questions together, which the recorder will then write down.

Procedure:

A. Stretch the spring to a length of 5 meters, keeping it on the floor.

B. Each person will start to move their hand back and forth repeatedly at a different frequency. Person #1 will move their slinky very slowly. Person #2 will move their slinky very fast.

1. Describe what happens to the slinky.

2. In order to get a standing wave, can each end of the slinky have different frequencies?

C. Now each person will move their hand back and forth with the same frequency. However, person #1 will produce a small amplitude (1/2 a tile maximum), while person #2 will produce a large amplitude (1 to 1 1/2 tiles minimum).

3. Describe what happens to the slinky

4. In order to get a standing wave, can each end of the slinky have the same frequency but a different amplitude?

D. Now each person will move their hand back and forth with the same frequency and amplitude.

5. How many nodes found in this standing wave pattern?

6. Make a drawing of the standing wave pattern produced. Label the drawing. The places where the slinky is not moving back and forth are called nodal points (or nodes), and the places where the slinky is moving really far from side to side are called antinodes, or loops.

E. Now each person will slow down the frequency of their hands until another standing wave is produced.

7. How many nodes are found in this standing wave pattern?

F. Now each person will produce another standing wave by speeding up the frequency of their hands until their frequency is faster than it was originally (in step D).

8. How many nodes are found in this standing wave pattern?

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9. "As we increase the frequency of the source there are (the same/more/less) number of nodes in the standing wave pattern."

10."As we decrease the frequency of the source there are (the same/more/less) number of nodes in the standing wave pattern."

G. Another way to produce a standing wave is to have person #2 become a fixed end, and only person #1 is allowed to move their hand back and forth. Try this and have person #1 change the frequency until a standing wave pattern is produced.

11. We learned in question 4 that both ends of a slinky must have the same frequency and amplitude in order to obtain a standing wave pattern. Therefore, explain what the reflected waves and the original waves must have in common with each other when a standing wave is produced.

H. Once a standing wave pattern is produced by person #1 (person #2 remains a fixed end), have person #1 change the frequency of their hand just slightly.

12. Is a standing wave pattern produced?

13.Hypothesize: Are standing wave patterns produced at any frequency, or just at certain frequencies?

I. Check out your hypothesis by having person #1 start by moving at a very slow frequency, and then slowly increasing until a standing wave is made. Then have them slowly increase again until another standing wave is produced. Continue this pattern until the frequency is very fast.

14. Was your hypothesis correct?

Note; As a matter of fact, the textbook states on page 291 that "for a given length of rope or any other medium, only certain wavelengths are capable of maintaining the standing wave interference pattern, because the reflecting ends must be nodal points."