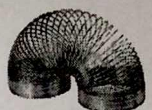
Name: Key

Wavey Lab w/ PhET Waves Simulation Minilab



Materials: Slinky String Textbook

Important Formulas: $\boxed{f = \frac{1}{T}}$ $\boxed{v = \frac{\lambda}{T}}$ $\boxed{v = \lambda f}$

/30

Part I: What's a wave?

- With a partner, stretch and hold a slinky spring to about 1.5m on the class table (do not damage the slinky)
- From one end, give the spring a flick (down the spring, at your parner) with your finger.
- 1 What do you see? The wave compresses and dilates as the energy moves through the slinky.
- What happens when both partners flick the spring, from each end, at the same time? The wave travels to the other person
- 1 What kind of wave is this? longitudinal or primary
- Stretch out the spring a little more (to about 2.0m) and send a pulse down the spring. How is this pulse different than the earlier pulse? 1 It travels faster
- Next, have one partner quickly move the end to one side and back one time.
- 1 What do you see? The wave moves side to side.
- 1 What happens when both partners move the spring to the same side at the same time? a trough forms at the center
- 1 What happens when both partners move the spring to the opposite sides at the same time? a crest forms at the center
- 1 What kind of wave is this? transverse or secondary

Part II: Reflected Waves:

- With the spring stretched between two lab partners, send a sideways pulse down the slinky (move the slinky quickly to the right)
- Observe how the pulse is reflected.
- 1 Did the pulse come back on the same side, or the opposite side? opposite
- Hold one end of the slinky between the cover and pages of your textbook (held upward).
- Send a sideways pulse down the slinky (move the slinky quickly to the right)
- Observe how the pulse is reflected away from the book
- 1 Did the pulse come back on the same side, or the opposite side? opposite
- Attach a ½-meter piece of string to the end of the slinky.
- Have on partner hold the string and another holding the other end of the slinky
- Send a sideways pulse down the slinky (move the slinky quickly to the right)
- Observe how the pulse is reflected.
- 1 Did the pulse come back on the same side, or the opposite side? Same side
- 1 Do hard materials reflect wave on the same side, or the opposite side? Opposite side

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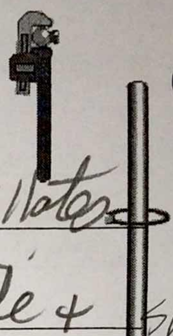
Part III: PhET Wave Simulation: PhET Simulations → Play With Sims → Sound and Waves → Wave on a String



- Set *Damping* to 10
- Give the wrench an upward jerk and observed the wave pulse that is created and reflected. Repeat.
- Set the boundary end to *Loose End* and send another pulse down the string.
- Click *Oscillate* and observe the wave created.
- 1 For fun, remove the damping and observe the wave. What happened? The ring oscillates up + down.
- Set *Dampers* to 10 again and play with the *Frequency*.
- f What effect did increasing the frequency have? More pronounced amplitude + shorter wavelength
- Check *Rulers* and enable the rulers  Rulers can be moved!
- Reset and send an oscillating wave down to a fixed boundary.
- Change the frequency of the wave until a *standing wave* is created. A *standing wave* appears to not move (left-right), but be a fixed wave that is reinforced with each new wave pulse. A standing wave will have nodes and antinodes that appear to stay the same distance from the wave source (try to get CLOSE).
  - ○ Frequency of standing wave found: ~1.56 HZ s^{-1}
  - ○ Wavelength of standing wave (peak-peak): 2.0 cm m

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wave speed:
$V=f\cdot\lambda=1.56\frac{c+c}{sec}\cdot .02m = .03\frac{m}{s}=3\frac{cm}{s}$

- Change the frequency and look for another standing wave.
  - ○ Frequency of a different standing wave: ~1.67 HZ s^{-1}
  - ○ Wavelength of standing wave (peak-peak): ~2.6cm m

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wave speed:
$V=f\cdot\lambda=1.67\frac{c+c}{sec}\cdot .026m = .04\frac{m}{s} = 4\frac{cm}{s}$

- Wave speed (m/s) is the product of wavelength (m) and frequency (s^{-1}). What is the wave speed of the two waves above?

Conclusion Questions and Calculations:

1 1. When a wave strikes a boundary that is **more** dense than the original wave medium, the wave comes back *upright* / [✓ *inverted.*]

1 2. When a wave strikes a boundary that is **less** dense than the original wave medium, the wave comes back [✓ *upright*] / *inverted.*

1 3. Two wave pulses strike each other traveling in opposite directions. If the first pulse has amplitude of +18cm and the second pulse +24 cm, what is the amplitude of the resulting interfered wave? 24cm - 18cm = cm. 6cm

1 4. After the two wave pulses pass each other, the original waves are *enlarged* / *reduced* / [✓ *unchanged.*]

1 5. A wave with peaks separated by .34 m has a wavelength of 0.34 m.

1 6. Imagine standing near the door of a dog house. If a puppy comes running out every three seconds, what would the period of the exiting puppies be? 3 s.

1 7. Considering the above, how many puppies (or fraction of a puppy) exit every second? $f=\frac{1}{T}=\frac{1}{3}=$ s^{-1}. $0.33\frac{c+c}{sec}$

1 8. If a certain wave has a new wave crest created every 2.5 seconds, the period is 2.5 s.

1 9. What is the frequency of the wave described above in #8? $f=\frac{1}{T}=\frac{1}{2.5s}=$ s^{-1}. $0.4\frac{c+c}{sec}$

1 10. Using the above formula for wave speed, how fast does a sound wave move that has a frequency of 410 s^{-1} (Hz) and a wavelength of 83 cm? ________ m/s.

$V=f\cdot\lambda=410\frac{c+c}{sec}\cdot .83m = 340\frac{m}{s}$

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