

Name _____
Regents Physics
Period _____

Date _____
Lab Activity #18 (50 pts)
Mrs. Nadworny

Partners: _____

Due Date _____

Intro to Waves

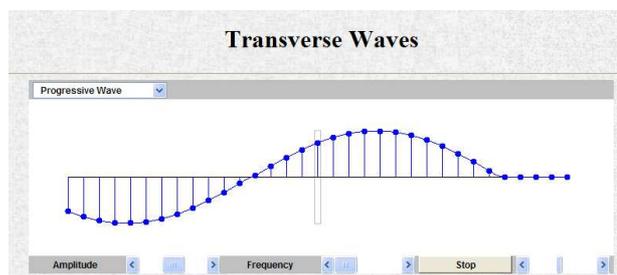
NO Lab Write-Up Required

Purpose

- To explore the properties of waves.

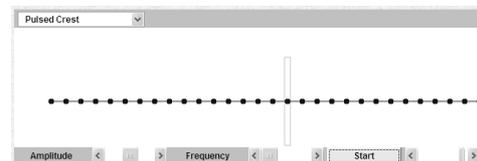
Part One: Transverse Waves

- Go to <http://surendranath.tripod.com/Applets.html>. Click on **Applet Menu** in the upper left hand corner then **Waves/Transverse Waves/Transverse Waves**. You should see the screen at right which represents a string with many particles (dots) attached to it.



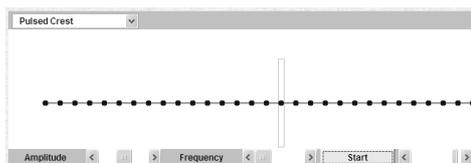
- Choose *Pulsed Crest* from the drop-down menu. Describe what you see happening on the screen. (1 pt)

- On the axes at right, sketch what you see when a pulsed crest is sent along the string. (1 pt)

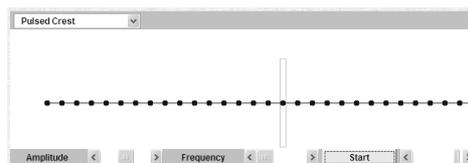


- Change the Amplitude slider bar to its maximum and its minimum values. What changes about the wave? (1 pt)

- On the axes below, sketch a pulsed crest with maximum amplitude and one with minimum amplitude. (2 pts)



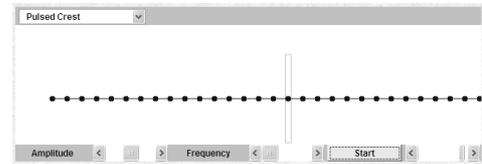
Maximum Amplitude



Minimum Amplitude

6. Choose *Pulsed Trough* from the drop-down menu. Describe what you see happening on screen. (1 pt)

7. On the axes at right, sketch what you see when a pulsed trough is sent along the string. (1 pt)



8. What is difference between a crest and a trough? (1 pt)

9. Choose *Progressive Wave* from the drop-down menu. What is the difference between a pulse, like the pulsed crests and pulsed troughs you already have made, and a wave? (1 pt)

10. Use the slider bar to change the amplitude of the wave. When you increase the amplitude of the wave, does the wave get bigger horizontally or vertically? (1 pt)

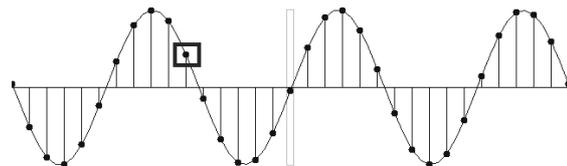
11. Use the other slider bar to change the frequency of the wave. When you increase the frequency of the wave, does the wave get longer or shorter horizontally? (1 pt)

12. Set the slider bars for amplitude and frequency to a medium value and watch the single particle (dot) on the string that is in the central grey box. Which way does this particle move – up and down vertically or left to right horizontally? (1 pt)

13. Stare at any crest as it moves across the string to see which way the wave itself is moving. Which way is it moving - up and down vertically or left to right horizontally? (1 pt)

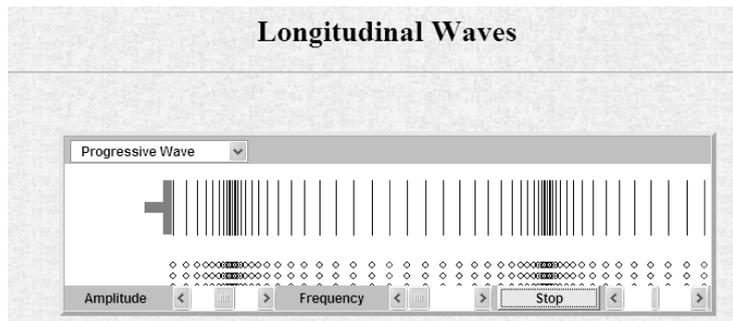
14. Compare your answers to the previous two questions. Is the motion of the particle parallel to the motion of a wave crest or perpendicular to the motion of a wave crest for this transverse wave? (1 pt)

15. Draw an arrow on the particle in the grey box on the diagram at right to show which way it is moving at the instant shown. You may need to go back to the applet and stop and start it a few times to figure this out. Also, draw an arrow to show which way the wave crests are moving. (2 pts)



Part Two: Longitudinal Waves

16. Click on **Applet Menu** in the upper left hand corner then **Waves/Longitudinal Waves/Longitudinal Waves**. You should see the screen at right. The top graphic represents a Slinky that is being compressed. Each vertical line represents one coil of the Slinky. The bottom graphic represents molecules of air (dots) that are being compressed.



17. Choose *Pulsed Compression* from the drop-down menu. As the compression moves along, are the Slinky coils (air molecules) squished closer together or spread far apart? (1 pt)

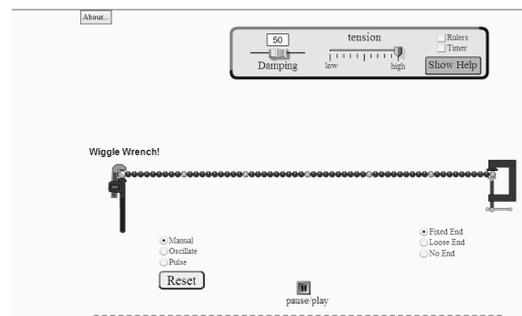
18. Choose *Progressive Wave* from the drop-down menu. Watch as the Slinky and the air molecules are alternately compressed and expanded. Which way is this wave of compressions and expansions moving – up and down vertically or left to right horizontally? (1 pt)

19. Watch a single blue coil or a single blue molecule as the wave travels. Which way does this single coil/molecule move – up and down vertically or left side to side horizontally? (1 pt)

20. Compare your answers to the previous two questions. Is the motion of the particle parallel to the motion of the wave or perpendicular to the motion of the wave for this longitudinal wave? (1 pt)

Part Three: Wave on a String

21. Go to <http://phet.colorado.edu>. Click on **Play with Sims** or **How to Run Simulations/On Line** to get to the list of simulations. From the menu choose **Physics** and then click on the **Wave on a String** simulation. Click on **Run Now!** to open the simulation. You should see the screen at right.



22. Click *No End*, *Pulse*, and set *Damping* to 0, *Pulse Width* to 50, and *Tension* to the middle of the slider bar.

23. Set the *Amplitude* to its highest value and click *PULSE* to get the pulse moving on the string. To determine the speed of this pulse you will need to measure the distance it travels and the time it takes. Click on *Rulers* and *Timer*. Measure the distance and time and record your data below. (4 pts)

Distance: _____

Time: _____

24. Calculate the speed of the pulse. Show your calculation in the space below. (3 pts)
25. Now move the amplitude bar back and forth from high to low and some in between values and send several pulses down the string. See how long it takes each pulse to get to the end of the string. (HINT: Send a few down right after each other and see who wins the race.) Compare the speed of a high amplitude pulse with the speed of a low amplitude pulse – which is faster or are they same? (1 pt)
26. Set *Amplitude* to 100 and move the *Pulse Width* slider bar back and forth between its maximum and minimum values. Send down pulses of different widths to see how fast they are. (HINT: Send a few down right after each other and see who wins the race.) Compare the speed of a pulse with a small width with the speed of a pulse with a large width – which is faster or are they same? (1 pt)
27. Set the *Amplitude* to 100 and the *Pulse Width* to 50. Start sending some pulses down the string but while they are moving, slide the *Tension* bar back and forth to see what effect this has on the speed of the pulses. Compare the speed of a low tension pulse with the speed of a high tension pulse – which is faster or are they the same? (1 pt)
28. Set the *Tension* to its highest value, set *Amplitude* to 100, *Frequency* to 50 and click on *Oscillate*. Click on *Pause*. The amplitude is measured from the middle dashed yellow line (the equilibrium position) to the top of a crest or to the bottom of a trough (but **not** from the crest to the trough). Use a ruler to measure the amplitude of the wave. Record your measurement for the amplitude of this wave. (2 pts)
29. The wavelength of a wave is the distance between any two consecutive crests (or troughs). Use a ruler to measure the wavelength of the wave. Record your measurement for the wavelength of this wave. (2 pts)
30. Click on *Play*. Increase and decrease the amplitude to see what effect it has on the wave. When you increase the amplitude of the wave, does the wave get bigger horizontally or vertically? (1 pt)
31. As you increase the amplitude of the wave, does the wavelength increase, decrease, or remain the same? You may need to pause and use the ruler again to decide. (1 pt)

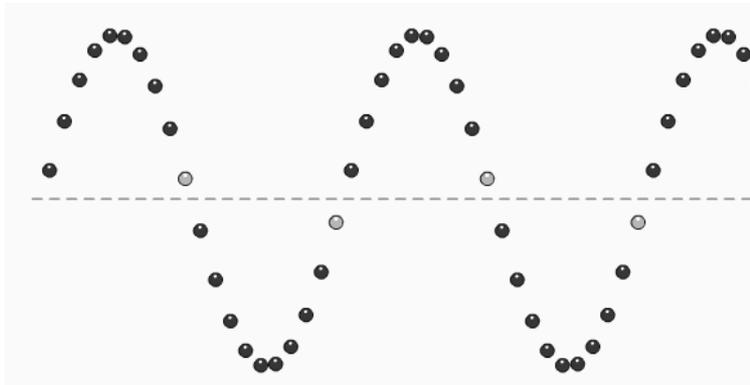
32. Set the Amplitude to 100. Increase and decrease the frequency to see what effect it has on the wave. When you increase the frequency of the wave, does the wave generator (the green dot on the end of the pole attached to the circle) oscillate (vibrate) up and down faster or slower? (1 pt)
33. When you increase the frequency of the wave, does the wave get longer or shorter horizontally? (1 pt)
34. As you increase the frequency of the wave, does the wavelength get longer or shorter or remain the same? You may need to pause and use a ruler to decide. (1 pt)

Conclusion Questions

35. In which type of wave do the particles move perpendicular to the direction of motion of the wave? (1 pt)
36. In which type of wave do the particles move parallel to the direction of motion of the wave? (1 pt)
37. Does the speed of a wave measure how fast the wave moves horizontally or how fast the particles move vertically? (1 pt)
38. Which of the following factor(s), if any, affect the speed of a wave: amplitude, frequency, wavelength, tension? (2 pts)
39. Does increasing the amplitude of a wave make the wave bigger vertically or horizontally? (1 pt)
40. Does increasing the frequency of a wave make the wave bigger or smaller horizontally? (1 pt)
41. Does increasing the frequency of a wave make the wavelength bigger or smaller? (1 pt)

42. On the diagram below, draw an arrow between two points to indicate how you can measure the amplitude. (1 pt)

43. On the diagram below, draw an arrow between two points to indicate how you can measure the wavelength. (1 pt)



44. In the space below or on another sheet of paper, write a well-written conclusion paragraph about some concepts you learned in this lab. (5 pts)