**Waves on a String PhET Lab 1 Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_ Date \_\_\_\_\_\_\_\_**

**Physics B DAL 3/19/13**

# Go to Google, search for “phet waves string”, and click on the first link. Then click the Run Now button.

***Please answer all questions in grammatically correct sentences.***

1) Open the “Wave on a String” simulation. With your mouse, wiggle the first bead to send waves down the string. Note how they reflect back. Adjust Tension to see how High and Low tension affect the speed of the waves.

2) **Set the Tension to High**. **Select Oscillate** to make a machine create the waves. **Leave these buttons at those settings** until directed to change them!

3) Select No End to let the waves travel out the door (meaning they never reflect back).

4) Increase and decrease the Damping slider.

**A) How do the waves change as damping is increased?**

5) **Set the damping to zero** and the **amplitude to 100%**. This “amplitude” is not actually a distance, it is just the maximum the computer will make. Set the amplitude to 0, 40, 60, and 100. (You can also just type the number into the box instead of using the slider, but do not use the backspace key!)

## B) Use the onscreen ruler to measure the amplitude of the wave at two settings:

## Set amplitude to 100%. Run the wave for a few seconds. Then use the vertical ruler to measure from the midline (equilibrium) to the top of the highest circle on the crest.

## Record amplitude in cm:\_\_\_\_\_\_

## Measure vertical distance from equilibrium to trough: Record amplitude in cm:\_\_\_\_\_\_

1. **Now change the amplitude to 40%. Measure and record the new amplitude: \_\_\_\_\_\_\_\_**

6) Adjust the frequency slider.

**C) As frequency is increased what happens to the rate at which waves are made?**

**D) What does increasing the frequency do to the wavelength? What does it do to the amplitude?**

Now, practice measuring the time for a certain number of cycles.

Set the frequency to **15%**.

Time 8 cycles. Write down your time. \_\_\_\_\_\_\_\_\_\_\_

Was it around 14.8 seconds? If so, great!

If you got a time of around 12.9 seconds, you are very precise with the timer, but counted the wrong number of cycles. Remember to say, "Ready, set, go, 1, 2, 3... up to the number of cycles you want. Practice timing until you get close to 14.8 seconds for 8 cycles.

7) Keeping the amplitude constant at 50, adjust the frequency slider to 25, 50, and 70. Using the onscreen timer, measure the amount of time it takes to complete 15 full cycles at each frequency setting. (It will help to watch the wave maker and give yourself a countdown, “wave, wave, wave, ready, set, GO.”

**E) f= 25%: 15 waves take \_\_\_\_\_ seconds**

**f= 50%: 15 waves take \_\_\_\_\_ seconds**

**f= 70%: 15 waves take \_\_\_\_\_ seconds**

8) At each setting, use the numbers from **(E)** to calculate the period of the wave. This is the amount of time it takes to make each wave, or the seconds per wave. (seconds divided by waves.)

**F) f= 25%: Period = \_\_\_\_\_**

**f= 50%: Period = \_\_\_\_\_**

**f= 70%: Period = \_\_\_\_\_**

**G) As frequency is increased, what happens to the time between each wave?**

9) The “frequency” slider just tells the computer to go slow or fast. It does not match the actual frequency in Hertz. Use the numbers from **(E)** to calculate the actual frequency in Hertz, which is the number of waves per second.

**H) At screen setting of 25%, Actual frequency = \_\_\_\_\_\_\_ Hz**

**At screen setting of 50%, Actual frequency = \_\_\_\_\_\_\_ Hz**

**At screen setting of 70%, Actual frequency = \_\_\_\_\_\_\_ Hz**

10) At the same frequency settings you used in **(E)**, measure the wavelength using the onscreen ruler. You can measure from crest to crest, trough to trough, or any part to the next matching part. You will need to run the animation for a few seconds at each new frequency, and pause the animation to measure the wavelength.

**I) f=25%:** λ **= \_\_\_\_\_\_\_ cm f=50%:** λ **= \_\_\_\_\_\_\_ cm f=70%:** λ **= \_\_\_\_\_\_\_ cm**

**= \_\_\_\_\_\_\_\_ m = \_\_\_\_\_\_\_\_ m = \_\_\_\_\_\_\_\_ m**

(remember this is just like converting from cents to dollars – so 92 cm would equal 0.92 m)

11) Calculate the velocity of the waves, for each ACTUAL frequency (using the data from **(H) and (I)**.

(v = λf) VELOCITY = WAVELENGTH x ACTUAL FREQUENCY

m/s = meters x waves

wave second

**J) f= 25%: v= \_\_\_\_\_ m/s f= 50% v = \_\_\_\_\_ m/s f= 70%: v = \_\_\_\_\_ m/s**

NOTE: Since the waves are traveling through the same medium (the same string), they should all have the same speed. Check your math!

**K) Explain what changed and what stayed the same as the frequency was increased.**

**\*L) Assuming your velocities were close to each other, use the average velocity to calculate what frequency is needed to produce a wavelength of 46cm. Type in that frequency to see if you are correct.**

**\*\* Extra Credit \*\*** : Reduce the tension from “High” to “8 Tenths” and calculate the velocity at three different frequencies **Record your data and calculations on a separate sheet, and attach it to this one.**  In one or two sentences, explain what happens velocity as tension is increased.