Waves on a String PhET Lab 1 **Name_____ Hour ____ Date _____**
Physics DAL 1/31/17

Go to Google, search for "phet waves string", and click on the first link. Run the app.

Please answer all questions in grammatically correct sentences.

1) Open the "Wave on a String" simulation. With your mouse, wiggle the wrench 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) Set the Damping to zero. Gradually increase the damping and see what happens.

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

5) **Set the damping to zero**.

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

i. **Set amplitude to Maximum. Run the wave for a few seconds and then pause it. Then move the vertical ruler to measure from the midline (equilibrium) to the top of the highest point on the crest.**

Record amplitude in cm:_____

ii. **Measure vertical distance from equilibrium to bottom of trough:**

Record amplitude in cm:_____

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 0.75 HERTZ.
TIME 10 CYCLES. WRITE DOWN YOUR TIME. _____

WAS IT AROUND 13.3 SECONDS? IF SO, GREAT!
IF YOU GOT A TIME OF AROUND 12.0 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 13.3 SECONDS FOR 10 CYCLES.

7) Keeping the amplitude constant at 1.25, adjust the frequency slider to .50 Hz, 1.00 Hz, and 2.00 Hz. 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= .50 Hz: 15 waves take _____ seconds**

f= 1.00 Hz 15 waves take _____ seconds

f= 2.00 Hz 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= 0.50 Hz: Period = _____ seconds**

f= 1.00 Hz Period = _____ s

f= 2.00 Hz Period = _____ s

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

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.

H) ***f*** **= 0.50 Hz:** λ = _____ **cm** ***f*** **= 1.00 Hz:** λ = _____ **cm** ***f*** **= 2.00 Hz:** 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)**.

($v = \lambda f$) VELOCITY = WAVELENGTH x FREQUENCY

$$m/s = \frac{\text{meters}}{\text{wave}} \times \frac{\text{waves}}{\text{second}}$$

I) ***f*** **= .50 Hz: v= _____ m/s** ***f*** **= 1.00 Hz: v = _____ m/s** ***f*** **= 2.00 Hz: 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!

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