Waves on a String: Speed Waves Lab

Name:	Period:
Date:	Assignment #:

Part A: Method for determining the speed of a wave

Learning Objective

Develop an experimental method to determine the speed of a wave on a string.

I. Initial Ideas: Answer the following questions in your notebook.

1) What is a wave? Define "wave" in your own words.

2) What types of waves exist? How are these waves made? How are these waves similar and different?

3) Recall the word "speed". What is speed? What equation(s) do we have for calculating speed? How can we measure the speed of a moving object?

4) We often talk about the *speed of sound* and the *speed of light*. Sound and light are two different types of waves. What do you think we mean when we talk about the "speed" of a wave?

II. Explore the PhET Sim: Waves on a String

5) Open the sim **bit.ly/3aPUWYT**

6) Set up the sim:
   a) Select "no end"
   b) Adjust "Dampening" to zero

7) You will have 10 minutes to explore the sim. You have two challenges for your exploration:
   a) Explore the controls and determine what types of variables you can modify.
   b) Develop a basic method for determining the speed of a wave on a string. Write/sketch a brief description of your method below.

Part B: Variables Affecting the Speed of a Wave

Learning Objective:

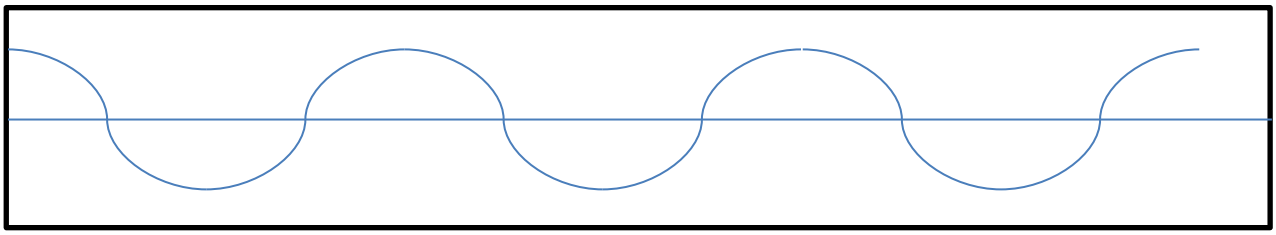
8) Write a prediction about the relationship between one of the wave variables & its effect on wave speed.

9) Design an experiment to test wave speed hypothesis and the relationships between the wave variables.

10) Make claims about the relationships (direct, inverse, none) between wave variables, using evidence to support claims, and explaining the relationship between the claim and evidence.

Anatomy of a Wave & Key Vocabulary

11) Label *amplitude* and *wavelength* on the sketch below.



12) Define and describe the following terms

a) Amplitude

b) Wavelength

c) Frequency

d) Period

e) Tension

II. Investigation 1: How can you increase the speed of a wave?

13) Brainstorm a list of variables that you think might change the speed of a wave.

14) Select one of your variables from Step 13), and write a statement that makes a claim about how changing your chosen variable will affect the speed and explains your reasoning using the format of *"If I increase…then…because…"*. **Get a stamp on this before you continue.**

15) Test your prediction and record your observations using the following table:

Action *What did you do?*	**What changed?**	**How did it change? Record your observations.**	**Type of Relationship**
			☐ Direct ☐ Inverse ☐ None

16) Make a claim about whether or not your prediction was correct, using evidence from your lab to support your answer and explaining your reasoning. Be prepared to share your results with the class.

III. Investigation 2: How are other wave variables related?

17) Investigate one other relationship between variables and record your observations in the table below

Action *What did you do?*	**What changed?**	**How did it change? Record your observations.**	**Type of Relationship**
			☐ Direct ☐ Inverse ☐ None

18) Make claims about the relationship between two of the variables, providing evidence from your investigations to support your claim, and reasoning to connect your claim and evidence.

Part C: New Equation for the Speed of a Wave

Learning Objective

Develop an equation that demonstrates the relationships between wavelength, frequency & speed of a wave

19) Identify the wave variables that we measured to indicate length and time during the lab, then substitute these values into the speed equation to develop an equation for the speed of a wave. Compare your equation with your neighbor table group.

Speed Quantity	**Length Quantity**	**Time Quantity**	**Speed Equation**
Speed of a Moving Object	distance (d)	time (t)	$s = \frac{d}{t}$
Speed of a Wave (your equation)			$s =$
Speed of a Wave (neighbor's equation)			$s =$

20) Frequency and wavelength are both in your equation for speed. Why is it that, when you changed the frequency, you did not change the speed of the wave?

21) The only variable we found that affects the speed of a wave on a string was the tension of the string. How does this relate to how a musician tunes a stringed instrument?