Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_

Properties of Waves Virtual Lab

**Simulation A:**

Go to Google Classroom and click on the link for [Wave on a String](https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html).

In the top left box, choose “**Oscillate**.” In the top right box, choose “**No End**.” In the box at the bottom, change Damping to “**None**.” (Slow motion might be helpful.)

1. Is this a transverse or longitudinal wave?
	1. How do you know?
2. In which direction is the wave traveling compared to the disturbance, perpendicular or parallel?
3. Spend a few minutes exploring the amplitude of the wave by increasing and/or decreasing it.

Describe **amplitude** in your own words.

1. Explore how **amplitude** affects **wavelength**. Use the following settings and measure the approximate wavelength. Pause the simulation after a few waves pass and use the ruler. (Grab the ruler and drag it to measure.)

|  |  |  |
| --- | --- | --- |
| Amplitude | Frequency | Wavelength |
| 0.75 cm | 1.60 Hz |  |
| 0.90 cm | 1.60 Hz |  |
| 1.05 cm | 1.60 Hz |  |
| 1.20 cm | 1.60 Hz |  |

1. When amplitude increases, wavelength \_\_\_\_\_\_\_\_\_.
	1. increases
	2. decreases
	3. stays the same.
2. This means that the relationship between amplitude and wavelength is \_\_\_\_\_\_\_\_
	1. direct
	2. inverse
	3. not related
3. When amplitude increases, energy \_\_\_\_\_\_
	1. increases
	2. decreases
	3. stays the same.
4. Return the amplitude to 0.75 cm. Then, spend a few minutes exploring the frequency of the wave by increasing and/or decreasing it. Describe **frequency** in your own words.
5. Explore how **frequency** affects **wavelength**. Use the following settings and measure the approximate wavelength. Pause the simulation after a few waves pass and use the ruler.

|  |  |  |
| --- | --- | --- |
| Amplitude | Frequency | Wavelength |
| 0.75 cm | 1.40 Hz |  |
| 0.75 cm | 1.80 Hz |  |
| 0.75 cm | 2.10 Hz |  |
| 0.75 cm | 2.40 Hz |  |

1. When frequency increases, wavelength \_\_\_\_\_\_\_.
	1. increases
	2. decreases
	3. stays the same.
2. This means that the relationship between frequency and wavelength is:
	1. direct
	2. inverse
	3. not related
3. Return the frequency to 1.50 Hz and the amplitude to 0.75 cm. Now focus your eyes on one bead of the string. (Slow motion may help.) **Describe the motion of the bead.**
4. Do waves transfer matter? **Use evidence from the simulation to support your answer.**
5. Draw a transverse wave. Label the crest, trough, amplitude, and wavelength.



**Simulation B:**

Go back to Google Classroom and click on the link for [Waves Intro](https://phet.colorado.edu/sims/html/waves-intro/latest/waves-intro_en.html). Choose **Sound**. Do not change any of the settings.

1. Push the green button to start the waves. Is this a transverse or longitudinal wave?
	1. How do you know?



1. Change the setting on the right to “particles.” **In which direction is the wave traveling compared to the disturbance, perpendicular or parallel?** (Switching to the box on the bottom left that sends out one pulse might help if you are unsure. Just be sure to switch it back.)
2. Sound travels better in solids than in gases. **Why? Use your experience with the simulation to help you to explain.**



1. Click the orange reset button. Check the box on the right to “**play tone**.” Play with changing the **amplitude**.
	1. How does the sound change when amplitude changes?
	2. Changes in amplitude affect (choose 2):
		1. volume
		2. pitch
		3. energy
		4. wavelength



1. Click the orange reset button. Check the box on the right to “**play tone**.” Play with changing the **frequency.**
	1. How does the sound change when frequency changes?
	2. Changes in frequency affect (choose 2):
		1. volume
		2. pitch
		3. energy
		4. wavelength
2. Draw a sound wave. Label compression, rarefaction, and wavelength.



Change the simulation to **water** (on the bottom of the screen). Change the view to “**side view**.” Click the green button to start the water.

1. In which direction is the wave traveling compared to the disturbance (water drops), perpendicular or parallel? 
2. Are water waves transverse or longitudinal?
	1. How do you know?
3. Play with changes in frequency. Changing frequency affects
	1. wavelength
	2. energy
	3. amplitude
4. Play with changes in amplitude. Changing amplitude affects:
	1. wavelength
	2. energy
	3. frequency

Change the simulation to light (on the bottom of the screen). Click the green button to turn on the light.

1. Play with changes in amplitude. Changing **amplitude** affects (choose 2):
	1. wavelength
	2. energy
	3. brightness
	4. Color
2. Reset the simulation. Check the box for **graph**.
	1. What happens to the **light** when amplitude is at max?
	2. What happens to the **graph** when amplitude is at max?
	3. What happens to the **light** when amplitude is at zero?
	4. What happens to the **graph** when amplitude is at zero?
3. Set the amplitude to max. Play with frequency. Changing **frequency** changes (choose 2):
	1. wavelength
	2. energy
	3. brightness
	4. Color
4. Adjust the frequency to high (right) and low (left).
	1. What happens to the **light** when frequency is high?
	2. What happens to the **graph** when frequency is high?
	3. What happens to the **light** when frequency is low?
	4. What happens to the **graph** when frequency is low?
5. Based on your observations, answer the following. You may want to pause the simulation and use the measuring tape.
	1. When frequency increases, wavelength \_\_\_\_\_\_\_.
		1. increases
		2. decreases
		3. stays the same.
	2. This means that the relationship between frequency and wavelength is:
		1. direct
		2. inverse
		3. not related