Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Interference and Diffraction PhET Lab**



**Introduction:** When waves momentarily overlap, they temporarily add their amplitudes without affecting the original waves. This **interference** can be seen when two wave sources are used and their overlaps viewed. You will view this phenomenon in parts I and II of this lab. When a wave strikes a barrier, some of the energy will bend around the barrier and spread out. This is known as **diffraction**. In part three of the lab, you will view the results of splitting a single wave source with a narrow slit, and then observe as the new waves created at the slit interfere. The interference pattern that results is symmetrical. The bands of constructive interference are referred to as *maxima* (single=*maximum*).

**Procedure:** *Go to https://connexions.github.io/simulations/wave-interference/*

**Part I: Water Waves Analogy** *take some time to familiarize yourself with the simulation’s controls*

* Observe the water waves created in the faucet analogy. The darker areas are areas of higher amplitude.
* Adjust frequency and amplitude and observe the characteristics of the waves.
* Comment on the waves as amplitude is changed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Comment on the waves as frequency is changed: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Now add a second drip to the simulation. Observe the interference of the two water waves.
* Comment on the interference of the two waves: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part II: Light Wave Interference** *Please note the waves take some time to settle out and show good graphs-be patient*

* Change the simulation to show extremely-slowed light emission from the single-light source. ****
* Observe the wavelength of red light and then move the wavelength slider to cyan or blue light.
* Comment on the actual wavelength of blue light versus red light.
* Add the screen to show how the light would look if viewed on a screen 
* Add a second light source and view the interfering waves and the pattern they create on the screen.
* Showing the *Intensity Graph* quantifies the energy that is incident upon the screen.

What effect does amplitude have on the maxima separation in the interference pattern?

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What effect does source spacing have on the maxima separation in the interference pattern?

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What effect does wavelength have on the maxima separation in the interference pattern?

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**Part III: Light Wave Diffraction**

* Reset the light waves simulation and show the screen and graph.
* Add a 2-slit barrier to the simulation and allow the graphs to be formed.
* Observe the interference pattern created when the characteristics of the simulation are adjusted.
* You may have to adjust amplitude when other elements of the simulation are changed to observe the graph.

What effect does a larger amplitude have on the maxima separation in the interference pattern?

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What effect does a shorter wavelength have on the maxima separation in the interference pattern?

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What effect does a larger barrier-to-screen distance have on the maxima separation in the interference pattern?

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What effect does a smaller slit width have on the maxima separation in the interference pattern?

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What effect does a smaller slit separation have on the maxima separation in the interference pattern?

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**Conclusion Questions and Calculations:** *You may check your approximate answers in the simulation*

1. Why would a helicopter passing over or near a TV antenna cause a garbled or unusable TV signal?

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1. The simulation uses monochromatic light. If white light was used instead, what would be seen on the screen?

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1. As wavelength of the incident light increases (blue🡪red) the maxima separation *increases / decreases*.