LAB 33, DIFFRACTION AND INTERFERENCE

Name _____ Period_____

According to Huygens' principle, every point on a light wave front may be considered a new source of light. In general, however, all parts of each new wavelet are canceled by destructive interference except for those that are moving in the same direction as the original wave front. Thus the whole wave front appears to move as a unit.

If a series of wave fronts strike a barrier having two narrow slit openings, as shown in Figure 33-1, each opening acts as a new source, and new wavelets travel out in phase with each other. In certain regions they will reinforce each other, producing bright bands. In alternate regions they will interfere producing dark bands. White light, since it is a polychromatic source, yields indistinct bands.

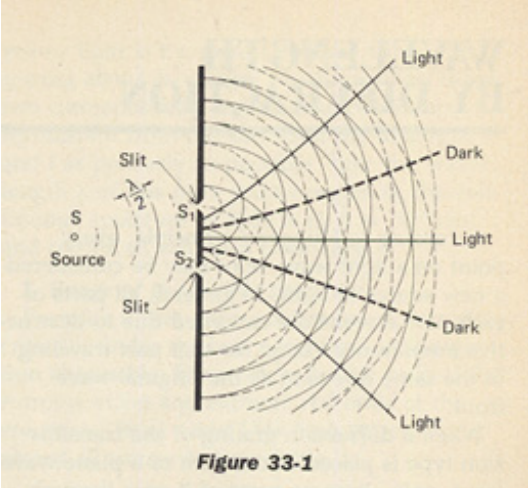

Figure 33-1

OBJECTIVE:

After completing this experiment, you should be able to interpret diffraction and interference patterns in terms of the wave nature of light.

PROCEDURE:

1. Diffraction:

Set up a line source of light in a vertical position. Hold a slit close to your eye so that it is oriented vertically (parallel to the line source) and view the line source through it from a distance of several meters. Across the lab is great (10 meters away). Repeat using other single slits of different widths. Make sketches of the best diffraction patterns you observe through a narrow slit and a wide slit. Briefly describe the difference between the two patterns. Observation.

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2. Interference:

Observe the line source of light through double slits. Compare the pattern seen through pairs of slits of different spacing. Sketch on the back your best pattern observed through very closely spaced slits and your best pattern observed through the more widely spaced slits.

Observe a single-slit pattern again and carefully note the similarities and differences. Observation.

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Examine a double-slit pattern carefully to see if color fringes are evident. Suggest an explanation for any color effects observed. Place a color filter in front of the white-light source. Record the result. Observation.

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Change to another color. Again record the result. Observation.

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Select two color filters from the end regions of the spectrum, red and blue for example, and observe the interference pattern with first one and then the other in front of the line source of light. Describe the changes you observe. Observation.

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Cover half of the source with the red filter and the other half with the blue filter. From the pattern you observe, estimate the ratio of the wavelength of blue light to the wavelength of red light. Observation.

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Now use the Diffraction Grating and make observations:

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QUESTIONS:

1. How does the diffraction pattern through a single slit change as a slit is made narrower?

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2. How do the interference patterns compare when formed by two narrow slits very closely spaced and by two narrow slits more widely spaced?

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3. How do the interference patterns of red light and blue light compare when formed by the same pair of slits?

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CRITIQUE: