Teacher Reference

Introduction:
This experiment introduces Young’s Double Slit experiment. A wave striking a narrow opening behaves something like a point source, expanding thereafter in a circular shape. Two such openings will produce a diffraction pattern, as the path length difference from the two openings produce constructive and destructive interference in the combined waves.

Experimental goals:
After completing this experiment, students will be able to describe Young’s double slit experiment, the diffraction of straight waves as they pass through openings in barriers, and the effect of frequency on the double-slit diffraction pattern.

Equipment:
The basic ripple tank setup, ruler, dry-erase marker, protractor.
For setup instructions, see the Basic Setup handout.

Keywords:
Diffraction, Constructive interference, Destructive interference.

Notes:
Students may have difficulty in using the hand stroboscopes. Most of these difficulties will be in turning the stroboscopes too fast. One revolution per second is a good starting point.
The initial setup is very important to successful completion of this lab. If the waves aren’t straight to start with, it will be very difficult to get good angles in the lab.

Answers:

6: The images are straight before the waves strike the barrier. As the waves pass through the openings, they will form circular wavefronts.
8: The drawings should show the regions of prominent waves and regions of smoothness fanning out from the barrier between the two slits.
9: The smooth areas result when the crest of a wave arriving from one slit arrives at a location simultaneously with the trough of a wave from the other slit. The two waves cancel each other.
13: Answers will vary, but should be around 30°.
16: Answers will vary, but should be around 15°.
17: Decreasing the wavelength decreased the angle of diffraction.
The path difference from each slit at any point along the first order maximum will be one wavelength. The student’s sketch should show a line going from each slit to a point on the first maximum. The shorter line will be L units long. The longer line will be L+λ units long.