

Physics 132

Section MV

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Wave Optics

Abstract: In this experiment we tested how illuminating light through a series of different slits could diffract light. We examined the patterns made by the light to see how it diffracts. When light is sent through a double slit it makes bands of dark bright spots. When it is sent through a single slit it makes it gets diffracted off the straight edge of the slit. The different patterns were able to tell us when the light was in phase and when it was out of phase.

Questions:

1. Wavelength is the distance that it takes for the wave to go from crest to crest. The frequency is the measure of the number of periods that occur in a set amount of time. When frequency is high the wavelengths are short, and when frequency is low wavelengths are longer. The relationship is shown by the equation $\lambda f = c$.
2. The pattern observed from diffraction around a straight edge was that it spread out after it bounced off the edge. We saw this when the light was shined through a slit. I think that light is a wave. It moves in a wavelike pattern and expresses wavelike patterns when it comes into contact with other objects.
3. When the light was illuminated through the straight edge/opaque disk a very bright spot shown on the center of the screen and there were duller

spots next to it. This happened because the most concentrated wavelengths are in the center of the screen.

4. We used laser light so the light would be concentrated into a certain area so we could conduct experiments with it. It also made it easier to see, because all the light around us is white light so it would be challenging to distinguish between the two.

5.
a. If the wavelength increased then the width of the central maxima would also increase.
b. If the slit width a decreased then the central maxima would still increase.

6. The blue light would be diffracted to the distance $y = 15.1\text{cm}$. I figured this out by first looking at the numbers given for red. The equation I set up was $y/l = m(\text{wavelength})/d$. Filling in the numbers given, $.221/1 = m(656\text{E-}9)/(3.33\text{E-}4) = 111.17$. Then to find the blue light you used the equation, $y/1 = 111.17(452\text{E-}9)/(3.33\text{E-}4) = 15.1$. This distance of light would be smaller, so it would be closer to the center.

7. The bright spots will get closer together because the wavelength is going to get smaller because the refractive index is higher. This means that each wave is going to travel farther with before it hits another wave, which makes the interference patterns happen closer together because the diffraction angle is much smaller.

8. $Y = M\text{wavelength}/D$ is the formula you use to solve it this questions. $Y = 2(500\text{E-}9)/(2)/.5$ this equals $y = 4\text{E-}6$.

Conclusion: In conclusion I think that the slit tests were a very accurate way to measure how light is diffracted. We were able to see the different diffraction patterns when light was shown through different slits. There was room for human

error in this experiment because some of the measurements we were making were extremely small and made it difficult to accurately make measurements. By using our data we were able to plug the measurement into a formula and find the wavelength of the light that we were testing with.