**Wave Character of Light**

- When _______ interacts with object several _______ it's ________, it acts like a ________
- When _______ interacts with _______ objects, it acts like a ________
- When light hits _______ from a ________, it ________ down
  - _______ stays the same
  - \( c = f \lambda \)
  - \( v = \frac{c}{n} = f \frac{\lambda}{n} \)
  - \( \lambda_n = \frac{\lambda}{n} \)
  - Where \( \lambda_n = \) wavelength in medium, \( n = \) index of refraction

**Huygens' Principle**

- Every point on a _______ front acts as a _______ of tiny _______ that move forward with the same _______ as the ________; the wave _______ at a later instant is the _______ to the wavelets.

**Young's Double Slit Experiment**

- Thomas Young showed that two overlapping _______ waves _______ and was able to calculate _______.
- Bright fringe where \( \ell_1 - \ell_2 = m\lambda \)
- Dark fringe where \( \ell_1 - \ell_2 = (m + \frac{1}{2})\lambda \)
- Brightness of fringes _______
  - Center fringe the ________ and ________ on either side

  (a) Rays from slits \( S_1 \) and \( S_2 \), which make approximately the same _______ \( \theta \) with the horizontal, strike a distant _______ at the _______ spot.
  (b) The difference in the _______ lengths of the _______ rays is \( \Delta\ell = d \sin \theta \).
  (c) The angle \( \theta \) is the angle at which a _______ fringe \( (m = 2, \) here) occurs on either side of the _______ bright fringe \( (m = 0) \)
  - _______ fringe: \( \sin \theta = \frac{\lambda}{d} \)
  - _______ fringe: \( \sin \theta = \left(m + \frac{1}{2}\right)\frac{\lambda}{d} \)

A laser beam \( (\lambda = 630 \text{ nm}) \) goes through a double slit with separation of 3 \( \mu \text{m} \). If the interference pattern is projected on a screen 5 m away, what is the distance between the third order bright fringe and the central bright fringe?
Homework

1. What type of experimental evidence indicates that light is a wave?

2. Why does the wavelength of light decrease when it passes from vacuum into a medium? State which attributes change and which stay the same and, thus, require the wavelength to decrease.

3. Does Huygens’s principle apply to all types of waves?

4. Young’s double slit experiment breaks a single light beam into two sources. Would the same pattern be obtained for two independent sources of light, such as the headlights of a distant car? Explain.

5. Find the range of visible wavelengths of light in crown glass. (OpenStax 27.2) 250 nm to 500 nm

6. What is the index of refraction of a material for which the wavelength of light is 0.671 times its value in a vacuum? Identify the likely substance. (OpenStax 27.3) 1.49, Polystyrene

7. Analysis of an interference effect in a clear solid shows that the wavelength of light in the solid is 329 nm. Knowing this light comes from a He-Ne laser and has a wavelength of 633 nm in air, is the substance zircon or diamond? (OpenStax 27.4) 1.92, Zircon

8. At what angle is the first-order maximum for 450-nm wavelength blue light falling on double slits separated by 0.0500 mm? (OpenStax 27.6) 0.516°

9. Calculate the angle for the third-order maximum of 580-nm wavelength yellow light falling on double slits separated by 0.100 mm. (OpenStax 27.7) 0.997°

10. What is the separation between two slits for which 610-nm orange light has its first maximum at an angle of 30.0°? (OpenStax 27.8) 1.22 × 10⁻⁶ m

11. Find the distance between two slits that produces the first minimum for 410-nm violet light at an angle of 45.0°. (OpenStax 27.9) 0.290 μm

12. Calculate the wavelength of light that has its third minimum at an angle of 30.0° when falling on double slits separated by 3.00 μm. (OpenStax 27.10) 600 nm

13. What is the wavelength of light falling on double slits separated by 2.00 μm if the third-order maximum is at an angle of 60.0°? (OpenStax 27.11) 577 nm