

Name

## Interference and Diffraction Concepts

Total questions: 15

Worksheet time: 8mins

Instructor name: Dr. Ramanathan Saitechinfo

Class

Date

- What is the formula for the fringe separation in Young's double slit experiment?
  - $\Delta y = d/\lambda$
  - $\Delta y = \lambda D^2/d^2$
  - $\Delta y = \lambda D/d$
  - $\Delta y = \lambda/d$
- Describe the conditions for constructive interference in a double slit experiment.
  - The path difference is an integer multiple of the wavelength.
  - The path difference is a half-integer multiple of the wavelength.
  - The slits must be of different widths.
  - The light waves must be out of phase by 180 degrees.
- What is the condition for destructive interference in Young's double slit experiment?
  - Path difference =  $(2n + 1) * (\lambda/2)$ , where n is an integer.
  - Path difference =  $(2n) * (\lambda/2)$
  - Path difference =  $n * \lambda$
  - Path difference =  $(2n + 1) * \lambda$
- How does the width of a single slit affect the diffraction pattern observed?
  - The width of a single slit affects the diffraction pattern by causing narrower slits to produce wider patterns and more pronounced central maxima.
  - The slit width has no effect on the diffraction pattern.
  - All slit widths produce identical diffraction patterns.
  - Wider slits create sharper patterns with less central maxima.



11. Describe the characteristics of the central maximum in a single slit diffraction pattern.
- a) The central maximum appears at the edges of the pattern.
  - b) The central maximum is narrower than the other maxima.
  - c) The central maximum is the brightest and widest part of the diffraction pattern, located at the center, resulting from constructive interference.
  - d) The central maximum is the dimmest part of the diffraction pattern.
12. How does the distance between the slits affect the interference pattern in a double slit experiment?
- a) The distance between the slits only affects the brightness of the fringes.
  - b) The distance between the slits has no effect on the interference pattern.
  - c) Increasing the distance between the slits increases the fringe width.
  - d) The distance between the slits inversely affects the fringe spacing in the interference pattern.
13. What is the significance of the path difference in determining interference patterns?
- a) The path difference only affects the brightness of the light.
  - b) The path difference is irrelevant in determining wave speed.
  - c) The path difference has no impact on interference patterns.
  - d) The path difference determines the type of interference (constructive or destructive) and the resulting pattern.
14. Calculate the angular width of the central maximum in a single slit diffraction pattern if the slit width is 1 mm and the wavelength is 550 nm.
- a)  $1.1 \times 10^{-3}$  radians
  - b)  $3.0 \times 10^{-4}$  radians
  - c)  $5.5 \times 10^{-4}$  radians
  - d)  $2.2 \times 10^{-5}$  radians
15. Explain the difference between single slit diffraction and double slit interference.
- a) Single slit diffraction creates an interference pattern, while double slit diffraction causes wave spreading.
  - b) Single slit diffraction involves one slit causing wave spreading, while double slit interference involves two slits creating an interference pattern.
  - c) Double slit interference involves one slit causing wave spreading, while single slit diffraction involves two slits creating an interference pattern.
  - d) Single slit diffraction and double slit interference both involve multiple slits creating similar patterns.

## Answer Keys

1. c)  $\Delta y = \lambda D/d$
2. a) The path difference is an integer multiple of the wavelength.
3. a) Path difference =  $(2n + 1) * (\lambda/2)$ , where n is an integer.
4. a) The width of a single slit affects the diffraction pattern by causing narrower slits to produce wider patterns and more pronounced central maxima.
5. c) 0.0687 degrees
6. b) The fringe width is inversely proportional to the slit separation.
7. d) The intensity of light varies in a double slit interference pattern due to constructive and destructive interference, resulting in alternating bright and dark fringes.
8. b) The diffraction pattern becomes wider and the central maximum increases in intensity.
9. c)  $(7.5 \times 10^{-6} * L) \text{ m}$
10. a) The diffraction pattern becomes wider.
11. c) The central maximum is the brightest and widest part of the diffraction pattern, located at the center, resulting from constructive interference.
12. d) The distance between the slits inversely affects the fringe spacing in the interference pattern.
13. d) The path difference determines the type of interference (constructive or destructive) and the resulting pattern.
14. c)  $5.5e-4$  radians
15. b) Single slit diffraction involves one slit causing wave spreading, while double slit interference involves two slits creating an interference pattern.

