

Ch 18

18.1 Conceptual Questions

- _____ 1) Monochromatic coherent light shines through a pair of slits. If the distance between these slits is decreased, which of the following statements are true of the resulting interference pattern? (There could be more than one correct choice.)
- A) The distance between the maxima stays the same.
 - B) The distance between the maxima decreases.**
 - C) The distance between the minima stays the same.
 - D) The distance between the minima increases.
 - E) The distance between the maxima increases.
- _____ 2) In a double-slit interference experiment you are asked to use laser light of different wavelengths and determine the separation between adjacent maxima. You observe that this separation is greatest when you illuminate the double slit with
- A) blue light.
 - B) green light.
 - C) yellow light.**
 - D) red light.
 - E) The separation is the same for all wavelengths.
- _____ 3) Two light sources are said to be *coherent* if they are
- A) of the same frequency.
 - B) of the same frequency, and maintain a constant phase difference.**
 - C) of the same amplitude, and maintain a constant phase difference.
 - D) of the same frequency and amplitude.
- _____ 4) What do we mean when we say that two light rays striking a screen are in phase with each other?
- A) When the electric field due to one is a maximum, the electric field due to the other is also a maximum, and this relation is maintained as time passes.**
 - B) They are traveling at the same speed.
 - C) They have the same wavelength.
 - D) They alternately reinforce and cancel each other.
- _____ 5) In a double-slit experiment, it is observed that the distance between adjacent maxima on a remote screen is 1.0 cm. What happens to the distance between adjacent maxima when the slit separation is cut in half?
- A) It increases to 2.0 cm.
 - B) It increases to 4.0 cm.
 - C) It decreases to 0.50 cm.**
 - D) It decreases to 0.25 cm.
 - E) None of these choices are correct.

- _____ 6) What principle is responsible for light spreading as it passes through a narrow slit?
- A) refraction
 - B) **polarization**
 - C) diffraction
 - D) dispersion
- _____ 7) Which of the following changes would *increase* the separation between the bright fringes in the diffraction pattern formed by a diffraction grating?
- A) Increase the wavelength of the light used.
 - B) Increase the separation between the slits.
 - C) Immerse the apparatus in water.
 - D) All of these.
 - E) None of these.

18.2 Problems

- 8) Coherent light of wavelength 519 nm passes through two slits. In the resulting interference pattern on a screen 4.6 m away, adjacent bright fringes are 4.0 mm apart. What is the separation of the two slits?
- _____ 9) In a two-slit experiment using coherent light, the distance between the slits and the screen is 1.10 m, and the distance between the slits is 0.100 mm. If the first-order bright fringe is measured to be 3.40 cm from the centerline, what is the wavelength of the light?
- A) 354 nm
 - B) 241 nm
 - C) 133 nm
 - D) 3.09 μm
 - E) 2.11 μm
- _____ 10) An optical engineer needs to ensure that the bright fringes from a double-slit are 15.7 mm apart on a detector that is 1.70 m from the slits. If the slits are illuminated with coherent light of wavelength 633 nm, how far apart should the slits be?
- A) 68.5 μm
 - B) 74.0 μm
 - C) 79.5 μm
 - D) 63.0 μm

Ch 18**Answer Section**

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|--------------------|--------|---------------|
| 1) ANS: D, E | PTS: 1 | REF: Var: 1 |
| 2) ANS: D | PTS: 1 | REF: Var: 1 |
| 3) ANS: B | PTS: 1 | REF: Var: 1 |
| 4) ANS: A | PTS: 1 | REF: Var: 1 |
| 5) ANS: A | PTS: 1 | REF: Var: 1 |
| 6) ANS: C | PTS: 1 | REF: Var: 1 |
| 7) ANS: A | PTS: 1 | REF: Var: 1 |
| 8) ANS: 0.60 mm | | |
| | PTS: 1 | REF: Var: 50+ |
| 9) ANS: D | PTS: 1 | REF: Var: 1 |
| 10) ANS: A | PTS: 1 | REF: Var: 50+ |