1. [1pt] In a Young’s double-slit experiment, the angle of the second-order bright fringe is 2.0°. If the slit separation is $3.4 \times 10^{-5}$ m, what is the wavelength of the light?

2. [1pt] Two narrow slits are illuminated by a laser with a wavelength of 574 nm. The interference pattern on a screen located $x = 5.20$ m away shows that the fourth-order bright fringe is located $y = 6.90$ cm away from the central bright fringe. Calculate the distance between the two slits.

3. [1pt] The screen is now moved 0.9 m further away. What is the new distance between the central and the fourth-order bright fringe?

4. [1pt] What is the minimum thickness of coating which should be placed on a lens in order to minimize reflection of 541 nm light? The index of refraction of the coating material is 1.55 and the index of the glass is 1.60.

5. [1pt] A single vertical slit of width 28 $\mu$m is located 2.30 m from a screen. The intensity pattern below is observed. The distances on the screen can be measured from the scale. Each tick mark is equal to 1 cm. What is the wavelength of the light?

6. [1pt] Light of wavelength 564 nm shines down on two glass plates, spaced at one end by a thin piece of paper. Looking down on the plates (the figure shows a side view only), 28 bright interference fringes are observed across the top plate with a dark fringe at the end by the paper. How thick is the piece of paper?

7. [1pt] The diagram shows light incident from above on a film of thickness $d$. Each of the three materials in the figure can be chosen to be air, with index of refraction $n = 1.00$, water, with index $n = 1.33$, or glass, with index $n = 1.50$. Under which of the following conditions will there be constructive interference? A) $d = \frac{\lambda}{4}$, material 1 is glass, 2 is air, 3 is water. B) $d = \frac{\lambda}{2}$, material 1 is glass, 2 is air, 3 is glass. C) $d = \frac{\lambda}{4}$, material 1 is water, 2 is glass, 3 is air. D) $d = \frac{\lambda}{2}$, material 1 is air, 2 is water, 3 is glass. E) $d < \frac{\lambda}{4}$, material 1 is air, 2 is water, 3 is glass.

8. [1pt] A thin film of soap (with $n = 1.34$) hanging in the air reflects dominantly red light (657 nm). What is the minimum thickness of the film?

9. [1pt] Now this film is on a sheet of glass, with $n = 1.54$. What is the longest wavelength (in air) that will now be predominantly reflected?

10. [1pt] Two antennas located at points A and B are broadcasting radio waves of frequency 94.0 MHz, perfectly in phase with each other. The two antennas are separated by a distance $d = 9.30$ m. An observer, P, is located on the x axis, a distance $x = 620$ m from antenna A, so that APB forms a right triangle with PB as hypotenuse. What is the phase difference between the waves arriving at P from antennas A and B?

11. [1pt] Now observer P walks along the x axis toward antenna A. What is P’s distance from A when he first observes fully destructive interference between the two waves?

12. [1pt] If observer P continues walking until he reaches antenna A, at how many places along the x axis (including the place you found in the previous problem) will he detect minima in the radio signal, due to destructive interference?

13. [1pt] A set of narrow vertical slits is located a distance D from a screen. The slits are equally spaced and have the same width. The intensity pattern in the figure is observed when light from a laser passes through the slits, illuminating them uniformly. The slits are perpendicular to the direction of the light. What is the spacing between the slits? Data: Distance to the screen = 2.11 meters; Wavelength of light = 632.8 nm.
14. [1pt] Calculate the width of the slits.

15. [1pt] If the slits' separation is increased by a factor of 2, what would be the distance between the principal peaks on the screen?

16. [1pt] A beam of light of wavelength 591 nm passes through two slabs of material of identical thickness \( d = 1.20 \, \mu m \), as shown in the figure. The slabs have different indices of refraction: \( n_1 = 1.38 \) and \( n_2 = 1.55 \). What is the phase difference (in radians, do not enter units) between the two parts of the beam after it passes through the slabs?

17. [1pt] What is the pathlength difference between the two waves from the two slits at the first (\( m=0 \)) minimum on the screen?

18. [1pt] What is the pathlength difference between the two waves from the two slits at the first (\( m=0 \)) minimum on the screen?

19. [1pt] Calculate the distance on the screen between the central maximum (\( m=0 \)) and the first (\( m=1 \)) maximum (You can assume \( \sin \theta = \tan \theta = \theta \) with \( \theta \) expressed in radians).

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21. [1pt] What is the pathlength difference between the two waves from the two slits at the first (\( m=0 \)) minimum on the screen?

22. [1pt] Calculate the distance on the screen between the central maximum (\( m=0 \)) and the first (\( m=1 \)) maximum (You can assume \( \sin \theta = \tan \theta = \theta \) with \( \theta \) expressed in radians).

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