85 + 7 = 92% A Excellent

1116/1200 = 93.0% A-am.

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PHYSICS 242 EXAM 13dS12 PAGE 1 OF 2 NAME JAMES L. HAYNES

AT THE RIGHT OF THE PAGE, FILL IN THE "o" OF THE BEST ANSWER, FOR EXAMPLE, do.
>IF YOU DON'T KNOW IT, RULE OUT THE OBVIOUSLY WRONG ANSWERS AND THEN *GUESS*.<
RECALL THAT 2π RADIANS = 360 DEGREES.

1. The device called a refracting _____ uses two lenses to form a virtual image of the original *distant* object. (That image has a large net angular magnification.)

a) virtualizer b) interferometer c) microscope d) telescope ao bo co do● 1.

2. In using the equation $2y = m\lambda$ in this block, m is the

a) mass of the wavelength
b) lateral magnification
c) number of Michel's son's interfering meters
d) number of fringes moving past a point ao bo co do● 2.

3. An ideal approached by laser light, _____ light has a single vacuum wavelength.

a) monochromatic b) telescope c) Michelson d) microscope a● bo co do 3.

4. Light moving in air ($n = 1.000$) hits perpendicular to a water ($n = 1.333$) surface. That light reflects back into the air with a phase change upon reflection of _____.

a) π rad b) 0.333 rad c) 90° d) zero a● bo co do 4.

5. By conservation of energy for an insulating thin film, a reflection maximum gives a transmission min while a reflection minimum gives a transmission max.

a) minimum, minimum
b) maximum, minimum
c) maximum, maximum
d) minimum, maximum ao bo co do● 5.

6. To correctly find the *minimum, non-zero* thickness of a thin film (normal incidence, all dielectrics) for a given wavelength, we use $m =$ 0 in the equation $2t = (m + \frac{1}{2})\lambda$ and $m =$ 1 in the equation $2t = m\lambda$.

a) 0, 0 b) 1, 1 c) 0, 1 d) 1, 0 ao bo co● do 6.

7. Light moving in an $n = 1.333$ dielectric medium reflects off an $n = 1.000$ dielectric medium (normal incidence). The phase change for this reflection is _____.

a) π rad b) 0.333 rad c) 90° d) zero ao bo co do● 7.

8. The angular magnification is *defined* by the equation

a) $m \equiv -\frac{s'}{s}$ b) $M \equiv \frac{\theta'}{\theta}$ c) $M \equiv \frac{y'}{y}$ d) $m \equiv \frac{\theta'}{\theta}$ ao bo● co do 8.

9. Monochromatic coherent light waves of wavelength 555 nm leave two rectangular slits in phase. When they arrive at point P, wave 2 has traveled 666 nm farther than wave 1. There are no reflections. The phase difference between the two waves at point P is _____.

$\lambda = 555$ $(r_2 - r_1) = 666$ $\phi = \frac{2\pi}{\lambda}(r_2 - r_1)$

a) $\frac{2\pi}{555}$ 666 rad b) $\frac{2\pi}{555}$ 666 degrees c) $\frac{2\pi}{666}$ 555 rad d) $\frac{2\pi}{666}$ 555 degrees a● bo co do 9.

10. When two identical waves arrive at a point _____ out of phase (for example), maximum *constructive* interference occurs. $\pm 2\pi$ rad

a) -2π radians b) π radians c) 2π degrees d) –180° a● bo co do 10.

11. The equation we use for a Michelson interferometer is

a) $2t = m\lambda$ b) $2y = m\lambda$ c) $d \sin\theta = m\lambda$ d) $2t = (m + \frac{1}{2})\lambda$ ao bo● co do 11.

12. In this block, _____ means having a definite constant phase relation.

a) microscopic b) coherence c) telescopic d) conphasation ao bo● co do 12.

13. The index of refraction of a thin dielectric film is greater than 1. There is vacuum on both sides of the film. For a reflection maximum, we could use $n > 1$ $\lambda = \frac{\lambda_0}{n}$

a) $2nt = (m + \frac{1}{2})\lambda_0$ b) $2t = (m + \frac{1}{2})\lambda_0$ c) $2t = (n + \frac{1}{2})\lambda_0$ d) $2mt = (n + \frac{1}{2})\lambda_0$ a● bo co do 13.

Perfect page

$2t = (m+\frac{1}{2})\lambda \Rightarrow 2t = (m+\frac{1}{2})\frac{\lambda_0}{n} \Rightarrow 2nt = (m+\frac{1}{2})\lambda_0$

14. The device called a _____ uses two lenses to form a virtual image of the original *nearby* object. (That image has a large net angular magnification.)

a) virtualizer b) interferometer c) microscope d) telescope ao bo co do 14.

15. You wish to use a magnifier as discussed in our textbook to give a lateral magnification of infinity and an angular magnification of 3.2. It should be a _____ lens of focal length _____ cm.

converging bc magnifier

a) zoom, 3.2(25) b) diverging, $\frac{3.2}{25}$ c) converging, $\frac{25}{3.2}$ d) flat, ∞ ao bo co do 15.

16. In $2t = m\lambda$, m is

a) the lateral magnification b) a whole number, ≥ 1 c) the film's mass d) $\frac{25\text{ cm}}{f}$ ao bo co do 16.

17. Light of vacuum wavelength 543 nm is incident normally on a thin horizontal dielectric film. The light's wavelength is 357 nm in the dielectric medium above the thin film, 388 nm in the thin film itself, and 408 nm in the dielectric medium below the thin film. In the equation $2t = m\lambda$, the correct value of λ is _____ nm.

$\lambda_{film} = 388nm$

a) 357 b) 543 c) 388 d) 408 ao bo co do 17.

18. In Problem 17 above, the index of refraction of the film equals

$n = \frac{\lambda_0}{\lambda}$

a) $\frac{543}{357}$ b) exactly one c) $\frac{543}{388}$ d) $\frac{543}{408}$ ao bo co do 18.

19. Maximum *destructive* interference occurs when the oscillations of two identical waves at a point are _____.

a) in phase b) incoherent c) perpendicular d) π radians out of phase ao bo co do 19.

20. Coherent laser light is split into two beams. The two beams come back together at point P, with a path length of 106.3 wavelengths for beam 2 and 84.3 wavelengths for beam 1. The beams have a phase difference at point P due solely to their path difference. That phase difference is _____ degrees.

$(\ell_2 - \ell_1) = 106.3 - 84.3$

a) $\frac{360}{106.3} - \frac{360}{84.3}$ b) 360(106.3 – 84.3) c) $\frac{2\pi}{\lambda}(106.3 - 84.3)$ d) $\frac{360}{106.3 - 84.3}$ ao bo co do 20.

21. Using a Michelson interferometer with monochromatic light, you move the movable mirror 89.0 μm and 321 dark fringes move past a point in the interference pattern. Therefore, the light's wavelength is _____ μm .

a) $\frac{321(89.0)}{2}$ b) 2(321)(89.0) c) $\frac{89.0}{2(321)}$ d) $\frac{2(89.0)}{321}$ ao bo co do 21.

22. A magnifier has an angular magnification of 3.2. The angle subtended at your eye by the object is 5.5° when the object is 25 cm from your eye and the magnifier is not present. You then use the magnifier as discussed in this block (you place the object in the magnifier's focal plane). Then the angle subtended at your eye by the image seen through the magnifier is

$\frac{\theta}{3.2}$

a) $\frac{25}{3.2}$ cm b) $\frac{5.5°}{3.2}$ c) 3.2 × 5.5° d) 3.2 × 25 rad ao bo co do 22.

23. We correctly use the equation $2t = m\lambda$ for a reflection minimum from a thin film (normal incidence, all dielectrics). Therefore, we *must* have _____ phase shift(s) of π rad upon reflection from the film boundaries.

a) 2 (*not* 0 or 1) b) 1 (*not* 0 or 2) c) 0 or 2 (*not* 1) d) 0 (*not* 1 or 2) ao bo co do 23.

24. The center-to-center distance between two rectangular slits is 2.53 wavelengths. The largest value of the sine function is 1. We find the largest possible angle for the center of a bright fringe of that wavelength using m = ___.

$\sin\theta = 1$ $\sin^{-1}(1) = \theta = \sin^{-1}\left(\frac{m}{2.53}\right) d = 2.53\lambda$ $\sin\theta = 1$ (@ $\frac{2\pi}{2}$) $\sin\left(\frac{2\pi}{2}\right) = \frac{m\lambda}{2.53\lambda}$ $\frac{1}{1} =$ m is whole # $2.53\sin\theta = m$

a) 2 b) ~~2.53~~ c) 3 d) 1 ao bo co do 24.

25. Consider two rectangular slits coherent emitting coherent monochromatic light rays in phase. For maximum constructive interference, our equation says their *path* difference should equal a whole number of wavelengths. Thus we showed in class yesterday that their *phase* difference when they arrive at a point on a distant screen equals _____ (in terms of their angle with the normal.)

d = whole # $\phi = \frac{2\pi}{\lambda}(\ell_2 - \ell_1)$ $d\sin\theta = m\lambda$ $\phi = ?$ $\frac{2\pi}{d}m = d\sin\theta$ $\frac{d\sin\theta}{m} = \lambda$ $\phi = \frac{2\pi m}{d\sin\theta}d =$

a) $\frac{\lambda\phi}{2\pi}$ b) $2\pi\theta$ c) $\frac{2\pi}{\lambda}d\sin\theta$ d) $m\sin\theta$ ao bo co do 25.

26. The index of refraction of a thin dielectric film is greater than 1. There is vacuum on both sides of the film. For a reflection minimum, we could use

λ_0 $\lambda = \frac{\lambda_0}{n}$ $2t = m\lambda$

a) $2nt = m\lambda_0$ b) $2t = m\lambda_0$ c) $2t = n\lambda_0$ d) $2mt = n\lambda_0$ ao bo co do 26.