Physics 2426
Engineering Physics II
Instructor: McGraw
Review Questions -Final Exam

1. The photon energy for light of wavelength 500 nm is approximately
A) 1.77 eV B) 3.10 eV C) 6.20 eV D) 2.48 eV E) 5.46 eV
Ans: D

3. If the wavelength λ of the incident light is large compared with the size of the atom, the probability of elastic scattering varies as
A) λ B) λ^4 C) λ^{-4} D) λ^2 E) λ^{-3}
Ans: C

13. A glass block with index of refraction 1.50 is immersed in water whose index of refraction is 1.33. The critical angle at the glass–water interface is
A) 6.5º B) 41.9º C) 48.8º D) 56.3º E) 62.5º
Ans: E

14. Light is incident on a piece of glass in air at an angle of 37.0º from the normal. If the index of refraction of the glass is 1.50, the angle that the refracted ray makes with the normal is approximately
A) 8.6º B) 21.8º C) 23.6º D) 41.8º E) 56.4º
Ans: C

15. Which of the following statements is true about the speeds of the various colors of light in glass?
A) All colors of light have the same speed in glass.
B) Violet has the highest speed, red the lowest.
C) Red has the highest speed, violet the lowest.
D) Green has the highest speed, red and violet the lowest.
E) Red and violet have the highest speed, green the lowest.
Ans: C

16. A light wave traveling at speed v_1 in medium 1 passes into medium 2 where its speed is v_2. By which of the following equations is the frequency f_1 of the wave in medium 1 related to its frequency f_2 in medium 2? (θ_1 and θ_2 are the angles of incidence and refraction.)

A) $f_1 \sin \theta_1 = f_2 \sin \theta_2$
B) $f_1 v_2 = f_2 v_1$
C) $f_1 = f_2$
D) $f_1 v_1 = f_2 v_2$
E) $f_1 \sin \theta_2 = f_2 \sin \theta_1$

Ans: C

17. Light that has been traveling in a medium with an index of refraction n_2 is incident on the boundary surface of another medium with an index of refraction n_1. Given a sufficient angle of incidence, which of the following conditions must be satisfied for total internal reflection to occur?

A) $n_1 < n_2$
B) $n_1 > n_2$
C) $n_1 = n_2$
D) Any of these may be correct.
E) None of these is correct.

Ans: A

18. From directly above, you're watching a fish swim 1.83 m beneath the surface of a clear lake (n = 1.33). How far beneath the surface does the fish seem to be?

A) 0.914 m B) 1.37 m C) 1.83 m D) 2.44 m E) 2.93 m

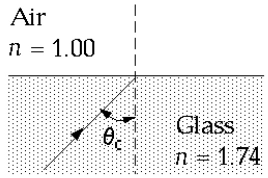
Ans: B

20. A ray of light passes from air into water, striking the surface of the water with an angle of incidence of 45º. Which of the following four quantities change as the light enters the water: (1) wavelength, (2) frequency, (3) speed of propagation, and (4) direction of propagation?

A) 1 and 2 only
B) 2, 3, and 4 only
C) 1, 3, and 4 only
D) 3 and 4 only
E) 1, 2, 3, and 4

Ans: C

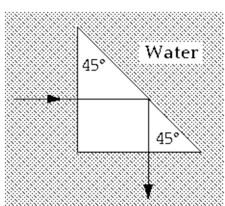
23.



The light ray in the figure is incident on a glass-air surface. The index of refraction of the glass is 1.74. The approximate critical angle for total internal reflection is
A) 48º B) 35º C) 30º D) 22º E) None of these is correct.
Ans: B

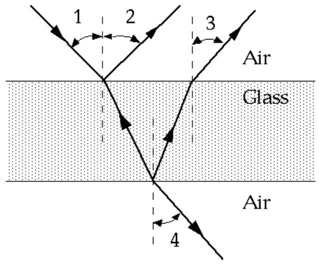
30. The speed of yellow sodium light in a certain liquid is 1.92×10^8 m/s. With respect to air, the index of refraction of this liquid for sodium light is approximately
A) 1.92 B) 1.56 C) 1.23 D) 0.64 E) 1.33
Ans: B

38.



For the prism immersed in water (n = 1.33), the minimum index of refraction that will produce total reflection of the indicated ray is approximately
A) 0.94 B) 1.28 C) 1.50 D) 1.65 E) 1.88
Ans: E

47.



The rays in the figure are reflected and refracted at the front and back surfaces of the glass. Which of the following is true of these rays?

A) $\angle 1 = \angle 2 = \angle 3 = \angle 4$

B) $\angle 1 = \angle 2$; $\angle 3 = \angle 4$; but $\angle 1 \neq \angle 3$

C) $\angle 1 = \angle 2 = \angle 3$; but $\angle 4 \neq \angle 1$

D) $\angle 1 = \angle 4$; but $\angle 2 \neq \angle 4$

E) $\angle 1 \neq \angle 2 \neq - \angle 3 \neq \angle 4$

Ans: A

48. A light wave traveling in air impinges on an amber plate at an angle of incidence of 60º. If the angle of refraction is 34º, the velocity of light in amber must be approximately

A) 0.52×10^8 m/s
B) 4.64×10^8 m/s
C) 1.86×10^3 m/s
D) 1.94×10^8 m/s
E) 4.64×10^{10} m/s

Ans: D

54. A "X" is marked on the bottom of a glass container. A microscope is adjusted so that it is focused on the "X". A liquid is now poured into the glass to a depth of 6.00 cm. If the microscope has to be backed up by a distance of 1.50 cm to refocus on the "X," then calculate the refractive index of the liquid.

A) 1.25 B) 4.00 C) 1.33 D) 0.75 E) 3.00

Ans: C

74. In any wave motion, dependence of velocity on wavelength is called

A) polarization B) deviation C) dispersion D) diffraction E) scattering

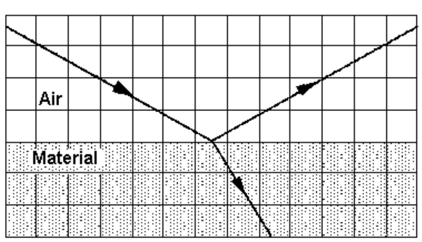
Ans: C

80. Light is circularly polarized if
   A) the cross section of a spherical wave front is polarized.
   B) it consists of two plane-polarized waves that are out of phase with each other by 90º.
   C) it is refracted by a medium that has a high index of refraction.
   D) it is reflected at the critical angle and polarized.
   E) it is polarized by scattering from molecules.
   Ans: B

87. Sound waves differ from light waves in many respects. One important difference is that sound waves cannot
   A) be refracted.
   B) be reflected.
   C) show interference.
   D) show diffraction.
   E) be polarized.
   Ans: E

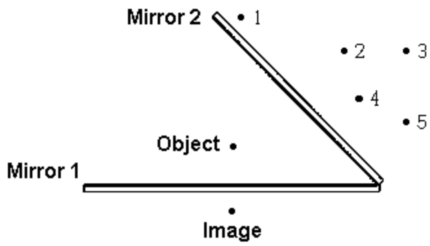
90. When light is reflected from a plane surface of glass at the polarizing angle, the
   A) reflected ray is at right angles to the incident ray.
   B) angle of reflection is equal to the angle of refraction.
   C) incident ray is at right angles to the refracted ray.
   D) reflected ray is at right angles to the refracted ray.
   E) intensity of the reflected light is a maximum.
   Ans: D

92.



A ray of light is shown being reflected at the surface of a material. If the reflected ray is completely plane polarized, the index of refraction of the material is approximately
A) 1.3 B) 1.9 C) 0.63 D) 0.80 E) 1.8
Ans: B

3.



An object is placed between two mirrors set at an angle to each other. The location of the image of the object in mirror 1 is shown in the figure. The location of the image of that image in mirror 2 is at

A) 1 B) 2 C) 3 D) 4 E) 5

Ans: C

6. A concave spherical mirror has a radius of curvature of 50 cm. The image of an object located 35 cm in front of the mirror is

A) real, inverted, magnified 2.5 times, and 87.5 cm from the mirror.
B) real, erect, magnified 2.5 times, and 87.5 cm from the mirror.
C) virtual, erect, magnified 3.3 times, and 117 cm from the mirror.
D) real, inverted, magnified 3.3 times, and 117 cm from the mirror.
E) real, inverted, diminished 0.42 times, and 14.6 cm from the mirror.

Ans: A

7. An object 25 cm from a convex mirror is observed to produce an image 13.6 cm behind the mirror. What is the focal length of the mirror?

A) 8.8 cm B) –8.8 cm C) 30 cm D) –30 cm E) –60 cm

Ans: D

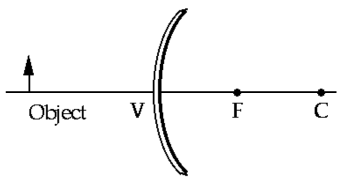
12. When an object is farther from a concave mirror than twice the mirror's focal length, the

A) magnification is less than one.
B) image is inverted.
C) image distance is less than the object distance.
D) image is real.
E) All of these are correct.

Ans: E

14. A concave spherical mirror can produce which one of the following types of images?
A) virtual, inverted, and magnified
B) real, erect, and magnified
C) diminished, erect, and virtual
D) magnified, erect, and virtual
E) diminished, real, and erect
Ans: D

17.



The image of an object, placed in front of a spherical convex mirror as shown, forms between
A) O and V and is magnified.
B) V and F and is magnified.
C) V and F and is diminished.
D) F and C and is diminished.
E) F and C and is magnified.
Ans: C

21. An object is placed between 2*f* and infinity in front of a concave mirror of focal length *f*. The image is located
A) behind the mirror, between 2*f* and the mirror.
B) behind the mirror, between 2*f* and infinity.
C) in front of the mirror, between the mirror and *f*.
D) in front of the mirror, between *f* and the center of curvature.
E) in front of the mirror, between the center of curvature and infinity.
Ans: D

24. An object is placed 4.24 cm in front of a concave mirror that has a radius of curvature of 20.3 cm. The image is located
A) 12.1 cm in front of the mirror.
B) 12.1 cm behind the mirror.
C) 7.26 cm behind the mirror.
D) 16.9 cm behind the mirror.
E) 16.9 cm in front of the mirror.
Ans: C

26. Two parallel mirrors are a distance d apart. An object is placed 1.0 inch in front of the right-hand mirror. After 5 reflections, with the first reflection from the right-hand mirror, an image is located 17 inches behind the right-hand mirror. Calculate the distance between the mirrors.
A) 5.3 in B) 3.2 in C) 6.0 in D) 4.0 in E) 3.6 in
Ans: D

28. A circular coin is 33.3 cm from a concave spherical mirror. (Assume the coin is on the optical axis.) The image of the coin is produced 10.0 cm from the mirror and on the same side as its real position. If the coin is moved to a position 23.3 cm from the mirror, then calculate how far from the mirror the new image is.
A) 13.7 cm B) 10.0 cm C) 15.1 cm D) 8.35 cm E) 11.5 cm
Ans: E

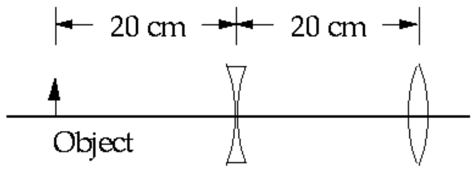
40. A real object is 42.1 cm from a negative lens that has a focal length of 25.6 cm. The object is 2.45 mm high. The height and orientation of the image are
A) 3.8 mm and inverted.
B) 0.93 mm and erect.
C) 6.4 mm and erect.
D) 0.38 mm and erect.
E) None of these is correct.
Ans: B

41. An object 2 cm high is placed 20 cm from a thin convex lens that has a focal length of 10 cm. Which of the following statements describes the image formed?
A) It is 2 cm high.
B) It is 20 cm from the lens.
C) It is inverted.
D) It is real.
E) All of these are correct.
Ans: E

42. A real object is 30 cm from a negative lens that has a focal length $f = -20$ cm. The image is
A) virtual and 30 cm from the lens.
B) real and 12 cm from the lens.
C) virtual and 12 cm from the lens.
D) real and 20 cm from the lens.
E) None of these is correct.
Ans: C

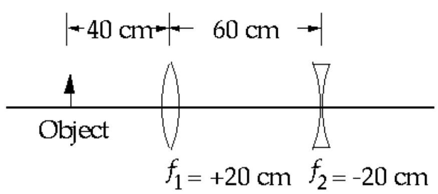
44. A lens forms an erect image of a real object. The image is twice the size of the object and appears to be 40 cm from the lens. Determine the power of the lens in diopters (D).
A) There is not sufficient information.
B) –2.5 D
C) +2.5 D
D) +7.5 D
E) None of these is correct.
Ans: C

45.



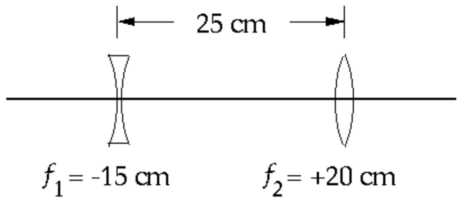
A negative lens with a focal length of –10.0 cm is on the same axis as a positive lens with a focal length of +20.0 cm as illustrated. The distance between the lenses is 20.0 cm. A real object 3.00 cm high is placed 20.0 cm to the left of the negative lens. After the light has passed through both lenses, the image is
A) 3.0 cm high and virtual.
B) 1.0 cm high and virtual.
C) 1.0 cm high and real.
D) 3.0 cm high and real.
E) None of these is correct.
Ans: D

46.



Two lenses, one with a focal length f_1 = +20 cm and the other with a focal length f_2 = –20 cm, are on the same axis and 60 cm apart as shown. A real object is 40 cm to the left of the positive lens. The image formed by the negative lens is
A) real and 10 cm from the negative lens.
B) virtual and 10 cm from the negative lens.
C) at infinity.
D) virtual and 20 cm from the negative lens.
E) None of these is correct.
Ans: B

47.



A negative lens with a focal length of –15 cm is 25 cm from a positive lens with a focal length of +20 cm on the same asix. Parallel light from the left is incident on the negative lens. The image formed by the positive lens is

A) real and 40 cm from the positive lens.
B) virtual and 20 cm from the positive lens.
C) real and 20 cm from the positive lens.
D) real and 13 cm from the positive lens.
E) None of these is correct.

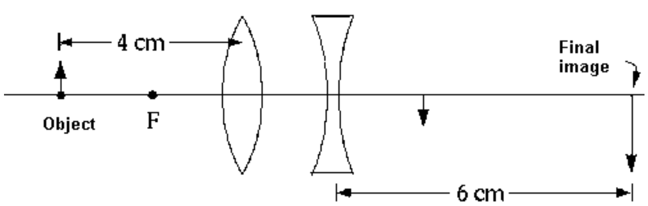
Ans: A

51. A positive lens of focal length 40 cm is placed 20 cm behind a negative lens of focal length –80 cm. An object is placed 240 cm in front of the negative lens. The final image distance relative to the positive lens is

A) –40 cm B) 56 cm C) –56 cm D) 80 cm E) –80 cm

Ans: D

53.



An object placed 4 cm to the left of a positive lens of focal length 2 cm produces an image 4 cm to the right of the lens. A negative lens placed at the focal point of the positive lens as shown produces a final image 6 cm to the right of the negative lens. The negative lens has a focal length of

A) –1.5 cm B) –3.0 cm C) –6.0 cm D) 10 cm E) –2.0 cm

Ans: B

56. When a human eye that has a power of +60 D is fitted with a contact lens of –10 D, the equivalent lens combination is

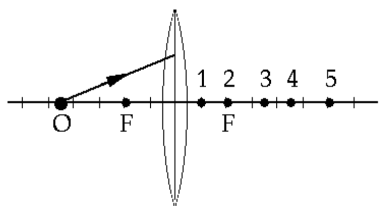
A) diverging and of focal length 2 cm.
B) converging and of focal length 50 cm.
C) converging and of focal length 2 cm.
D) focal length 0.02 cm.
E) focal length 0.2 cm.

Ans: C

60. The objective of a certain lens system is a double-convex lens of 10.2 cm focal length; the eyepiece is a lens of 15.2 cm focal length and is placed 25.4 cm behind the objective. When an object is 30.5 cm in front of the objective, how far is the image from the eyepiece?
A) 44.2 cm B) 30.5 cm C) 5.08 cm D) 22.1 cm E) 61.0 cm
Ans: B

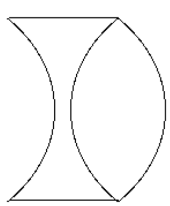
Section: 32-2 Topic: Lenses Type: Numerical
67. A concave-convex lens of flint glass has radii of 12 cm and 10 cm, respectively, and an index of refraction of 1.60. The focal length of this lens is
A) 100 cm B) –100 cm C) 9.1 cm D) –9.1 cm E) 14.5 cm
Ans: A

74.



A ray of light leaves point O and passes through a thin positive lens. It crosses the principal axis at point
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: C

77.



The figure shows a doublet lens in which the positive lens and the negative lens are both manufactured from flint glass and have the same radius of curvature. The focal length of the negative lens is –50.8 cm, and the focal length of the positive lens is 50.8 cm. The combined focal length of the doublet is
A) –25.4 cm B) 25.4 cm C) –102 cm D) 102 cm E) infinite.
Ans: E

85. A 6-cm-high candle is placed in front of a converging lens with a focal length of magnitude 30 cm. If the image distance is +50 cm, then find the image height of the candle and whether it is upright or inverted.
A) 4.0 cm upright
B) 3.3 cm upright
C) 3.3 cm inverted
D) 4.0 cm inverted
E) None of these is correct.
Ans: D

87. An object is placed to the left of a thin converging lens with a focal length of 8 cm. A real and inverted image is formed 13.3 cm to the right of the lens. What is the distance of the object from the lens?
A) 20.1 cm B) 13.3 cm C) 5.00 cm D) 0.20 cm E) 21.3 cm
Ans: A

92. For a myopic eye that cannot focus on objects more than 25 cm in front of it, the power in diopters of the lens needed for distinct distant vision is
A) +25 diopters
B) +4.0 diopters
C) –4.0 diopters
D) –2.5 diopters
E) None of these is correct.
Ans: C

95. Your hypermetropic eye cannot focus on objects that are closer than 225 cm from it. The power in diopters of the lens you need for distinct distant vision is
A) +2.25 diopters
B) $+4.4 \times 10^{-3}$ diopters
C) +3.6 diopters
D) –0.44 diopters
E) None of these is correct.
Ans: C

103. Your nearsighted instructor cannot focus clearly on objects more distant than 150 cm from her eyes. What power lenses are required for her to see distant students clearly?
A) 1.5 B) 0.15 C) 0.67 D) –0.67 E) –1.5
Ans: D

114. A person uses two microscopes to view the same object. Microscope A is twice as long as microscope B and contains lenses with focal lengths that are one-half those of B. If microscope A provides a magnification of m, then what magnification does B provide? (Assumes that the inter-lens spacing L is such that $L_A = 2L_B$.)
A) m B) $2m$ C) $m/2$ D) $8m$ E) $m/8$
Ans: E

116. You have two lenses for making a compound microscope: $f_o = 0.800$ cm and $f_e = 1.20$ cm. How far apart should you set the the lenses to get a magnification of –300? (Assume the normal near point of 25.0 cm.)
A) 11.5 cm B) 12.7 cm C) 13.5 cm D) 13.9 cm E) 15.0 cm
Ans: C

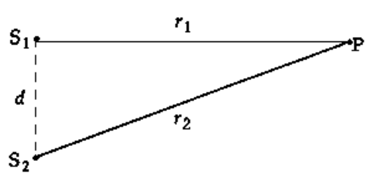
119. A simple refracting telescope has an objective of focal length 75 cm and an eyepiece of focal length 3.0 cm. When viewed by the naked eye, the moon subtends an angle of about 0.009 radians. What angle is subtended by the moon when it is viewed through this telescope?
A) 0.022 rad
B) 0.22 rad
C) 3.6×10^{-4} rad
D) 0.078 rad
E) 3.0×10^{-3} rad
Ans: B

121. The 200-in reflecting telescope at Mt. Palomar has an objective mirror with a focal length of 16.8 m. If you use an eyepiece with a focal length of 2.00 cm, what is the overall magnification of this telescope?
A) –250 B) –130 C) –840 D) –38 E) –300
Ans: C

129. A two lens magnifying system uses lenses of focal lengths 2.5 and 9.5 cm for the objective and eyepiece respectively. The two lenses are positioned 23 cm apart. An object for study is placed 3.0 cm in front of the objective lens. Find the position of the final image relative to the eyepiece lens.
A) –27.7 cm B) –50.7 cm C) 15.0 cm D) –1.59 cm E) –35.3 cm
Ans: B

1. A phase shift of 180º occurs when a light wave
   A) is transmitted through a boundary surface into a medium that is more dense than the medium from which the wave came.
   B) is transmitted through a boundary surface into a medium that is less dense than the medium from which the wave came.
   C) reflects from the boundary surface of a medium that is less dense than the medium in which the wave is traveling.
   D) reflects from the boundary surface of a medium that is more dense than the medium in which the wave is traveling.
   E) Both c and d are correct.
   Ans: D

6. Two side-by-side coherent light sources radiate at 633 nm. At a point in space where the path difference to these two sources is 30 nm, the phase difference could be
   A) 0.238 radians
   B) 0.298 radians
   C) 0.324 radians
   D) 0.356 radians
   E) 0.429 radians
   Ans: B

10.


Two coherent sources of monochromatic light are located at S_1 and S_2 as shown. If the sources are in phase, the intensity at point P is a maximum when
A) $d = \lambda$ B) $r_2 + r_1 = \lambda$ C) $r_2 - r_1 = \lambda$ D) $r_2 + r_1 = \lambda/2$ E) $r_2 - r_1 = \lambda/2$
Ans: C

14. The minimum path difference that will produce a phase difference of 180º for light of wavelength 600 nm is
   A) 600 nm B) 500 nm C) 300 nm D) 200 nm E) 100 nm
   Ans: C

18. For two identical rays of light to interfere destructively, their path lengths
    A) must be equal.
    B) must differ by an odd number of half wavelengths.
    C) must differ by an even number of half wavelengths.
    D) must differ by an integral number of wavelengths.
    E) need not satisfy any of these conditions.
    Ans: B

19. You dip a wire loop into soapy water (n = 1.33) and hold it up vertically to look at the soap film in white light. The soap film looks dark at the top because it has sagged, and its thickness there is nearly zero, causing the reflected wavelengths to interfere destructively. Part way down the loop you see the first red band of the reflected white light. What is the thickness of the soap film there? (Take the wavelength of red light to be 680 nm.)
    A) 130 nm B) 170 nm C) 220 nm D) 250 nm E) 340 nm
    Ans: A

21. You place a convex lens on top of a flat plate of glass and illuminate it with monochromatic light of wavelength 600 nm. You observe a dark circle at the center of the lens, surrounded by a series of concentric dark rings. What is the thickness of the air space between the lens and the flat glass plate where you see the sixth dark ring?
    A) 3.90 μm B) 3.60 μm C) 1.80 μm D) 1.95 μm E) 2.10 μm
    Ans: C

24. You deposit a thin film of magnesium difluoride on a glass lens (n > 1.60), reducing the reflection of yellow light, at normal incidence, to a minimum. You find that the thinnest coating that accomplishes this is 106 nm thick. The index of refraction for MgF_2 for yellow light (λ = 585 nm) is
    A) 1.50 B) 1.38 C) 1.15 D) 1.00 E) 0.707
    Ans: B

28. Two optically flat plates lie one on top of the other. A sheet of paper 0.1 mm thick is inserted between the plates at one edge. When the plates are illuminated by light of wavelength 589 nm, the number of interference fringes observed by reflected light is approximately
    A) 470 B) 340 C) 294 D) 170 E) 123
    Ans: B

32. A 3.5-cm-long microscope glass slide has one edge in contact with a flat plane of glass, while the other edge is slightly raised due to the insertion of a thin piece of paper. Sodium light of wavelength 589 nm is normally incident on the glass from above and interference fringes are observed by reflection with a regular spacing of 0.22 mm. Calculate the thickness of the piece of paper.

A) 9.4×10^{-5} m
B) 5.5×10^{-5} m
C) 2.4×10^{-5} m
D) 4.7×10^{-5} m
E) None of these is correct.

Ans: D

35. Which of the following statements about Young's double-slit experiment is *false?*

A) The bands of light are caused by the interference of the light coming from the two slits.
B) The results of the double-slit experiment support the particle theory of light.
C) Double-slit interference patterns can also be produced with sound and water waves.
D) If the slits are moved closer together, the bands of light on the screen are spread farther apart.
E) The pattern of light on the screen consists of many bands, not just two bands.

Ans: B

36. The distance between the slits in a double-slit experiment is increased by a factor of 4. If the distance between the fringes is small compared with the distance from the slits to the screen, the distance between adjacent fringes near the center of the interference pattern

A) increases by a factor of 2.
B) increases by a factor of 4.
C) depends on the width of the slits.
D) decreases by a factor of 2.
E) decreases by a factor of 4.

Ans: E

39. Two slits separated by 1.0 mm are illuminated with light of a single unknown wavelength. The tenth bright line from the central point of the interference pattern is observed to be at an angle of 0.34º. What is the wavelength of the light?

A) 620 nm B) 590 nm C) 560 nm D) 450 nm E) 600 nm

Ans: B

44. Light of wavelength 500 nm illuminates parallel slits and produces an interference pattern on a screen that is 1 m from the slits. In terms of the initial intensity I_0, the light's intensity in the interference pattern at a point for which the path difference is 300 nm is

A) 0.262 I_0 B) 0.382 I_0 C) 0.447 I_0 D) 0.581 I_0 E) 0.629 I_0

Ans: B

50. In a double slit experiment, a very thin plate of glass of refractive index 1.58 is placed in the light path of one of the slit beams. When this was done, the center of the fringe pattern was displaced by 35 fringe widths. Calculate the thickness of the glass plate if the wavelength of light is 680 nm.

A) 4.1×10^{-5} m
B) 1.5×10^{-5} m
C) 3.0×10^{-5} m
D) 8.2×10^{-5} m
E) 3.8×10^{-5} m

Ans: A

54. Light of wavelength 450 nm is incident on a narrow slit. The diffraction pattern is observed on a screen 5.0 m from the slit, and the central maximum is observed to have a width of 22 cm. What is the width of the slit?

A) 4.5 µm B) 5.0 µm C) 10 µm D) 20 µm E) 0.20 µm

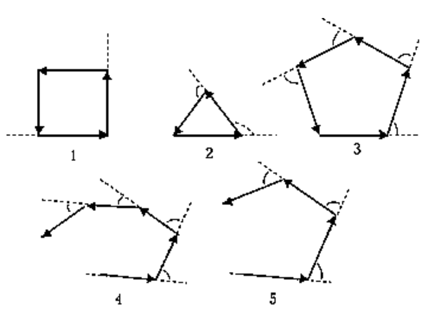
Ans: D

59. As the width of the slit producing a single-slit diffraction pattern is slowly and steadily reduced (always remaining larger than the wavelength of the light), the diffraction pattern

A) slowly and steadily gets wider.
B) slowly and steadily gets brighter.
C) does not change because the wavelength of the light does not change.
D) slowly and steadily gets narrower.
E) None of these is correct.

Ans: A

66.



Which of the phasor diagrams shows the first minimum for five equally spaced in-phase sources?

A) 1 B) 2 C) 3 D) 4 E) 5

Ans: C

72. The headlights of an oncoming car are 1.2 m apart. What is the maximum distance from the car at which you can resolve the lights as two sources if the diameter of the pupil of your eye is 5.0 mm and the wavelength of the light is 555 nm?
A) 8.9 km B) 22 km C) 4.4 km D) 5.4 km E) 13 km
Ans: A

74. Rayleigh's criterion is most closely associated with
A) diffraction B) coherence C) dispersion D) polarization E) reflection
Ans: A

75. The pupil of the human eye has a diameter of about 5 mm. When the wavelength of light incident on the pupil is 500 nm, the smallest angular separation of two resolvable sources is approximately (Find the closest one within a factor of 2 or 3).
A) 1" B) 1' C) 1º D) 10º E) 1 radian
Ans: B

78. Diffraction occurs when light passes
A) by a small particle.
B) through a small hole.
C) through a double slit.
D) by a sharp edge.
E) Diffraction occurs in all of these conditions.
Ans: E

81. In accordance with the Rayleigh criterion, two points can be just resolved if the centers of their diffraction patterns are separated by
A) one wavelength.
B) twice the width of either central maximum.
C) one-half the width of either central maximum.
D) the width of the aperture.
E) the reciprocal of one wavelength.
Ans: C

83. A monochromatic beam of light of wavelength 600 nm falls on a grating at normal incidence and produces a second-order image at an angle of 30º. The grating spacing must be
A) 0.60 µm B) 2.4 µm C) 0.30 µm D) 1.4 µm E) 1.0 µm
Ans: B

87. For a grating with $d = 3.5\lambda$, the maximum order m of an interference maximum that can be observed for a specified λ is
A) 3.5 B) 3 C) 1 D) 2 E) 2.5
Ans: B

92. For a given light source and collimator slit width, the spectral lines obtained using a prism are brighter than those using a diffraction grating because
A) the grating absorbs more light than the prism.
B) light is dispersed more by a prism than by a grating.
C) the prism forms a single spectrum and the grating forms multiple spectra.
D) light passes through the prism at minimum deviation.
E) light is dispersed more by a grating than by a prism.
Ans: C

98. When a first-order spectrum is examined by means of a one-inch grating having 10,000 lines/inch, the resolving power is R. When a second-order spectrum is examined by means of a two-inch grating having 20,000 lines/inch, the resolving power is
A) $R/4$ B) $R/2$ C) $2R$ D) $4R$ E) $8R$
Ans: E

101. Hydrogen emits violet light with a wavelength of 410 nm and red light with a wavelength of 656 nm. A parallel beam of hydrogen light is normally incident on a diffraction grating that has 5500 lines per cm. What is the angle between the second order red line and the third order violet line that appear close together?
A) 3.62 degrees
B) 2.58 degrees
C) 4.23 degrees
D) 5.79 degrees
E) None of these is correct.
Ans: A

102. A parallel beam of sodium light of wavelength 589 nm is normally incident on a diffraction grating. If the second order diffraction maximum is observed at 50.25 degrees to the normal, then calculate the number of lines per cm of the grating.
A) 5.69×10^5 cm^{-1}
B) 1.53×10^6 cm^{-1}
C) 6.53×10^3 cm^{-1}
D) 1.31×10^6 cm^{-1}
E) 1.31×10^4 cm^{-1}
Ans: C