PHYSICS

BOOKS - MTG-WBJEE PHYSICS (HINGLISH)

WAVE OPTICS

Wb Jee Workout Mcq S

1. Two identical light waves, propagating in the same direction, have a phase difference δ.

After they superpose the intensity of the resulting wave will be proportional to

A. $\cos\delta$

B. $\cos(\delta/2)$

C. $\cos^2(\delta/2)$

D. $\cos^2\delta$

Answer: C

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2. The light beams of intensities in the ratio of $9:1$ are allowed to interfere. What will be the ratio of the intensities of maxima and minima ?

A. $3:1$

B. $4:1$

C. $25:9$

D. $81:1$

Answer: B

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3. In Young's double slit experiment the two slits are d distance apart. Interference pattern is observed on a screen at a distance D from the slits. A dark fringe is observed on the screen directly opposite to one of the slits. The wavelength of light is

A. $\frac{D^2}{2d}$

B. $\frac{d^2}{2D}$

C. $\frac{D^2}{d}$

D. $\frac{d^2}{D}$

Answer: D

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4. In a Young's experiment, two coherent sources are placed $0.90mm$ apart and the fringes are observed one metre away. If is produces the second dark fringe at a distance of $1mm$ from the central fringe, the

wavelength of monochromatic light used would be

A. $60 \times 10^{-3} cm$

B. $10 \times 10^{-4} cm$

C. $10 \times 10^{-5} cm$

D. $6 \times 10^{-5} cm$

Answer: D

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5. A parallel beam of monochromatic light of wavelength 5000Å is incident normally on a single narrow slit of width $0.001mm$. The light is focused by a convex lens on a screen placed on the focal plane. The first minimum will be formed for the angle of diffraction equal to

A. 0°

B. 15°

C. 30°

D. 50°

Answer: C

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6. An interference pattern was made by using red light. If the red light changes with blue light, the fringes will become

A. Wider

B. narrower

C. Fainter

D. Brighter

Answer: B

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7. A double slit experiment is performed with light of wavelength $500nm$. A thin film of thickness $2\mu m$ and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maximum will

A. Remain unshifted

B. Shift downward by nearly two fringes

C. Shift upward by nearly two fringes

D. Shift downward by 10 fringes.

Answer: C

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8. In the Young's doubel slit experiment, a poiint P on the central bright fringe is such that intensity of point P is 1/4 times the maximum intensity, distance between the slits

is d and wavelength λ. Then angular separation of point P is

A. $\sin^{-1}\left(\frac{\lambda}{d}\right)$

B. $\sin^{-1}\left(\frac{\lambda}{2d}\right)$

C. $\sin^{-1}\left(\frac{\lambda}{3d}\right)$

D. $\sin^{-1}\left(\frac{\lambda}{4d}\right)$

Answer: C

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9. The maximum number of possible interference maxima for slit-separation equal to twice the wavelength in Young's double-slit experiment is

A. Infinite

B. Five

C. Three

D. Zero

Answer: B

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10. If the ratio of the intensity of two coherent sources is 4 then the visibility $[(I_{\max} - I_{\min})/(I_{\max} + I_{\min})]$ of the fringes is

A. 4

B. $4/5$

C. $3/5$

D. 9

Answer: B

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11. In a Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen when light of wavelength $600nm$ is used. If the wavelength of light is changed to $400nm$, number of fringes observed in the same segment of the screen is given by

A. 12

B. 18

C. 24

D. 30

Answer: B

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12. Wavefront is the locus of all points, where the particles of the medium vibrate with the same

A. phase

B. amplitude

C. frequency

D. period

Answer: A

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13. A source emiting two light waves of wavelength $580nm$ and $700nm$ is used in a young's double slit interference experiment.

The swparation between the slits is $0.20mm$ and the interference is observed on a screen placed at $150cm$ from the slits. Find the linear separation between the frist maximum (next to the central maximum) corresponding to the two wavelenghts.

A. 0.8 mm

B. 1.1 mm

C. 0.9 mm

D. 2.1 mm

Answer: C

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14. In a Young's double slit experiment the slit is illuminated by a source having two wavelength of $400nm$ and $600nm$. If distance between slits, $d = 1mm$, and distance between the plane of the slit and screen, $D = 10m$ then the samllest distance from the central maximum where is complete darkness in :

A. 2mm

B. 3mm

C. 12mm

D. there is o such point

Answer: D

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15. In the figure, if a parallel beam of white light is incident on the plane of the slits, then the distance of the white spot on the screen

from O is [assume $d < \ < D, \lambda < \ < d$]

A. 0

B. $d/2$

C. $d/3$

D. $d/6$

Answer: C

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16. In YDSE using monochromatic light the fringe pattern shifts by a certain distance on the screen when a mica sheet of refractive index 1.6 and thickness 1.964 microns is introduced in the path of one of the interfering waves. The mica sheet is then removed and the distance between the plane of slits and the screen is doubled. It is found that the distance between successive maxima (or minima) now is the same as the observed fringe shift upon the introduction of the mica sheet. Calculate the wavelength of the light.

A. 3000 Å

B. 4850 Å

C. 5892 Å

D. None of these

Answer: C

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17. In the ideal double-slit experiment, when a glass-plate(refractive index 1.5) of thickness t is introduced in the path of one of the

interfering beams (wave-length λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is

A. 2λ

B. $2\lambda/3$

C. $\lambda/3$

D. λ

Answer: A

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18. If the first minima in Young's double-slit experiment occurs directly in front of one of the slits (distance between slit and screen $D = 12cm$ and distance between slits $d = 5cm$), then the wavelength of the radiation used can be

A. 2 cm

B. 4cm

C. 6cm

D. $\frac{4}{3}$ cm

Answer: A

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19. 

Wavefronts are incident on an interface at an angle of 30° as shown. Find the angle of the refracted wavefronts.

A. 30°

B. 45°

C. 60°

D. 75°

Answer: B

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20. Two beams of light having intensities I and 4I interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\pi/2$ at point A and π at point B. then

the difference between the resultant intensities at A and B is

A. 2I

B. 4I

C. 5I

D. 7I

Answer: B

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21. Consider Fraunhoffer diffraction pattern obtained with a single slit illuminated at normal incidence. At the angular position of the first diffraction minimum the phase difference (in radians) between the wavelets from the opposite edges of the slit is

A. $\pi/4$

B. $\pi/2$

C. 2π

D. π

Answer: C

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22. The blue colour of sky is due to :

A. interference

B. scattering

C. diffraction

D. total internal reflection

Answer: B

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23. What is the minimum thickness of thin film required for constructive interference in the reflected light through it ?

(Given, the refractive index of the film $= 1.5$, wavelength of the lilght incident on the film $= 600$ nm.

A. 100nm

B. 300nm

C. 50nm

D. 200nm

Answer: A

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24. A single slit Fraunhoffer diffraction patternn is formed with white light. For what wavelength of light the third secondary maximum in the diffraction pattern coincides with the second secondary maximum in the patternn of red light of wavelength 6300 Å?

A. 4400 Å

B. 4100 Å

C. 4642.8 Å

D. 9100 Å

Answer: C

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25. In Young's double slit experiment, the sepcaration between the slits is halved and

the distance between the slits and the screen is doubled. The fringe width is

A. unchanged

B. halved

C. doubled

D. quadrupled

Answer: D

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26. In a Young's double-slit experment, the fringe width is β. If the entire arrangement is now placed inside a liquid of refractive index μ , the fringe width will become

A. $n\beta$

B. $\frac{\beta}{n+1}$

C. $\frac{\beta}{n-1}$

D. $\frac{\beta}{n}$

Answer: D

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27. In a single slit diffraction experiment, the width of the slit is made double its original width. Then the central maximum of the diffraction pattern will become

A. broader and brighter

B. sharper and brighter

C. sharper and fainter

D. broader and fainter

Answer: D

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28. Huygens wave theory allows us to know

A. The wavelength of the wave

B. The velocity of the wave

C. The amplitude of the wave

D. The propagation of wave fronts.

Answer: D

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29. If the two slits in Young's double slit experiment are of unequal width, then

A. the bright fringes will have unequal spacing.

B. the bright fringes will have unequal brightness

C. the fringes do not appear

D. the dark fringes are not perfectly dark.

Answer: D

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30. A micture of light, consisting of wavelength 590nm and an unknown wavelength, illuminates Young's double slit and gives rise to two overlapping interference patterns on the scree. The central maximum of both lights coincide. Further, it is obseved that the third bright fringe of known light coincides with the 4th bright fringe of the

unknown light. From this data, the wavelength of the unknown light is:

A. 393.4nm

B. 885.0 nm

C. 442.5 nm

D. 776.8 nm

Answer: C

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31. In YDSE, bichromatic light of wavelengths 400 nm and 560 nm

are used. The distance between the slits is 0.1 mm and the distance between the

plane of the slits and the screen is 1m. The minimum distance between two

successive regions of complete darkness is

A. 4mm

B. 5.6mm

C. 14mm

D. 28mm

Answer: D

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32. Figure shows plane waves refracted from air to water. Using Huygen's principle, find the, ratio of refractive index of water w.r.t. air from the diagram, if a,b,c,d,e are lengths on the diagram.

A. a/e

B. b/e

C. b/d

D. d/b

Answer: C

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33. The Young's double slit experiment has been shown in figure. Q is the position of the first bright fringe on the right side from O and

P is the 11th bright fringe on the other side as measured from Q. if wavelength of the light used is 6000 Å, find the distance S_1B.

A. $6 \times 10^{-6}m$

B. $12 \times 10^{-6}m$

C. $18 \times 10^{-6}m$

D. $36 \times 10^{-6}m$

Answer: A

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34. In a standard $YDSE$ apparatus a time film $(\mu = 1.5, t = 2.1\mu m)$ is placed in front of upper slit.How far above or below the center point of the screen are two nearest maximum located? Take $D = 1m, d = 1mm, \lambda = 4500\text{Å}$.(Symbols have usual meaning).

A. 1.5mm

B. 0.6mm

C. 0.15mm

D. 0.3mm

Answer: C

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35. In a double slit experiment instead of taking slits of equal widths, one slit is made twice as wide as the other. Then, in the interference pattern

A. the intensities of both the maxima and the minimum increase

B. the intensity of the maxima increases and the minima has zero intensity

C. the intensity of the maxima decreases and that of the minima increases

D. the intensity of the maxima decreases and the minima has zero intensity.

Answer: A

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36. A beam of light of wave length 600 nm from a distance source fall on a single slit 1mm wide and a resulting. Diffraction pattern is observed on a screen 2m away. The distance between the first dark fringes on either side of central bright fringe is

A. 1.2cm

B. 1.2mm

C. 2.4cm

D. 2.4mm

Answer: D

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37.

Consider the optical system shown in the figure that follows. The point source of light S is having wavelength equal to λ. The light is reaching screen only after reflection. For point

P to be 2nd maxima, the value of λ would be $(D > > d$ and $d > > \lambda)$.

A. $\frac{12d^2}{D}$

B. $\frac{6d^2}{D}$

C. $\frac{3d^2}{D}$

D. $\frac{24d^2}{D}$.

Answer: A

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38. Two coherent narrow slits emitting light of wavelength λ in the same phase are placed parallel to each other at a small separation of 3λ. The light is collected on a screen S which is placed at a distance $D(>>\lambda)$ from the slits. What will be the order of maxima at point O ?

A. 0

B. 1

C. 2

D. 3

Answer: D

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39. White light is incident normally on a glass plate (in air) of thickness $500nm$ and refractive index of 1.5. The wavelength (in nm) in the visible region $(400nm - 700nm)$ that is strongly reflected by the plate is:

A. 4500 Å

B. 6000 Å

C. 4000 Å

D. 4000 Å

Answer: B

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40. Two identical radiators have a separation of $d = \lambda/4$ where λ is the wavelength of the waves emitted by either source. The initial phase difference between the sources is $\lambda/4$.

Then the intensity on the screen at a distant point situated at an angle $\theta = 30^\circ$ from the radiators is (here I_0 is intensity at that point due to one radiator alone)

A. I_0

B. $2I_0$

C. $3I_0$

D. $4I_0$

Answer: B

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41. The ratio of the intensity at the centre of a bright fringe to the intensity at a point one-quarter of the distance between two fringe from the centre is

A. 2

B. $1/2$

C. 4

D. 16

Answer: A

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42. Consider Fraunhoffer diffraction pattern obtained with a single slit illuminated at normal incidence. At the angular position of the first diffraction minimum the phase difference (in radians) between the wavelets from the opposite edges of the slit is

A. $\pi/4$

B. $\pi/2$

C. π

D. 2π

Answer: D

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43. In an interference arrangement similar to Young's double-slit experiment, the slits S_1 and S_2 are illuminated with coherent microwave sources, each of frequency $10^6 Hz$. The sources, are synchronized to have zero phase difference. The slits are separated by a

distance d=150.0m. the intensity $I(\theta)$ is measured as a function of θ, where θ is defined as shown. if I_0 is the maximum intensity, then $I(\theta)$ for $0 \leq \theta \leq 90^\circ$ is given by

A. $I(\theta) = I_0/2,$ for $\theta = 30^\circ$

B. $I(\theta) = I_0/4,$ for $\theta = 90^\circ$

C. $I(\theta) = I_0,$ for $\theta = 0^\circ$

D. $I(\theta)$ is constant for all values of θ.

Answer: C

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44. In a double slit experiment, the distance between the slits is 5.0 mm and the slits are 1.0m from the screen. Two interference patterns can be seen on the screen one due to light with wavelength 480nm, and the other due to light with wavelength 600nm. What is the separation on the screen between the third order bright fringes of the two intergerence patterns?

A. 0.20 mm

B. 0.05 mm

C. 0.072 mm

D. 0.09 mm

Answer: C

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45. In Young's double slit experiment the fringe width is found to be 0.3 mm. Now if a thin glass plate of refracting index 1.5 is placed in the path of any one of light rays coming

from the slits then the width of the fringe will be

A. zero

B. 0.3 mm

C. 0.45 mm

D. 0.15 mm

Answer: B

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46. In a Young's double slit experiment, the separation between the two slits is d and the wavelength of the light is λ. The intensity of light falling on slit 1 is four times the intensity of light falling on slit 2. Choose the correct choice (s).

A. If $d = \lambda$ the screen will contain only one maximum

B. If $\lambda < d < 2\lambda$ at least one more maximum (besides the central

maximum) will be observed on the screen.

C. If the intensity of light falling on slit 1 is reduced so that it becomes equal to that of slit 2, the intensities of the observed dark and bright fringes will increase

D. if the intensity of light falling on slit 2 is increased so that it becomes equal to that of slit 1, the intensities of the

observed dark and bright fringes will increase.

Answer: A::B

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47. White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and the screen is at a distance d`(gtb) from the slits. At a point on the screen directly in front of one

of the slits, certain wavelength are missing. Some of these missing wavelength are

A. $\lambda = \frac{b^2}{d}$

B. $\lambda = \frac{2b^2}{d}$

C. $\lambda = \frac{b^2}{3d}$

D. $\lambda = \frac{2b^2}{d}$

Answer: A::C

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48. In the Young's double slit experiment, the interference pattern is found to have as intensity ratio between the bright and dark fringes as 9. This implies that

A. the intensities at the screen due to the two slits are 5 units and 4 units respectively

B. the intensities at the screen due to the two slits are 4 units and 1 units respectively

C. the amplitude ratio is 1

D. the amplitde ratio is 2

Answer: B::D

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49. The minimum value of d so that there is a dark fringe at O is $d_{\min}$. The distance at which are next bright fringe is formed is x. then

A. $d_{\min} = \sqrt{\lambda D}$

B. $d_{\min} = \sqrt{\frac{\lambda D}{2}}$

C. $x = \frac{d_{\min}}{2}$

D. $x = 3d_{\min}$

Answer: B::D

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50.

Two point monochromatic and coherent sources of light of wavelength λ are each

placed as shown in the figure. The initial phase difference between the sources is zero O. $(D > > d)$. Selected the correct statement (s)

A. If $d = \frac{7\lambda}{2}$, O will be minima

B. If $d = \lambda$, only one maxima can be observed on screen

C. If $d = 4, 8\lambda$ then a total 10 minima would be there on screen

D. If $d = \frac{5\lambda}{2}$, then intensity at O would be minimum

Answer: A::B::C::D

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51. In a YDSE perfromed with light of wavelength 600Å, the screen is placed 1 m from the slits. Fringes formed on the screen are observed by a student sitting close to the slits. The student's eye can distinguish two neighboring fringes. If they subtend an angle more then 1 minute of ace, then

Find the location of third bright fringe from center of the screen.

A. $\frac{3}{\pi}$mm

B. $\frac{6}{\pi}mm$

C. $\frac{4.5}{\pi}mm$

D. $\frac{6.48}{\pi}mm$

Answer: D

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52. In Young's double slit experiment, one of the slit is wider than other, so that amplitude of the light from one slit is double of that from other slit. If I_m be the maximum intensity, the resultant intensity I when they interfere at phase difference ϕ is given by:

A. $\frac{I_m}{3}\left(1+2\cos^2\frac{\phi}{2}\right)$

B. $\frac{I_m}{5}\left(1+4\cos^2\frac{\phi}{2}\right)$

C. $\frac{I_m}{9}\left(1+\ \cdot\ \frac{\cos^2(\phi)}{2}\right)$

D. $\frac{I_m}{9}(4+\cos\phi)$

Answer: C

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53. If white light is used in a Young's double slit experiment,

A. bright white fringe is formed at the centre of the screen

B. fringes of different colours are observed clearly only in the first order

C. the first-order violet fringes are closer to the centre of the screen than the first-order red fringes

D. the first-order red fringes are closer to the centre of the screen than the first order violet fringes.

Answer: A::B::C

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54. In Young's double slit experiment, phase difference between the waves at a point on screen having intensity less than the average intensity on screen may be

A. $\pi/4$

B. $2\pi/3$

C. π

D. $7\pi/8$

Answer: B::C::D

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55. In the Young's double slit experiment using a monochromatic light of wavelength λ, the path difference (in terms of an integer n) corresponding to any point having half the peak

A. $(2n+1)\frac{\lambda}{2}$

B. $(2n+1)\frac{\lambda}{4}$

C. $(2n+1)\frac{\lambda}{8}$

D. $(2n+1)\frac{\lambda}{16}$

Answer: B

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Wb Jee Previous Years Question Mcq S

1. S_1 and S_2 are two coherent sources. The intensity of both sources are same. If the intensity at the point of maxima is $4Wm^{-2}$, the intensity of each source is

A. $(3\lambda, 0)$

B. $(4\lambda, 0)$

C. $(5\lambda/4, 0)$

D. $(2\lambda/3, 0)$

Answer: B

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2. Two coherent monochromatic beams of intensities I and 4 I respectively are superposed. The maximum and minimum intensities in the resulting pattern are

A. 5I and 3I

B. 9I and 3I

C. 4I and I

D. 9I and I

Answer: D

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3. A thin plastic of refractive index 1.6 is used to cover one of the slits of a double slit arrangement. The central point omn the

screen is now occupied by what would have been the 7th bright fringe before the plastic was used. If the wavelength of light is 600 nm, what is the thickness (in μm) of the plastic?

A. 7

B. 4

C. 8

D. 6

Answer: A

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4. Two monochromatic coherent light beams A and B have intensities L and $\frac{L}{4}$ respectively.If these beams are superposed the maximum and minimum intensities will be

A. $\frac{9L}{4}, \frac{L}{4}$

B. $\frac{5L}{4}, 0$

C. $\frac{5L}{2}, 0$

D. $2L, \frac{L}{2}$

Answer: A

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5. In Young's double slit experiment

A. All the bright fringes will be coloured.

B. All the bright fringes will be white.

C. The central fringe will be white

D. No stable interference pattern will be visible.

Answer: C

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6. In Young's experiment for the interference of light, the separation between the slits is d and the distance of the screen from the slits is D. if D is increased by 0.5% and d is decreased by 0.3% then for the light of a given wavelength, which one of the following is true ? "The fringe width . . . "

A. increases by 0.8%

B. decreases by 0.8%

C. increases by 0.2%

D. decreases by 0.2%

Answer: A

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7. When the frequency of the light used is changed from $4 \times 10^{14} s^{-1}$ to $5 \times 10^{14} s^{-1}$, the angular width of the principal (central) maximum in a single slit fraunhoffer diffraction pattern changes by 0.6 radian.

What is the width of the slit (assume that the experiment is performed in vacuum) ?

A. $1.5 \times 10^{-7} m$

B. $3 \times 10^{-7} m$

C. $5 \times 10^{-7} m$

D. $6 \times 10^{-7} m$

Answer: C

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8. For Fraunhofer diffraction to occur

A. Light source should be at infinity

B. Both source and scree should be at infinity

C. Only the source should be at finite distance

D. both source and screen should be at finite distance.

Answer: B

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9. Find the right condition(s) for Fraunhofer diffraction due to a single slit

A. Source is at infinite distance and the incident beam has converged at the slit

B. source is near to the slit and the incident beam is parallel.

C. Source is at infinity and the incident beam is parallel

D. Source is near to the slit and the incident beam has

Answer: B::C

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