RK VISION ACADEMY

PHYSICS

XII – WAVE OPTICS

SECTION A

1. **In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelengths λ_1=12000 Å and λ_2=10000 Å. At what minimum distance from the common central bright fringe on the screen 2 m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?**

(1) 4 mm

(2) 3 m

(3) 8 mm

(4) 6 mm

2. **A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen is placed at a large distance from the slit. If the speed of the electrons is increased, which of the following statements is correct?**

(1) The angular width of the central maximum will be unaffected

(2) Diffraction pattern is not observed on the screen in the case of electrons 2

(3) The angular width of the central maximum of the diffraction pattern will increase

(4) The angular width of the central maximum will decrease

3. **A beam of light of λ = 600 nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. The distance between first dark fringes on either side of the central bright fringe is**

(1) 1.2 cm

(2) 1.2 mm

(3) 2.4 cm

(4) 2.4 mm

4. **In the Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ is K, (λ being the wavelength of light used). The intensity at a point where the path difference is λ/4, will be**

(1) K

(2) 4K

(3) K/2

(4) Zero

5. **At the first minimum adjacent to the central maximum of a single-slit diffraction pattern the phase difference between the Huygens's wavelength from the edge of the slit and the wavelet from the mid point of the slit is:**

(1) $\pi/8$

(2) $\pi/4$

(3) $\pi/2$

(4) π

6. **Two slits in Young's experiment have widths in the ratio 1 : 25. The ratio of**

intensity at the maxima and minima in the interference pattern, I_{max}/I_{min} is:

(1) 4/9

(2) 9/4

(3) 12/149

(4) 49/121

7. In a double slit experiment, the two slits are 1 mm apart and the screen is placed 1 m away. A monochromatic light of wavelength 500 nm is used. What will be the width of each slit for obtaining ten maxima of double slit within the central maxima of single slit pattern?

(1) 0.1 mm

(2) 0.5 mm

(3) 0.02 mm

(4) 0.2 mm

8. For a parallel beam of monochromatic light of wavelength 'λ', diffraction is produced by a single slit whose width 'a' is of the order of the wavelength of the light. If 'D' is the distance of the screen from the slit, the width of the central maxima will be

(1) $D\lambda/a$

(2) Da/λ

(3) $12D/a$

(4) $2D\lambda/a$

9. In a diffraction pattern due to a single slit of width a, the first minima is observed at angle 30^0 when the light of wavelength 5000 Å is incident on the slit. The first secondary maximum is observed at an angle of:

(1) $\sin^{-1}(1/4)$

(2) $\sin^{-1}(2/3)$

(3) $\sin^{-1}(1/2)$

(4) $\sin^{-1}(3/4)$

10. The intensity at the maximum in a Young's double slit experiment is I_0. Distance between two slits is d = 5λ, where λ is the wavelength of light used in the experiment. What will be the intensity in front of one of the slits on the screen placed at a distance D = 10d?

(1) I_0

(2) $I_0/4$

(3) $3I_0/4$

(4) $I_0/2$

11. The interference pattern is obtained with two coherent light sources of intensity ratio n. In the interference pattern, the ratio $(I_{max}-I_{min})/(I_{max}+I_{min})$ will be

(1) $\sqrt{n}/(n+1)^2$

(2) $2\sqrt{n}/(n+1)^2$

(3) $\sqrt{n}/n+1$

(4) $2\sqrt{n}/n+1$

12. A linear aperture whose width is 0.02 cm is placed immediately in front of a lens of focal length 60 cm. The aperture is illuminated normally by a parallel beam of wavelength 5×10^{-5} cm. The distance of the first dark band of the diffraction pattern from the center of the screen is

(1) 0.20 cm

(2) 0.15 cm

(3) 0.10 cm

(4) 0.25 cm

13. A parallel beam of light of wavelength λ is incident normally on a single slit of width d. Diffraction bands are obtained on a screen placed at a distance D from the slit. The second dark band from the central bright band will be at a distance given by

(1) $2\lambda D / d$

(2) $\lambda d / D$

(3) $\lambda D / 2d$

(4) $2\lambda d / D$

14. Two coherent sources of intensity ratio α interfere. The value of $(I_{max}-I_{min})/(I_{max}+I_{min})$ will be:

(1) $2\sqrt{\frac{\alpha}{1+\alpha}}$

(2) $\frac{2\sqrt{\alpha}}{1+\alpha}$

(3) $\frac{1+\alpha}{2\sqrt{\alpha}}$

(4) $\frac{1-\alpha}{1+\alpha}$

15. Two Polaroids P_1 and P_2 are placed with their axis perpendicular to each other. Unpolarised light I_0 is incident on P_1. A third polaroid P_3 is kept in between P_1 and P_2 such that its axis makes an angle 45° with that of P_1. The intensity of transmitted light through P_2 is

(1) $I_0/4$

(2) $I_0/8$

(3) $I_0/16$

(4) $I_0/2$

16. Young's double slit experiment is first performed in air and then in a medium other than air. It is found that 8th bright fringe in the medium lies where 5th dark fringe lies in air. The refractive index of the medium is nearly

(1) 1.59

(2) 1.69

(3) 1.78

(4) 1.25

17. The ratio of resolving powers of an optical microscope for two wavelengths λ_1=4000 Å and λ_2=6000 Å is

(1) 9 : 4

(2) 3 : 2

(3) 16 : 81

(4) 8 : 2

18. An astronomical refracting telescope will have large angular magnification and high angular resolution, when it has an objective lens of

(1) Large focal length and large diameter

(2) Large focal length and small diameter

(3) Small focal length and large diameter

(4) Small focal length and small diameter

19. In Young's double slit experiment the separation d between the slits is 2 mm, the wavelength λ of the light used is 5896 Å and distance D between the screen and slits

is 100 cm. It is found that the angular width of the fringes is 0.20°. To increase the fringe angular width to 0.21° (with same λ and D) the separation between the slits needed to be changed to

(1) 2.1 mm

(2) 1.9 mm

(3) 1.8 mm

(4) 1.7 mm

20. Unpolarised light is incident from air on a plane surface of a material of refractive index 'μ'. At a particular angle of incidence 'i', it is found that the reflected and refracted rays are perpendicular to each other. Which of the following options is correct for this situation?

(1) $i=\sin^{-1}(1/\mu)$

(2) Reflected light is polarised with its electric vector perpendicular to the plane of incidence

(3) Reflected light is polarised with its electric vector parallel to the plane incidence

(4) $i=\tan^{-1}(1/\mu)$

21. In a double slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 1 m away, was found to be 0.2°. What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water?

(μ_{water}=4/3)

(1) 0.266°

(2) 0.15°

(3) 0.05°

(4) 0.1°

22. Two coherent sources of light interfere and produce fringe pattern on a screen. For central maximum, the phase difference between the two waves will be

(1) π

(2) $3\pi 2$

(3) $\pi 2$

(4) Zero

23. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes

(1) Half

(2) Four times

(3) One-fourth

(4) Double

24. The Brewsters angle I_b for an interface should be

(1) $30°<I_b<45°$

(2) $45°<I_b<90°$

(3) $I_b=90°$

(4) $0°<I_b<30°$

25. In a Young's double slit experiment, a student observes 8 fringes in a certain segment of screen when a monochromatic light of 600 nm wavelength is used. If the wavelength of light is changed to 400 nm,

then the number of fringes he would observe in the same region of the screen is

(1) 8

(2) 9

(3) 12

(4) 6

26. For Young's double slit experiment, two statements are given below:

Statement I: If screen is moved away from the plane of slits, angular separation of the fringes remains constant.

Statement II: If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes decreases

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II is true

(3) Both Statement I and Statement II are true

(4) Statement I is true but Statement II are false

27. If the monochromatic source in Young's double slit experiment is replaced by white light, then

(1) Interference pattern will disappear.

(2) There will be a central dark fringe surrounded by a few coloured fringes.

(3) There will be a central bright white fringe surrounded by a few coloured fringes.

(4) All bright fringes will be of equal width.

28. An unpolarised light beam strikes a glass surface at Brewster's angle. Then

(1) The reflected light will be partially polarised.

(2) The refracted light will be completely polarised.

(3) Both the reflected and refracted light will be completely polarised.

(4) The reflected light will be completely polarised but the refracted light will be partially polarised

29. A plane wave passes through a convex lens. The geometrical shape of the wavefront that emerges is

(1) Plane

(2) Diverging spherical

(3) Converging spherical

(4) None of these

30. To observe diffraction, the size of the obstacle

(1) Should be $\lambda/2$, where λ is the wavelength

(2) Should be of the order of wavelength

(3) Has no relation to wavelength

(4) Should be much larger than the wavelength

31. Two slits are separated by a distance of 0.5 mm and illuminated with light of wavelength λ = 6000 Å. If the screen is placed at 2.5 m from the slits. The distance of the third bright image from the centre will be

(1) 1.5 mm

(2) 3 mm

(3) 6 mm

(4) 9 mm

32. Angular width of central maximum of a diffraction pattern on a single slit does not depend upon:

(1) Distance between slit and source

(2) Wavelength of light used

(3) Width of the slit

(4) Frequency of light used

33. Assertion: When thin transparent sheets are placed in front of both the slits of Young's experiment, the fringe width will remains same.

Reason: In Young's experiment, the fringe width is directly proportional to wavelength of the source used.

(1) Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

(2) Both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.

(3) Assertion is true but Reason is false. (4) Both Assertion and Reason are false.

34. If the ratio of amplitude of two waves is 4 : 3, then the ratio of maximum and minimum intensity is

(1) 16 : 18

(2) 18 : 16

(3) 49 : 1

(4) 94 : 1

35. Which of the following is conserved when light waves interfere

(1) Intensity

(2) Energy

(3) Amplitude

(4) Momentum

SECTION B

36. Light from two coherent sources of the same amplitude A and wavelength λ illuminates the screen. The intensity of the central maximum is I. If the source were incoherent, the intensity at the same point will be

(1) 4I

(2) 2I

(3) I

(4) I /2

37. Assertion: Wavefront obtained from light emitted by a point source in an isotropic medium are always spherical.

Reason: Speed of light in isotropic medium is constant.

(1) Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

(2) Both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.

(3) Assertion is true but Reason is false.

(4) Both Assertion and Reason are false

38. In double slit experiment, for light of which colour the fringe width will be minimum

(1) Violet

(2) Red

(3) Green

(4) Yellow

39. The fringe width in Young's double slit experiment increases when

(1) Wavelength increases

(2) Distance between the slits increases

(3) Distance between the source and screen decreases

(4) The width of the slits increases

40. A thin mica sheet of thickness 2×10^{-6}m and refractive index ($\mu = 1.5$) is introduced in the path of the first slit in YDSE. The wavelength of the wave used is 5000 Å. The central bright maximum will shift

(1) 2 fringes upward

(2) 2 fringes downward

(3) 10 fringes upward

(4) None of these

41. A parallel beam of light of wavelength 560 nm falls on a thin film of oil (refractive index=1.4). What should be the minimum thickness of the film so that it strongly reflects the light?

(1) 10000 nm

(2) 10 nm

(3) 1000 nm

(4) 100 nm

42. In YDSE with white light

(1) Center of screen is central maxima

(2) White fringe is the central maxima

(3) Dark bands are observed on screen

(4) Fringe width of each colour is same

43. A diffraction is obtained by using a beam of red light. What will happen if the red light is replaced by the blue light

(1) Bands will get narrower and crowded full together

(2) Bands become broader and further apart

(3) No change will take place

(4) Bands disappear

44. The two slits at a distance of 1 mm are illuminated by the light of wavelength 6.5×10^{-7} m. The interference fringes are observed on a screen placed at a distance of 1 m. The distance between third dark fringe and fifth bright fringe will be

(1) 0.65 mm

(2) 1.63 mm

(3) 3.25 mm

(4) 4.88 mm

45. 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 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is given by

(1) 12

(2) 18

(3) 24

(4) 30

46. In Young's double slit interference experiment, the slit separation is made 3 folds. The fringe width becomes

(1) 1/3 times

(2) 1/9 times

(3) 3 times

(4) 9 times

47. Two light waves superimposing at the midpoint of the screen are coming from coherent sources of light with phase difference 3 rad. Their amplitude are 1 cm each. The resultant amplitude at the given point will be

(1) 5 cm

(2) 3 cm

(3) 2 cm

(4) Zero

48. In the case of light waves from two coherent sources S_1 and S_2, there will be constructive interference at an arbitrary point P, if the path difference $S_1P - S_2P$ is

(1) $(n + 0.5)\lambda$

(2) $n\lambda$

(3) $(n - 0.5)\lambda$

(4) $\lambda/2$

49. The idea of secondary wavelets for the propagation of a wave was first given by

(1) Newton

(2) Huygens

(3) Maxwell

(4) Fresnel

50. Two sources of waves are called coherent if

(1) Both have the same amplitude of vibrations

(2) Both produce waves of the same wavelength

(3) Both produce waves of the same wavelength having constant phase difference

(4) Both produce waves having the same Velocity

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PHYSICS

XII – WAVE OPTICS

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SECTION B

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