PHYSICS

BOOKS - MODERN PUBLICATION

Diffraction of Light

Example

1. A slit of width 0.15 cm is illuminated by ilght of wavelength 5×10^{-5} cm and a diffraction

pattern is obtained on a screeen 2.1 m away .Calculate the width of the central maxima.

Watch Video Solution

2. Calculate the resolving power of a telescope,whose objective lens has an aperture of 1.0 m for the wave-length of light 500 nm?

Watch Video Solution

3. A beam of light of wavelength 600 nm from a distant source falls on a single slit 1.00 mm wide and the resulting diffraction pattern is observed on a screen 2m away. What is the distance between the first dark fringes on either side of the central fringe?

Watch Video Solution

4. A slt of width a illuminated by mono-chromatic ligth of wavelength 650 nm at

normal incidence .Calculate the value of a when

the first minimum falls at an angle of diffraction of 30°,

Watch Video Solution

5. A slt of width a illuminated by mono-chromatic ligth of wavelength 650 nm at normal incidence .Calculate the value of a when

the first maximum falls at an angle of diffraction of 30°.

Watch Video Solution

6. Two wavelengths of sodium light of 590 nm nd 596 nm are used in turn to study the diffraction taking place at a single slit of aperture $2 \times 10^{-6} m$.Calculate the separation between the positions of first maxima of the diffraction pattern obtained in the two cases.

Watch Video Solution

7. In a simple slit diffraction experiment,first minimum of rd light(660 nm) coincides with first maximum of some other wavelength λ'. Find the value of λ'.

Watch Video Solution

8. For a single slit of width a ,the first minimum of the interference pattern of a monochromatic ligth of wavlength λ.occurs at an angle of λ/a.At the same angle of λ/a,we

get a maximum for two narrow sits separated bby a distance a.Explain.

Watch Video Solution

9. Light of wavelength 550nm is incident as parallel bea on a silt of width 0.1 mm.Find the linear width and the angular width of the principal maxima in the resulting diffraction pattern on a screen kept at a distance of 1.1 m from the slit.Which of these widths would not

change,if the screen were moved to a distance of 2.2 m from the slit?

Watch Video Solution

10. Light of wavelength 600 nm is incident on an aperture of size 2 mm.Calculate the distance upto which the ray of light can travel,such that its spread is less than the size of the aperture.

Watch Video Solution

11. A telescope is used to resolve two stars separated by 4.6×10^{-6} radian.If the wavelength fo light used is $5,460\overset{\circ}{A}$,what shold be the aperture of the objective of the telescope?

Watch Video Solution

12. Diameter of human eye lens is 2 mm.What will be the minimum distance between two points to resolve them,which are situated at a

distacne of 50 m from eye?The wavleength of ligth is $5,000\overset{\circ}{A}$.

Watch Video Solution

13. Angular width of centrl maximum in the Fraunhofer diffraction pattern of a slit is measured.The slit is iluminated by igth of wavelength $6,000\overset{\circ}{A}$.When the slit is illuminated by light of another wavelength,the angular width decreases y 30%.Calculate the wavelength of this light.

The same decrease in the angular width of centrl maximum is obtained ,when the original appartus is immersed in a liquid.Fin refractive index of the liquid.

Watch Video Solution

14. What is diffraction of light?

Watch Video Solution

15. Does diffraction of light give information about the nature (transverse or longitudinal) of light waves.

Watch Video Solution

16. Which phenomena establish the wave nature of ligth?

Watch Video Solution

17. What are the reasons to believe that light is a wave motion?

Watch Video Solution

18. What are the reasons to believe that light is a wave motion?

Watch Video Solution

19. State the necessary condition for diffraction of light to occur?

Watch Video Solution

20. What should be the order of size of obstacle/aperture for diffraction of light?

Watch Video Solution

21. What should be the order of size of obstacle/aperture for diffraction of light?

Watch Video Solution

22. For a given single slit,the diffraction pattern is obtained on a fixed screen,first by using red ligth and then with blue light.In which case,will the central maxima,in the observed diffraction pattern,have a larger angular width?

Watch Video Solution

23. Yellow light is used in a single slit diffraction experiment with slit width of 0.6 mm. If yellow light is replaced by X-rays, how will the diffraction pattern be affected?

Watch Video Solution

24. What is the condition for first minimum in case of diffraction due to single slit?

Watch Video Solution

25. Distinguish between interference and diffraction?

Watch Video Solution

26. A diffraction greating has 5000 lines per cm. what is its greating element?

Watch Video Solution

27. A diffraction greating has 5000 lines per cm. what is its greating element?

Watch Video Solution

28. Define resolving power of an optical instrument. How does it depend on wavelength?

Watch Video Solution

29. Define resolving power of a compound microscope. How does the resolving power of a compound microscope change when wavelength of radiation used is increased.

Watch Video Solution

30. Define resolving power of telescope.

Watch Video Solution

31. What is meant by the term angular resulution of a telescoe?

Watch Video Solution

32. How does magnifying power of a telescope change on decreasing the aperture of its objective lens?Justify your answer.

Watch Video Solution

33. What is differnce between diffraction and interfernce?

Watch Video Solution

34. Why is the diffraction of sound more evident in daily life that of the light waves?

Watch Video Solution

35. Why can sound waves be diffracted more easily than light waves?

Watch Video Solution

36. Which of the following phenomenon is not common to sound and light waves?

Watch Video Solution

37. Radio waves diffract pronouncedly around building while light waves do not why?

Watch Video Solution

38. Coloured specrtrum is seen,when we look through a muslin cloth.Why?

Watch Video Solution

39. General instruction same as in chapter 1.

Assertion:If we look through a muslin cloth, a coloured spectrum is seen.

It is due to diffraction of white light on passing through fine slits.

Watch Video Solution

40. Why can we not get diffraction from a wide slit illuminated by a monochromatic light?

Watch Video Solution

41. A slit of width a is illuminated by monochromtic light at normal incidence .Draw the intensity distribution curve observed on the screen due to diffraction.

Watch Video Solution

42. Draw the intensity pattern for single slit diffraction and double slit interference. Hence, state differences between interference and diffraction.

Watch Video Solution

43. Answer the following questions: When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why?

Watch Video Solution

44. What two main changes in diffraction pattern of a single slit will you observe,when the monochromatic source of light is replaced by a source of white light?

Watch Video Solution

45. Show that the central maximum in the single slit diffraction is twice as wide as the second maxima and the pattern becomes narrow as the width of slit is increased.

Watch Video Solution

46. In a single slt diffraction pattern,how is the width of cetral bright maximum changed,when teh slit width is decreased,

Watch Video Solution

47. In a single slt diffraction pattern,how is the width of cetral bright maximum changed,when the distance between the slit and the screen is increased

Watch Video Solution

48. In a single slt diffraction pattern,how is the width of cetral bright maximum changed,when light of smaller wavelength is used.Justify you answer.

Watch Video Solution

49. In the diffraction of a single slit experiment, how would the width of and the

intensity of central maximum change,if

slit width is halved and

Watch Video Solution

50. In the diffraction of a single slit experiment, how would the width of and the intensity of central maximum change,if

visible light of longer wavelength is used?

Watch Video Solution

51. Answer the following questions: In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band?

Watch Video Solution

52. Give two differences between fringes formed in single slit diffraction and Young's double slit experiment.

Watch Video Solution

53. Give two points of differences between the phenomenon of interfernce and diffraction.

Watch Video Solution

54. Distinguish between interference and diffraction?

Watch Video Solution

55. Define resolving power of compound microscope.

Watch Video Solution

56. Define resolving power of compound microscope.

Watch Video Solution

57. Define resolving power of compound microscope.

Watch Video Solution

58. How does the resolving power of a compound microscope get affected on decreasing the diameter of its objective?

Watch Video Solution

59. How does the resolving power of a compound microscope get affected on increasing the focal length of its objective?

Watch Video Solution

60. How does the resolving power of a compound microscope change of decreasing the wave length of light used,and

Watch Video Solution

61. How does the resolving power of a compound microscope get affected on decreasing the diameter of its objective?

Watch Video Solution

62. Define resolving power of telescope.

Watch Video Solution

63. Define resolving power of an optical instrument. How does it depend on wavelength?

Watch Video Solution

64. How does magnifying power of a telescope change on decreasing the aperture of its objective lens?Justify your answer.

Watch Video Solution

65. Define resolving power of telescope.

Watch Video Solution

66. Two convex lenses of same focal length but of aperture D_1 and $D_2(D2 < D1)$,are used as the objective lenses in two astronomical telescopes having identical eyepieces.

what is the ratio of their resolving powers? Which telescope will you prefer and why ? Give reason.

Watch Video Solution

67. You are given the following three lenses. Which two lenses will you use as an eye piece and as an objective to construct an astronomical telescope? Give reasons.

Lenses	Power (D)	Aperture (cm)
L_1	3	8
L_2	6	1
L_3	10	1

Watch Video Solution

68. How will the resolving power of a compound microscope be affeced,when

the frequency of light used to illuminate the object is increased,and

Watch Video Solution

69. How does the resolving power of a compound microscope get affected on increasing the focal length of its objective?

Watch Video Solution

70. Why are diffraction effects more prominent through a slit formed by two blades than through a slit formed by two fingers?

Watch Video Solution

71. In a single slt diffraction experiment,the thrid minimum due to red light of wavelength 720 nm coinciedes with the fourth maximum

due to ligth of some unkown wavelength.Find the value of the unkown wavelength.

Watch Video Solution

72. The diameter of the pupi of the human eye is 2 mm and it is most sensitive to the ilght of wavelength 555 nm.

Find the angular limit of resolution of the eye.

Watch Video Solution

73. The diameter of the pupi of the human eye is 2 mm and it is most sensitive to the ilght of wavelength 555 nm.

Find the angular limit of resolution of the eye.

Watch Video Solution

74. Stars are often photographed through a blue filter.What is the advantage of this?

Watch Video Solution

Exercise

1. What is diffraction of light?

Watch Video Solution

2. What is meant by diffraction ?Explain diffraction at a single slit.

Watch Video Solution

3. What is diffraction of light?

Watch Video Solution

4. What is diffraction of light?

Watch Video Solution

5. What is the condition for first minimum in case of diffraction due to single slit?

Watch Video Solution

6. Discuss fully diffraction at a single slit and derive the relation for the linear width of central maximum.

Watch Video Solution

7. Answer the following questions: In a single slit diffraction experiment, the width of the slit is made double the original width. How does

this affect the size and intensity of the central diffraction band?

Watch Video Solution

8. What is dispersion of light? Explain it with a diagram. Also explain the cause of dispersion.

Watch Video Solution

9. Discuss fully diffraction at a single slit and derive the relation for the linear width of

central maximum.

Watch Video Solution

10. Discuss fully diffraction at a single slit and derive the relation for the linear width of central maximum.

Watch Video Solution

11. Show that the central maximum in the single slit diffraction is twice as wide as the

second maxima and the pattern becomes narrow as the width of slit is increased.

Watch Video Solution

12. A parallel beam of monochromatic light falls normally on a single narrow slit. How does the angular width of the central maximum in the resulting diffraction pattern depend on the wavelength of the incident light?

Watch Video Solution

13. Discuss fully diffraction at a single slit and derive the relation for the linear width of central maximum.

Watch Video Solution

14. Discuss the diffraction produced by a narrow slit which is illuminated by a monochromatic light.

Watch Video Solution

15. Show that the central maximum in the single slit diffraction is twice as wide as the second maxima and the pattern becomes narrow as the width of slit is increased.

Watch Video Solution

16. Give two points of differences between the phenomenon of interfernce and diffraction.

Watch Video Solution

17. Draw the intensity pattern for single slit diffraction and double slit interference. Hence, state differences between interference and diffraction.

Watch Video Solution

18. What is diffraction of light?

Watch Video Solution

19. Give two points of differences between the phenomenon of interfernce and diffraction.

Watch Video Solution

20. Define resolving power of an optical instrument. How does it depend on wavelength?

Watch Video Solution

21. Define resolving power of compound microscope.

Watch Video Solution

22. Define the term 'resolving power of a telescope'. How will the resolving power be affected with the increase in wavelength of light used?

Watch Video Solution

23. How will the resolving power of a compound microscope be affeced,when the frequency of light used to illuminate the object is increased,and

Watch Video Solution

24. How does the resolving power of a compound microscope get affected on increasing the focal length of its objective?

Watch Video Solution

25. Explain with reasons,how the resolving power of a compound microscope will change when

aperture of the objective lens is increased.

Watch Video Solution

26. Define the term resolving power of an astronomical telescope.How does it get affeted on

increasjing the aperture of the objective lens?

Watch Video Solution

27. Define the term resolving power of an astronomical telescope.How does it get affeted on

increasing the wavelength of light used?

Watch Video Solution

28. Explain with reason,how the resolving power of an astronomical telescoe will change when

frequency of the incident light on the objective lens is increased

Watch Video Solution

29. Explain with reason,how the resolving power of an astronomical telescoe will change when

focal length of the objective lens is increased and

Watch Video Solution

30. Explain with reason,how the resolving power of an astronomical telescoe will change when

aperture of the objective lens is halved.

Watch Video Solution

31. What do you mean by deviation of light?

Watch Video Solution

32. What is the condition for first minimum in case of diffraction due to single slit?

Watch Video Solution

33. Discuss fully diffraction at a single slit and derive the relation for the linear width of central maximum.

Watch Video Solution

34. Discuss fully diffraction at a single slit and derive the relation for the linear width of central maximum.

Watch Video Solution

35. Discuss fully diffraction at a single slit and derive the relation for the linear width of central maximum.

Watch Video Solution

36. Discuss fully diffraction at a single slit and derive the relation for the linear width of central maximum.

Watch Video Solution

37. What is the condition for first minimum in case of diffraction due to single slit?

Watch Video Solution

38. In the diffraction of a single slit experiment, how would the width of and the intensity of central maximum change,if slit width is halved and

Watch Video Solution

39. In the diffraction of a single slit experiment, how would the width of and the intensity of central maximum change,if slit width is halved and

Watch Video Solution

40. Two nearby narrow slits are illuminated by a single monochromatic source. Name the pattern obtained on the screen. One of the slits is now covered. What is the name of the pattern now obtained on the screen? Write two differences between the pattens obtained in the two cases.

Watch Video Solution

41. Show with the help of a diagram, how to obtain the diffraction pattern by a single slit .Draw a plot of intensity distribution.

Watch Video Solution

42. What is diffraction of light?

Watch Video Solution

43. Two nearby narrow slits are illuminated by a single monochromatic source. Name the pattern obtained on the screen. One of the slits is now covered. What is the name of the pattern now obtained on the screen? Write two differences between the pattens obtained in the two cases.

Watch Video Solution

44. The light of wavelength 600 nm is incident normally on a slit of width 3 mm. Calculate the linear width of central maximum on a screen kept 3 m away from the slit.

Watch Video Solution

45. The light of wavelength $6,000\mathring{A}$ falls normally on a slit odf width 2 mm.Calculate the linear width of central mximum on a screen kept 4 m away from teh slit.

Watch Video Solution

46. Light of wavelngth 600 nm is incident on a single slit of width 0.5 mm at normal incidence.Calculate the separation between two dark bbands on either side off the central maximum,if the diffration pattern is observed on a screen placed at 2 m from the slit.

Watch Video Solution

47. Red light of wavelenggth $6,500\mathring{A}$ from a distant source falls on a slit 0.5 mm wide.What is the distnce between two dark bands on each side of central brigth band of diffraction pattern observed on a screen placed 1.8 m from the slit?

Watch Video Solution

48. A screen is placed 2 m away from a narrow slit.Find the sit width ,if the first minimum lies

5 mm on eighter side of the central maximum,when plane waves of 5×10^{-7} m are incident on the slit.

Watch Video Solution

49. A slit 4.0 cm wide is irradiated with microwaves of wavelength 2.0 cm .Fin the angular spread of central maxima assuming incidence normal to the plane of the slit.

Watch Video Solution

50. Light of wavelength $5.4 \times 10^{-5} cm$ passes through a silt 0.12 cm wide and forms a diffraction pattern on a screen 2.7 m away. What is the width of the central maxima?

Watch Video Solution

51. If the apparatus is immersed in a liquid of refractive index 1.35,what would be the width of the central fringe?

Watch Video Solution

52. Determine the angular separation betwen central maximum and first order maximum of the difraction pattern due to a single slit of width 0.25 mm,when light of wavelength $5,890\overset{\circ}{A}$ is incident on it normally.

Watch Video Solution

53. 9 A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m

away. It is observed that the first minimum is at a distance of 2.5 mm from the centre of the screen. Find the width of the slit.

Watch Video Solution

54. A parallel beam of ligth of wavelength 600 nm is incident normally on a slit of width d .If the distance between teh slit and the screen is 0.8 m and the distance fo teh second order maximum from teh centre of the screen is 15 mm,calculate the width of the slit.

Watch Video Solution

55. A slt of width a illuminated by mono-chromatic ligth of wavelength 650 nm at normal incidence .Calculate the value of a when

the first minimum falls at an angle of diffraction of 30°,

Watch Video Solution

56. A slt of width a illuminated by mono-chromatic ligth of wavelength 650 nm at normal incidence .Calculate the value of a when

the first minimum falls at an angle of diffraction of 30°,

Watch Video Solution

57. A slt of width a illuminated by mono-chromatic ligth of wavelength 650 nm at

normal incidence .Calculate the value of a when

the first maximum falls at an angle of diffraction of 30°.

Watch Video Solution

58. A slt of width a illuminated by mono-chromatic ligth of wavelength 650 nm at normal incidence .Calculate the value of a when

the first minimum falls at an angle of diffraction of 30°,

Watch Video Solution

59. A slt of width a illuminated by mono-chromatic ligth of wavelength 650 nm at normal incidence .Calculate the value of a when

the first maximum falls at an angle of diffraction of 30°.

Watch Video Solution

60. Light of wavelength 600 nm is incident on an aperture of size 2 mm.Calculate the distance upto which the ray of light can travel,such that its spread is less than the size of the aperture.

Watch Video Solution

61. What is the minimum angular separation between two stars ,if a telesope is used to

observe them witha n objective of aperture 0.2 m?The wavelength of light used is $5,900A$.

Watch Video Solution

62. A telescope has an objective of diameter of 60 cm. The focal lengths of the objective and eye piece are 2.0 m and 1.0 cm respectively. The telescope is directed to view two distant almost point sources of light (e.g. two stars of a binary). The sources are at roughly the same distance $\left(= 10^4 lightyears \right)$ along the line of

sight but separated transverse to the line of sight by a distnace of $10^{10}m$. what will the telescope resolve the two objects i.e. will it see two distinct stars?

Watch Video Solution

63. Two slits are 1 m mapart and the same slits are 1 m from a screen.Find out fringe separation,when light of wavelength 500 nm is used.

Watch Video Solution

64. What should be the width of each slit to obtain 10 maxima of the double slit interfernce pattern ,within the central maximum of teh singel slit diffraction pattern?

Watch Video Solution

65. Two wavelengths of sodium light of 590 nm nd 596 nm are used in turn to study the diffraction taking place at a single slit of aperture $2 \times 10^{-6} m$.Calculate the separation

between the positions of first maxima of the diffraction pattern obtained in the two cases.

Watch Video Solution