



PHYSICS

BOOKS - R G PUBLICATION

RAY OPTICS AND OPTICAL INSTRUMENTS

Exercise

1. What step can be taken to achieve high revolving power of a telescope?



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2. State Snell's law of refraction of light.



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3. What is the range of wavelength of electromagnetic radiation that nature has endowed our retina to detect?



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4. What is the range of wavelength of electromagnetic radiation that nature has endowed our retina to detect?



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5. Why is a photodiode preferable used in the reverse bias condition for measuring light intensity?



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6. An object is placed at the focus of Convex lens. Where will the image be formed?



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7. What is magnifying power of an astronomical telescope? Draw the necessary ray diagram of the final image at distinct vision by an astronomical telescope.



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8. Draw a ray diagram to show the formation of final image by a compound microscope. Find an expression for magnification of an image formed by a compound microscope.



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9. Draw the ray diagram to show the formation of real and virtual image in concave mirror.



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10. Establish the following relation for total deviation δ of a ray light refracted through a triangular glass prism.

$$\delta = i + e - A$$

Where i is the angle of incidence, e is the angle of emergence and A is the angle of the prism.



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11. State two important differences between interference and diffraction.



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12. Two lenses of powers +5D and - 3D are in contact: Find the focal length of the combination.



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13. Deduce the relation $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ for a concave lens.



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14. An object is placed 30cm away from a concave lens of focal length 15cm. Find the position, size and nature of the image.



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15. Draw a ray diagram to show the formation of final image at least distance of distinct vision by a compound microscope.



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16. Draw a ray diagram for the formation of an image by a reflecting telescope.



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17. Derive the expression for the equivalent focal length of a combination of two thin convex lenses in contact.



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18. Deduce the relation $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ for a concave lens.



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19. What is astigmatism? How it can be removed?



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20. A man stands on vertical tower of height 20m. Calculate the distance upto which he will be able to see the surface of the earth. Given radiur of earth is $6.4 \times 10^3 km$.



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21. Draw the ray diagram for the formation of image by a compound microscope.



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22. The objective lens and eye piece lens of a Compound microscope have focal length 1.5cm and 5 cm respectively. The object is placed at a distance 1.8 cm. What is its magnification?



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23. Establish the lens maker's formula for a biconvex lens.



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24. Two identical equiconvex lenses of refractive index $\frac{3}{2}$ and focal length 16cm are kept in contact. The space between the lenses is filled with water of refractive index $\frac{4}{3}$. What is the focal length of the combination?



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25. Draw the ray diagram to show the location of the principal focus of a Convex mirror, Identify the pole and Centre of Curvature.



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26. A square loop of side 3cm is placed 25 cm away from a Convex mirror of focal length 10cm. The axis of the mirror passes through the intersecting point of the diagonals of the loop and is perpendicular to the plane of the loop. What is the area enclosed by the image of the loop?



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27. A convex lens and a Concave lens of focal length 0.1m each are placed co-axially 0.03m apart. Find the position of the image of an object placed 0.15m in front of the Convex lens.



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28. You are given a prism in which the two refracting surfaces are at 90° with each other.

Draw ray diagrams using this prism so that the image of an object is rotated by 90°



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29. You are given a prism in which the two refracting surfaces are at 90° with each other.

Draw ray diagrams using this prism so that the image of the object is rotated by 180° .



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30. A myopic person uses a lens of power -1.25D . What is his farpoint?



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31. "In between a fixed object and a fixed screen, a convex lens can cast two images at two different positions of the lens". Taking this to be a true statement show that product of the image sizes is equal to the square of the object size.





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32. Establish the lens maker's formula for a biconvex lens.



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33. The focal lengths of objectives and eyepiece of a telescope are 200cm and 10 cm respectively. It is used to get an image of the Sun on a screen placed 40cm behind the eyepiece. The diameter of the image is 6cm.

What is the diameter of the Sun? Give the distance from earth to the Sun is $1.5 \times 10^{11}m$.



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34. A pair of stars of actual separation one minute of arc is observed with an astronomical telescope of magnifying power 100. What will be the separation of the image of the pair in degree?



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35. Draw the schematic diagram of a Cassegrain telescope.



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36. Derive the expression for the equivalent focal length of a combination of two thin convex lenses in contact.



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37. Name the principle on which an optical fibre works.



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38. An object is placed at the focus of concave lens. Where will its image be formed?



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39. What is paraxial?



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40. Draw a neat diagram of image formed by a convex mirror.



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41. What is lens maker's formula?



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42. What is Snell's law.



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43. What is critical angle? How is it related with refractive index?



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44. What is the focal length of a plane mirror.



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45. What is absolute refractive index and relative refractive index?



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46. What is the technical applications of total internal reflection?



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47. What is minimum deviation for an equilateral prism?



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48. What is myopia? How it can be removed?



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49. What is pure spectrum?



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50. What is meant by dispersion of light?



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51. What is the ratio of speed of IR rays and UV rays in vacuum?



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52. Determine the refractive index of a substance if critical angle is 45° .



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53. Can dispersive power of prism be negative?



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54. State the nature of solar spectrum.



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55. What is the condition for total internal reflection?



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56. Draw 180° and 90° deviation in a prism.



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57. What is Fraunhofer lines?



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58. Define cartesian sign convention?



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59. Give the geometry of reflection of an incident ray on a concave spherical mirror.



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60. Give the geometry of reflection of an incident ray on a convex spherical mirror.



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61. Give the relation between focal length and radius of curvature of a spherical mirror.



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62. Give the spherical mirror equation.



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63. what is optical centre?



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64. What is refraction of light?



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65. What is meant by total internal reflection?



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66. Draw a ray diagram to show the total internal reflection.



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67. What is the technical applications of total internal reflection?



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68. Deduce the expression for refractive index n of a prism, which is given by

$$n = \frac{\sin[(A + D_m) / 2]}{\sin(A / 2)}$$



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69. Plot the graph of a angle of deviation (δ) versus angle of incidence (i) for a triangular prism.



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70. Draw the ray diagram to show the formation of real and virtual image in concave mirror.



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71. Prove that $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ in concave mirror for virtual image.



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72. What is meant by critical angle for a pair of medium? Find the relation between the critical angle and their refractive index.



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73. The critical angle of glass is 30° . If the glass is placed in water what will be the critical angle refractive index of water 1.33?



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74. The angle of prism is 60° and the refractive index of the matter of the prism is 1.6. For what minimum angle deviation will be minimum ?



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75. For a convex lens for any image prove that

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$



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76. State the function of each of the following parts of the human eye;- (a) Cornea (b) Iris



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77. What is the meant by power of a lens? How the power of a lens related with focal length?



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78. Write down the lens makers formula. Will there be change of focal length when

immersed in water?



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79. Draw a neat diagram of image formed by a concave mirror with an object between the pole and the focus.



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80. What are the laws of refraction? Describe.



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81. Draw a ray diagram to show the lateral shift of a ray refracted through a parallel side slab.



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82. Write an experimental demonstration to show the total internal reflection in water with a laser beam.



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83. Give some examples of total internal reflection in nature.



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84. What is optical fibres? What principle is used in it?



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85. Write a short note on optical fibre.



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86. Deduce the equation for the refraction at a spherical surface separating two media.



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87. Deduce the familiar thin lens formula

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}.$$



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88. What is dispersion by a prism. Write with a ray diagram.



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89. Write a brief note on formation of a rainbow.



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90. What is hypermetropia Describe.



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91. Draw the ray diagram of a simple microscope.



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92. Write the working of a compound microscope with a ray diagram for the

formulation of image.



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93. Write the working principle of a telescope.



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94. Derive lens maker's formula for a spherical surface.



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95. For a simple microscope prove that magnification $m = 1 + D/f$.



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96. For a compound microscope prove that magnification is multiplied.



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97. Describe the working and construction of Galileos telescope.



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98. What is astigmatism? How it can be removed?



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99. Deduce the expression for refractive index

n of a prism, which is given by

$$n = \frac{\sin[(A + D_m) / 2]}{\sin(A / 2)}$$



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100. When an object is placed at a distance 6 cm from a concave lens a virtual image is formed at a distance 4cm from it. Find the focal length of the lens.



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101. The angle of minimum deviation produced by a 60° prism is 40° . Calculate the refractive index of the material of the prism.



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102. From power prove that for lens.

$$P = P_1 + P_2 + P_3 + \dots + P_n$$



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103. How would you combine two lens of focal length 25cm to 2.5 cm to make a telescope?



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