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PHYSICS

BOOKS - BINA LIBRARY PHYSICS (ASSAMESE ENGLISH)

Optics-I

Example

1. An object is at a distance of 1 metre from the pole of a concave mirror. Its image is found to

be one-third of the size of the object. Find the position of the image, radius of curvature of the mirror and its focal length.

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2. An object 2 cm in height is placed at a distance of 20 cm from a convex mirror of radius 30 cm. Determine the nature, size and position of the image.

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3. An object is placed at a distance of 25 cm from a convex mirror. A plane mirror is placed such that the two images formed by the two mirrors are in the same plane. The distance of the plane mirror from the object at this position is 20 cm. Calculate the radius of the convex mirror.

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4. Find the focal length of a convex mirror whose radius of curvature is 32 cm.

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5. Define 1 dioptre of power of a lens

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6. The radius of curvature of a spherical mirror is 20 cm. What is its focal length?

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7. The refractive index of water w.r.t. air is 1.3 and that of glass is 1.5. Calculate the refractive index of water w.r.t. glass.

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8. What is the speed of light in glass of refractive index 1.5 if the velocity of light in the free space is $3x10^{8}ms^{-1}$?

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9. A beam of light of wavelength 6000×10^{-8} cm passes from air to glass (n = 1.5). Find the velocity.

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10. A beam of light of wavelength 6000×10^{-8} cm passes from air to glass (n = 1.5). Find the wavelength.

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11. The speed of light in air is 3×10^8 ms^−1. Calculate the speed of light in glass. The refractive index of glass is 1.5.

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12. Light enters from air to glass having refractive index 1.50. What is the speed of light in the glass? The speed of light in vacuum is 3 × 108 m/s .

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13. Find the power of a concave lens of focal length 2 m ?

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14. Find the focal length of a lens of power −2.0 D. What type of lens is this?

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15. A coin is placed at the bottom of a beaker containing water (refractive index =4/3) to a depth of 12cm. By what height the coin appears to be raised when seen from vertically above?

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16. Light from a point source in air falls on a convex spherical glass surface (refractive index = 1.5, radius of curvature = 20 cm). The

distance of light source from the glass surface is 100 cm. At what position is the image formed ?

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17. A double convex lens is made of a glass of refractive index 1.55, with both faces of the same radius of curvature. Find the radius of curvature required, if the focal length is 20 cm.

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18. A convex lens of focal length 24 cm is totally immersed in water (n = 1.33). Find its focal length in water (n = 1.5).

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19. A rod of 2 cm in height is held in front of a convex lens. The, image formed at a distance 60 cm and object at 10 cm from the mirror. What is the focal length of the lens ?

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20. Focal length of a convex lens is 15cm. Where should an object be placed so that real and three times larger image is formed?

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21. An object is placed 50 cm from a lens produces a virtual image at a distance of 10 cm in front of the lens. Draw a diagram to show the formation of image and calculate the focal length of the lens

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22. A needle placed at 30 cm from the lens forms an image on a screen placed 60 cm on the other side of the lens. Identify the type of lens and determine the focal length.

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23. An object is placed at a distance of 50 cm from a concave lens of focal length 20 cm. Find the nature and position of the image.

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24. A convex lens of focal length 15 cm is placed in front of a convex mirror co-axially 5 cm from the mirror. The image of an object placed at a distance 20 cm from the lens found to have been formed over the object. Estimate the radius of curvature of the mirror.

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25. The distance between an object and a screen is 3 metre. What is the power of a lens which can produce an image twice the size of the object when placed in between the lens and the screen.

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26. Two lenses 3D and -1.5 D were put in contact. What is the focal length of the combination?

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27. Lenses of power 3D and - 5D are combined to from a compound lens. An object is placed at a distance of 50 cm from this lens. Find the position of its image ?

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28. Two lenses 3D and -1.5 D were put in contact. What is the focal length of the combination?

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29. What will be the minimum deviation for an equilateral prism of refractive index root(2) ?

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30. Find the angle of incidence of a ray of light on one face of a 60°.prism, if the ray is just totally reflected on meeting the opposite face (refractive index of glass = 1.5).

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31. Calculate the dispersive power of a prism having R.I of 1.56 for red ,1.60 for yellow and 1.68 for violet light.

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32. A short-sighted person cannot see objects beyond 50 cm from the eye. Determine the focal length and power of the lens that will enable him to see distant objects clearly.

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33. For a long sighted man the least distance of distinct vision is 100 cm. Calculate the power of the lens that will enable him to see an object placed at a distance of 50 cm.

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34. A convex lens of focal length 6.25cm is used as a simple microscope. To obtain

maximum magnification, the object distance should be

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35. A convex lens of focal length 6.25cm is used as a simple microscope. To obtain maximum magnification, the object distance should be

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36. A compound microscope has a magnification of 30. The focal length of its eye piece is 5 cm. Assuming the final image to be formed at near point, calculate the magnification produced by the objective.

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37. A compound microscope has an objective with focal length 1 cm and an eyepiece with focal length 2 cm. An object is placed at a

distance of 1.5 cm away for the normal adjustment. Find its angular magnification.

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38. A compound microscope has an objective of focal length 1 cm, an eye piece of focal length 2.5 cm and a tube of length 15 cm. Find its magnification for normal adjustment.

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39. What are dyads?

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40. The focal lengths of the objective and the eye piece of an astronomical telescope are 100 cm and 5 cm respectively. Calculate its magnifying power.

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Exercise

1. What is reflection?

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2. Define the angle of incidence and angle of reflection.

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3. Define an image.

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4. Distinguish between a real and a virtual image.

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5. What is pole of a spherical mirror?

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6. What is centre of curvature of a spherical mirror?

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7. Define principal axis of spherical mirror .

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8. Define principal axis of spherical mirror .

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9. What is the nature of image formed by a convex mirror?

Watch Video Solution

10. When is a virtual image formed by a concave mirror?

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11. Can a real image be formed by a convex mirror?

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12. Define linear magnification.

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

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14. Define critical angle of a pair of media.

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15. Define the refractive index of a medium.

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16. What is meant by the angle of minimum deviation of a prism?

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17. How are angles of incidence and deviation related in case of prism?

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18. A glass prism is immersed in water. What happens to the value of angle of minimum deviation?

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

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20. With what kind of lens can you convert a converging beam of rays into a parallel beam?

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21. With what kind of lens can you convert a diverging beam of rays into a parallel beam?

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22. Define centre of curvature.

Watch Video Solution

23. Can a concave lens produce a real image?

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24. Why has a lens two focal points but a mirror only one?

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25. What is meant by power of a lens? What is its unit?

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26. If a thin lens is dipped in water, does its focal length change?

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27. Define principal axis of spherical mirror .

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28. Is the focal length of a lens the same for lights of all colors ?

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29. What is dispersion of light?

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30. Which colour of white light suffers maximum deviation in dispersion?

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31. Which colour of white light travels with least speed in a transparent medium?

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32. What is the nature of the final image in an astronomical telescope?

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33. What type of lenses are used in a compound microscope?

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34. what is optical centre?

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35. What is the fundamental difference between a microscope and a telescope?

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36. What is the nature of the final image in an astronomical telescope?

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37. Why an astronomical telescope is not suitable for viewing earthly objects?

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38. How many lenses are there in a terrestrial telescope?

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39. By what length is the tube of a terrestrial telescope longer than the astronomical telescope?

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40. Define the magnifying power of a telescope.

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41. Define focus.

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42. Draw a lebelled ray diagram to show the formation of image using a convex mirror

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43. Draw diagram to show formation of virtual image by a concave mirror.

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44. Find an expression for the linear magnification of a real and a virtual image produced by a concave mirror.

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45. Find an expression for lateral deviation.

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46. What is the condition for total internal reflection?

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47. What is the condition for total internal reflection?

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48. Describe briefly the formation of mirage.

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49. Establish the following relation for total deviation δ of a ray light refracted through a

traingular 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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50. What is meant by despersion of light?

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51. Write a brieft note on formation of a rainbow.

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52. If an eye produces too much covergence in the incident beam what is the defect of vision? How is this defect remedied?

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

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

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55. The radius of curvature of a spherical mirror is 20 cm. What is its focal length?

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

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

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58. Prove the relationship $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ for a convex mirror.

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59. Deduce the equation for the refraction at a spherical surface seperating two media.

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

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

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62. Derive the lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ for a convex lens.

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63. What is meant by power of a lens? What is its unit?

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64. When two thin converging lenses of focal lengths f, and f, are held in contact with each other, calculate the power of the combination.

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65. What is meant by the angle of minimum deviation of a prism?

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66. Find a relation between minimum deviation and the refractive index of the material of the prism.

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67. Explain why white light is dispersed while passing through a prism.

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68. What are the two main defects of vision? State how these are rectified.

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69. With the help of a labelled ray diagram, show the image formation by a compound microscope.

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70. Derive an expression for compound microscope's magnifying power.

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71. Draw a labelled ray diagram of an astronomical telescope for a near point adjustment.

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72. Write down the expression for astronomical magnifying power.

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73. Draw a labelled ray diagram to show the image formation in an astronomical telescope for normal adjustment.

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74. Write down the expression for astronomical magnifying power.

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75. State two drawbacks of astronomical telescope.

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76. Draw a labelled ray diagram to show the image formation in a reflecting type telescope.

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77. Write two advantages of a reflecting telescope over a refracting telescope.

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78. Modern telescope prefer using mirrors over using suitable lenses. Give two reasons for this.

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79. Concave mirrors are used as shaving mirrors. Why?

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80. Give reasons why convex mirrors are generally used as driving mirrors.

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81. How will you distinguish between plane, concave and convex mirrors?

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82. If a concave mirror is held in water, will its focal length change as compared to its value in air?

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83. Bubbles of air coming out through water in glass vessel appears silvery to an observer standing by the sides Explain the reason.

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84. Name a mirror that can give an erect and enlarged image of an object.

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85. Does the focal length of a lens depends on the medium in which it is immersed ?

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86. Is it possible for a given lens to act as a converging lens in one medium and a diverging lens in another medium?

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87. Why goggles(sun glasses) have zero power even though their surfaces are curved?

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88. Does the focal length of a lens change if instead of blue light, monochromatic red light is used to measure it ?

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89. A thin converging lens has a focal length 'f in air. If it is completely immersed in a liquid, briefly say how the focal length of the lens will vary?

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90. Explain why rainbow is never seen on the surface of the moon.

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91. Explain why is the sun visible a little before actual sunrise and a little after actual sunset.

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92. Explain the origin of the blue colour of sky.

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93. Explain why the setting sun looks red?

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94. Why is red light used as a danger signal ?

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95. Explain why yellow head-lights are used in cars in foggy weather.

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96. In order to take colour photograph of a planet, what kind of telescope should be used ?

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97. Why should a simple magnifying glass be placed closer to the eye ?

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98. What is the best position for eye viewing an object through microscope ?

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99. Define beam of light.

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100. Find the position of an object which when placed in front of a concave mirror of focal

length 20cm, produces a virtual image, which is twice the size of the object.

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101. When an object is placed at a distance of 60 cm from a convex mirror, the magnification produced is 1/2. Where should the object be placed to obtain a magnification of 1/3?

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102. An object is kept at 0.2 m from a convex lens of focal length 0.15 m. Find the position of the image formed.

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103. A double convex lens made of glass of refractive index 1.5 has both radii of curvature of magnitude 20 cm. An object 2 cm high is placed at 10 cm from the lens. Find the position, nature and size of the Image.

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104. Calculate the focal length of the combination of a convex lens of focal length 30 cm in contact with a concave lens of focal length 20 cm. Is the system a converging or diverging lens?

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105. A converging lens has focal length of 20 cm in air. It is made of a material of refractive

index 1.6. If it is immersed in a liquid of refractive index 1.3, what will be its new focal length?

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106. Two lenses of powers, 15D and +5D are in contact with each other forming a combination lens. What is the focal length of the combination?

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107. The refractive index of a prism of angle 60 degree is 1.62 for sodium light. What is the angle of minimum deviation?

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108. A ray of light incident on an equilateral glass prism shows minimum deviation of 30 degree. Calculate the speed of light through the prism.

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109. A ray of light passes through an equilateral prism such that the angle of incidence is equal to the angle of emergence and the latter is 3/4 th of the angle of prism. Calculate the angle of minimum deviation and refractive index.

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110. An astronomical telescope of magnifying power 10 consists of two thin lenses 55 cm

apart. Calculate the focal lengths of lenses.

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111. A near point of hypermetropic person is 50 cm from the eye. What is the power of the lens required to enable the person to read clearly a book held at 25 cm from the eye?

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112. An astronomical telescope uses two lenses of powers 10 dioptre and 1 dioptre. If the final image of a distant object is formed at infinity, calculate the length of the telescope.

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113. The focal length of a convex lens of R.I. 1.5 in air is 2 cm. The focal length of the lens in a liquid of R.I. 1.25 will be

A. 10 cm

B. 2.5 cm

C. 5 cm

D. 7.5 cm

Answer: C

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114. Time taken by sunlight to pass through a window of thickness 4 mm whose RI is 1.5 is

A. 2×10^{-8}s

B. 2×10^{8}s

C. 2×10^{-11}s

D. 2×10^{11}s

Answer: C

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115. Radius of curvature of a convex mirror is 40 cm and the size of the object is twice as that of the image, then the image distance is

A. 10 cm

B. 20cm

C. 40 cm

D. 30 cm

Answer: A

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116. A convex lens has a focal length f. It is cut into two parts along a line perpendicular to principal axis. The focal length of each part is

A. $\frac{f}{2}$

B. f

C. $\left(\frac{3}{2}\right)f$

D. 2f

Answer: D

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117. Two thin lenses of focal lengths f_1, and f_2 are placed co-axially in contact. The

combination acts as a single lens of focal length

A. $\frac{f_1 f_2}{f_1 + f_2}$

B. root(f1.f2)

C. $(f_1 + f_2)$/(f1.f2)`

D. $\frac{f_1 + f_2}{2}$

Answer: A

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118. The plane surface of a plano convex lens of focal length f is silvered. It will behave as a

A. plane mirror

B. convex mirror of focal length 2f

C. concave mirror of focal length f/2

D. none of the above

Answer: C

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119. The magnifying power of a telescope is m. If the focal length of the eyepiece is doubled,magnifying power will be

A. 2m

B. $\frac{m}{2}$

C. m

D. 3m

Answer: B

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120. When red glass is heated in a dark room it seems

A. green

B. purple

C. black

D. yellow

Answer: A

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121. Focal length of a convex lens will be maximum for

A. blue light

B. yellow light

C. green light

D. red light

Answer: D

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122. Rainbow is due to a combination of

A. dispersion and total internal reflection

B. refraction and scattering.

C. dispersion and scattering

D. refraction and absorption

Answer: A

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123. An astronaut in a spaceship sees the sky as

A. blue

B. red

C. white

D. black

Answer: D

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124. The sky looks blue due to-

A. red light is absorbed

B. blue light is scattered most

C. blue light is absorbed

D. it is the natural colour

Answer: B

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125. A convex lens of focal length 0.5 m and a concave lens of focal length 1 m are combined.The power of the resulting lens is

A. $1D$

B. $-1D$

C. $0.5D$

D. $-0.5D$

Answer: A

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126. An enlarged virtual image can be obtained only in

A. concave spherical mirror

B. convex spherical mirror

C. plane mirror

D. parabolic mirror

Answer: A

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127. A convex mirror gives images which are

A. real and inverted

B. real and erect

C. virtual and inverted

D. virtual and erect

Answer: D

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128. A vitrual image larger than the object can be produced by

A. convex mirror

B. plane mirror

C. concave mirror

D. parabolic mirror

Answer: C

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129. A concave mirror forms an image of a real object. Which statement is wrong?

A. the image is real

B. the image is erect

C. the image is smaller than the object

D. the image lies between the pole and the focus

Answer: A

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130. Give reasons why convex mirrors are generally used as driving mirrors.

A. plane mirror

B. concave mirror

C. parabolic mirror

D. convex mirror

Answer: D

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131. The image of an object placed between the principal focus and the centre of curvature of a concave mirror is

A. erect, magnified and virtual

B. inverted, diminished and real

C. inverted, diminished and real

D. inverted, magnified and real

Answer: D

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132. The distance of an object and its image from the focus of a concave mirror are 8 cm and 12 cm respectively. The focal length of the mirror is

A. 8cm

B. 12cm

C. 10cm

D. between 8 and 12

Answer: C

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133. An inverted image can be seen in a convex mirror

A. under no circumstances

B. when the object is at infinity

C. when the object is at C

D. when the object is at F

Answer: A

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134. A concave mirror produces a virtual image when the object is

A. beyond C

B. at C

C. between C and F

D. between F and pole

Answer: D

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135. What is the speed of light in glass of refractive index 1.5 if the velocity of light in the free space is $3x10^8 ms^{-1}$?

A. 2×10^{-8}s

B. $4.5 \times 10^8 ms^{-1}$

C. $3 \times 10^8 ms^{-1}$

D. $3 \times 10^{10} ms^{-1}$

Answer: A

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136. The refractive index of a medium is 1.8. A bubble lies in this medium at an apparent depth of 10 cm. The real depth of the bubble is

A. $\frac{10}{1.8}$cm

B. 18 cm

C. 12cm

D. 9cm

Answer: B

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137. When light travels from glass to air, there is no change in its

A. wavelength

B. frequncy

C. amplitude

D. velocity

Answer: B

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138. The lateral shift produced in a parallel sided glass slab depends on

A. angle of incidence

B. thickness of slab

C. refractive index of the material of the slab

D. all of these

Answer: D

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

A. reflection

B. refraction

C. total internal reflection

D. scattering

Answer: C

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140. The refractive index of an equilateral prism is 'sq.root 3' . What is its angle of minimum deviation?

A. 30^{o}

B. 370

C. 45^{o}

D. 60^{o}

Answer: D

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141. The minimum distance between an object and its real image is

A. f

B. 2f

C. 3f

D. 4f

Answer: D

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142. Critical angle of light passing from glass to air is minimum for

A. red

B. yellow

C. green

D. violet

Answer: A

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143. The critical angle for a medium is 60°. Then the refractive index of the medium will be

A. $\sqrt[3]{/2}$

B. $\frac{2}{\sqrt[3]{}}$

C. $\frac{1}{\sqrt[3]{}}$

D. $\sqrt[3]{}$

Answer: B

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144. In which of the following cases total internal reflection can not be obtained ?

A. a ray going from glass to air

B. a ray going from glass to water

C. a ray going from water to glass

D. a ray going from water to air

Answer: C

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145. The distance between the object and its real image formed by a convex lens

A. cannot be greater than 2f

B. cannot be less than 2

C. cannot be less than 4f

D. cannot be greater than 4f

Answer: C

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146. The focal length of a lens depends upon

A. colour of light

B. material of the lens

C. curvature of the surface

D. all the above

Answer: D

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147. A contact combination is made of a thin convex lens (f = 9 cm) and a thin concave lens(f = 18 cm), the focal length of the combination is

A. 6cm

B. 12cm

C. 18cm

D. 27 cm

Answer: C

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148. Two thin lenses of focal length 20 cm and 25 cm are placed in contact. The effective power of combination is

A. 9 diapter

B. $\frac{1}{9}$ diapter

C. $\frac{1}{45}$ diopter

D. 45 diopter

Answer: A

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149. A lens behaves as a converging lens in air and a diverging lens in water. The refractive index of the material of the lens is

A. between unity and 1.33.

B. equal to unity

C. equal to 1.33

D. greater than 1.33

Answer: A

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150. An eye has a defect of myopia if it does not see

A. near objects

B. distant objects

C. objects at infinity

D. both near and distant objects

Answer: A

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151. For removal of hypermetropia, one should use

A. concave

B. convex

C. cylindrical

D. plano-concave lens

Answer: B

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152. On increasing the tube-length of a compound microscope its magnifying power

A. increases

B. decreases

C. becomes zero

D. remains unchanged

Answer: A

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153. A sharp image is observed through a compound microscope. Now if the eye pieces pushed slightly into the microscope tube. State if

A. clearer image will be seen

B. the image will not be seen

C. no effect will be observed

D. the image will be blurred

Answer: D

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154. A convex lens of focal length 10 cm is used as a simple microscope. Its magnifying power when the image is formed at near point.

A. 3.5

B. 0.1

C. 10

D. 2.5

Answer: A

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