PHYSICS

BOOKS - MODERN PUBLICATION

REFRACTION OF LIGHT

Example

1. The refractive index of glass is 1.5. What is the speed of light in glass? (Speed of light in vacuum is $3.0 \times 10^8 ms$)

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2. Velocity of light in glass in $2 \times 10^8 ms^{-1}$ and that in air is $3 \times 10^8 ms^{-1}$ .By how much would an ink dot appear to be raised,when covered by a glass plate 6.0 cm thick?

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3. Refractive index of glass is 1.5 find critical angle for glass.

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4. A small point object is placed in air at a distance of 60 cm from the convex spherical refracting surface of refractive index 1.5.If radius of curvatrure of the spherical surface is 25 cm,calculate the power of the refracting surface.

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5. A binoconves lens with both faces of the same radius of curvature is to be manufatured from a glass of refractive index 1.55.What should be the radius of curvature for the focal length of the lens to be 20 cm?

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6. A beam of light converges at a point P. Now a lens is placed in the path of the convergent beam 12cm from P. At what point does the

beam converge if the lens is: a convex lens of focal length 20cm?

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7. A beam of light converges at a point P. Now a lens is placed in the path of the convergent beam 12cm from P. At what point does thebeam converge if the lens is: a concave lens of focal length 16cm?

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8. A convex lens of focal length 0.12 m produces an inverted image ,which is three times as long as the object.Find the distance between the object and the lens for a real image.

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9. Two thin converging lenses of focal lenths 15 cm and 30 cm are held in contact with each other.Calculate power and focal length of the combination.

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10. The refractive index of glass is 1.5 and that of water is 1.3.If the speed of light in water is $2.25 \times 10^8 ms^{-1}$,what is the speed of light in glass?

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11. A light of wavelength $6,000\overset{\circ}{A}$ in air, enters a medium with refractive index 1.5.What will be

frequency and wavelength of light in the medium?

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12. Monochromatic light of wavelength 589 nm is incident from air on a water surface. What are the wavelength, frequency and speed of reflected?

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13. Monochromatic light of wavelength 589 nm is incident from air on a water surface. What are the wavelength, frequency and speed of-refracted light. Refractive index of water is 1.33

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14. A pile 4 m high stands in the lake,such that it protrudes y 1m above the surface of water.Determine th elength of the shadow of the pile on the botton of lake,when the

sunrays make an angle of 45° with the water surface.Tke refractive index of water,$\mu = 4/3$.

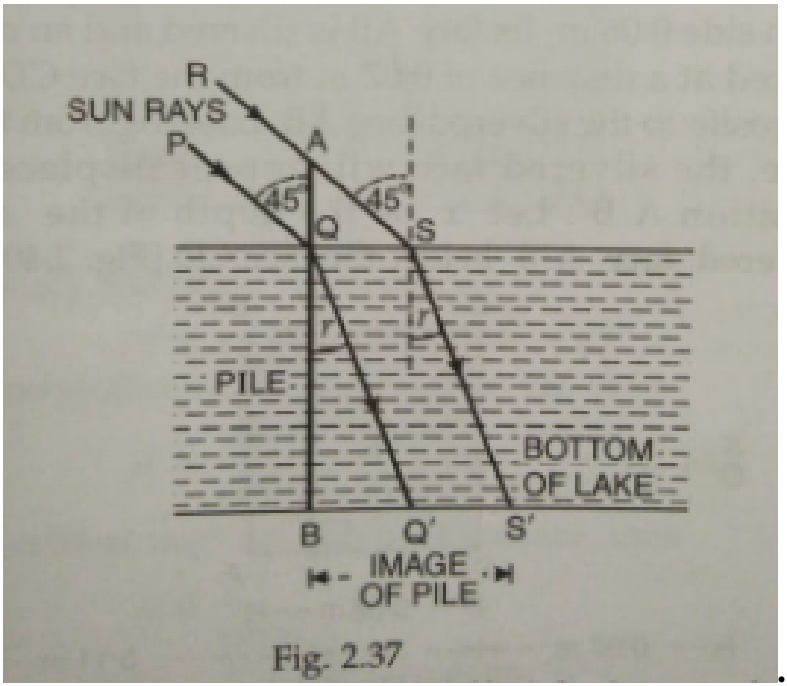

Fig. 2.37

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15. A ray of light is incident at an angle of 60° on one face of a rectangular glass slab of thichness 0.1 m and refractive index 1.5.Calculate the lateral shift produced.

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16. Refractive indices of water and glass are $4/3$ and $3/2$ respectively.A ray of light travelling in water is incident on the water-

glass interface at 30°.Calculate the angle of refraction.

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17. A mark is made at the bottom of a beaker and a microscope is focussed on it.the microscope is then raised through 0.015 m.To what height water must be poured into the beaker to bring the mark again into focus? Given$a^{\mu}_w = 4/3.$

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18. What is the apparent position of an object below a rectangular block of glass 6 cm thick ,if a layer of water 4 cm thick is on top of the glass?Given that $a^{\mu}\_g = 3/2$ and $a^{\mu}\_w = 4/3$.

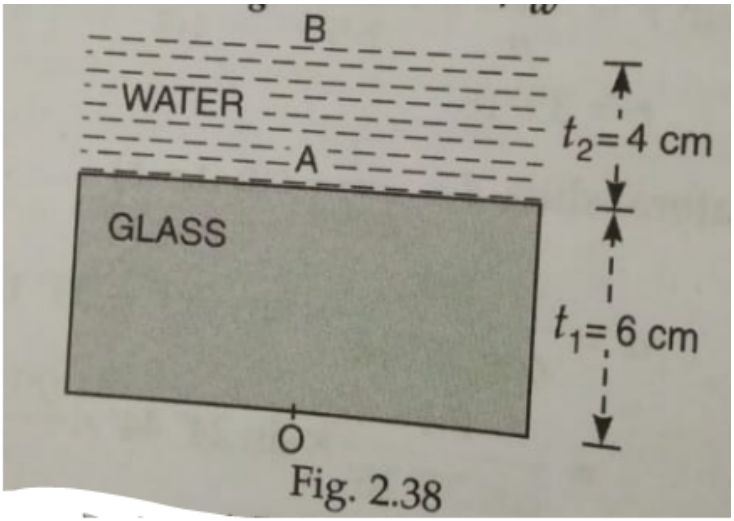

Fig. 2.38

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19. A transparent cube of side 210 mm contains a small air bubble. Its apparent distance, when viewed through one face of the cube is 100 mm and when viewed through the opposite face is 40 mm. What is the actual distance of the bubble from the second face and what is the refractive index of the material of the cube?

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20. One face of a glass cube of side 0.06 m is silvered.An object is placed at a distance of 0.07 m from the face opposite to the silvered face.Looking from the object side,the image of the object appears to be 0.11 m behind the silvered face.Calclate the refrative index of the material of glass.

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21. Find the critical angle for a glass-water interface,if refractive index of glass$3/2$ and that of water is $4/3$.

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22. A glass slab is immersed in water.Find the critical angle at glass-water interface.Given, $\mu^a\_g = 1.5$ and $\mu^a\_w = 1.33$.

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23. Calculate the critical angle for a glass-air surface,if a ray of light which is incident in air on the surface is deviated through 15°,when its angle of incidence is 40°.

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24. A ray of light incident on the horizontal surface of a glass slab t 70° just grazes the adjacent vertical surface after refraction. Compute the critical angle and refractive index of the glass.

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25. A liquid of refractive index 1.5 is poured into a cylindrical jar of radius 20 cm upto a height of 20 cm.A small bulb is lighted at he centre of the bottom of the jar.Find the area of the liqud surface throug which the light of the bulb passes into air.

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26. A narrow beam of light is incident normally on one face of a glass prism having refractive index 1.48. Find the angle of prism if the ray makes a grazing emergence along the other face. Draw a diagram showing the path of rays.

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27. A beam of light of wavelength 400 nm is incident normally on a right angled prism as shown in fir.2.45.

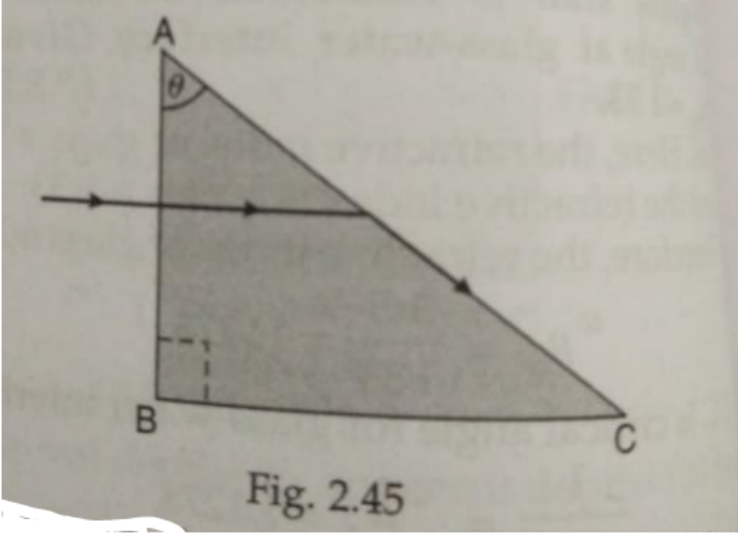

Fig. 2.45

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It is observed that the light just grazes long the surface AC after falling on it.Give that there fractive index of the material of the prism varies with the wavelength as per the relation.

$$\mu = 1.2 + \frac{b}{\gamma^2}$$

Calculate the value of b and the refractive

index of the prism material for a wavelength $\gamma = 500nm$.Given $\theta = \sin^{-1} 0.625$.

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28. What curvature must be given to the bounding surface of a refracting medium $(\mu = 1.5)$ for the virtual image of an object in the adjacent medium $(\mu = 1)$ at 10 cm to be formed at a distance of 40 cm?

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29. A spherical surface radius of curvatue R seprates air (refractive index 1.0) from glass 9refractive index 1.5).The centre of curvature is in the glass.A point object P is placed in air is found to have a real image Q in the glass.The line PQ cuts the surface at a point O and PO = OQ[Fig.2.47].Find the distance of object from the shperical surface.

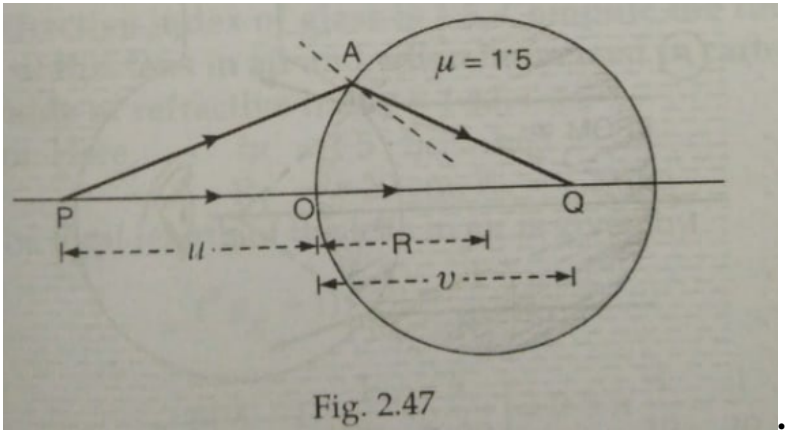

Fig. 2.47

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30. A small piece of paper stucjk on a glass shpere of 5 cm radius is viewed through the glass from the position directly opposite .Find the position of the image .Refractie index of glass is 1.5.

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31. Fig.2.49 shows a solid glass sphere of radius 5 cm that has a small air bubble O

trapped at a distance 2 cm from the centre C.Th refractive index of the material of glass is 1.5.Find the apparent position of the bubble where it will appear ,when seen throught the surface from an ougtside point E.

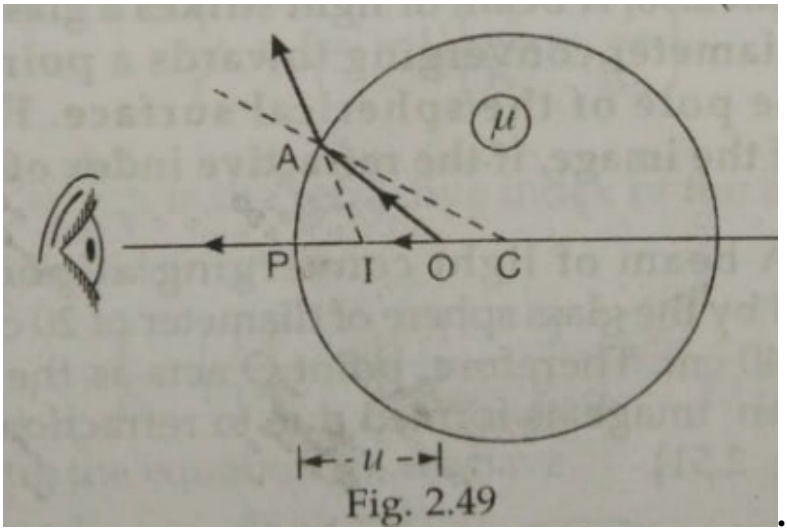

Fig. 2.49

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32. A small air bubble within a glass sphere of radius 0.02 m appears to be 0.01 m below the surface,when looked along a diameter containing the buble.Find the real depth of the bubble along the line of sight.Given, $\mu = 1.54.$

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33. A beam of light strikes a glass sphere of 20 cm diameter converging towards a point 40

cm behind the pole of the spherical surface.Fnd the position of the image,if the refractive index of glass is 1.5.

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34. An empty spherical flask of diameter 15 cm is placed in water of refractive index $4/3$ .A parallel beam of light strikes the flask.Where does it get focussed,when obsrved from within the flask?

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35. Find the radius of curvature of the convex surface of a plano convex lens,whose focal length is 0.3 m and the refractive index of the material of the lens is 1.5/

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36. The radius of curvature of eithr face of a conex lens is equal to ts focal length .What is the refractive index of its material?

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37. A double convex lens has radii 20 cm.The refractive index of glass is 1.5.Compure the focal length of this lens in air and when immersed in carbon disulphide of refractive index = 1.63.

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38. A convex lens of focal length 0.2 m and made of glass $9\mu = 1.50)$ is immersed in

water $9\mu = 1.33$).Find the chajnge in the focal length of the lens.

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39. Explain what happens ,when a convex lens of refractive index 1.2 is immersed in a liquid of refractive index 1.3.

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40. A convex lens made up of glass of refractive index 1.5 is dipped,in turn ,in medium A of refractive index 1.65. will it behave as converging or diverging lens?

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41. A convex lens made up of glass of refractive index 1.5 is dipped,in turn ,in medum B of refractive index 1.33. whether it

will behave as a converging lens or a diverging lens?

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42. A double convex lens has 10 cm and 15 cm as its two radii of curvature.The image of an object,placed 30 cm from the lens,is formed at 20 cm from the lens on the other side.Find the refractive index of the material of the lens.Whgat will be the focal length ?What will

be the focal length of the lens,if it is immersed in water of refractive index 1.33?

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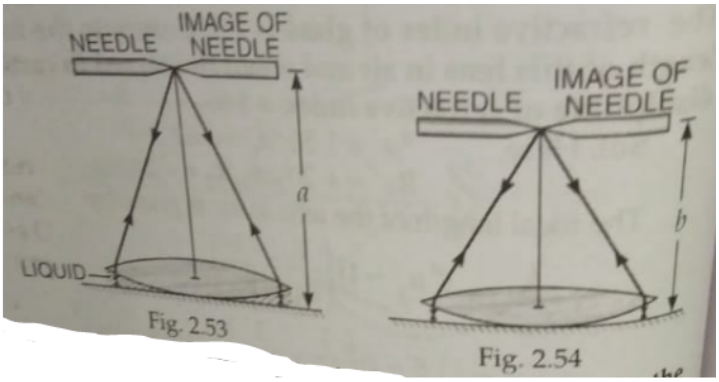
43. An equiconvex lens with radii of curvature of magnitude R each,is put over a liquid layer poured on top of a plane mirror.A small needle ,with its tip on the principal axis of the lens,is moved along the axis until its inverted real image coincides with the needle itself.The distance of the needle from the lens is

measured to be a as shown in Fig.2.53.

On removing the liquid layer and repeating the ezperiment,the distance is found to be b as shown in Fig.254 .Gien that tow values of distances meeawured reepresent the focal length values in the two cases, obtain a formula for the refractive index of the liquid.



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44. Calculate the distance d,so that a real image of an object at O,15 cm in front of a convex lens of focl length 10 cm be formed at the same point O as sohwn in Fig.2.45. te radius of cuvature of the mirro is 20 cm.Will the image be inverted or erect?

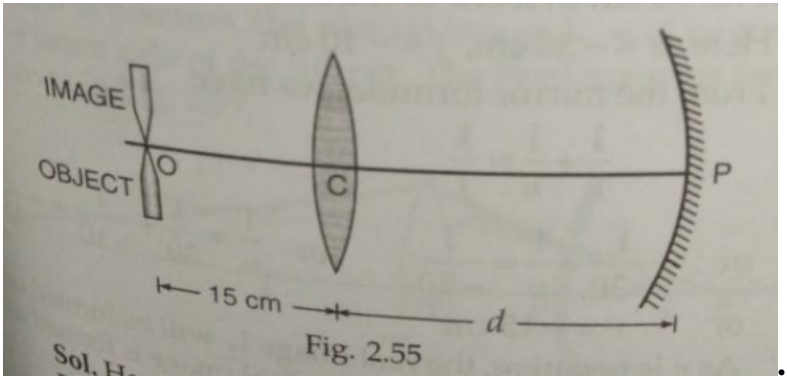

Fig. 2.55

Sol. H

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45. In Fig.2.56 ,the direct image formed by the lens(f=10cm) of an object placed of O and that formed after reflection from the spherical mirror are formed at same point.What is the radius of curvature of the mirror?

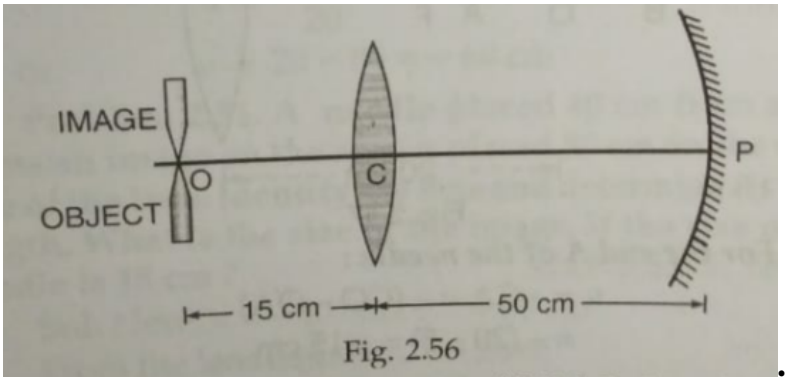

Fig. 2.56

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46. A convergent beam of light passes through a diverging lens of focal length 0.2 m and comes to focus at distance 0.3 m behind the lens.Find the position of the point at which the beam would converge in the absence of the lens.

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47. A beam of light converges at a point P. Now a lens is placed in the path of the convergent beam 12cm from P. At what point does the

beam converge if the lens is: a convex lens of focal length 20cm?

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48. A beam of light converges at a point P. Now a lens is placed in the path of the convergent beam 12cm from P. At what point does thebeam converge if the lens is: a concave lens of focal length 16cm?

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49. A camera lens of focal length 5 cm is mounted on a fine screw thread for adjusting the focus.What range of movement is neede,if the amer ais to be able to take sharp photographs at 1 m as well as from great distances?

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50. A 5 cm long needle lies along the principal axis axis of a concave miror of focal length 20 cm in such a way that the end closer to the

pole is 40 cm from it.Find the length of the image of the needle formed by the mirror.

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51. A double convex lens made of glass of refactive index 1.56 has both radii of curvature of magnitude 20 cm.If an object is placed at a distance of 10 cm from this lens,find the positiojn of the image formed.

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52. A convex lens of focal lenght 20 cm is placed coaxially with a concave mirror of focal length 10 cm at a distance of 50 cm apart from each other.A beam of ligh coming parallel to the principal axis is incident on the convex lens.Find the position diagram showing the formation of the imge.

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53. A convex lens of focal lenght 20 cm is placed coaxially wih a convex mirror of radius

of curvature 20 cm.the two are kept at 15 cm apart.A point object lies 60 cm in front of the convex lens.Draw a ray diagram to show the formation of the image by the combination.Determine the nature and position of the image formed.

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54. A convex lens is used to obtain a magnified image of an object on a screen 10 m from the

lens .If the magnification is 19,find the foal length of the lens.

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55. The image obtained with a convex lens is erect and its lenth is four times the length of the object.If the focal length of the lens is 20 cm,calculate the object and image distance.

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56. A needle placed 40 cm from a lens forms an image on a screen placed 80 cm on the other side of the lens. Identify the type of lens and determine its focal length. What is the size of the image, if the size of needle is 15 cm ?

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57. A needle placed 40 cm from a lens forms an image on a screen placed 80 cm on the other

side of the lens. Identify the type of lens and determine its focal length. What is the size of the image, if the size of needle is 15 cm ?

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58. An object is placed at a distance of 1.5 m from a screen and a convex lens is interosed between them .the magnification produced is 4.What is the focal length of the lens?

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59. A convex lens is made of glass of refractive index 1.5.If radius of curvature of the each of its twosurfaces is 20 cm,find the ratio of the power of the lens,when placed in air to its power ,when immersed inside a liquid of refractive index 1.25.

60. Show that a convex lens produces an N times magnified image,when the object distances from the lens have magnitude

$(f \pm f/N)$.Here,f is the magnitude of the focal length of the lens.Hene,find the two values of object distance,for which a convex lens of power 2.5 D will produce an image that is four times as large as the object.

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61. Two lenses f powers-1.5 and +2.75 D are kept in contact.Find the focal length of the combination.

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62. A converging and a diverging lens of equal focal lengths are placed co-axially in contact. Find the power and the focal length of the combination.

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63. AB and CD are two slabs[Fig.2.61.].The medium between the slabs has refractive index 2.Find the minimum angle of incidence at Q, so that the ray is totally reflected by both

the slabs.

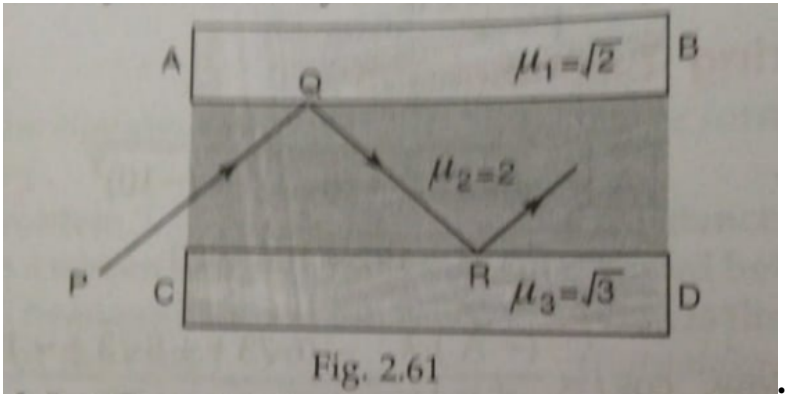

Fig. 2.61

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64. An object is placed 21 cm in front of a concave mirror of radius of curvature 10 cm.A glass slab of thickness 3 cm and refractive index 1.5 is then placed close to the irror in the space between the object and mirror as shown

in Fig.2.62.Find the position of the final image formed.You may take the distacne of the near surface of the slab from the mirror to be 1 cm.

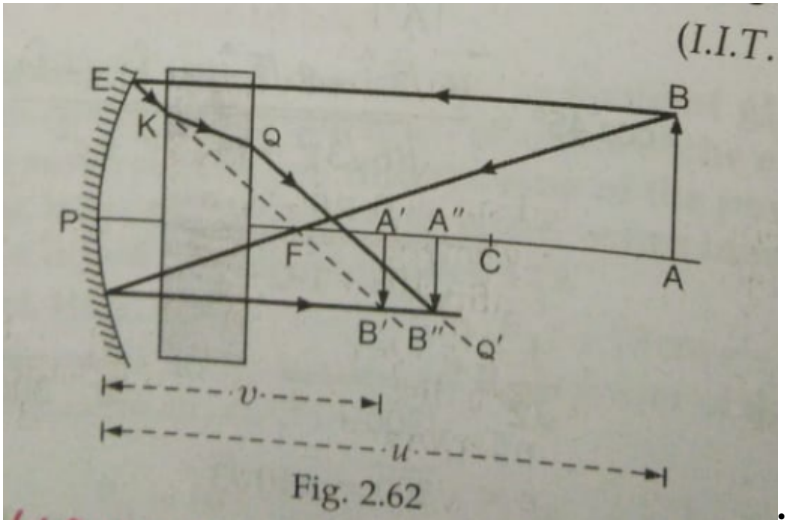

Fig. 2.62

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65. A rectangular glass block of thickness 10 cm and refractive index 1.5 is placed over a

small coin.A beaker is filled with water of refractive index $4/3$ to a height of 10 cm and is placed over a small block.

Find the apparent position of jthe object,when it is viewed at normal incidence.

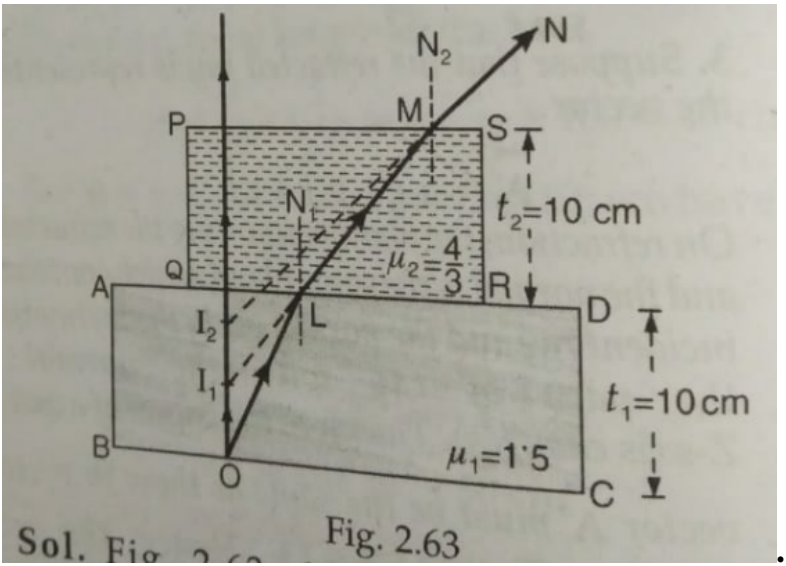

Fig. 2.63

Sol. Fig

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66. A rectangular glass block of thickness 10 cm and refractive index 1.5 is placed over a small coin.A beaker is filled with water of refractive index $4/3$ to a height of 10 cm and is placed over a small block.

If the eye is slowly moved away from the normal at a certain position,the coin is found to diappear due to total internal reflection.At

what surface does it happen and why?

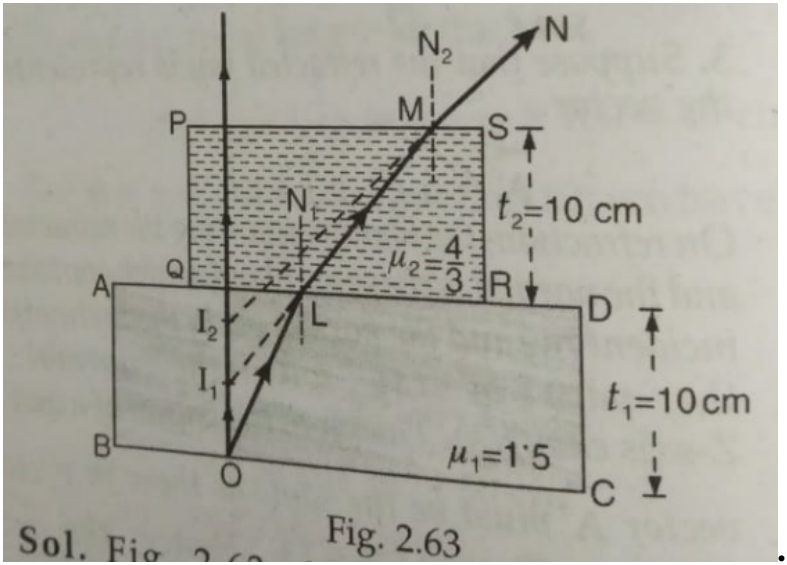

Fig. 2.63

Sol. Fig.

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67. Fig.2.64 shown an irregular block of material of refractive index $sqr2$.A ray of light strikes the face AB.After refraction,it is

incident on a spherical surface CD of radius of curvature 0.4 m and neters a medium of refractive index 1.514 to meet PQ at E.Find the distnce OE up to two decimal.

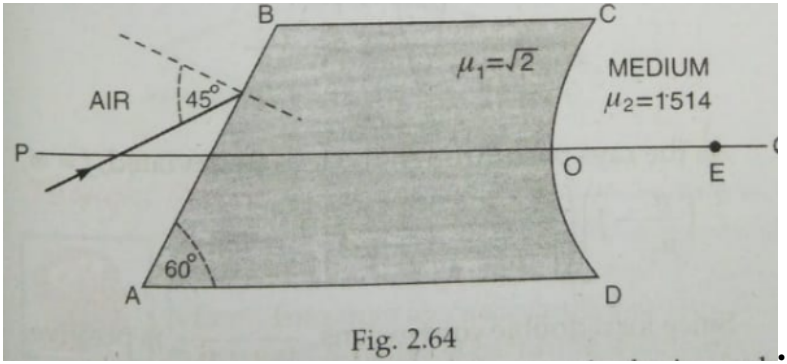

Fig. 2.64

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68. A quater cylinder of radius R and refractive index 1.5 is placed on a table .A point object P

is kept at a distance of m R from it.Find the value of m for which a ray from P will emerge parallel to the table as shown in fir.2.65.

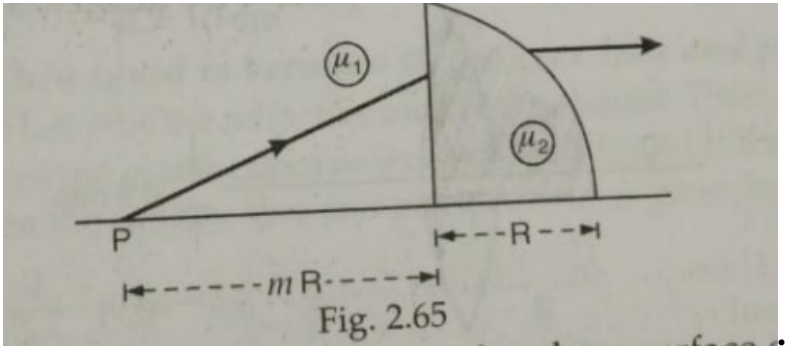

Fig. 2.65

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69. A point object is placed at a distance of 0.3 m from a convex lens(focal length 0.2 m) cut into two halves,each of which is displaced by

0.5 mm as shown in Fig.2.67 .Find the positio of the image.If more than one image is formed,find their number nd the distance between them.

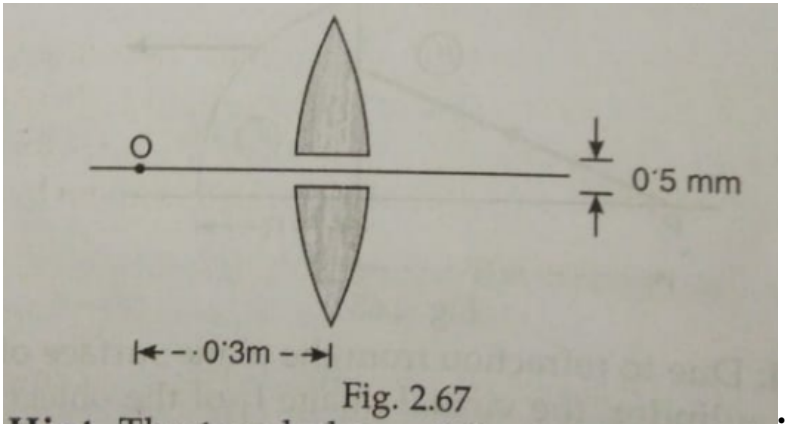

Fig. 2.67

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70. Light is incident on a thin lents a shown in Fig.2.68.The radius of curvature for both the surfaces is R.Determine the focal length of this system.

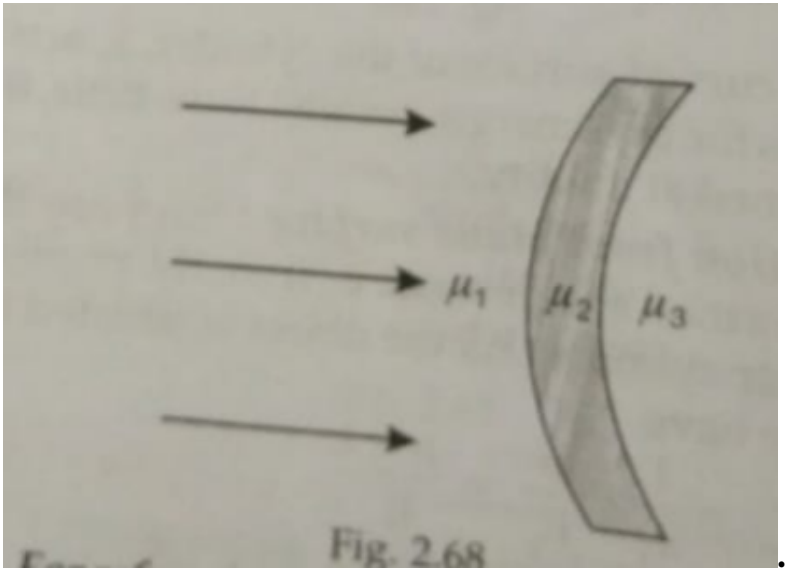

Fig. 2.68

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71. What is the relation between refractive indicisesμ, μ_1 and μ_2,if the behaviour of light rays is as shown in Figs.2.69 and 2.70?

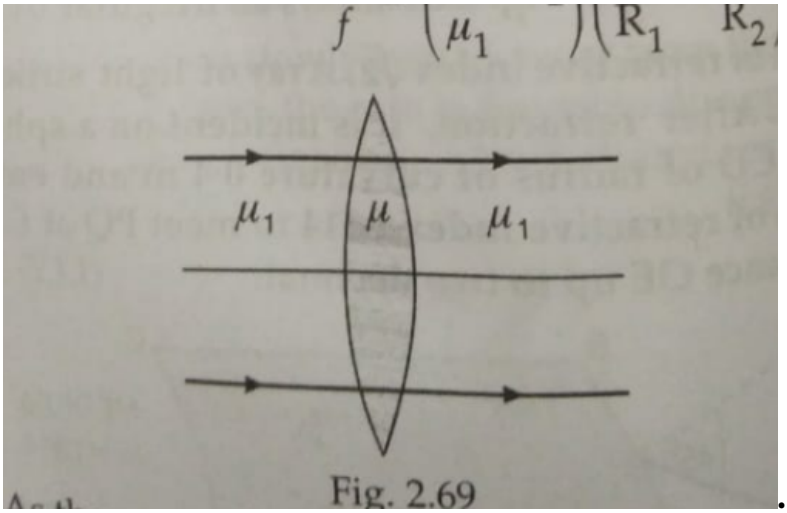

Fig. 2.69

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72. A plano - convex lens has thickness 4 cm.When placed on a horizontal table with the

curved surface in contact with it,the apparent depth of the bottom-most point of the lens is found to be 3 cm.If the lens is inverted ,such that the plane face is in contact with the table,the apparent depth of the centre of plane face of the lens is found to be $25/8$ cm.Find the focal length of the lens.

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73. The distance between two sources of light is 24 cm.Find out where would you place a

converging lens of focal length 9 cm,so that the images of both sources are formed at the same point.

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74. An object is approaching a thin convex lens of focal length 0.3 m with a speed of 0.01 ms^{-1}.Find the magnitudes of the rates of change of position and lateral magnification of image,when the object is at distacne of 0.4 m from the lens.

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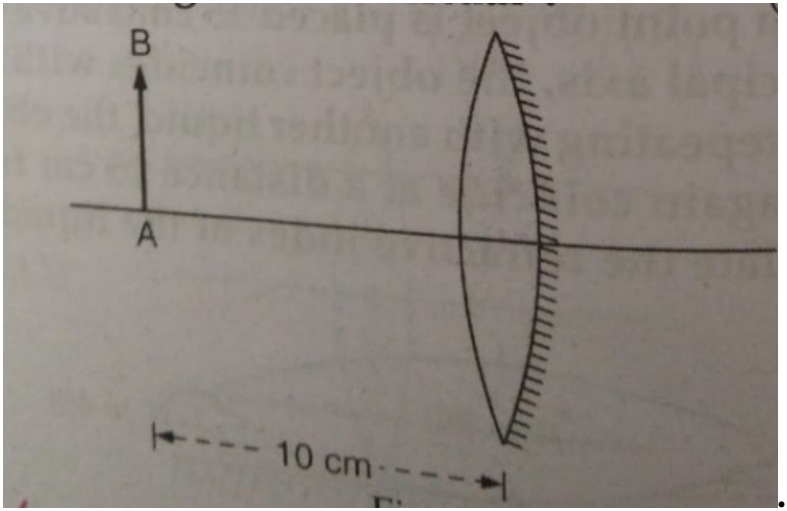
75. A pin is placed 10 cm in front of convex lens of focal lenth 20 cm made of material of refractive index 1.5 .the surface of the lens farther away from the pin is silvered and has a radius curvature 22 cm.Detrermine the position of the final image.Is the image real or

virtual?



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76. The radius of curvture of the convex face of a plano-covex lens is 12 cm and its refractive index is 1.5.

Find the focal length of the lens.

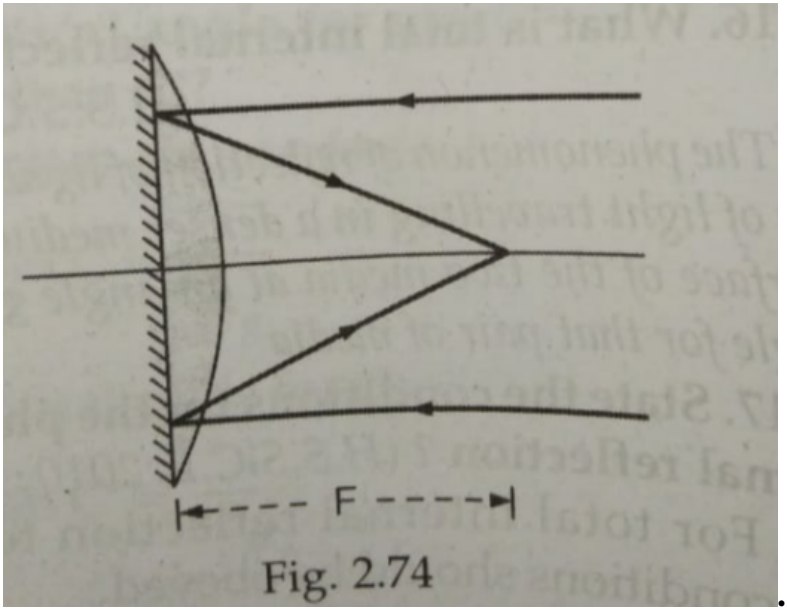

Fig. 2.74

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77. The radius of curvture of the convex face of a plano-covex lens is 12 cm and its refractive index is 1.5.

Find the focal length of the lens.

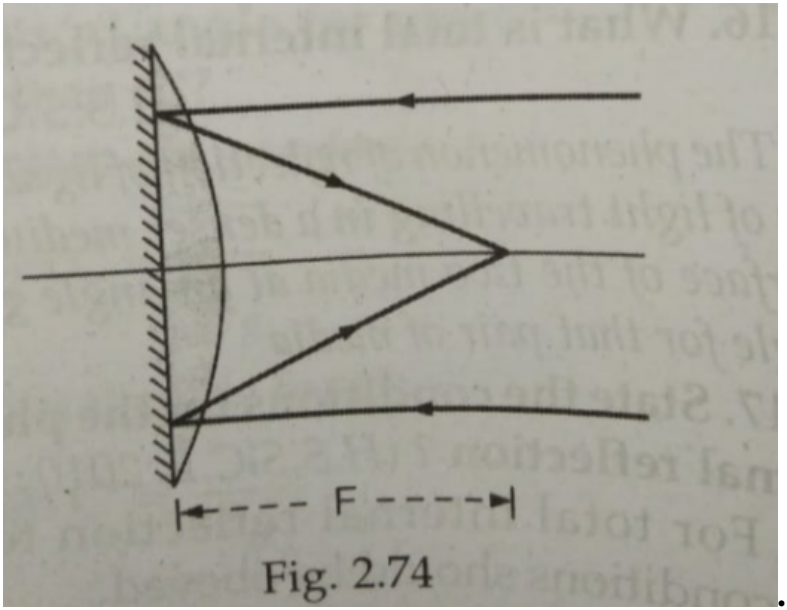

Fig. 2.74

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78. The radius of curvture of the convex face of a plano-covex lens is 12 cm and its refractive index is 1.5.

Calculate the image distance,when a point object is paced on the axis 20 cm from the lens.

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79. Two thin lenses,when in contact,produce a combinatin of power+10 dioptres.When they are 0.25 m apart,the power reduces to +6 dipotres.Find the power of the two lenses.

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80. What is refraction of light?

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81. What is the basic cause of refraction of light?

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82. What is refraction of light?

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83. When light travels from a rarer to denser medium,the speed decreases.Does the decrease in speed imply a decrease in the energy carried by the light wave?Justify you answer.

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84. Give the ratio of velocities of light waves of wavelengths 4000λ and 8000λ in vacumm.

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85. How the speed of light in vacuum is affected by the change of wavelength of light?

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86. Is the ratio of frequencies of ultraviolet rays and infrared rays in glass more than, less than or equal to 1?

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87. Out of speed,frequency and wavelength,name the parameters which remain same after reflectrion?

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88. How does the frequency of a beam of ultraviolt light change when it goes from air to glass?

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89. Define refractive index of a medium w.r.t. another medium.

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90. Can absolute refractive index of any material be less than one? Why?

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

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92. Write down two formulas for μ.

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93. Can relative refractive index of a medium w.r.t another be less than unity?

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94. For what angle of incidenc e,the lateral shift produces by a parallel sided glass plate is zero?

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95. For what angle of incidence,the lateral shift produced by a parallel sided glass plate is maximum?

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96. What are the factors on which the normal shift depends?

Watch Video Solution

97. Explain total internal reflection. What are its conditions?

Watch Video Solution

98. Write the conditions for total internal reflection to takeplace?

Watch Video Solution

99. Give illustrative examples for total internal reflection.

Watch Video Solution

100. Define critical angle for total internal reflection.

Watch Video Solution

101. Define critical angle for total internal reflection.

Watch Video Solution

102. Define critical angle for total internal reflection.

Watch Video Solution

103. What is the relation between critical angle and refractive index? What is critical angle for diamond?

Watch Video Solution

104. What is the critical angle for materail of refractive index $\sqrt{2}$?

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105. A substance has critical angle 45° for yellow light. What is its refractive index?

Watch Video Solution

106. For glass-air interface,the critical angle is C.Will the critical angle for glass-water interface be greater or less than C?

Watch Video Solution

107. Can total inrternal reflection take place,when light travesl from rarer to denser medium?

Watch Video Solution

108. What is potical figbre?

Watch Video Solution

109. Which of the main parts of an optical fibre has a higher value of refractiv index?

Watch Video Solution

110. State the principle of optical pipe.

Watch Video Solution

111. Name the physical principle on which th eworking of potical fibres is bases.

Watch Video Solution

112. What is lens?

Watch Video Solution

113. Define the principal axis of a lens.

Watch Video Solution

114. Define focus and principal focus.

Watch Video Solution

115. A glass lens of refractive index 1.5 is placed in a trough of liquid. What must to be the refractive index of the liquid in order to make the lens diappear.

Watch Video Solution

116. A lens when immersed in a transparent liquid becomes invisible. Under what condition does it happen?

Watch Video Solution

117. Can a lens be used in the medium of which is is made of?

Watch Video Solution

118. under what condition does a biconvex lens of glass having a certain refractive index act as a plane glass sheet,when immersed in a liquid?

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119. Converging lens of refractive index 1.5 is kept in a liquid medium having the same refractive index what would be the focal length of the lens in this medium?

Watch Video Solution

120. How can a convex lens behavae like a diverging lens?

Watch Video Solution

121. A double convex lens made from a material of refractive index μ_1 is immersed in a liquid of refactive index μ_2 where$\mu_2 > \mu_1$. What change, if any, would occur in the nature of the lens?

Watch Video Solution

122. A biconvex lens of a transparent material of refractive index 1.25 is immersed in water of refractive index 1.33 will the lens behave as a converging or a diverging lens?Give reason.

Watch Video Solution

123. A convex lens made up of glass of refractive index 1.5 is dipped,in turn ,in medum B of refractive index 1.33. whether it

will behave as a converging lens or a diverging lens?

Watch Video Solution

124. A biconvex lens of a transparent material of refractive index 1.25 is immersed in water of refractive index 1.33 will the lens behave as a converging or a diverging lens?Give reason.

Watch Video Solution

125. A biconvex lens of a transparent material of refractive index 1.25 is immersed in water of refractive index 1.33 will the lens behave as a converging or a diverging lens?Give reason.

Watch Video Solution

126. What type of lens is an air bubble inside water?

Watch Video Solution

127. What happens to be focal length of convex lens when it is immersed in water?

Watch Video Solution

128. An object is held at the principal focus of a concave lens of focal length F. where is the image formed?

Watch Video Solution

129. A converging and a diverging lens of equal focal lengths are placed co-axially in contact. Find the power and the focal length of the combination.

Watch Video Solution

130. A converging and a diverging lens of equal focal lengths are placed co-axially in contact. Find the power and the focal length of the combination.

Watch Video Solution

131. The image of an object formed by a lens on the screen is not in sharp focus.Suggest a method to get a clear focussing of the image on the screen without distrubing the position of the object,the lens or the screen.

Watch Video Solution

132. A portion of a lens is broken. Will we get a complete image of an object with such a lens?

Watch Video Solution

133. ...is the unit of power of the lens

Watch Video Solution

134. Define power of a lens

Watch Video Solution

135. Define power of a lens

Watch Video Solution

136. A glass lens is immersed in water. How is power of the lens affected? Justify your answer.

Watch Video Solution

137. Write expression for the focal length and power of a lens combination.

Watch Video Solution

138. When monochromatic light travels from one medium to another, its wavelength changes but its frequency remains the same. Why?

Watch Video Solution

139. The refractive index of water is $4/3$.How much time will light take to travel through a water column of length 500 m?

Watch Video Solution

140. The refractive index of air w.r.t glass is $2/3$.The refractive index of diamond w.r.t. air is $12/5$.What is the refrative index of glass w.r.t. diamond?

Watch Video Solution

141. For the same angle of incidence,the angles of refraction in three different mediaA,B and C

are $15^\circ, 25^\circ$ and 35° respectively.In which medium will the velocity of light be minimum?

Watch Video Solution

142. A ray of light of frequency of $5 \times 10^{14} Hz$ is passed through a liquid.the wavelength of light measured inside the liquid is found to be $450 \times 10^{-9} m$.Calculate refractive index of the liquid.

Watch Video Solution

143. A ray of monochromatic light travelling in vacuum with speed c ,wavelength γ and frequency v,enters into a medium of refrative index 1.5 .What will be its new speed ,wavelength and frequency?

Watch Video Solution

144. When does snell's law in refraction fails?

Watch Video Solution

145. Answer the following questions: A diver under water, looks obliquely at a fisherman standing on the bank of a lake. Would the fisherman look taller or shorter tothe diver than what he actually is?

Watch Video Solution

146. Write the conditions for total internal reflection to takeplace?

Watch Video Solution

147. How will you explain twinkling of stars?

Watch Video Solution

148. Watching the sunset on a beach, one can see for several minutes after it has 'actually set'. Explain.

Watch Video Solution

149. Watching the sunset on a beach, one can see for several minutes after it has 'actually set'. Explain.

Watch Video Solution

150. How does refraction of light affect the length of the day?

Watch Video Solution

151. Discuss refraction through a glass slab and show that emergent ray is parallel to incident ray but displaced?

Watch Video Solution

152. A glass-slab is placed over a page,over which letters are printed in different colours.Will the image of all the letters lie in the same plane?Explain.

Watch Video Solution

153. A glass-slab is placed over a page,over which letters are printed in different colours.Will the image of all the letters lie in the same plane?Explain.

Watch Video Solution

154. A coin placed at the bottom of a tank appears to be raised,when water is poured into the tank.Why?

Watch Video Solution

155. Why does a tank filled with water appear shallow?

Watch Video Solution

156. Answer the following questions: Does the apparent depth of a tank of water change if viewed obliquely? If so, does the apparent depth increase or decrease?

Watch Video Solution

157. A stick partially immersed obliquely under water appears to be bent.Explain,why.

Watch Video Solution

158. Explain total internal reflection. What are its conditions?

Watch Video Solution

159. Explain total internal reflection. What are its conditions?

Watch Video Solution

160. Define critical angle for total internal reflection.

Watch Video Solution

161. Write the conditions for total internal reflection to takeplace?

Watch Video Solution

162. Prove that $\mu = \frac{1}{\sin C}$ where C is the critical angle?

Watch Video Solution

163. What is the relation between critical angle and refractive index? What is critical angle for diamond?

Watch Video Solution

164. State the condition of total internal reflectoin to take place at an interface separating two transparent media. Hence derive the expression for the critical angle in terms of speed of light in two media.

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165. State the condition of total internal reflection. Calculate the speed of light in the medium whose critical angle of 45°.

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166. An empty test tube is placed slanting in the water and viewed from above, what will you observe?

Watch Video Solution

167. Two monochromatic rays of light are incident normally on the face AB of an isosceles right-angled prism ABC.The refractive indices of the glass prism for the two rays 1 and 2 are respectively 1.35 and 1.45[Fig.2.76]Trace the path of these rays after

entering through the prism

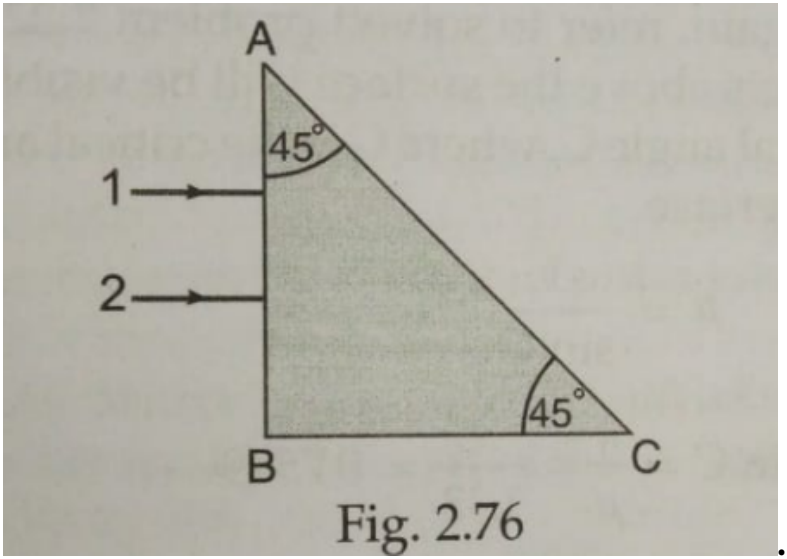

Fig. 2.76

Watch Video Solution

168. A right angled isosceles glass prism is made from glass of refractive index 1.5.Show that a ray of light incident normally on

one of the equal sides of this prism is deviated through 90°.

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169. A right angled isosceles glass prism is made from glass of refractive index 1.5.Show that a ray of light incident normally on the hypotneuse of this prism is deviated through 180°.

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170. Fig.2.68 shows object PQ in front of a right angled$(45^\circ - 90^\circ - 45^\circ)$ glass prism.the critical angle of glass is 42°.Redrw this figure tracing the complete path of rays from P and Q into and out of the prism.

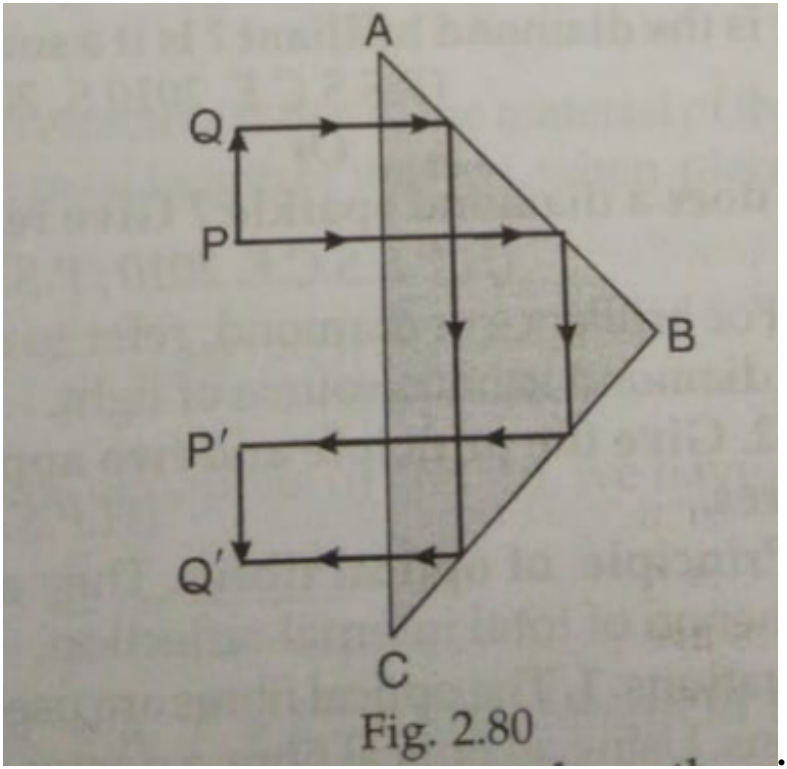

Fig. 2.80

Watch Video Solution

171. Show with a ray diagram,how an image is produced in total reflecting prism.

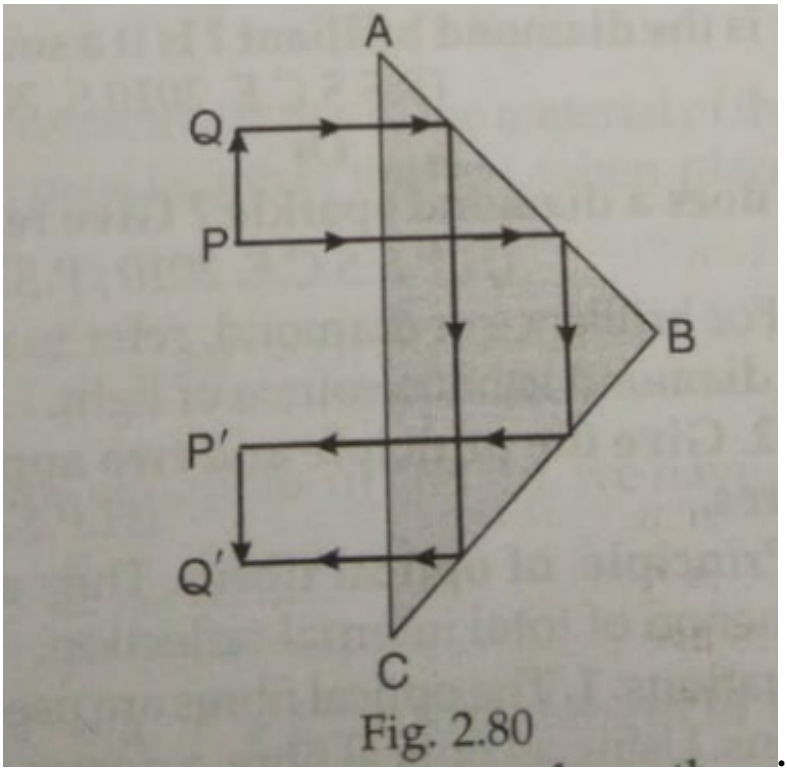

Fig. 2.80

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172. Draw ray diagrams to show how specially designed prisms make use of total internal reflection to obtain inverted image of the object by deviating rays through 180°?

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173. Draw ray diagram to show how a right angeld isosceles prism can be used to deviate the ray through 180°

Watch Video Solution

174. Draw ray diagram to show how a right angled isosceles prism can be used to deviate the ray through 90°.

Watch Video Solution

175. Draw ray diagram to show how a right angled isosceles prism can be used to deviate the ray through 90°.

Watch Video Solution

176. What are the advantage of total reflecting prism over a plane mirror?

Watch Video Solution

177. How do you explain the mirage effect produced in very hot deserts?

Watch Video Solution

178. Explain the formation of mirage.

Watch Video Solution

179. On a hot summer day in desert ,one sees the relected image of the distant objects.Explain,why.

Watch Video Solution

180. Explain the formation of mirage.

Watch Video Solution

181. Explain the brilliance of a diamond.

Watch Video Solution

182. Why does a diamond sparkle?

Watch Video Solution

183. Why does a diamond sparkle?

Watch Video Solution

184. Give the principle and two applications of optical fibres.

Watch Video Solution

185. What is an optical fibre?

Watch Video Solution

186. What is an optical fibre?

Watch Video Solution

187. What is the major use of optical fibres?

Watch Video Solution

188. Explain with a ray diagram,how optical fibres transmit signals.

Watch Video Solution

189. A luminous object is paced just below a glass slab of thickness t. A circular opaque disc is placed vertically above on the surface of the glass-slab. If C is critical angle for glass-air interface, then predict the minimum radius of the opaque disc so that the object cannot be seen from any uncovered portion of the glass-slab.

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190. When observed from under water, all the objects above the surface can be seen within a cone of 97°. Why? Explain.

Watch Video Solution

191. A fish in tank sees the outside world as if it is at the vertex of a cone such that the circular base of the cone is at the surface of the water.If the depth of the fish is d and the

critical angle for water-air interface is C,what is the radius of circle?

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192. A convex lens is placed in contact with a plane mirror.A point object at a distance of 20 cm on the axis f this combinatin has its image coinciding with itself.What is the focal length of the lens?

Watch Video Solution

193. For a spherical surface,when refraction takes place from a rarer medium (μ_1) to a denser medium (μ_2), we write

$$-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$$

where the symbols have their usual meanings. Now suppose that the object is placed in the denser to the rarer medium . Then, rewrite the above equation.

Watch Video Solution

194. What is a lens maker's formula? Why is it called so? Derive it for a thin convex lens.

Watch Video Solution

195. What is a lens maker's formula? Why is it called so? Derive it for a thin convex lens.

Watch Video Solution

196. What is the focal length of a convex lens $(\mu = 1 \cdot 5)$ with radii of curvature R?

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197. The radii of curvature of he two surfaces of a lens are not the same .It forms image of an object.The surfaces of the lens facing the object and image are interchanged .Will the position of the image change ?

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198. Briefly explain,how the focal length of a convex lens changes with increase in wavelength of incident light.

Watch Video Solution

199. Red light is incident on a think converging lens of focal length f. Briefly explain how the focal length of the lens will change,if red light is replaced with blue light.

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200. What changes in the focal length of a concave mirror when the incident violet light on them is replaced by red light?

Watch Video Solution

201. What changes in the focal length of a convex lens occur,when the incident violet light on them is replaced by red light?

Watch Video Solution

202. How does the power of a convex lens vary,if the incident violet light is replaced by red light?

Watch Video Solution

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

Watch Video Solution

204. Can a convergent lens in one medium behave as a divergent lens in some other medium?

Watch Video Solution

205. A concave mirror and a convex lens are held separetly in water. What changes, if any, do you except in the focal length of either?

Watch Video Solution

206. A convex lens(refractive index μ_L) is immersed in a medium (refractive index μ_M).Will it behave as a convergent or divergent lens,if

$\mu_L > \mu_M$.

Watch Video Solution

207. A convex lens made up of glass of refractive index 1.5 is dipped,in turn ,in

medium A of refractive index 1.65. will it behave as converging or diverging lens?

Watch Video Solution

208. Explain,why an air bubble inside a transparent liquid behaves like a diverging lens.

Watch Video Solution

209. A convex lens made of material of refractive index n_1 is kept in a medium of refractive index n_2. Parallel rays of light are incident on the lens. Complete the path of light emerging from the convex lens, if $n_1 < n_2$

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210. A convex lens made of material of refractive index n_1 is kept in a medium of

refractive index n_1. Parallel rays of light are incident on the lens. Complete the path of light emerging from the convex lens, if $n_1 = n_2$

Watch Video Solution

211. A convex lens made of material of refractive index n_1 is kept in a medium of refractive index n_2. Parallel rays of light are incident on the lens. Complete the path of

light emerging from the convex lens, if $n_1 < n_2$

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212. A concave lens made of a material of refractive index μ_g is immersed in a medium of refractive index μ_l, greater than,A paprallel beam of light is incident on the lens. Trace the path of emerged rays

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213. A concave lens made of a material of refractive index μ_g is immersed in a medium of refractive index μ_l,

equal to and

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214. The refractive index of a material of a concave lens is n_1. It is immersed in medium of refractive index n_2. A parallel beam of light if incident on the lens. Trace the path of the

emergent lays when

$n_2 = n_1$

Watch Video Solution

215. The refractive index of a material of a concave lens is n_1. It is immersed in medium of refractive index n_2. A parallel beam of light if incident on the lens. Trace the path of the emergent lays when $n_2 < n_1$.

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216. You are given three lenses L_1, L_2 and L_3 each of focal lenth 15 cm.An object is kept at 20 cm in front of L_1 as shown in Fig.2.87.

The real image is formed at the focus I of L_3 .Find the separations between L_1, L_2 and L_3.

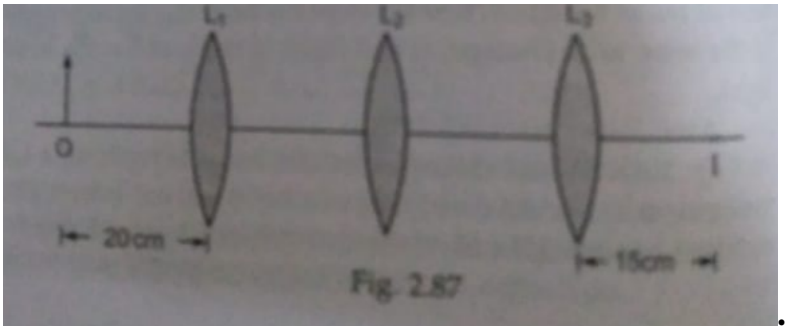

Fig. 2.87

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217. The image of a candle is formed by a convex lens on a screen. The lower half of the lens is painted black to make it completely opaque. Draw the ray diargram to show the image formation. How will this image be different from the one obtained when the lens is not painted black?

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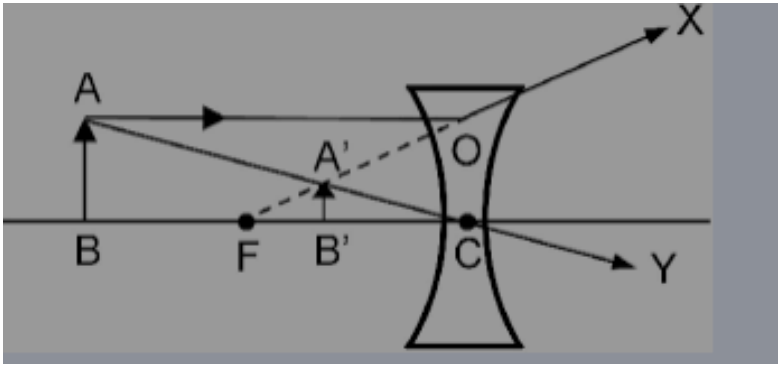
218. Describe the formation of image by a concave lens.



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219. Use the mirror equation to deduce that: a convex mirror always produces a virtual image independent of the location of the object.

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220. Define power of a lens

Watch Video Solution

221. Define 1 dioptre of power of a lens

Watch Video Solution

222. Define power of a lens

Watch Video Solution

223. The following data was recorded for values of object distance and the corresponding values of image distance in the experiment on study of real image formation by a convex lens of power +5 D.One of these observations is incorrect.Identify this observation and give reason for your choice:

S. No	Object distance (cm)	Image distance (cm)
1.	25	97
2.	30	61
3.	35	37
4.	45	35
5.	50	32
6.	55	30

.

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224. Although the surfaces of a goggle lens are curved,it does not have any power.Explain,why.

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225. What are the uses of putting two lenses in contact with each other ?

Watch Video Solution

226. Draw a diagram to illustrate spherical aberration in a convex lens.

Watch Video Solution

227. What happens to the image if aperature of a spherical mirror is large?

Watch Video Solution

228. Explain,how spherical aberration can be minimised.

Watch Video Solution

229. A beam of light is converging towards a point on a screen.A plane parallel plate of glass is introduced in the path of this converging beam.How will the point of convergence be shited ?Draw the ray diagram.

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230. A container is filled with water $(\mu = 1.33)$ upto a height of 33.25 cm .a concave miror is placed 15 cm above the water level and the image of an object placed at the bottom is formed 25 cm below the water leverl[Fig.2.90].Find the focal length of the concave mirror.

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231. A concve mirror of radius of curvature 1 m is placed at the bottom of a tank of water.The mirror forms an image of the sun,when it is directly overhead.Calculate the distance of the images from the mirror for different depths,80 cm and 40 cm of the water in the tank.

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232. A fish swims in a glass tank.A person,whose eye is above the level of water

,sees two fishes.Draw a ray diagram to illustrate this.

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233. The moon moves across the sky at approximately 0.5° per hour.

What you would see,if the moon had an atmosphere like the earth?

Watch Video Solution

234. The moon moves across the sky at approximately 0.5° per hour.

What you would see,if the moon had an atmosphere like the earth?

Watch Video Solution

235. A convex and concave lens having focal lengths of 30 cm and j10 cm respectively are placed at a distance 20 cm from each other.Whre should a source of light be placed

so that the system of the two lenses will produce a beam of parallel rays?

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236. A lens shown in the figure VSAQ 9.73 is made of two different materials. A point object is placed on its axis. How many images will it

form?

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237. The greatest thickness of a Plano-convex lens ,when viewed normally through its plane surface, appears to be $8/300$ m and when

viewed normally through its curved surface,appears to be $16/500m$.If the actual thickness is 0.04 m,find its refractive index,

Watch Video Solution

238. The greatest thickness of a plano-convex lens ,when viewed normally through its plane surface,appears to be $8/300$ m and when viewed normally through its curved surface,appers to be $16/500m$.If the actual

thickness is 0.04 m,find its

radius of cruature

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239. The greatest thickness of a Plano-convex lens ,when viewed normally through its plane surface, appears to be $8/300$ m and when viewed normally through its curved surface,appears to be $16/500m$.If the actual thickness is 0.04 m,find its refractive index,

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240. What is minimum distance between an object and the real image formed by a convex lens?

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241. An ant is approaching a convex lens with a uniform speed upto first focus.How would the speed of the image of the ant formed by lens change?

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Exercise

1. Explain the phenomenon of refraction at a plane surface separating two transparent media and show that $\mu = c/v$ where letters have their usual meanings.

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2. Define refractive index in terms of velocity of light?

Watch Video Solution

3. Prove the Relation : ${}^{a}\mu_{b} = \frac{1}{{}^{b}\mu_{a}}$

Watch Video Solution

4. When a ray of light passes through a parallel slab of transport medium, then show

that angle of incidence is equal to angle of emergence.

Watch Video Solution

5. What is meant by lateral shift ?Explain for a given slab,what is the quantity that determines lateral shift?Obtain the expression for lateral shift for refracion throug a parallel sided glasss slab.

Watch Video Solution

6. Discuss refraction through a glass slab and show that emergent ray is parallel to incident ray but displaced?

Watch Video Solution

7. State generalized Snell's law for refration through multiple parallel media.Prove the relation:$a^{\mu}\_c = a^{\mu}\_b \times b^{\mu}\_c$.

Watch Video Solution

8. Show that apparent depth of a water tank is less than real depth.

Watch Video Solution

9. Find relation for refractive index in terms of real depth and apparent depth.

Watch Video Solution

10. What is normal shift?Explain.Obtain he expression for normal shift .Indicate,how this

helps to determine refractie index of a medium.

Watch Video Solution

11. Write the conditions for total internal reflection to takeplace?

Watch Video Solution

12. Obtain a relation between a critical angle and refractive index of medium.

Watch Video Solution

13. Obtain a relation between a critical angle and refractive index of medium.

Watch Video Solution

14. Obtain a relation between a critical angle and refractive index of medium.

Watch Video Solution

15. Obtain a relation between a critical angle and refractive index of medium.

Watch Video Solution

16. Write the conditions for total internal reflection to takeplace?

Watch Video Solution

17. Explain total internal reflection. What are its conditions?

Watch Video Solution

18. Obtain a relation between a critical angle and refractive index of medium.

Watch Video Solution

19. State the condition of total internal reflectoin to take place at an interface separating two transparent media. Hence derive the expression for the critical angle in terms of speed of light in two media.

Watch Video Solution

20. Define critical angle for total internal reflection.

Watch Video Solution

21. What are the uses of optical fibre?

Watch Video Solution

22. Explain briefly the phenomenon of total internal reflection used in fibre optics.

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23. Sparkling Brilliance of Diamond

The total internal reflection of light is used in polishing diamonds to create a sparking briliance. By polishing the diamond with specific cuts, it is adjusted so that most of the light rays approaching the surface are incident with an angle of incidence more than critical angle. hence they suffer multiple reflections and ultimatley come out of the diamond from the top. This gives the diamond a sparkling brilliance.

The following diagram shows the same diamond cut in two different shapes.

The brilliance of diamond in the second diamond will be:

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24. Which optical phenomenon is used to explain the working of an optical fibre?

Watch Video Solution

25. Explain total internal reflection. What are its conditions?

 Watch Video Solution

26. What are the uses of optical fibre?

 Watch Video Solution

27. What are fibres?

 Watch Video Solution

28. What is lens formula ? Give its sign conventions

Watch Video Solution

29. Obtain lens makers formula using the expression

$$\frac{\mu_1}{u} + \frac{\mu_2}{v} = \frac{\mu_2 - \mu_1}{R}$$

Here the ray of light propagating from a rare r medium of rerfracitve index (μ_1) to a dneser medium of refractive indes(μ_2) is incident on

the convex side of spherical refracting surface of radius of curvature R.

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30. Prove the following formula when refraction takes place at a convex spherical refracting surface and source of light lies in the rarer medium and image formed is real $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$ Where the terms have their usual meanings.

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31. The image of a candle is formed by a convex lens on a screen. The lower half of the lens is painted black to make it completely opaque. Draw the ray diargram to show the image formation. How will this image be different from the one obtained when the lens is not painted black?

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32. By giving sign-conventions, derive the lens formula relating object distance, image distance and focal length for a thin convex lens. Draw a ray diagram to show the formation of image of an object placed between optical centre and focus of a convex lens.

Watch Video Solution

33. By giving sign-conventions, derive the lens formula relating object distance, image distance and focal length for a thin convex lens. Draw a ray diagram to show the formation of image of an object placed between optical centre and focus of a convex lens.

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34. Derive lens formula $\left[\frac{1}{v}-\frac{1}{u}=\frac{1}{f}\right]$ for a thin convex lens, using diagram for the formation of a real image by convex Lens.

Watch Video Solution

35. Draw a ray diagram to show how the image is formed when the object is placed between f and 2 f distances from a convex lens.Deduce the relation between the distances of he oject

and the image from the lens and the focal length of the lens under this condition.

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36. Define linear magnification produced by a lens.Hence derive expression for it also define the power of a lence and its unit.

Watch Video Solution

37. What do you mean by linear magnification produced by a lens? Derive its various expressions.

Watch Video Solution

38. What is meant by linear magnification of a spherical mirror? Derive expressions for it.

Watch Video Solution

39. What do you mean by linear magnification produced by a lens? Derive its various expressions.

Watch Video Solution

40. By giving sign-conventions, derive the lens formula relating object distance, image distance and focal length for a thin convex lens. Draw a ray diagram to show the formation of image of an object placed

between optical centre and focus of a convex lens.

Watch Video Solution

41. Give the position and nature of image of an extended object for different distances from a concave mmirror.

Watch Video Solution

42. Define power of a lens

Watch Video Solution

43. Derive the expression for the power of two thin lenses placed in contact with each other.

Watch Video Solution

44. Derive the expression for the power of two thin lenses placed in contact with each other.

Watch Video Solution

45. Derive the expression for the power of two thin lenses placed in contact with each other.

Watch Video Solution

46. Explain total internal reflection. What are its conditions?

Watch Video Solution

47. Define critical angle for total internal reflection.

Watch Video Solution

48. Obtain a relation between a critical angle and refractive index of medium.

Watch Video Solution

49. How do you explain the mirage effect produced in very hot deserts?

Watch Video Solution

50. Describe with ray diagrams,the applications of total reflection prisms.

Watch Video Solution

51. For a ray of light travelling from a denser medium of refractive index μ_1 to a rarer medium of refractive index μ_2,prove that $\frac{\mu_2}{\mu_1} = \sin C,$

where C is the critical angle of incidence for the media.

Watch Video Solution

52. Prove the following formula when refraction takes place at a convex spherical

refracting surface and source of light lies in the rarer medium and image formed is real $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$ Where the terms have their usual meanings.

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53. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u} + \frac{\mu_2}{v} = \frac{\mu_2 - \mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface $(\mu_1 < \mu_2)$. Where u, v and R are object

distance, image distance and radius of curvature of spherical surface respectively.

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54. What happens to the wavelength of light when it goes from rarer to denser medium?

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55. By stating the sign conventions and assumptions used, derive the relation between

distance of object, distance of image and radius of curvature of convex spherical surfaces, when refraction takes from optically rarer to optically denser medium.

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56. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface $(\mu_1<\mu_2)$. Where u, v and R are object

distance, image distance and radius of curvature of spherical surface respectively.

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57. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface $(\mu_1<\mu_2)$. Where u, v and R are object distance, image distance and radius of curvature of spherical surface respectively.

Watch Video Solution

58. Fig.2.100 shows a convex spherical surface with centre of curature C,separating the two media of refractive indices μ_1 and μ_2.

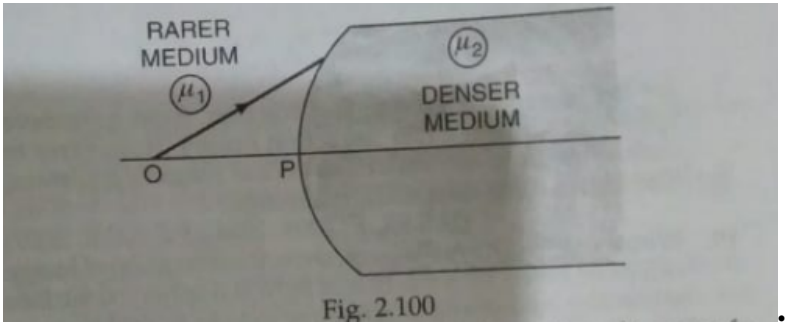

Fig. 2.100

Draw a ray diagram showing the formation of imge of a point object O lying on the principal axis.Derive the relationship between the object and image distances in terms of the

refractie indices of the wo media and the radius of curvature R of the surface.

Watch Video Solution

59. Fig.2.100 shows a convex spherical surface with centre of curature C,separating the two media of refractive indices μ_1 and μ_2.

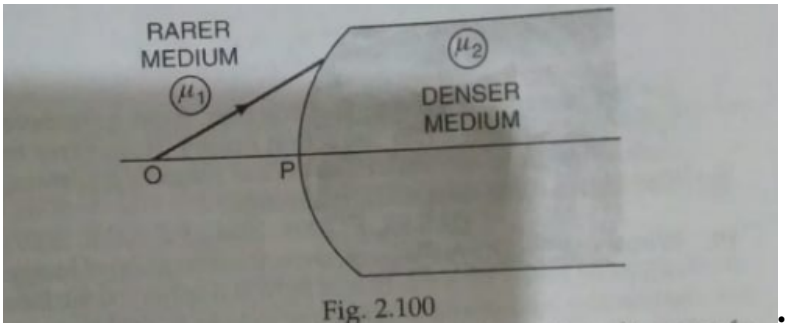

Fig. 2.100

Draw a ray diagram showing the formation of

imge of a point object O lying on the principal axis.Derive the relationship between the object and image distances in terms of the refractie indices of the wo media and the radius of curvature R of the surface.

Watch Video Solution

60. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface

$(\mu_1 < \mu_2)$. Where u, v and R are object distance, image distance and radius of curvature of spherical surface respectively.

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61. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface $(\mu_1 < \mu_2)$. Where u, v and R are object

distance, image distance and radius of curvature of spherical surface respectively.

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62. Prove the following formula when refraction takes place at a convex spherical refracting surface and source of light lies in the rarer medium and image formed is real $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$ Where the terms have their usual meanings.

Watch Video Solution

63. Prove the following formula when refraction takes place at a convex spherical refracting surface and source of light lies in the rarer medium and image formed is real $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$ Where the terms have their usual meanings.

Watch Video Solution

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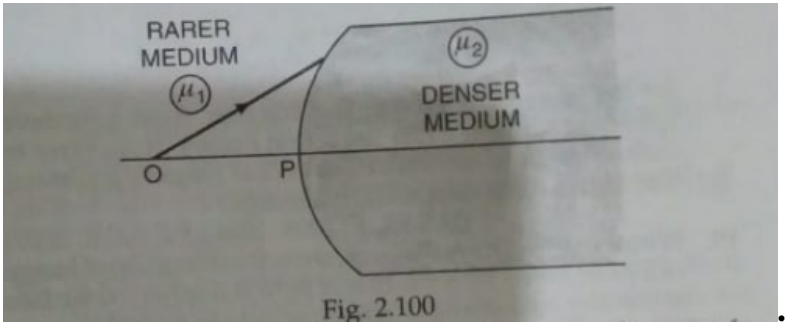

Fig. 2.100

Draw a ray diagram showing the formation of imge of a point object O lying on the principal axis.Derive the relationship between the object and image distances in terms of the refractie indices of the wo media and the radius of curvature R of the surface.

Watch Video Solution

65. Write formula for refraction of light from a single spherical surface.

Watch Video Solution

66. Derive the equation relating u,v and R in case of refraction i a medum of refactive index μ_1 from a medium of refractive index μ_2 .State te assumption made in you deriation.

Watch Video Solution

67. By stating the sign conventions and assumptions used, derive the relation between distance of object, distance of image and radius of curvature of convex spherical surfaces, when refraction takes from optically rarer to optically denser medium.

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68. By stating the sign conventions and assumptions used, derive the relation between

distance of object, distance of image and radius of curvature of convex spherical surfaces, when refraction takes from optically rarer to optically denser medium.

Watch Video Solution

69. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface $(\mu_1 < \mu_2)$. Where u, v and R are object

distance, image distance and radius of curvature of spherical surface respectively.

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70. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface $(\mu_1 < \mu_2)$. Where u, v and R are object distance, image distance and radius of curvature of spherical surface respectively.

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71. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface $(\mu_1 < \mu_2)$. Where u, v and R are object distance, image distance and radius of curvature of spherical surface respectively.

Watch Video Solution

72. Starting new cartesian sign conventions, derive the relation. $-\frac{\mu_1}{u}+\frac{\mu_2}{v}=\frac{\mu_2-\mu_1}{R}$, when refraction occurs from rarer to denser medium at convex spherical refracting surface $(\mu_1<\mu_2)$. Where u, v and R are object distance, image distance and radius of curvature of spherical surface respectively.

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73. What is the relation between focal length and radius of curvature of a concave mirror? What is focal length of a plane mirror?

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74. By giving assumptions made, derive the lens maker formula for a double convex lens.

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75. Derive lens maker's formula for a thin concave lens.

Watch Video Solution

76. By stating the sign conventions and assumptions used, derive the relation between distance of object, distance of image and radius of curvature of convex spherical surfaces, when refraction takes from optically rarer to optically denser medium.

Watch Video Solution

77. Derive lens maker's formula for a thin concave lens.

Watch Video Solution

78. By giving sign-conventions, derive the lens formula relating object distance, image distance and focal length for a thin convex lens. Draw a ray diagram to show the formation of image of an object placed

between optical centre and focus of a convex lens.

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79. Derive lens maker's formula for a thin concave lens.

Watch Video Solution

80. By giving assumptions made, derive the lens maker formula for a double convex lens.

Watch Video Solution

81. Derive lens maker's formula for a thin concave lens.

Watch Video Solution

82. Derive lens maker's formula for a thin concave lens.

Watch Video Solution

83. Derive lens maker's formula for a thin concave lens.

Watch Video Solution

84. Derive expression for the lens maker's formula i.e.: $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ where the letters have their usual meanings

Watch Video Solution

85. Derive expression for the lens maker's formula i.e.: $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ where the letters have their usual meanings

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86. What is a lens formula? Derive an expression for lens formula for a convex lens forming a real image.

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87. With the help of suitable diagram, sign conventions and assumptions, derive lens Maker's formula for a convex lens.

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88. By stating the sign conventions and assumptions used, derive the relation between distance of object, distance of image and radius of curvature of convex spherical surfaces, when refraction takes from optically rarer to optically denser medium.

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89. Draw a ray diagram to show the image formation by a concave mirror, when the object is kept between its focus and the pole.

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90. A ray of light passes from air to glass $(\mu = 1.5)$ at an angle of 30° .Calculate angle of refraction.

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91. Refractive indices of water and glass are $4/3$ and $3/2$ respectively.A ray of light travelling in water is incident on the water-glass interface at 30°.Calculate the angle of refraction.

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92. A ray of light of frequency of $5 \times 10^{14} Hz$ is passed through a liquid.the wavelength of

light measured inside the liquid is found to be $450 \times 10^{-9} m$.Calculate refractive index of the liquid.

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93. A tank is filled with water to a height of 12.5 cm. The apparent depth of a needle lying at the bottom of the tank is measured by a microscope to be 9.4 cm. What is the refractive index of water? If water is replaced by a liquid of refractive index 1.63 up to the same height,

by what distance would the microscope have to be moved to focus on the needle again?

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94. Calculate the index of refraction of a liquid from the following into glass:

Reading for the bottom of an empty beaker:11.324 cm .

Reading for the bottom of the beaker,when partially filled with the liquid:11.802 cm

Reading for the upper level of the liquid in the beaker:12.895 cm.

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95. While determining th refractive index of a liquid experimentally, he miroscope was focussed at the bottom of a beaker,when its reading was 3.965 cm.On pouring liquid upto a height of 2.537 cm inside the beaker ,the reading of the refocussed microscoe was 3.348 cm.Find the refractive index of the liquid.

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96. The bottom of a container is a 4.0 cm thick glass $(\mu = 1.5)$ slab. The container contains two immiscible liquids A and B of depths 6.0 and 8.0 cm respectively. What is the apparent position of a scratch on the outer surface on the bottom of the glass slab, when viewed through the container? Refractive indices of A and B are 1.4 and 1.3 respectively.

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97. Find the criical angle for a raay of light going from paraffin oil to air .Given that the refractive index of paraffin oil with repsect to air is 1.44.

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98. What is the critical anle for a ray going from glass into water?The refractive indices of glass and water are 1.62 and 1.32 respectivley.

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99. Velocity of light in a liquid is $1.5 \times 10^8 ms^{-1}$ and in air,it is $3 \times 10^8 ms^{-1}$.If a ray of light passes from this liquid to air ,calculate the value of critical angle.

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100. A small bulb is placed at the bottom of a tank containing water to a depth of 80cm. What is the area of the surface of water through which light from the bulb can emerge

out? Refractive index of water is 1.33. (Consider the bulb to be a point source.)

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101. A ocnvex refracting surface of radius of curvature 20 cm separeates two media of refractive indices $4/3$ and 1.60.An object is placed in the first medium $(\mu = 4/3)$ at a distance of 200 cm from the refractign surface.Calculate the position of the image formed.

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102. the radius of curvature of convex surface is 10 cm and if an object lies at a distance of 20 cm from it in the rarer medium,find the position of the image assuming that refractive index of the rarer medium is 1.0 ,while that of the denser medium is 2.0.

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103. One end of a cylinrical rod is grounded to a hemispherical surface or rdius R=20 mm.It is immersed in water of refractive ndex 1.33.If the refractive index of the rodd is 1.50,find the position of the image of an object placed on the axis of the rod inside water at 10 cm from the pole.

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104. A spherical refrativng suurface of denser medium $(\mu = 1.5)$ is placed in a rarer medium $(\mu = 1.3)$ .for an object lying in rarer medium at 20 cm from the surface,the virtual image is formed at 60 cm in rarer medium.find out the radius fo cruvature of the surface.

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105. A small object is enclosed in a spere of glass 7 cm in radius .It si situated 1 cm from

the centre and is veiwed from the side to whh it is nearest.where will it appear to be ,if refractive index is 1.4?Also find the appparent position of the oject as seen by an eye looking laong diameter throug greatest thickness of eh glass.

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106. Fig.2.49 shows a solid glass sphere of radius 5 cm that has a small air bubble O trapped at a distance 2 cm from the centre

C.Th refractive index of the material of glass is 1.5.Find the apparent position of the bubble where it will appear ,when seen throught the surface from an ougtside point E.

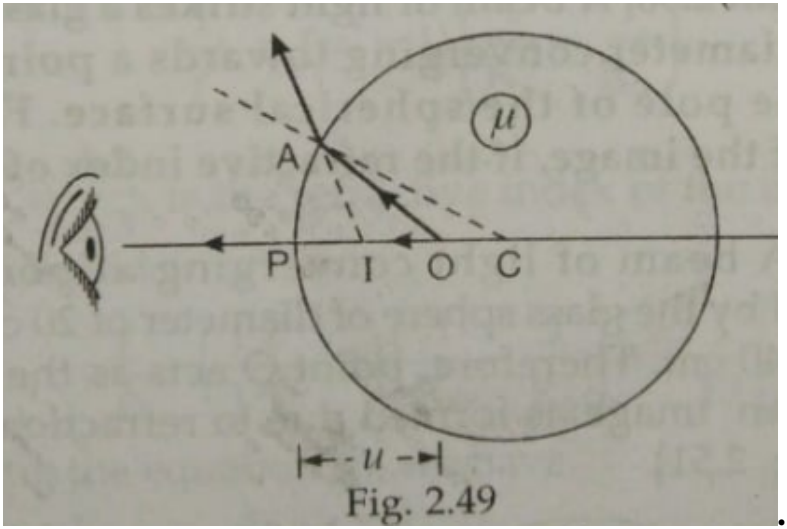

Fig. 2.49

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107. Find the surface area of a sphere of radius 14 cm.

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108. A point object is placed in air at distance of 40 cm from concave refrating surface of refractive index 1.5.If rasius of curvature of he spherical urface is 20 cm,calcuulate the position of the image.

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109. A concave spherical surface of refractive index $3/2$ is immersed in water of refracitve index $4/3$.If a piont object lies in water at a distance of 10 cm from the pole of the refracting surfae,calculate the position of the image.Given that radius of curvature of the spherical surface is 18 cm.

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110. A small object is 2 cm elow the concave mensicus of wae in a test tube.The radius of the meniscus is 5 mm and μ for water is $4/3$ .Find tthe nature and position of the image.

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111. The radii of curvature of he two surfaces of a lens are not the same .It forms image of an object.The surfaces of the lens facing the

object and image are interchanged .Will the position of the image change ?

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112. The radii of curvature of double convex lens are 30 cm and 60 cm and its refractive index is 1.5 .Calculate its focal length.

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113. A binovex lens has a focal lenth $2/3$ tiems the radius of curvature of either surface.Calculate the refractive index of lens material.

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114. The radii of curvature of the faces of a double convex lens are 10 cm and 12 cm respectively.If the focal length of the lens is 12

cm ,find the refractive index of the material of the lens.

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115. The radii of curvature of the two faces of a convex lens are 0.1 m and 0.15 m respectively.If the foal length of the lens is 0.12 m,find the refractie index of the material of the lens.

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116. A thin douel convex lens has surfaces of radii of curature 30 cm each.Find the refractive index of the material of lens,if the focal length is 25 cm.

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117. A equiconvex lens of focal length 30 cm is divided into two equal halves in thickness.find the focal lnegth of eah half.

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118. The radius of curvture of the convex face of a plano-covex lens is 12 cm and its refractive index is 1.5.

Find the focal length of the lens.

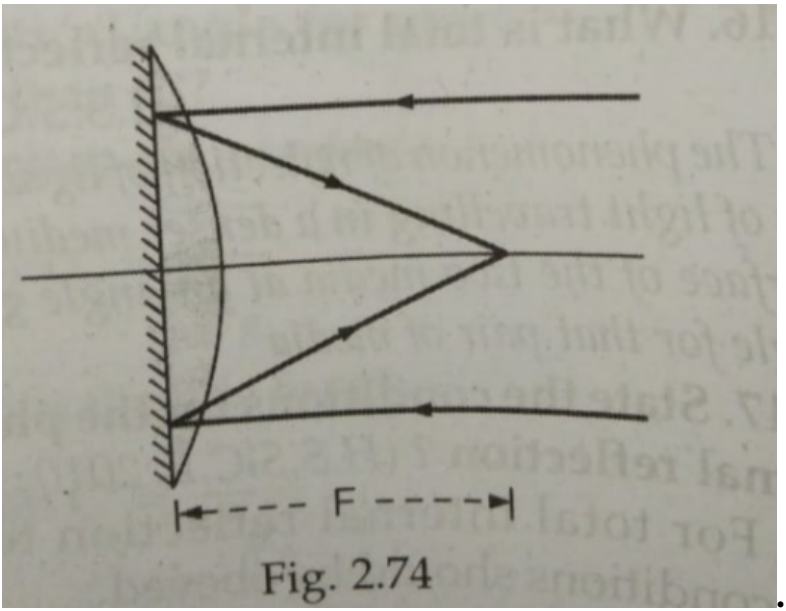

Fig. 2.74

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119. The radius of curvature of each face of a biconcave lens made of glass of refractive index 1.5 is 30 cm. Calculate the focal length of the lens is air.

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120. The radii of curvature of the two surface of a convexo concave ens ae15 cm and 30 cm .Find the focal lenth of the lens,if eh refractiveindex of its mterial is 1.6.

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121. The foal length of a glass convex lens in air is 15 cm.Calculate its focal lenth,when is is totally immersed in wate.Given $a^{\mu}\_w = 4/3$ and $a^{\mu}\_g = 1.5$.

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122. A glass $(\mu = 1.5)$ convex lens of focl length 40 cm is placed in water $(\mu = 1.3)$ .What will be its new focal length?

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123. The focal length of a concavo - convex lens of radii of curvature 5 cm and 10 cm is 20 cm.What will be its focal length in water $(\mu = 4/3)$?

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124. If the refractive index from air to glass is $3/2$ adn that from air to water is $4/3$,find the

ratio of the focal length of glass lens in water in air.

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125. A convex lens of refractive index 1.5 has a focal length of 18 cm in air.Calculate the change in focal length,when it is immersed in water of refractive index $4/3$.

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126. The radii of curvature of a convex lens are 20 cm and 30 cm nd the refractive index of its material is 1.5 .How its nature nd focal length will change ,when it is immersed in a liquid of refractive index = 1.6?

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127. A convex lens of refractive index 1.5 is immersed in a liquid of refractive index:

1.6 What will happen to the focal length and nature of lens ?

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128. Explain what happens ,when a convex lens of refractive index 1.2 is immersed in a liquid of refractive index 1.3.

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129. A convex lens of refrative index 1.5 is immersed in a liquid of refractive index:

1.5.

what changes happen to the focal length of the lens in the three cases?

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130. An object is placed at 0.06 m from a convex lens of focal length 0.10 m.Calculate the position and nature of the image.

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131. An object is kept 0.2 m from a conex lens of focal length 0.15 m .Find the position of the image.

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132. A 5.0 cm long needle is placed vertically at a distance 20 cm in front of a double convex lens made of a material of refractive index 1.5

having radii of curvature as 20 cm and 30 cm .Find the height of image formed.

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133. A convex lens of foal length 30 cm and a concave lens of focal length 60 cm are placed in contact.If the object is placed 40 cm away from the combination „ find the position of the image.

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134. A ocnverging bem of light forms of a sharp image on a screen. lens is placed in the path of the beam at 10 cm from the screen.It si found that screen has to be moved 8 cm further away from the lens to obtain a sharp image.Find the focal length and natrue of the lens.

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135. An object is placed at a distance of 75 cm from a screen .Where should a convex lens of

focal length 12 cm be placed so as to obtain on the screen?

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136. The image of needle placed 45 cm from a lens is formed on a screen placed 90 cm on the otehr side of teh lens.Find the displacement of the image,if the object is moved to 5.0 cm away from the lens.

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137. If the distance between the screen and object is 50 cm and the displacement of the lens is 10 cm,clculate the focal length of the lens.

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138. A convex lens of focal lenght 20 cm is placed coaxially wih a convex mirror of radius of curvature 20 cm.the two are kept at 15 cm apart.A point object lies 60 cm in front of the convex lens.Draw a ray diagram to show the

formation of the image by the combination.Determine the nature and position of the image formed.

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139. An object is placed at a distance 5 cm from a convex lens of focal lenth 10 cm.Calculate the position nd magnifiation of the image.

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140. Where should an object placed from a converging lens of focal length 20 cm,so as to obtain a real image of magnification 2?

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141. Calculate the distance at which an object should be placed in front of a convex lens of ocal length 10 cm,so as to obtain an image twice the size of the object?

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142. At what distance should be placed from a convex lens of focal length 15 cm to obtain an image three times the size of the object?

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143. A lens placed at a distance of 20 cm from an object produces a virtual image $2/3$ the size of the object.Find the position of image,kind of lens and its focal length.

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144. The image obtained with a convex lens is erect and its lenth is four times the length of the object.If the focal length of the lens is 20 cm,calculate the object and image distance.

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145. An object is placed at a distance of 1.5 m from a screen and a convex lens is interosed between them .the magnification produced is 4.What is the focal length of the lens?

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146. Two lenses of powers +4 D and -14 D form a combination.If a 2 cm size object is placed 30 cm from this combination,find the position,nature and size of the image.

Watch Video Solution

147. An iluminated object and a screen are placed 90 cm apart.Determine the focal length

and nature of the lens required to produce a clear image on the screen,twice the size of the object.

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148. A convex lens is used to obtain a magnified image of an object on a screen 10 m from the lens .If the magnification is 19,find the foal length of the lens.

Watch Video Solution

149. The image obtained iwth a convex lewns is ereect and its length is four times the length of the object.If the focal length of the lens is 20 cm,calculate the object and image distance.

Watch Video Solution

150. A lens of focal length 12 cm forms an upright image three times the size of a real object ,calculate the object and image distances.

Watch Video Solution

151. A lens of focal length 12 cm produces a virtual image,whose linear dimensions are $1/3$ that of the object.What kind of a lens is it? Dtermine the position of the object and the image.

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152. A lens has a power of +5 D in air.If completely immersed in water,what will be its

power ?Given,refractive index of glass = $3/2$,refractive index of water = $4/3$.

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153. Find the ratio of the powers of a glass lens in water and in air .Given,refractive index of glass =1.50,refractive index of water=1.33.

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154. A glass convex lens has a power of +10 D.When ths lens is totally immersed in a liquid,it acts as concave lens of focal length 50cm.Calculate the refractive index of the liquid.Given $\hat{}\ a\mu_g = 1.5.$

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155. What is the focal length of a convex lens of focal length 30cm in contact with a concave lens of focal length 20cm? Is the system a

converging or a diverging lens? Ignore thickness of the lenses.

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156. A concave lens is placed in contact with a convvex lens of focal lenght 25 cm.the combinatin produces a real image at a distance of 80 cm,when the object is at a distance of 40 cm.What is the focal length of the concave lens?

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157. Two thin lenses of focal lenths + 10 cm and - 5 cm are kept in contact.What is the focal length and

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158. Two thin lenses of focal lenths + 10 cm and - 5 cm are kept in contact.What is the power of combination.

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159. Two lenses of focal length 10 cm and -20 cm are placed in contact .What is the total power of the combination?

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160. A convex lens of focal lenth 30 cm and a concave lens of focal length 60 cm are placed in contact.Find the power of the combination.

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161. Two lenses of power 15.5 D and -5.5 D are placed in contact.What is teh focal length of the combbination?

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162. Two thin lenses of pwer +5D and -3D are in contact. What is the focal length of the combnation?

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163. A concave lens is kept in contact with a convex lens of focal length 20 cm.The combbination works as a convex lens of focal length 50 cm.Find the power of the concave lens.

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164. Two lenses of power +15 D and -5 D are in contact with each other forming a comvination lens.

what is the focal length of this combination?

Watch Video Solution

165. Two lenses of power +15 D and -5 D are in contact with each other forming a comvination lens.

what is the focal length of this combination?

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166. A compound lens is made of a convex lens of power 10 D and a concave lens of power 5 D. An object 2 cm high is placed in front of this

combination at a distance 40 cm from it. Find nature and size of the image formed.

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167. Two lenses of powers 10D - 5D are placed in contact

Calculate the power of the new lens.

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168. Two lenses of power +10 D and -5 D are placed in contact.

Where should an object be held from the lens,so as to obtain a virtual image of magnification 2?

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