PHYSICS

BOOKS - CHHAYA PHYSICS (BENGALI ENGLISH)

REFRACTION OF LIGHT

Numerical Examples

1. A ray of light is incident from water on the surface of separation of air and water at an angle 30°, Calculate the angle of refraction in air. μ of water $= \frac{4}{3}$

Watch Video Solution

2. A ray of light is incident on a block of glass in such a way that the angle between the reflected ray and the refracted ray is 90° . Determine the relation between the angle of incident and the refraction index of glass.

Watch Video Solution

3. Refractive index of glass is 1.5 and refractive index of water is 1.33. If the velocity in glass is $2 \times 10^8 m \cdot s^{-1}$, is the velocity of light in water?

Watch Video Solution

4. A monochromatic ray of light is refracted from vacuum to a medium of refractive index μ. Determine the relation of the wavelengths of light in vacuum and in medium.

Watch Video Solution

5. If a ray of light is incident on a plate inside water at an angle of 45°, what is the angle of refraction inside the plate? Given that the absolute refractive indices of the plate and water are 1.88 and 1.33 respectively.

Watch Video Solution

6. How much time will sunlight take to pass through the glass window of thickness 4 mm ? μ of glass = 1.5.

Watch Video Solution

7. Green light of wavelength 5640 in incident on an airglass interface. If the refractive index of glass is 1.5 what will be the wavelength of light in glass?

Watch Video Solution

8. A ray of light is incident on the plane face of a liquid at an angle 45° and due to refraction the ray is deviated through an angle 15°. Calculate the refractive index of the liquid.

Watch Video Solution

9. The opposite faces of a glass slab of thickness 15 cm are parallel. If a ray of light is incident on the glass slab at an angle 60°, calculate the lateral displacement of the ray when it emerges from the slab. $[\mu \quad \text{of glass} = 1.5]$

Watch Video Solution

10. A ray of light is refracted through a transparent sphere of refractive from μ in such a way that the ray passes through the ends of two radii inclined at an angle θ with each other. If δ is the angle of deviation of the ray while passing through the sphere then prove that,

$$\mu = \frac{\cos\frac{1}{2}(\theta - \delta)}{\cos\frac{\theta}{2}}$$

View Text Solution

11. A parallel beam of rays of width 20 cm passing through a glass slab makes an angle $\phi = 60^\circ$ with its plane surface. If the beam emerges into air from this surface then calculate the width of emergent beam. Refractive index of glass = 1.8.

View Text Solution

12. Refractive index of water with respect to air is 1.33, refractive index of oil with respect to water is 1.45 and that of glass with respect to oil is 0.78. What is the refractive index of glass with respect to air?

Watch Video Solution

13. There is a mark at the bottom of a beaker. A liquid of refractive index 1.4 is poured into it. If the depth of the liquid is 3.5 cm then determine how much will the mark appear to rise when it is viewed from above?

Watch Video Solution

14. There is a black spot at the bottom of a rectangular glass slab of thickness d and refractive index μ. When the spot is viewed

perpendicularly from above, the spot appears to be shifted through a distance $\frac{\mu - 1}{\mu}$ towards the observer. Prove it.

View Text Solution

15. In a beaker partly filled with water, the depth of water seems to be 9cm. On pouring more water in it, the real depth of water is increased by 4cm. Now the apparent depth of water seems to be 12 cm. Determine the refractive index of water and initial depth of water in the beaker.

Watch Video Solution

16. A small air bubble exists inside a transparent cube of side 15 cm each. The apparent of the bubble observed from one face is 6 cm and from the opposite face its apparent distance becomes 4 cm.

Determine the real distance of the bubble from the first face and refractive index of the material of the cube.

Watch Video Solution

17. A vessel is filled with two mutually immiscible liquids of refractive indices μ^1 and μ^2. The depths of the two liquids are d_1 and d_2 respectively. There is a mark at the bottom of the vessel. Show that the apparent depth of the mark when viewed normally is given by $\left(\frac{d_1}{\mu_1}+\frac{d_2}{\mu_2}\right)$.

View Text Solution

18. A rectangular slab of refractive index μ is placed on another slab of refractive index 3. Both the slabs are of the same dimensions. There is a coin at the bottom of the lower slab. What should be the

value of μ such that when viewed normally from above, the coin appears to be at the surface of separation of the two slabs?

View Text Solution

19. A tank contains ethyl alcohol of refraction index 1.35. The depth of alcohol is 308 cm. A plane mirror is placed horizontally at a depth of 154 cm in it. An object is placed 254 mm above the mirror. Calculate the apparent depth of the image formed by the mirror.

View Text Solution

20. A 20 mm thick layer of water $\left(\mu = \frac{4}{3}\right)$ floats on a 35 mm thick layer of another liquid $\left(\mu = \frac{7}{5}\right)$ in a tank. A small coin lies at the bottom of the tank. Determine the apparent depth of the coin when viewed normally from above the water.

Watch Video Solution

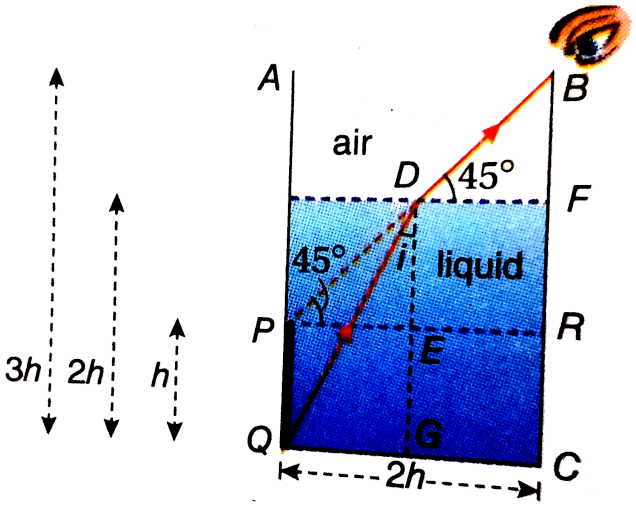
21. If a point source is placed at a distance of 18 cm from the pole of a concave mirror, its image is formed at a distance of 9 cm from the mirror. A glass slab of thickness 6 cm is placed between the point source and the mirror such that the parallel faces of the glass slab remains perpendicular to the principal axis of the mirror. If the refractive index of glass is 1.5 what will be the displacement of the image?

View Text Solution

22. A plane mirror is made of glass having thickness 1.5 cm. its back surface is coated with mercury. A man is standing at a distance of 50 cm from the front face of the mirror. If he looks at the mirror normally, where can he find his image behind the front face of the mirror? Refractive index of glass = 1.5.

View Text Solution

23. An observer can see the topmost point of a narrow rod of height h through a small hole [Fig.2.24]. The rod is placed inside a beaker. The beaker's height is 3h and radius is h. When the beaker is filled up to 2h of its height with a liquid the observer can see the entire rod. What is the value of the refractive index of the liquid?



View Text Solution

24. A ray of light is incident at the interface of glass and water at an angle of incidence i. If the ray finaily emerges parallel to the surface of water as shown in the Fig. 226, then what will be the value of μ_g ?

View Text Solution

25. If the absolute refractive index of a medium is $\sqrt{2}$, calculate the critical angle of glass to the medium. Given that the critical angle of glass to air is 30°.

Watch Video Solution

26. Refractive index of carbon disulphide for red light is 1.634 and the difference in the values of critical angle for red and blue light at the surface of separation of carbon disulphide and air is $0^\circ 56'$.

What is the value of refractive index of carbon disuphide for blue light?

Watch Video Solution

27. If the refractive index of diamond is 2.42, prove that all the beam of rays having angle of incidence more than 25° will be totally reflected. $[\sin 24.41^\circ = 0.4132]$

Watch Video Solution

28. A ray of light will go from diamond to glass. What should be the minimum angle of incidences at the surface of separation of the two media, diamond and glass, so that the ray of light cannot be refracted in glass ? μ of glass = 1.51 and μ of diamond = 2.47, $\sin 37.69^\circ = 0.61134$

Watch Video Solution

29. A cube has refractive index μ_1 . There is a plane of refractive index $\mu_2(\mu_2 < \mu_1)$ upon it. A ray travelling through air is incident on a side face of the cube. The refracted ray is incident on the upper face of the cube at the minimum angle for total internal reflection to occur. Finaily the reflected ray emerges from opposite face. Show that if the angle of emergence is ϕ then $\sin\phi = \sqrt{\mu_1^2 - \mu_2^2}$.

View Text Solution

30. A ray of light travelling through a denser medium is incident at an angle I in a rarer medium. If the angle between the reflected ray and refracted ray is 90° , show that the critical angle of the two media, $\theta_c = \sin^{-1}(\tan i)$

Watch Video Solution

31. A nail is fixed up perpendicularly at the centre of a circular wooden plate. Keeping the nail at bottom, the circular plate is made of float in water. What should be the maximum ratio of the radius of the plate and length of the nail so that the nail wil be out of vision? Refractive index of water = $\frac{4}{3}$.

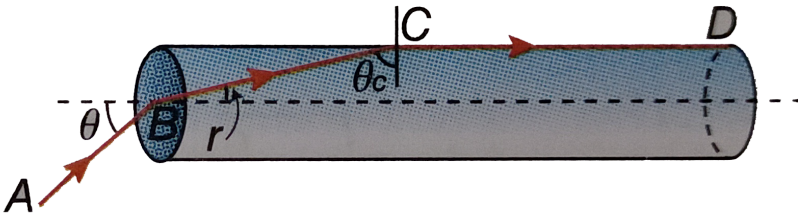
View Text Solution

32. The critical angle of glass relative to a liquid is $57^\circ 20'$. Calculate the velocity of light in the liquid. Given μ of glass = 1.58, Velocity of light in vacuum $3 \times 10^8 m \cdot s^{-1}$ and $\sin 57^\circ 20' = 0.8418$.

Watch Video Solution

33. A transparent solid cylindrical rod has a refractive index of $\frac{2}{\sqrt{3}}$. It is surrounded by air. A light ray is incident at the midpoint of one

end of the rod as shown in Fig 2.31. Determine the incident angle θ for which the light ray grazes along the wall of the rod.



View Text Solution

34. A point source of light is placed at a depth of h below the calm surface of water. From the source, light rays can only be transmitted to air through a definite circular section. (i) Draw the circular section of the surface of water by ray diagram and mark its radius r. (ii) Determine the angle of incidence of a ray of light incident at any point on the circumference of the circular plane. $\left[\text{Given : refractive index of water, } \mu = \frac{4}{3}, 48^\circ 36' = \sin^{-1}\right]$ (iii) Show that $r = \frac{3}{\sqrt{7}}h$.

View Text Solution

View Text Solution

35. The water in a pond has a refractive index $\frac{5}{3}$. A source of light is placed 4 m below the surface of water. Calculate the minimum radius of an opaque disc needed to be floated on water so that light does not come out.

Watch Video Solution

36. Fig.2.41 shows a longitudinal cross section of an optical fibre made of glass of refractive index 1.68. The pipe is coated with a material of refractive index 1.44. pipe is coated with a material of refractive index 1.44. What is the range of the angles of the incident rays with the axis of the pipe for which total reflection inside the fibre can take place?

View Text Solution

37. In which direction will the sun appear to set if the observe is inside the water of a pond? Refractive index of water , $\mu = 1.33$.

Watch Video Solution

38. The refractive index of the material of a prism is $\sqrt{\frac{3}{2}}$ and the refractive angle is 90° . What are the values of the angle of minimum deviation of the prism and the angle of the incidence at the minimum deviation position?

Watch Video Solution

39. The refractive index of the material of a prism is $\sqrt{2}$ and the angle of minimum deviation is 30° . Calculate the value of the refracting angle of the prism.

Watch Video Solution

Watch Video Solution

40. The angle of minimum deviation is the same as the angle of a glass prism of refractive index $\mu = \sqrt{3}$. What is the angle of the prism?

Watch Video Solution

41. What will be the angle of emergence of a ray of light through a prism for an angle of incidents 45° ? The angle of the prism = 60° , refractive index of the prism =$\sqrt{2}$.

Watch Video Solution

42. A ray of light is incident at an angle of incidents 40° on a prism having refractive index 1.6 . What should be the value of the angle of

the prism for minimum deviation?

Given $\sin 40^\circ = 0.6428, \sin 23^\circ 42' = 0.4018.$

Watch Video Solution

43. The refracting angle of a glass prism is 60° and the refractive index of glass is 1.6. If the angle of incidence of a ray of light on the first refracting surface is 45° Calculate the angle of deviation of the ray . Given that $\sin 26^\circ 14' = 0.4419, \quad \sin 33^\circ 46' = 0.5558$ and $\sin 62^\circ 47' = 0.8893$

Watch Video Solution

44. If the refracting angle of a prism is A, the refractive index of its material is μ and the angle of deviation of a ray of light incident normally on the first refraction face is δ, then prove that $\mu = \frac{\sin(A+\delta)}{\sin A}$.

Watch Video Solution

45. A ray of light is incident at an angle of 60° on a face of a prism with refracting angle 30° . If the ray emerges from the other face and makes an angle of 30° with the incident ray then, show that the emergent ray passes perpendicularly through the refracting surface. Determine the refractive index of the material of the prism.

Watch Video Solution

46. A glass prism of refracting angle 60° and of refractive index 1.6, is immersed in water (refractive index is 1.33). What is its angle of minimum deviation ? $[\sin 36.87^\circ = 0.6]$

Watch Video Solution

47. A ray of light passes through an equilateral prism in such a way that the angle of incidence becomes equal to the angle of emergence and each of these angles are $\frac{3}{4}$th of the angle of deviation. Determine the angle of deviation.

Watch Video Solution

48. The angle of minimum deviation of a glass prism refraction angle 60° is 30° . If velocity of light in vacuum is $3 \times 10^8 m \cdot s^{-1}$, then determine its velocity glass.

Watch Video Solution

49. A very thin prism deviates a ray of light through 5° . If the refractive index of the material of the prism is 1.5 , what is the value of the angle of prism?

Watch Video Solution

50. A prism having refracting angle 4° is placed in air Calculate the angle of deviation of a ray incident normally or nearly normally on it. The refractive index of the material of the prism $= \frac{3}{2}$.

Watch Video Solution

51. A thin prism with refracting angle 5° and having refracting index 1.6 is kept adjacent to another thin prism having refractive index. 1.5 such that one is inverted with respect to the other. An incident ray falling vertically on the first prism passes through the second prism without any deviation. Calculate the refracting angle of the second prism.

Watch Video Solution

52. To get emergent ray from a right-angled prism its refractive index should not exceed $\sqrt{2}$ - prove it.

Watch Video Solution

53. The refractive index of a prism having refracting angle 75° is $\sqrt{2}$. What should be the minimum angle of incidence on a refracting surface so that the ray will emerge from the other refracting surface of the prism?

Watch Video Solution

54. Find the value of the limiting angle of incidence if the refractive index of the material of prism is 1.333 and angle of prism is 60° .

Watch Video Solution

55. The refracting angle of a prism is 60° and its refractive index is $\sqrt{\frac{7}{3}}$. What should be the minimum angle of incidence on the first refracting surface so that the ray can emerge somehow from the second refracting surface?

Watch Video Solution

56. The refractive index of the material of a prism is $\sqrt{\frac{3}{2}}$ and the refractive angle is 90° . Calculate the angle of minimum deviation and the corresponding angle of incidence. Show that the limiting angle of incident for getting emergent ray is 45°.

Watch Video Solution

57. The refractive index of a prism is $\sqrt{2}$. A ray of light is incident on the prism grazing along one of its refracting surface. What should

be the limiting angle of the prism for no emergent ray from the other face?

Watch Video Solution

58. A man with a telescope can just observe the point A on the circumference of the base of an empty cylindrical vessel. When the vessel is filled completely with a liquid of refractive index 1.5, the man can just observe the middle point B of the base of the vessel without moving either the vessel or the telescope. If the diameter of the base of the vessel is 10 cm, what is the height of the vessel?

View Text Solution

59. A post of height 4 m is dipped straight in a pond. 1 m of the post remains above the water of the pond. If the rays of the sun are inclined at an angle of 45° to the surface of water what will be the

length of the shadow of the post at the bottom of the pond? Refractive index of water $\mu = \frac{4}{3}$.

View Text Solution

60. There is a point object at a height h above the surface of water in a tank. If the bottom of the tank acts as a plane mirror where will be the image formed? If an observer looks from air at the surface of water normally, calculate the distance of the image from that surface of water of the tank formed by the mirror-like bottom surface of the tank. Refractive index of water $= \frac{4}{3}$.

View Text Solution

61. A rectangular glass slab of thickness 3 cm and of refractive index 1.5 is placed in front of a concave mirror, perpendicular to its principal axis. The radius of curvature of the mirror is 10 cm. Where

is an object to be placed on the principal axis so that its image will be formed on the object?

View Text Solution

62. A cross mark at the bottom of an empty vessel is focussed with the help of a vertical microscope. Now water $\left(\text{refractive index} = \frac{4}{3}\right)$ is poured in the vessel. The height of water in the vessel is 4cm. Another lighter liquid which does not mix with water and whose refractive index is $\frac{3}{2}$, is poured on water. The height of the liquid is 2 cm. How much should the microscope be raised vertically to focus the mark again?

Watch Video Solution

63. A concave mirror of radius of curvature 1 m is placed at the bottom in a reservoir of water. When the sun is situated directly

over the head, the mirror forms an image of the sun. If the depth of water is (i) 80 cm and (ii) 40 cm , calculate the image distance from the mirror. $\left[\text{Given, } \mu_w = \frac{4}{3}\right]$

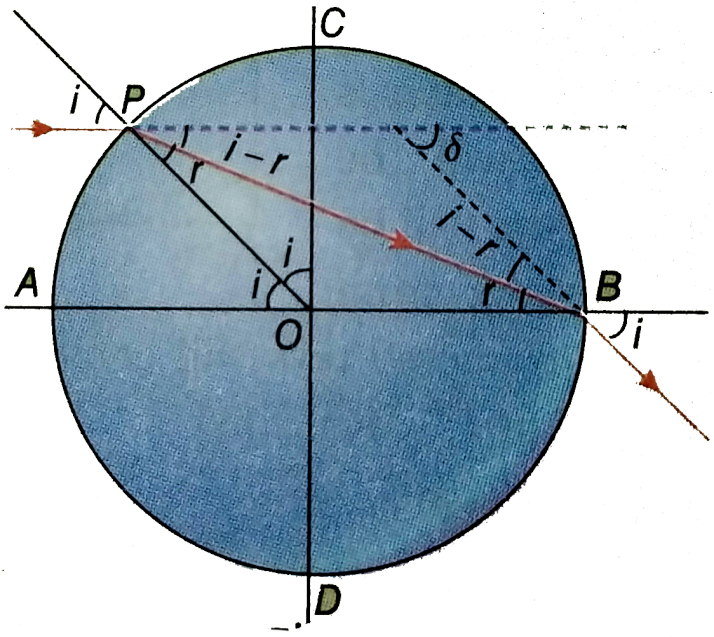
View Text Solution

64. The width of a rectangular glass slab is 5 cm. From a point on its bottom surface, length rays are incident on its top face and after total reflection form a circle of light of radius 8 cm. What is the refractive index of the glass slab?

View Text Solution

65. Fig.2.61 shows a glass sphere having center at O and two perpendicular diameters AOB and COD. A ray parallel to AOC is incident on the sphere at P where $\overset{\frown}{AB} = \overset{\frown}{PC}$ and emerges from the sphere at B. Calculate the refractive index of glass and the deviation

of the emergent ray.



View Text Solution

66. A glass slab is placed on a page of a book kept horizontally. What should be the value of the minimum refractive index of the glass slab so that the printed letters of the page will not be visible from any vertical side of the slab?

View Text Solution

67. A surface of a prism having refractive index 1.5 is covered with a liquid of refractive index $\frac{3\sqrt{2}}{4}$. When be the minimum angle of incidence of an incident ray so that on the other surface of the prism the the ray will be totally reflected from the surface covered with liquid? The refracting angle of the prism $75^\circ [\sin 48^\circ 36' = 0.75]$.

View Text Solution

68. A ray of light is incident normally on one side of an isosceles right-angled prism and is totally reflected from the other side. (i) What is the value of minimum refractive index of the material of the prism? (ii) If the prism is immersed in water, draw the diagram showing the directing of the emergent ray. In the diagram, point out the values of the angles, μ of water $= \frac{4}{3}$.

View Text Solution

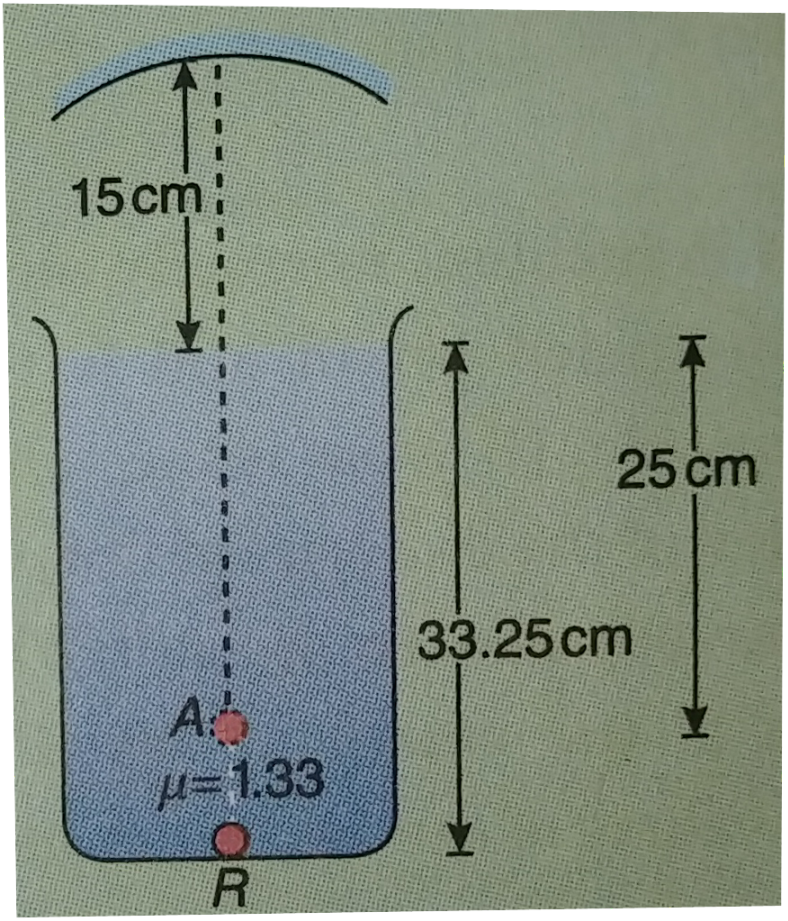
69. A ray of light is incident grazing the refracting surface of a prism having refracting angle A. It emerges the other refracting surface making an angle θ with the normal to the surface. Prove that the refractive index of the material of the prism is given by $\mu = \left[1 + \left(\frac{\cos A + \sin\theta}{\sin A}\right)^{-2}\right]^{1/2}$.

View Text Solution

70. A ray of light incident normally on a refracting surface of the prism is totally reflected from the other refracting surface. If the prism is immersed in water how will the ray act? Refractive index of glass = 1.5, refractive index of water = 1.33.

View Text Solution

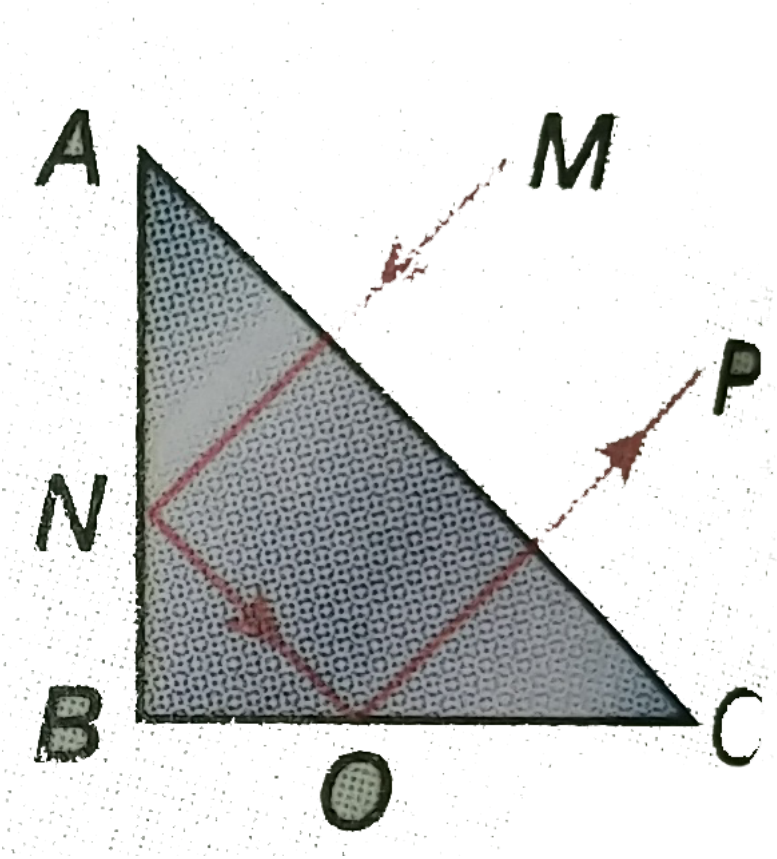
71. A tank of height 33.25 cm is completely filled with liquid $(\mu = 1.33)$. An object is placed at the bottom of tank of the axis of concave mirror as shown in the figure. Image of the object is formed 25 cm below the surface of the liquid. What is the focal length of the



mirror?

View Text Solution

72. What should be the minimum value of the refractive index of right angled isosceles prism so that the prism can deviate a ray through 180° by total internal reflection?



View Text Solution

73. The face of a prism of refracting angle A is coated with silver. A light ray after first being incident at an angle of incidence 2A on the first face of the prism, is refracted and is then reflected from the second face, retracting its path. Calculate the value of the refractive index of the prism.

View Text Solution

74. A ray of light falls normally on one side other than the hypotenuse of a right angled isosceles prism of refractive index 1.5. From which side will the ray emerge from the prism? Find the deviation of the incident ray.

Watch Video Solution

75. A vessel contains a liquid of refractive index $\frac{5}{3}$. Inside the liquid, S is a point source which is observed from above the liquid. An

opaque disc of radius 1cm is floating on the liquid such that its centre is just above the source. At this circumstances liquid of the vessel is leaving gradually through a hole. What is the depth of the liquid, so that the source no more remains visible from above?

View Text Solution

Higher Order Thinking Skill Hots Question

1. Monochromatic rays of light coming from vacuum are refracted in a medium of refractive index μ . Show that the ratio of the wavelength of the incident ray that of the refracted ray is equal to the refractive index of the medium.

Watch Video Solution

2. Can the value of absolute refractive index of a medium be less than 1?

Watch Video Solution

3. A beam of converting rays of light meets at a point on a screen. A parallel plane glass slab is kept in the path of the converging rays. How for will the intersecting point of the rays be shifted? Draw a diagram to show it.

View Text Solution

4. A ray of light is refracted from medium 1 to medium 2. Show that the ratio of the sine of the angle of incidence and the sine of the angle of refraction is equal to the ratio of speed of light in medium 1 and that in medium 2.

Watch Video Solution

5. μ_1 and μ_2 are the refractive indices of a medium for two electromagnetic waves. If μ_1 is greater than μ_2 then which wave will move faster than the other?

Watch Video Solution

6. An object is placed at a certain depth from the upper surface of a liquid. When it is seen from air, it appears that the object is raised through $\frac{1}{3}$ of the depth. Again if water is taken instead of the liquid it appears that the object is raised above through $\frac{1}{4}$ of the real depth. Refractive index of liquid = $\frac{3}{2}$ and refractive index of water = $\frac{4}{3}$. Explain the matter.

Watch Video Solution

7. What sort of arrangement is to be taken so that an object cannot be visible even in light?

Or, why is a piece of glass immersed in glycerin not visible?

Watch Video Solution

8. There is a branch hanging from a tree on the bank of a lake. It is at a height of h_1 from the surface of water. A diver under water sees it at height of h_2 . What is the relation between h_1 and h_2? Given, $\mu_w = 1.33$

Watch Video Solution

9. A red ray and a violet ray passing through a glass slab are incident simultaneously on an interface with air. It is seen that the red ray is refracted but the violet ray is reflected. Explain the reason behind it.

View Text Solution

10. A rod immersed horizontally in water does not appear small when is viewed normally but appears small if it is kept vertically. Explain.

View Text Solution

11. Critical angle of glass and air is 42° . If a ray of light is incident normally on a face of an equilateral prism, show that the ray will emerge from the base of the prism normally. Calculate the deviation of the ray.

View Text Solution

12. A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive indices of the

material of the prism for end, green and blue lights are 1.39 , 1.44 and 1.47 respectively. Will the prim separate the colours?

View Text Solution

13. A ray of light in incident on the medium A [Fig. 2.74]. If the emergent ray through the medium C is parallel to the ray incident on the medium A, then find the refractive index of the medium C.

View Text Solution

14. The phenomenon of refraction is associated with the change of velocity of light. When a ray of light is incident normally on a glass slab, change in velocity of light takes place. Then state why there is no change in the direction of light.

View Text Solution

15. A ray is incident at a small angle θ on a glass slab of thickness t. If the refractive index of glass is μ , show that the lateral displacement of the emergent ray from the slab is t $\theta(\mu - 1) / \mu$.

View Text Solution

16. When a rectangular glass slab is placed on different coloured letters, the violet coloured letter appears to be raised more. What is the reason behind it?

View Text Solution

17. For a few minutes before sunrise and for a few minutes after sunset we can see the sun - explain with proper reason.

View Text Solution

18. A ray of light passing through the medium of refractive index μ_1 is incident on the surface of separation of another medium of refractive index μ_2 . A part of the ray is reflected and another part is refracted. What should be the angle of incident so that reflected ray and the refracted ray are at right angles to each other?

Watch Video Solution

19. A ray of light passes through a glass slab of thickness t and refractive index μ. If velocity of light in vacuum is c then how much time will the light take to emerge from the slab?

View Text Solution

20. A bird is moving towards the water surface perpendicularly downwards. To a fish in a water just below the bird, where will the apparently appear to be in comparison to its actual position?

View Text Solution

21. For a beam of light emerging from glass into air, for which visible spectral colour the critical angle of glass will be minimum?

View Text Solution

22. For same angle of incidence the angles of refraction for three different media A, B and C are 15° , 25° and 35° respectively. In which medium the velocity of light is minimum?

Watch Video Solution

23. A glass prism is immersed in water. What change will take place in the value of the angle of minimum deviation?

Watch Video Solution

24. A ray of light is incident on a face of a triangular glass prism and is totally reflected [Fig. 2.78]. What conclusion will you draw regarding the value of refractive index of the glass prism? 

View Text Solution

25. On placing a transparent glass cube on the printed page of a book, it was found that the covered printed words are not visible from any of the lateral sides of the cube. Explain why?

View Text Solution

Section Related Question

1. What is meant by refraction of light?

Watch Video Solution

2. Indicate incident ray, refracted ray and normal at the point of incidence using a ray diagram.

Watch Video Solution

3. On what factors does the refractive index of a medium depend?

Watch Video Solution

4. State the two laws of refraction.

Watch Video Solution

5. Define absolute refractive index.

Watch Video Solution

6. Define relative refractive index. What is its relation with velocity of light?

Watch Video Solution

7. Explain the laws of refraction with the help of ray diagram.

Watch Video Solution

8. Establish the relationship between the relative refractive index of one medium with respect to another medium and their absolute refractive indices.

Watch Video Solution

9. What do you mean by deviation of a ray of light? How is deviation measured due to refraction?

Watch Video Solution

10. Establish the relation among deviation of a ray, angle of incidence and angle of refraction.

Watch Video Solution

11. Show that for refraction of light through a parallel glass slab, the incident ray and the emergent ray are parallel to each other.

Or, With the help of a diagram show how in case of a rectangular glass slab, when light is refracted by the two parallel faces of the slab, deviation between angle of incidence and angle of refractive is zero.

Watch Video Solution

12. What do you understand by critical angle?

Watch Video Solution

13. What do you understand by total internal reflection?

Watch Video Solution

14. State the conditions of total internal reflection.

Watch Video Solution

15. What do you mean by a thin prism?

Watch Video Solution

16. What do you mean by angle of deviation of a ray in case of refraction through a prism. Calculate the expression of the angle of deviation.

Watch Video Solution

17. Show that for normal incidence and nearly normal incidence the deviation of a ray in a thin prism is constant and does not depend on the angle of incidence.

Watch Video Solution

18. For minimum deviation δ_m , assuming that angle of incidence = angle of emergent, show that the refractive index of the material of the prism is $\mu = \dfrac{\sin\frac{A+\delta_m}{2}}{\sin\frac{A}{2}}$

Or, Show the ray diagram of a ray of light through a thick another

face. Show that $\delta = i_1 + i_2 - A$ and $A = r_1 + r_2$. The symbols have their usual meaning.

Watch Video Solution

Ncert Textbook Question With Answer Hint

1. A prism is made of glass of unknown refractive index. A parallel beam of light is incident on a face of the prism. By rotating the prism,the angle of minimum deviation is measured to be 40° . What is the refractive index of the material of the prism? If the prism is placed in water (refractive index 1.33), predict the new angle of minimum deviation of a parallel beam of light. Refracting angle of the prism is 60° .

Watch Video Solution

2. A small pin fixed on the table and top of it is viewed from above from a distance of 50 cm. By what distance would the pin appear to be raised if it is viewed from the same point through a 15 cm thick glass slab held parallel to the table? Refractive index of glass = 1.5. Does the answer depend upon the location of the slab?

View Text Solution

3. What is the answer if there is no outer covering of the pipe?

View Text Solution

4. A driver under water, looks obliquely at a fisherman standing on the bank of a lake. Would the fisherman look taller of shorter than what he actually is?

View Text Solution

5. At what angle should a ray of light be incident on the face of a prism of refractive angle 60° so that it just suffers total internal reflection at the other face? The refractive index of the material of the prism is 1.524 .

Watch Video Solution

Ncert Exemplar Questions With Answer Hint

1. You are given four sources of light each one providing a light of single colour - red, blue, green and yellow, Suppose the angle of refraction for a beam of yellow light corresponding to a particular angle of incidence at the interface of two media is 90° . Which of the following statement is correct if the source of yellow light is replaced with other lights without changing the angle of incidence?

A. The beam of red light would undergo total internal reflection

B. The beam of red light would bend towards the normal while it gets refracted through the second medium

C. The beam of blue light would undergo total internal reflection

D. The beam of green light would bend away from the normal as it gets refracted through the second medium

Answer: C

Watch Video Solution

2. An extended object kept under water in a deep container appears distorted when seen from near the edge of the container. It so happens because

A. the appears depth of the points away from the edge

B. the angle subtended by the object when submerged in water is less than that when the object is in air

C. some points away from the edge undergo total internal reflection and become invisible

D. the beam of green light would bend away from the normal as it gets refracted through the second medium.

Answer: A

View Text Solution

Exercise Multiple Choice Question

1. If c and c_1 are the velocities of light in vacuum and in a medium respectively, then the relation of velocity of light with the refractive index of the medium will be

A. $\mu = \frac{c_1}{c}$

B. $\mu = c_1 c$

C. $\mu = \frac{c}{c_1}$

D. $\mu = c - c_1$

Answer: C

Watch Video Solution

2. When light moves from glass to air, the property of it which remains unchanged is

A. velocity

B. wavelength

C. frequency

D. amplitude

Answer: C

Watch Video Solution

3. The refractive indices of a medium for two light waves are μ_1 and μ_2. If $\mu_1 > \mu_2$, then which wave will move faster in the medium?

A. first wave

B. second wave

C. the two waves will move with the same velocity

D. cannot be said correctly

Answer: B

Watch Video Solution

4. Refractive index of a medium in which velocity of light is $2 \times 10^8 m \cdot s^{-1}$, is

A. 1.4

B. 2.3

C. 1.5

D. 1.0

Answer: C

Watch Video Solution

5. wavelength, frequency, velocity and intensity of light when travelling in air is λ, ν, v and I respectively, When the light ray enters water the value of the above mentioned properties become λ_1, ν_1, v and I_1 respectively. Which relation is correct?

A. $\lambda = \lambda_1$

B. $\nu = \nu_1$

C. $v = v_1$

D. $I = I_1$

Answer: B

Watch Video Solution

6. In case of refractive of light which of the following phenomena must take place?

A. change of direction

B. change of velocity

C. both (A) and (B)

D. none of (A),(B),(C)

Answer: B

Watch Video Solution

7. If the refractive indices of particular medium for red and violet light be μ_r and μ_v respectively, then

A. $\mu_r > \mu_v$

B. $\mu_r < \mu_v$

C. $\mu_r = \mu_v$

D. none of these above

Answer: B

Watch Video Solution

8. Speed of light through two media of refractive indices μ_1 and μ_2 are u_1 and u_2 respectively, then

A. $u_1 = u_2$

B. $n_1 u_1 = n_2 u_2$

C. $n_1 u_2 = n_2 u_1$

D. $n_1 u_1^2 = n_2 u_2^2$

Answer: B

Watch Video Solution

9. In case of refractive, angle of deviation is maximum when the angle of incidence is

A. 45°

B. 0°

C. 90°

D. 60°

Answer: C

View Text Solution

10. In case of refraction, angle of deviation becomes minimum when the angle of incidence becomes

A. 45°

B. 0°

C. 90°

D. 60°

Answer: B

Watch Video Solution

11. The angle of deviation of a ray of light refracted through a parallel glass slab is

A. 45°

B. 0°

C. 90°

D. 60°

Answer: B

Watch Video Solution

12. A diverging beam of rays from a point source S , making a divergent angle , α are incident on a glass slab (as shown in Fig. 2.82). The angle of incidence of the extreme rays on the two sides is

the same. If thickness of the glass slab is t and refractive index n, then the angle of divergence of the emergent rays will be

A. zero

B. $-\alpha$

C. $\frac{\sin^{-1}(1)}{n}$

D. $2\frac{\sin^{-1}(1)}{n}$

Answer: B

View Text Solution

13. A ray of light is incident on the upper surface of a glass plate of thickness t $(\mu = \text{refractive index of glass})$. If the angle of incidence I is very small, then lateral displacement of the emergent ray will be

A. $\frac{ti\mu}{\mu+1}$

B. $\frac{ti(\mu-1)}{\mu}$

C. $\frac{ti\mu}{\mu - 1}$

D. $\frac{ti(\mu + 1)}{\mu}$

Answer: B

View Text Solution

14. A light ray travels through four adjacent media of refractive indices $\mu_1, \mu_2, \mu_3, \mu_4$ as shown in the Fig. 2.83. The bases of the media are parallel. If emergent ray is parallel to the incident ray AB then

A. $\mu_1 = \mu_2$

B. $\mu_2 = \mu_3$

C. $\mu_3 = \mu_4$

D. $\mu_4 = \mu_1$

Answer: D

View Text Solution

15. Let the XZ plane be the boundary between two transparent media. Medium 1 in $Z \geq 0$ has a refractive index of $\sqrt{2}$ and medium 2 with $Z > 0$ has a refractive index of $\sqrt{3}$. A ray of light in medium 1 given by the vector $,\vec{A} = 6\sqrt{3}\hat{i} + 8\sqrt{3}\hat{j} - 10\hat{k}$ is incident on the plane of separation. The light of refraction in medium 2 is

A. 45°

B. 60°

C. 75°

D. 30°

Answer: A

View Text Solution

16. The refractive indices of a rarer and a denser medium are μ_1 and μ_2 respectively. The apparent depth of an object, placed in a rarer medium, to an observer situated in a denser medium will be

A. $\frac{\mu_2}{\mu_1}$

B. $\frac{\mu_1}{\mu_2}$

C. $\frac{\mu_1}{\mu_2} \times \text{real depth}$

D. $\frac{\mu_2}{\mu_1} \times \text{real depth}$

Answer: D

Watch Video Solution

17. There is a point object at the center of a glass sphere of diameter 12cm and refractive index 1.5 . The distance of the virtual from the surface of the sphere is

A. 4 cm

B. 6 cm

C. 9 cm

D. 12 cm

Answer: B

View Text Solution

18. A rectangular glass slab is placed on different alphabets written in different colours. The coloured alphabet which appears to have been raised minimum in comparison with other alphabets is

A. blue

B. violet

C. green

D. red

Answer: D

Watch Video Solution

19. A container of depth 2d is half-filled with a liquid of refractive index $\sqrt{2}$ and another half with a liquid of refractive index μ. The two liquids do not mix with each other. The apparent depth of the inner surface of the bottom of the container will be (neglect the thickness of the bottom of the container)

A. $\frac{\mu}{d(\mu+2)}$

B. $\frac{d\left(\mu+\sqrt{2}\right)}{\mu\sqrt{2}}$

C. $\frac{\sqrt{2}\mu}{d\left(\mu+\sqrt{2}\right)}$

D. $\frac{\mu d}{d+3\mu}$

Answer: B

View Text Solution

View Text Solution

20. To a fish under water, viewing obliquely a fisherman standing on the bank of a lake, the man looks

A. taller than what he actually is

B. shorter than what he actually is

C. the same height as he actually is

D. depends on the obliquity

Answer: A

View Text Solution

21. A transparent cube of 0.21m edge contains a small air bubble. Its apparent distances when viewed through one face of the cube is 0.1

m and when viewed from the opposite face is 0.04 m. The actual distance of the bubble from the second face of the cube is

A. 0.06 m

B. 0.17 m

C. 0.05 m

D. 0.04 m

Answer: A

Watch Video Solution

22. A lens of refractive index 1.5 is kept in a medium of refractive index 1.5. The refractive index of the lens with respect to the medium will be

A. 1.5

B. 1.5×1.5

C. 1

D. $1.5 + 1.5$

Answer: C

Watch Video Solution

23. If a ray of light is incident normally on any face of an equilateral glass prism, then the ray will be deviated through an angle

A. 30°

B. 60°

C. 90°

D. 120°

Answer: A

Watch Video Solution

24. A ray of light is passed from an optically denser medium to a rearer medium. Critical angle for the pair of media is C. The maximum angle of deviation of the ray will be

A. $\pi - C$

B. $\frac{\pi}{2} - C$

C. 2C

D. $\frac{\pi}{2} + C$

Answer: B

Watch Video Solution

25. Critical angle depends on

A. colour of light

B. refractive indices of the two concerned media

C. colour of light and refractive indices of the two concerned media

D. wavelength of light

Answer: C

Watch Video Solution

26. A ray of light is incident normally on one face of a right angled isosceles prism. It then grazes the hypotenuse. The refractive index of the material of the prism is

A. 1.33

B. 1.414

C. 1.5

D. 1.732

Answer: B

View Text Solution

27. Light rays from a point source situated at a depth of h below water can emerge in air through a define circular section. If refractive index of water is $\frac{4}{3}$, the value of the radius of the circular section will be

A. $\frac{\sqrt{7}}{3}h$

B. $\frac{3}{\sqrt{7}}h$

C. $\frac{\sqrt{3}}{7}h$

D. $\frac{7}{\sqrt{3}}h$

Answer: B

View Text Solution

28. How does the surface of water appear to the eye of an observe inside water?

A. mirror with a circular hole

B. mirror with an elliptical hole

C. mirror without hole

D. mirror with a square hole

Answer: A

View Text Solution

29. A fish looking up through the water see the outside world, contained in a circular horizon. If the refraction index of water is $\frac{4}{3}$ and the fish is 12 cm below the water surface, then the radius of this circle in cm is

A. $39\sqrt{7}$

B. $\frac{36}{\sqrt{7}}$

C. $36\sqrt{5}$

D. $4\sqrt{5}$

Answer: B

View Text Solution

30. When a light ray travels from one medium to another and gets refracted, velocity of light becomes double. For total internal reflection in this condition, the value of critical angle is

A. 30°

B. 60°

C. 90°

D. cannot be determined

Answer: A

Watch Video Solution

31. The length of a day due to atmospheric refraction

A. decreases

B. increases

C. remains unchanged

D. sometimes decreases

Answer: B

Watch Video Solution

32. The twinkling effect of star light is due to

A. total internal reflection

B. high dense matter of star

C. constant burning of hydrogen in the star

D. the fluctuating apparent position of the star being slightly different from the actual position of the star

Answer: D

Watch Video Solution

33. The refractive angle of a prism is 60° . If the prism is immersed in a liquid then the minimum angle of deviation is 30° . Critical angle of glass with respect to the liquid is

A. 42°

B. 45°

C. 50°

D. 52°

Answer: B

Watch Video Solution

34. A ray of light passes through an isosceles triangle such that the angle of incidence is equal to the angle of emergence. If the angle of emergence and angle of incidence are both 45° then angle of deviation will be

A. 15°

B. 45°

C. 50°

D. 52°

Answer: D

View Text Solution

35. The refractive index of a prism is $\sqrt{2}$ and its refractive angle is 60° . If a ray emerge with the minimum angle of deviation then the angle of incidence will be

A. 45°

B. 60°

C. 90°

D. 150°

Answer: A

Watch Video Solution

36. A ray of light PQ is incident on the face of an isosceles glass prism kept on a horizontal table [Fig. 2.89]. If for the ray PQ the

prism is at the position of minimum deviation then

A. $\alpha = \beta$

B. $\alpha > \beta$

C. $\alpha < \beta$

D. $\alpha + \beta = 90$

Answer: A

View Text Solution

37. Angle of deviation for a thin prism of refractive index 1.5 is 4° for an incident ray. If that prism is dipped in water, then for the same incident ray, angle of deviation would be $\left[\text{given} \quad \mu_{water} = \frac{4}{3}\right]$

A. 1°

B. 2°

C. 8°

D. 16°

Answer: A

Watch Video Solution

38. A thin prism of angle 15° made of glass of refractive index $\mu_1 = 1.5$ is combined with another prism of glass of refractive index $\mu_2 = 1.75$. The combination of the prism produces dispersion without deviation, The angle of the second prism should be

A. 5°

B. 7°

C. 10°

D. 12°

Answer: C

View Text Solution

Exercise Very Short Answer Or Two Question Mark 1

1. What is the angle of deviation due to refraction of a ray of light incident perpendicularly on a refraction surface?

Watch Video Solution

2. Arrange the following media according to the increasing optical density: air, diamond, glass,water, glycerine.

Watch Video Solution

3. Can the value of absolute refractive index of a medium be less than 1?

Watch Video Solution

4. State the relation of velocity of light with refractive index.

Watch Video Solution

5. The refractive index of a medium depends on tempera-ture'- is the statement correct on wrong?

Watch Video Solution

6. Arrange the following media according to increasing velocity of light through them: vacuum, diamond, water, glycerine.

Watch Video Solution

7. Does velocity of light in vacuum depend on (a) wavelength of light (b) frequency of light (c) intensity of light?

Watch Video Solution

8. If water is heated, how refractive index of will change?

Watch Video Solution

9. Which of the following - wavelength , frequency or velocity does not change during refraction of light?

Watch Video Solution

10. Refractive index of glass is 1.5. What is the velocity of light in glass?

Watch Video Solution

11. Can relative refractive index of a medium with respect to another be less than unity?

Watch Video Solution

12. The refractive index of a medium is a physical quantity having no dimension and no unit - is the statement true or false?

Watch Video Solution

13. A light ray of wavelength 4500 $\mathring{A}$ enters a glass slab of refractive index 1.5 , from vacuum. What is the wavelength of light inside the slab?

Watch Video Solution

14. For which colour of light is the refractive index of the glass the minimum?

Watch Video Solution

15. If frequency of light increases will there be any change in the refractive index of the medium?

Watch Video Solution

16. For which colour of light is the refractive index of glass a maximum?

Watch Video Solution

17. Does the refractive index of glass depend on the colour of light? If so, how?

Watch Video Solution

18. When a ray of light is incident on a plane normally, then what is the value of angle of refractive?

Watch Video Solution

19. If the refractive index of water relative to air is $\frac{4}{3}$, what will be the refractive index of air relative to water?

Watch Video Solution

20. When light travels from air to glass, how does its wave - length change?

Watch Video Solution

21. Absolute refractive index of water and glass are $\frac{4}{3}$ and $\frac{3}{2}$. What is the ratio of velocity of light in glass and water?

Watch Video Solution

22. For any particular medium the refractive index is greater if the wavelength of light is _____ [Fill in blank].

Watch Video Solution

23. What is the value of the product of refractive index of second medium relative of first medium and that of first medium relative to second medium?

Watch Video Solution

24. For what angle of incidence the lateral shift produced by parallel sided glass plate is zero?

Watch Video Solution

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

View Text Solution

26. What is the maximum lateral shift produced by a parallel sided glass plate of thickness t ?

Watch Video Solution

27. If μ_a, μ_b and μ_c are the absolute refractive indices of three media then $a^{\mu} \times b^{\mu}$ _ (c) = _____ [Fill in blank].

View Text Solution

28. A bird descends vertically downwards in the direction of a pond during its flight. To a fish which is under water and directly below the bird, what will be the apparent position of the bird?

View Text Solution

29. An object lying inside a pond is viewed by a man from above (air) along horizontal plane. Now if the man moves away from the object keeping his along the same horizontal plane, how will the apparent depth of the object change?

View Text Solution

30. A transparent cube of glass of refractive index μ and thickness t is placed on a spot of ink drawn on a white paper, When the spot is

viewed from above (air) normally, the spot appears to shift through a distance of Δt towards the observer. What is the value of Δ t ?

Watch Video Solution

31. When a man stands inside a shallow pond the depth of water at that place appears _____ and the depth of other places appear comparatively _____ [Fill in blank].

View Text Solution

32. If a completely transparent object has to be made totally invisible in vacuum, what should be the value of its refractive index?

Watch Video Solution

33. Multiple images are formed in a thick mirror. Which image looks brightest?

View Text Solution

34. What is the critical angle of light when passing from water to air? $\left(\mu \text{of water} = \frac{4}{3}\right)$

Watch Video Solution

35. For which colour of light is the critical angle between glass and air minimum?

Watch Video Solution

36. For which colour of light is the critical angle between glass and air minimum?

Watch Video Solution

37. What are the factors of light which are responsible for creating mirage?

Watch Video Solution

38. In which direction do we have to look to see the setting sun if we are under water? $(\mu_w = 1.33)$

Watch Video Solution

39. From sunrise to sunset, the sun subtends an angle of 180° to our eyes. What will be the value of this angle to an observe under water?

View Text Solution

40. Critical angle of which pair of medium is lesser - air and water or air and diamond?

Watch Video Solution

41. Light passes through an optical fibre following which phyical phenomenon?

Watch Video Solution

42. If a ray of light moves from a _____ medium to a _____ medium, total internal reflection does not take place [Fill in the blank].

Watch Video Solution

43. What is the approximate value of the refractive index of diamond?

Watch Video Solution

44. What kind of image is formed in a desert by the formation of mirage?

Watch Video Solution

45. Does critical angle depend on colour of light?

Watch Video Solution

46. The angular altitude at which we see a star is not its actual angular altitude' - is the statement true of false?

Watch Video Solution

47. We see the sun a few minutes _____ sunset or _____ sunrise [Fill in the blank].

View Text Solution

48. The sun appears to be elliptical during sunset. What is the reason behind it?

View Text Solution

49. Under what condition the angle of deviation of a refracted ray through a prism will be minimum? '

Watch Video Solution

50. If the medium surrounding the four faces of a prism is denser than the material of the prism, then in which direction will the light rays bend when emerging from the prism?

Watch Video Solution

51. How can an inverted image be made erect by using a total reflecting prism?

Watch Video Solution

52. When light travels from a rarer medium to a prism which is a denser medium, light ray bends towards the base of the prism. Is the statement true of false?

Watch Video Solution

53. At the position of minimum deviation what is the nature of the path of a light - ray through a prism?

Watch Video Solution

54. For a thin prism on what factor does the magnitude of angle of deviation of light rays depend?

Watch Video Solution

55. What will be the angel of deviation of a ray of light incident normally on any smaller side of a total reflecting prism?

Watch Video Solution

Exercise Short Answer Type Question 1

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

Watch Video Solution

2. Does refraction of light mean a change in the deviation of light propagation? If not, then what does refractive exactly mean?

Watch Video Solution

3. Show that $a^{\mu}b = \frac{1}{b^{\mu}a}$.

Watch Video Solution

4. Refractive index of water is 1.33' - What if the meaning of the statement?

Watch Video Solution

5. A 10 cm long fish lies horizontally at a depth of 4 cm under water. If observed from air above water how long will the fish appear to be?

Watch Video Solution

6. When light rays pass from medium I to medium j then refractive index of medium j with respect to medium I is expressed as $i^{\mu}j$. Therefore what will be the product of $2^{\mu}1, 3^{\mu}2 \text{ and } 4^{\mu}3$?

Watch Video Solution

7. The critical angle of water is 49° - explain the statement.

Watch Video Solution

8. What do you mean by the statement that refractive index of glass is 1.5?

Watch Video Solution

9. What is the ratio of velocities of two light waves travelling in vacuum and having wavelengths 4000 Å and 8000 Å?

Watch Video Solution

10. Which of the two parts of an optical fibre has a higher value of refractive index?

Watch Video Solution

11. What do you understand by the term 'superior mirage' ?

Watch Video Solution

12. What do you understand by the term 'inferior mirage'?

Watch Video Solution

13. Mention two situations in which Snell's law of refraction fails.

Watch Video Solution

14. Why does a diamond sparkle with great brilliance?

Or, Why does a diamond cut in the same fashion shine more brightly than a piece of glass?

Watch Video Solution

15. Monochromatic light is refracted from air into glass of refractive index μ. Find the ratio of wavelength of the incident and refracted light.

Watch Video Solution

16. Is critical angle for a given interface greater for red light or for blue light?

Watch Video Solution

Exercise Short Answe Type Question Ii

1. Why does a vessel filled with water appear comparatively shallow when it is viewed from above?

Watch Video Solution

2. A ray of light is refracted from medium 1 to medium 2. Show that the ratio of the sine of the angle of incidence and the sine of the angle of refraction is equal to the ratio of velocity of light in medium 1 and that in medium 2.

Watch Video Solution

3. A light ray travels from vacuum into a medium of refractive index μ . If angle of incidence is twice the angle of refraction then calculate the angle of incidence.

Watch Video Solution

4. Why is a glass rod not visible when it is immersed in glycerine?

Watch Video Solution

5. When a rectangular glass slab is kept on a few letter of different colours, the letter of violet colour appears to be raised more. What is the reason behind it?

Watch Video Solution

6. What sort of arrangement is to be taken so that an object will not be visible even in the presence of light?

Watch Video Solution

7. Show that for an object lying under a parallel glass slab, the apparent displacement of its image in the observer's direction does not depend on the position of the object.

Watch Video Solution

8. Stars, especially near the horizon, twinkle, but not the planets - explain the reason.

Watch Video Solution

9. Why do we see the sun sometime before sunrise and sometime after sunset?

Watch Video Solution

10. If an empty test tube is immersed obliquely in water the immersed portion appears shining - explain why.

Watch Video Solution

11. a red ray and a violet ray are incident simultaneously on a glass slab. It is seen that the red ray is refracted but the violet ray is reflected. Explain the reason.

Watch Video Solution

12. The sun subtends an angle of 180° to our eyes form sunrise to sunset. But to the eyes of a fish this angle is 98° - explain.

Watch Video Solution

13. There is air above water. Total internal reflection may take place for a ray of light passing from water to air. If a glass slab is placed above water, is it possible for a ray to be totally reflected? Where will the total internal reflection take place?

Watch Video Solution

14. Why does the crack of a glass window shine?

Watch Video Solution

15. Why will not the total internal reflection take place if light travels from a rarer medium to a denser medium?

Watch Video Solution

16. Why is total internal reflection called total?

Watch Video Solution

17. Why does a metal ball coated with lamp - black appear shining when it is immersed in water?

Watch Video Solution

18. For the fish under water, the water surface appears like a huge mirror with a hole at its centre - explain. Establish the relation between depth of the fish in water and the radius of the circular hole. '

Watch Video Solution

19. A ray of light is incident on a prism of refractive index μ and angle A at the angle of incidence i_1 and emerges at the angle i_2. If the ray is incident on the prism at the angle i_2, calculate the deviation of the ray.

Watch Video Solution

20. A light ray is incident on one refraction face of a prism, of refractive angle A, at an angle of incidence, I and emerges from the opposite face, normally. If refractive index of the material of the prism be μ what will be the value of the angle of incidence?

Watch Video Solution

Problem Set I

1. If the refractive index of water is $\frac{4}{3}$ and the velocity of light in vacuum is $3 \times 10^8 m \cdot s^{-1}$, how much time will light take to travel a distance of 900 m in water? '

Watch Video Solution

2. The velocity of light in glass $(a^{\mu}g = 1.5) \text{is} 2 \times 10^8 m \cdot s^{-1}$ It is seen that velocity of light in a particular liquid is $2.5 \times 10^8 m \cdot s^{-1}$. What is the refractive index of the liquid with respect to air?

Watch Video Solution

3. Light travels with a velocity of $3 \times 10^8 m \cdot s^{-1}$ in air and is then incident on another medium making an angle 45° and emerges out at an angle of 30°. What is the velocity of light in the medium?

Watch Video Solution

4. The wavelength of a monochromatic light is 4200 Å in air. What will be its wavelength when passing through water $\left(\mu_{\omega}=\frac{4}{3}\right)$?

Watch Video Solution

5. A monochromatic light of frequency 5×10^{14} Hz travels from vacuum to a medium of refraction index 1.5. What will be the wavelength of light in that medium?

Watch Video Solution

6. A ray of light is incident at an angle of incidents 60° on a transparent glass slab. The angle between the reflected ray and the refracted ray is 90°. What is the refractive index of the slab?

Watch Video Solution

7. A rectangular glass slab is placed at the bottom of vessel filled with water. A ray is incident at an angle of incidence 50° on the surface of water and on being refracted through water becomes incident on the glass slab. What is the angle of refraction in the glass slab? Refractive indices of water and glass are $\frac{4}{3}$ and $\frac{3}{2}$ respectively. $[\sin 50^\circ = 0.766, \sin 30^\circ 43' = 0.5108]$

View Text Solution

8. A ray of light enters a rectangular glass block and is incident on the lower face of the block. Angle of incidence is 30°. Part of the ray is reflected inside it and the rest emerges out of the block. Refractive index of glass is 1.5. What is the angle between the emergent ray and the reflected ray? $[\sin 48^\circ = 0.75]$

Watch Video Solution

9. The thickness of a glass slab $(\mu = 1.5)$ is 10 cm. A ray of light is incident at an angle of 60° on a face of the slab and it emerge from the other face. Calculate the lateral displacement of the ray.

Watch Video Solution

10. A man observe a fish at a depth of 6 cm from the surface of water in a pond. To hunt the fish, at what depth will he have to through the spear? Refractive index of water = $\frac{4}{3}$.

Watch Video Solution

11. A swimmer is 12 m below the water surface. 18 cm above the water surface, right above the swimmer's eye, three is a bird. Refractive index of water is $\frac{4}{3}$. Calculate the apparent height of the bird from water surface as seen by the swimmer.

Watch Video Solution

12. An ink dot on a sheet of paper is viewed from above a distance of 50 cm. By what distance would the ink dot appear to be raised if it is viewed through a glass slab of thickness 15 cm held parallel to the appear? Given refractive index of glass = 1.5.

Watch Video Solution

13. Refractive index of glass is 1.5 and that of water is 1.33. will total internal reflection takes place what will be the critical angle?

Watch Video Solution

14. A transparent liquid of refractive index $\sqrt{3}$ is poured in a beaker. Above it an oil of refractive index $\frac{3}{2}$ is poured . What is the critical angle between the two oils?

Watch Video Solution

15. The critical angle of a glass slab in air is 30°. What will be the critical angle if the slab is placed in a medium of refractive index $\sqrt{2}$

Watch Video Solution

16. The critical angle of a ray of light incident at the surface of separation of two immscible liquids is $64^\circ 48'$. If the refractive index of a liquid is 1.4 and velocity of light in vacuum is $3 \times 10^{10} cm \cdot s^{-1}$, calculate the probable two values of light in the other liquid.

Watch Video Solution

17. Two transparent media A and B are adjacent to each other. Velocity of light in medium A is $2 \times 10^8 m \cdot s^{-1}$ and in medium B it is $2.5 \times 10^8 m \cdot s^{-1}$. If ray of light under goes total internal

reflection when travelling from A to B then what is the critical angle for the pair of media?

Watch Video Solution

18. A light ray is incident on a rarer medium from a denser medium. The velocity of light in rarer medium is double its value in denser medium. For total internal reflection what should be the value of the critical angle?

Watch Video Solution

19. What is the semi-vertical angle of the cone through which a man, 12 cm under water, can see the sky?

Watch Video Solution

20. The angle of a prism is 60° and minimum angle of deviation is $48^\circ 30'$. Calculate the refractive index of the prism.

Watch Video Solution

21. A monochromatic ray of light is incident normally on a refracting face of a prism of angle 30° . If the refractive index of the material of the prism is 1.5 , calculate the angle of emergence and the angle of deviation. $[\sin 48.6^\circ = 0.75]$

Watch Video Solution

22. What should be the angle of prism of refractive index 1.6 so that a ray incident at an angle 40° will have minimum deviation? $[\sin 23^\circ 42' = 0.4019]$

Watch Video Solution

23. A glass prism of refractive index 1.5 is immersed in water of refractive index 1.33. In this condition what should be the limiting angle of the prism for no emergent ray?

Watch Video Solution

24. The angle of minimum deviation is 30° for a prism with refractive angle 60° . If velocity of light in vacuum is $3 \times 10^8 m \cdot s^{-1}$ then what is its velocity in the prism?

Watch Video Solution

25. For green light the refractive index of prism, of refractive angle 5° , is 1.5. What will be the value of the minimum angle of deviation of a green light?

Watch Video Solution

Problem Set Ii

1. The length of the side of a transparent cube is 18 cm . Inside the cube there is an air bubble. If it is seen from one face of the cube, the depth of the bubble is 2 cm and if it is seen from the opposite face the depth is 10 cm. What is the refractive index of the cube and what is the distance of the bubble from the first face?

Watch Video Solution

2. A tank's depth is 2d and the apparent depth of the liquid in the tank is 60% its actual depth. What is the refractive index of the liquid with respect to air?

Watch Video Solution

3. A ray of light is incident on a transparent block of refractive index 1.62. If the reflected ray and refracted ray are perpendicular to each other, what is the value of the angle of incidence?

Watch Video Solution

4. The height of a vessel is 15 cm . Liquid is poured into the vessel such that the surface of the liquid remains 5 cm below the vessel's top. On seeing from above the depth of the liquid appears to be half. Calculate the refractive index of the liquid.

Watch Video Solution

5. The length of a fish is 12 cm. The fish is advancing forward to the front glass face of an aquarium. When the fish is at a distance of 36 cm from the face, what will be the apparent length of the fish if it is

viewed through the glass face?

Refractive index of water relative to air = $\frac{4}{3}$.

View Text Solution

6. There is a mark at the base of an empty beaker. The mark is focussed with the help of a microscope from above. If turpentine oil of 4 cm height is poured in the beaker, the microscope is to raised by 1.28 cm upwards, to focus the mark.

Determine the refractive index of the turpentine oil.

Watch Video Solution

7. A hemisphere of radius 4 cm is placed centrally on cross mark. When it is viewed directly from above what will be the position of the image for the two following cases: (i) when the plane surface of

the hemisphere is in contact with the cross mark, (ii) when the curved surface is in contact with the cross mark?

View Text Solution

8. A rectangular block of thickness 10 cm and refractive index 1.5 is placed on a small coin. A beaker is placed on the block and water (mu = (4)/(3))` of height 10 cm poured in the beaker. What will be the apparent position of the coin when viewed normally, from above?

Watch Video Solution

9. A microscope is focussed on a point at the base of an empty vessel. Now water $\left(\mu = \frac{4}{3}\right)$ is poured in it up to a height of 4 cm. Next a light oil $\left(\mu = \frac{4}{3}\right)$ is placed on water up to a height of 2 cm. The oil does not mix with water. In this condition by how much should the microscope be raised to focus the particular point?

Watch Video Solution

10. A part of straight stick is immersed in water in an inclined way. When the immersed portion is viewed normally from the air above, it appears to be inclined at an angle of 30° with the surface of water. Calculate the actual angle of the stick with the surface of water. Refractive index of water = $\frac{4}{3}$. " " $[\tan 37.6^\circ = 0.77]$

View Text Solution

11. A glass is filled with water up to 12.5 cm. The apparent depth of an object lying at the bottom of the glass is measured by a microscope to be 9.4 cm. Calculate 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 has to be moved to focus the object again?

Watch Video Solution

12. A glass if filled with water up to 12.5 cm. The apparent depth of an needle lying at the bottom of the tank is measured by microscope to be 9.3 cm. What is the refractive index of water? If water is replaced by a liquid of refractive index 1.6 up to the same height, by what distance would the microscope have to be moved to focus on the needle again?

Watch Video Solution

13. A small electric lamp is placed at a depth of 46 cm inside a tank full of water. (i) Calculate the area on the surface of water through which light will be emitted. (ii) what is the maximum distance an emergent ray will travel before emerging from the surface of water?

$[\mu \quad \text{of water} = 1.3, \sin 50.3^\circ = 0.7694 \text{ and } \tan 50.3^\circ = 1.205]$

View Text Solution

14. A luminous point source is placed at a depth of 30 cm in a source containing a liquid of refractive index 1.25. From the source light rays are being emitted in all directions. The rays which are refracted from the upper surface of the liquid form a circle. Calculate the radius of the circle.

Watch Video Solution

15. A source of light is placed at the bottom of a tank filled with water up to the height of 80 cm. Calculate the area at the surface of water through which light rays will be emitted. Refractive index of water = 1.33.

Watch Video Solution

16. wavelength of light in a medium is 4000 Å and that in another medium is 6000 Å . What will be the critical angle if light ray moves from first medium to second medium?

Watch Video Solution

17. Light ray passes through an equilateral prism $(\mu = 1.5)$ such that the angle of incidence is equal to angle of emergence and is $\frac{3}{4}$ th of the angle of deviation. Calculate the angle of deviation.

Watch Video Solution

Hots Numerical Problems

1. A ray of light from air is incident on a sphere of refractive index $\sqrt{3}$. If the angle of incidence is 60° , calculate the angle between the

incident ray and the emergent ray with the help of a diagram.

Watch Video Solution

2. An object is placed at a distance of 21 cm from a concave mirror of radius of curvature 10 cm. Now a glass slab of thickness 3 cm and refractive index 1.5 is placed between the object and the mirror. Determine the position of the final image. The distance of the nearer face of the slab from the mirror is 1 cm.

View Text Solution

3. A concave mirror of focal length 8 cm is placed on a table with its reflecting face turned upwards. The mirror contains a little amount of water inside it. At what distance from the pole of the mirror should a point object be placed on the axis of the mirror so that the object and its image coincide? Refractive index of water = $\frac{4}{3}$

View Text Solution

4. A small fish is situated ft a depth of 6 ft in a tank and at a distance of 4.5 at from the bank. A boy of height 5 ft is standing at a distance of 8 ft from the bank. By what distance should the boy proceed towards the bank so that his movement will be visible to the fish? Refractive index of water = $\frac{4}{3}$.

View Text Solution

5. A ray of light is incident on a glass slab of thickness t and refractive index μ in such a way that the reflected ray and the refracted ray are at right angles to each other. Calculate the angle of incidence and the lateral displacement of the emergent ray.

View Text Solution

6. A swimming pool is filled with water up to its brim. A swimmer observes a source of light just over the edge of the pool looking from a depth of 2 m in water and at a distance of 1.5 m from the vertical wall of the pool. The source of the light is placed at a height of 3 m from the ground and at a distance of 4 m from the edge of the pool. Find the refractive index of water in the swimming pool.

View Text Solution

7. A ray of light is incident on a glass sphere and it makes an angle α with the normal, and then it is refracted at an angle β. Calculate the angle of deviation between the incident and emergent ray.

Watch Video Solution

8. A ball is dropped from a height of 20 cm above the water surface of a lake. Refractive index of water = $\frac{4}{3}$. A fish situated below the surface of water along the path of motion of the ball is observing the ball. When the ball reaches a depth of 12.8cm from the surface of water, then what will be the velocity of the ball relative to the fish?

View Text Solution

9. There is a vessel containing a liquid of refractive index 1.4. A point source of light is situated at a depth of 5 cm from the surface of the liquid. An opaque disc floats directly above the source of light. If anyone looks downwards from any point on the surface of the liquid and if the point source of light is not visible, what will be the minimum radius of the disc?

View Text Solution

10. A prism of refracting angle 60° makes an angular deviation of 40° between two rays having a difference of 11° in their angles of incidence. Find the refractive index of the material of the prism.

View Text Solution

11. A glass prism is immersed in a liquid of refractive index 1.4. If the refractive index of glass is 1.6 , find the limiting angle of the prism for emergence of ray through it.

Watch Video Solution

12. The refractive angle of a prism is 1.5. A ray of light is incident at an angle of 40° on a face of the prism. What will be the limiting angle of the prism for emergence of the ray from the other face. $[\sin 41^\circ 19' = 0.6602' \sin 25^\circ 22' = 0.4284]$

View Text Solution

13. One refracting surface of an isosceles glass prism is coated with mercury. A ray of light is incident normally on the other refracting surface and is reflected twice within the prism. Lastly the ray is incident normally on the base of the prism and emerges from the prism. Calculate the angles of the prism.

View Text Solution

14. If a ray of light passes through a prism symmetrically, calculate the angle of incidence and the angle of deviation. Angle of the prism = 80°, $\mu = 1.5, \sin 40^\circ = 0.6428, \sin 74^\circ 37' = 0.9642.$

Watch Video Solution

15. A ray of light is emerged from a prism of refracting angle 70°. If the angle of refraction in the first refracting surface is 28°, what is

the angle of incidence at the second face?

Watch Video Solution

16. The refracting angle of a prism is 45° and the refractive index of the material of the prism is 1.6. What should be the minimum angle of deviation of a ray on a face of the prism so that no internal reflection of the ray takes place on the second face at the time of emergence.

View Text Solution

17. A right angled prism is immersed in water. When a ray of light is incident normally on a side adjacent to the right angle, the ray is totally reflected from the face opposite to the right angle and emerges through the other adjacent side of the right angle. But if the ray is incident normally on the face opposite to the right angle

and no internal reflection takes place. If the other two angles of the prism are 60° and 30° respectively what is the range of the value of the refractive index of the material of the prism? Refractive index of water in vacuum = 1.33

View Text Solution

18. A ray of light is incident normally on a face of the prism of refracting angle 30° and refractive index $\sqrt{2}$. Calculate the angle of deviation in degree.

Watch Video Solution

19. n transparent slabs are arranged one on top of each other. The refractive indices of the material of the slabs are $\mu_1, \mu_2, \mu_3 \star, \mu_n$ and the thickness are $t_1, t_2, t_3, \star t_n$. An image is formed at a particular position when a point object is seen perpendicularly

through this combination of slabs. If the image is formed at the same position when seen through a single glass slab instead of the combination of slabs, what is the equivalent refractive index of the new glass slab?

View Text Solution

20. An object having a distance of 21 cm is placed away from the concave mirror of radius of curvature 10 cm. A glass slab of refractive index 1.5 is placed perpendicular to the principle axis. Thickness of the glass plate is 3 cm. Find out the final position of the image. Distance of the nearer end of the glass slab from the mirror is 1 cm.

View Text Solution

1. Statement I : Greater is the refractive index of a medium or denser the medium, lesser is the velocity of light in that

Statement II : Refractive index is inversely proportional to velocity.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true. '

Answer: A

Watch Video Solution

2. Statement I : Critical angle of the light passing from glass to air is minimum for violet colour.

Statement II : The wavelength of violet light is greater than the light of other colours.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true. '

Answer: C

 Watch Video Solution

3. Statement I : The twinkling of star is due to reflection of light.

Statement II : The velocity of light changes while going from one medium to the other.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true. '

Answer: D

Watch Video Solution

4. Statement I : Relative refractive index of a medium can be less than unity.

Statement II : The angle of incidence is equal to the angle of refraction.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true. '

Answer: C

Watch Video Solution

5. Statement I : When a ray of light enters glass from air, is frequency changes.

Statement II : The velocity of light in glass is less than that in air.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true. '

Answer: D

Watch Video Solution

6. Statement I : Refractive index of a medium is inversely proportional to temperature.

Statement II : Refractive index is directly proportional to the density of the medium.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true. '

Answer: B

Watch Video Solution

7. Statement I : The velocity of light rays of different colours is the same. But the velocity of the light rays are different for any other medium.

If v = velocity of light in the respective medium c = velocity of light in vacuum, μ = refractive index, then $v = \frac{c}{\mu}$.

Statement II : μ is different for different media.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true. '

Answer: A

Watch Video Solution

8. Statement I : The images formed by total internal reflections are much brighter than those formed by lenses.

Statement II : There is no loss of intensity during total internal reflection.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true. '

Answer: A

Watch Video Solution

Multiple Correct Answer Type

1. A monochromatic beam of light of wavelength λ and frequency f travelling in vacuum enters a diamond of refractive index 2.4 . Then

A. its wavelength will reduce to $\frac{\lambda}{2.4}$

B. its wavelength will increase to 2.4λ

C. its frequency will reduce to $\frac{f}{2.4}$

D. its velocity will reduce to $\frac{c}{2.4}$

Answer: A::D

Watch Video Solution

2. A ray of light travelling in a transparent medium falls on a surface separating the medium from air at an angle of incidence of 45°. The ray undergoes total internal reflection. If μ is the refractive index of

the medium with respect to air, select the possible values (s) of μ from the following

A. 1.3

B. 1.4

C. 1.5

D. 1.6

Answer: C::D

Watch Video Solution

3. For a light ray passing through a given prism

A. if the angle of incidence is increased, the deviation increases

B. if the angle of incidence is decreased, the deviation increases

C. if the angle of incidence is either increased or decreased from a certain value, the deviation increases

D. the angle of minimum deviation is directly proportional to the angle of the prism, if the prism is thin

Answer: A::C

Watch Video Solution

4. A bird flies down vertically towards a water surface. To a fish inside the water, vertically below the bird, the bird will appear to

A. be farther away than its actual distance

B. be closer than its actual speed

C. move faster than its actual speed

D. move slower than its actual speed

Answer: A::C::D

View Text Solution

5. Refractive index of the material of an equilateral prism is $\sqrt{2}$.

A. For a ray of light, minimum angle of deviation is 30°

B. For a ray of light, minimum angle of deviation is 45°

C. At 45° angle of incidence, deviation of a ray becomes minimum

D. At 60° angle of incidence, deviation of a ray becomes minimum

Answer: C::D

Watch Video Solution

6. In vacuum, speed of light is v_0, frequency is n_0 and wavelength is λ_0. When a ray travels from one medium to another, the above physical quantities become v,n and λ respectively. μ is refractive index of the medium. Which of the following statements are correct?

A. $n = \frac{n_0}{\mu}$

B. $\lambda = \frac{\lambda_0}{\mu}$

C. $v = \frac{v_0}{\mu}$

D. $n = n_0$

Answer: A::C

Watch Video Solution

7. The refractive indices of three media 1,2 and 3 and μ_1, μ_2 and μ_3 respectively $(\mu_1 > \mu_2 > \mu_3)$. Which of the following statements are correct?

A. Total internal reflection of light ray takes place when it travels from medium 3 to 1

B. The value of critical angle for refractive of light when it travels from medium 1 to 2 is less than that when it travels from medium 1 to 3

C. The value of critical angle for refraction of light when it travels from medium 1 to 2 is more than that when it travels from medium 1 to 3

D. The possibility of total internal reflection is more when light ray travels from medium 1 to 3 than when it travels from medium 1 to 2

Answer: B::C::D

Watch Video Solution

Comprehension Type

1. A monochromatic ray of light in incident normally on a refracting face of a prism of angle 30° . The refractive index of the material of the prism 1.5 .

The angle of emergence will be

A. 32.5°

B. 20.6°

C. 48.6°

D. 18.6°

Answer: C

Watch Video Solution

2. The angle of deviation will be

A. 32.5°

B. 20.6°

C. 48.6°

D. 18.6°

Answer: D

View Text Solution

3. The refractive index of the material of a prism is $\sqrt{\frac{3}{2}}$ and the refracting angle is 90°

The angle of minimum deviation of the refracted ray by the prism is

A. 30°

B. 35°

C. 40°

D. 45°

Answer: A

Watch Video Solution

4. The corresponding angle of incidence is

A. 30°

B. 35°

C. 40°

D. 60°

Answer: D

View Text Solution

5. The limiting angle of incidence for emergent ray is

A. 30°

B. 45°

C. 50°

D. 60°

Answer: B

View Text Solution

Integer Answer Type

1. There is a small pin on a table. The pin is viewed from 50 cm above it. Now without disturbing the pin, a glass slab of 15 cm thickness is held above the pin, parallel to the table top. If the refractive index of

glass is 1.5 , calculate the height (in cm) at which (from the pin) the image of the pin is formed.

Watch Video Solution

2. There is a point object at the centre of a glass sphere of diameter 12 cm and refractive index 1.5 . Calculate the distance (in cm) of the image from the surface of the sphere.

Watch Video Solution

3. The height of a vessel is 15 cm . Liquid is poured into the vessel such that the surface of the liquid remains 5 cm below the vessel's top. On seeing from above the depth of the liquid appears to be half. Calculate the refractive index of the liquid.

Watch Video Solution

Examination Archive With Question

1. The refracting angle of an equilateral prism is A. Derive an expression for the angle of deviation for a ray of light incident on the refracting surface of the prism. Draw a neat curve to show the variation of deviation with angle of incidence of the incident ray.

View Text Solution

2. Calculate the speed of light in a medium whose critical angle is 45°.

Watch Video Solution

3. The refracting angle of a prism is 60° and the refractive index of its material is $\sqrt{\frac{7}{3}}$. Find the minimum angle of incidence of a ray of

light falling on one refracting face of the prism such that the emerging ray will graze the other refracting face.

Watch Video Solution

4. Light from a point source placed at the bottom of a rectangular glass slab of thickness 5 cm is internally reflected by the upper surface and a circle of radius 8 cm is formed at the bottom. Find the refractive index of glass.

Watch Video Solution

5. Define critical angle. A luminous object is placed at a depth h in a medium of refractive index μ. Show that the radius r of the circular base of the one through which light can emerge is $r = h / \sqrt{\mu^2 - 1}$

Watch Video Solution

6. Explain by using graph the minimum angle of deviation of a ray of light passing through a prism. (Graph sheet is not required.)

Watch Video Solution

7. What will be the change in focal length f of a concave mirror when immersed in a liquid of refractive index n ?

Watch Video Solution

8. (i) Explain total internal reflection from law of refraction.

(ii) A ray of light is incident at a small angle θ on a rectangular glass slab of thickness t. If the refractive index of glass is μ . Show that the perpendicular distance between the emergent ray from the slab and the incident ray is $t\theta(\mu - 1)/\mu$.

View Text Solution

Wbjee

1. A glass slab consists of thin uniform layers of progressively decreasing refractive indices [Fig. 2.95] such that the refractive index of any layer is $\mu - m\Delta\mu$. Here μ and $\Delta\mu$ denote the refractive index of the 0 th layer and the difference in refractive index between any two consecutive layers respectively. The integer $m = 0, 1, 2, 3 \cdots$ denotes the numbers of the successive layers. A rays light from the 0 th layer enters the 1 st layer at an angle of incidence of 30°. After undergoing the m th refraction, the ray emerges parallel to the interface. If $\mu = 1.5$ and $\Delta\mu - 0.015$ the value of m is

A. 20

B. 30

C. 40

D. 50

Answer: D

View Text Solution

2. A ray of light is incident at an angle I on a glass slab of refractive index μ. The angle between reflected and refracted light is 90° . Then the relationship between I and μ is

A. $i = \tan^{-1}\left(\frac{1}{\mu}\right)$

B. $\tan i = \mu$

C. $\sin i = \mu$

D. $\cos i = \mu$

Answer: B

Watch Video Solution

3. When light is refracted from a surface, which of its following physical parameters does not change?

A. velocity

B. amplitude

C. frequency

D. wavelength of light

Answer:

Watch Video Solution

4. A ray of light strikes a glass plate at an angle of 60° . If the reflected and refracted rays are perpendicular to each other, the refractive index of glass is

A. $\frac{\sqrt{3}}{2}$

B. $\frac{3}{2}$

C. $\frac{1}{2}$

D. $\sqrt{3}$

Answer: D

Watch Video Solution

5. Light travels through a glass plate of thickness t and having refractive index μ . If c be the velocity of light in vacuum, time taken by the light to travel through this thickness of glass is

A. $\frac{t}{\mu c}$

B. $\frac{tc}{\mu}$

C. $\frac{\mu t}{c}$

D. μtc

Answer: C

Watch Video Solution

6. A parallel beam of light is incident on a glass prism in the shape of a quarter cylinder of radius R = 0.05m and refractive index n= 1.5 , placed on a horizontal table as shown in the figure. Beyond the cylinder, a patch of light is found whose nearest distance x from the cylinder is

A. $\left(3\sqrt{3}-4\right)\times 10^{-2}m$

B. $\left(2\sqrt{3}-2\right)\times 10^{-2}m$

C. $\left(2\sqrt{5}-5\right)\times 10^{-2}m$

D. $\left(3\sqrt{2}-3\right)\times 10^{-2}m$

Answer: C

View Text Solution

7. There is a small air bubble at the centre of a solid glass sphere of radius r and refractive index μ . What will be the apparent distance of the bubble from the centre of the sphere, when viewed from outside?

A. r

B. $\frac{r}{\mu}$

C. $r\left(1-\frac{1}{\mu}\right)$

D. zero

Answer: D

Watch Video Solution

8. A ray of light is incident on a right-angled isosceles prism parallel to its base as shown in the figure. Refractive index of the material of the prism is $\sqrt{2}$. Then which of the following statement (s) is // are true?

A. a) The reflection at P is total internal.

B. b) The reflection at Q is total internal.

C. c) The ray emerging at R is parallel to the ray incident at S.

D. d) Total deviation of the ray is 150°

Answer: A::C

Watch Video Solution

Jee Main

1. Monochromatic light is incident on a glass prism of angle A. If the refractive index of the material of the prism is μ , a ray, incident at an angle θ , on the face PQ would get transmitted through the face PR of the prism provided.

A. $\theta > \sin^{-1}\left[\mu \sin\left(A - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

B. $\theta < \sin^{-1}\left[\mu \sin\left(A - \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

C. $\theta > \cos^{-1}\left[\mu \sin\left(A + \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

D. $\theta < \cos^{-1}\left[\mu \sin\left(A + \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

Answer: A

View Text Solution

2. In an experiment for determination of refractive index of glass of prism by $i - \delta$ plot, it was found that a ray incident at angle 35° ,

suffers a deviation of 40° and that it emerges at angle 79° . In that case which of the following is closest to the maximum possible value of the refractive index?

A. 1.5

B. 1.6

C. 1.7

D. 1.8

Answer: A

View Text Solution

Aimpt

1. The angle of a prism is A. One of its refracting surfaces is silvered. Light rays falling at an angle of incidence 2A on the first surface

returns back through the same path after suffering reflection at the silvered surface. The refractive index μ, of the prism is

A. $2\sin A$

B. $2\cos A$

C. $\frac{1}{2}\cos A$

D. $\tan A$

Answer: B

View Text Solution

2. The refracting angle of a prism is A, and refractive index of the material of the prism is $\cot(A/2)$. The angle of minimum deviation is

A. $180^\circ - 3A$

B. $180^\circ - 2A$

C. $90^\circ - A$

D. $180^\circ + 2A$

Answer: B

Watch Video Solution

Neet

1. The angle of incidence for a ray of light at a refracting surface of a prism is 45° . The angle of prism is 60° . If the ray surface minimum deviation through the prism, the angle of minimum deviation and refractive index of the material of the prism respectively, are:

A. 30° ,$\sqrt{2}$

B. 45° , $\sqrt{2}$

C. 30° , $\frac{1}{\sqrt{2}}$

D. 45° , $\frac{1}{\sqrt{2}}$

Answer: A

Watch Video Solution

2. If the angle of a prism is 60° and angle of minimum deviation is 40° , then the angle of refraction will be-

A. 4°

B. 30°

C. 20°

D. 3°

Answer: B

Watch Video Solution

3. The refractive index of the material of a prism is $\sqrt{2}$ and the angle of the prism is 30° . One of the two refracting surfaces of the prism is made a mirror inwards, by silver coating. A beam of monochromatic light entering the prism from the other face will retrace is path (after reflection from the silvered surface) if its angle of incidence on the prism is

A. 30°

B. 45°

C. 60°

D. zero

Answer: B

Watch Video Solution

Cbse Scanner

1. For the same angle of incidence, the angles of refraction in three different media A, B and C are $15^\circ, 25^\circ$ and 35° respectively. In which medium, will the velocity of light be minimum ?

Watch Video Solution

2. Two monochromatic rays of light are incident normally on the face AB of an isosceles right-angled prism ABC. The refractive of the glass prism for the two rays 1 and 2 are respectively 1.3 and 1.5. Trace the path of these rays after entering through the prism.

View Text Solution

3. For the same angle of incidence, the angle of refraction in two media A and B are $25^\circ \text{ and } 35^\circ$ respectively. In which medium is the speed of light less?

Watch Video Solution

4. A ray of light incident on an equilateral glass prism propagates parallel to the base line of the prism inside it. Find the angle of incidence of this ray. Given refractive index of material of glass prism is $\sqrt{3}$.

Watch Video Solution

5. A ray PQ incident on the refracting face BA is refracted in the prism BAC as shown in the figure and emerges from the other refracting face AC as RS such that AQ = AR. If the angle of prism A =

60° and refractive index of material of prism is $\sqrt{3}$, calculate angle θ.

View Text Solution

6. Monochromatic light of wavelength 589 nm in incident from air on a water surface. If μ for water is 1.33, find the wavelength, frequency and speed of the refracted light.

Watch Video Solution

7. How does the angle of minimum deviation of a glass prism vary, if the incident violet light is replaced by red light? Given reason.

Watch Video Solution

8. A ray of light incident on face AB of an equilateral glass prism, shows minimum deviation of 30° . Calculate the speed of light through the prism.

View Text Solution

9. Find the angle of incident at face AB so that the emergent ray grazes along the face AC.

View Text Solution

10. A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence `(3)/(4) of the angle of prism .Calculate the speed of light in the prism.

Watch Video Solution

11. The figure shows a ray of light falling normally on the face AB of an equilateral glass prism having refractive index $\frac{3}{2}$, placed in water of refractive index $\frac{4}{3}$. Will this ray suffer total internal reflection on striking the face AC? Justify your answer?

View Text Solution