PHYSICS

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR PHYSICS

RAY OPTICS AND OPTICAL INSTRAUMENTS

ILLUSTRATION

1. Demostrate that a light beam reflected from three mutually perpendicular plane mirrors in succession reverses its direction.

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2. Two plane mirrors are inclined at an angle of 70° to each other. Find the number of images formed when object is placed as shown in figure.

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3. Find the number f images formed by three mirrors AB, BC and AC in situation as shown in figure. The object is at the centre of tringle

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4. Figure shows a point O i.e. the object placed between two parallel mirrors. Its distance from is 2 cm and that from is 8 cm. find the distance of images from the two mirrors considering reflection reflection on mirror first.

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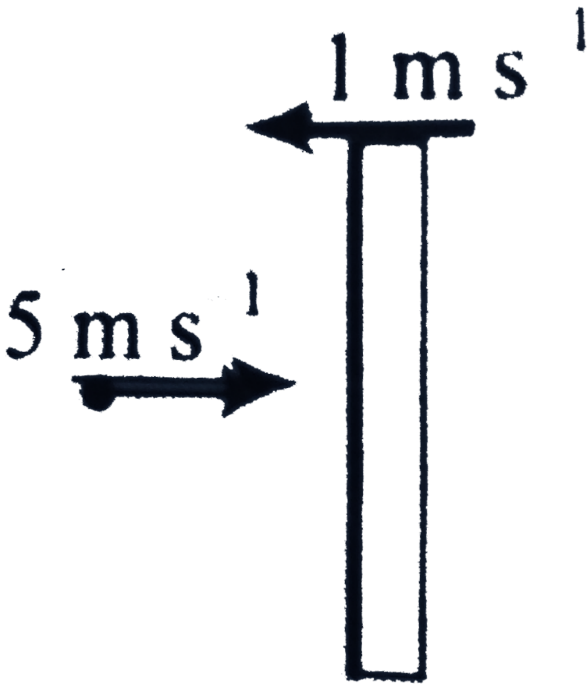
5. An object moves with $5ms^{-1}$ toward right while the mirror moves with $1ms^{-1}$ toward the left as shown in Figure. Find the velocity of image.



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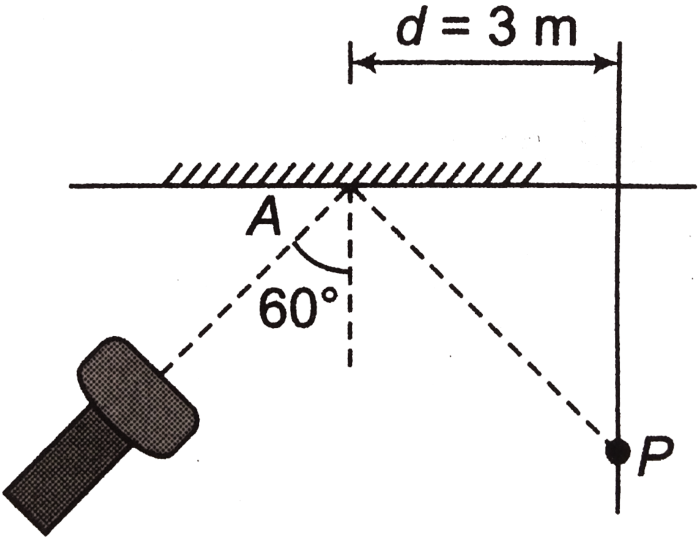
6. Figure shows a torch producing a straight light beam falling on a plane mirror at an angle 60° The reflected beam makes a spot P on the screen along y-axis . If at t=0, mirror starts ratating about the hinge A with an angular velocity $(\omega) = 1^\circ$ per second clockwise. Find the speed of the spot on screen after time t = 15 s.



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7. Find the minimum size of mirror required to see the full image of a wall behind a man standing at the centre of room, where H is the height of wall

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8. A ray of light travelling in the direction $\frac{1}{2}\left(\hat{i}+\sqrt{3}\hat{j}\right)$ is incident on a plane mirror. After reflectiion, it travels along the direction $\frac{1}{2}\left(\hat{i}-\sqrt{3}\hat{j}\right)$. The angle of incidence is

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9. A plane mirror is placed at origin parallel of y-axis, facing the positive x-axis. An object starts from (2m, 0, 0) with a velocity of $\left(2\hat{i} + 2\hat{j}\right)m/s$. The relative velocity of image with respect to object is along

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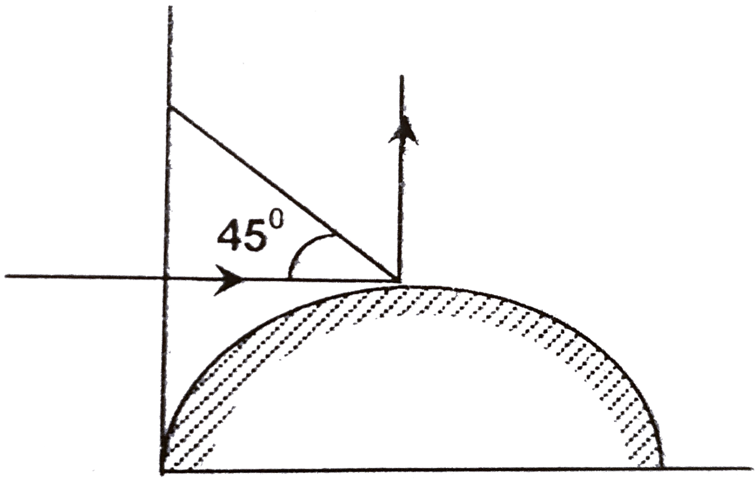
10. A reflecting surface is represented by the equation

$y = \frac{2L}{\pi}\sin\left(\frac{\pi x}{L}\right)$, where $0 \leq x \leq L$. A ray of light travelling horizontally becomes vertical after reflection with the surface. The co-ordinates of the point where this ray is incident is.



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11. The focal length of a concave mirror is 30 cm.Find the position of the object in front of the mirror,so that the image is there times the size of the objects.

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12. A reflecting surface is represented by the equation $x^2 + y^2 = a^2$. A ray travellingin negative x-direction is directed towardspositive y-direction after reflection from thesurface at point P. Then co-ordinates of point P are

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13. A point light source lies on the principal axis of concave spherical mirror with radius of curvature 160 cm. Its image appears to be back of the mirror at a distance of 70 cm from mirror. Determine the location of the light source.

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14. A point source of light is located 20 cm in front of a convex mirror with f=15 cm. Determine the position and nature of the image point.

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15. An object is 30.0 cm from a spherical mirror along the central axis. The absolute value of lateral magnification is $\frac{1}{2}$. The image produced is inverted. What is the focal length of the mirror?

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16. An object of length 10 cm is placed at right angles to the principal axis of a mirror of radius of curvature 60 cm such that its image is virtual, erect and has a length 6cm. What kind of mirror is it and also determine the position of the object?

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17. An object is placed in front of a convex mirror at a distance of 50cm. A plane mirror is introduced covering the lower half of the convex mirror. If the distance between the object and the plane mirror is 30cm, it is found that there is no parallax between the images formed by the two mirrors. What is the radius of curvature of the convex mirror?

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18. A concave mirror of focal length 10cm and a convex mirror of focal length 15cm are placed facing each other 40cm apart. A point object is placed between the mirrors, on their common axis and 15cm from the concave mirror. Find the position and nature of the image produced by successive reflections, first at the concave mirror and then at the convex mirror.

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19. Find the velocity of image w.r.t. ground.

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20. Find the velocity of image w.r.t grounds

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21. The image of a real object in a convex mirror is 4cm from the mirror. If the mirror has a radius of curvature of 24cm, Find the position of object and magnification

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22. Find the velocity of image in a situation as shown in the figure

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23. A point object located at a distance of 20 cm from the pole of a concave mirror of focal length 30 cm with height 2 cm is moving with a velocity $\left(\overline{V_{OG}} = 4\hat{i} - 5\hat{j}\right)$ m/s and velocity of the mirror is $\left(\overline{V_{mg}} = -6\hat{i} + 10\hat{j}\right)$ m I s as shown. Find the velocity of image w.r.t ground.

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24. Two concave mirrors, each having radius of curvature 40 cm are placed such that their

principle axes are parallel to each other and at a distance of 1 cm to each other. Both the mirrors are at a distance of 100 cm from each other. Considering first reflection at M_1 and then at M_2 , find the coordinates of the image thus formed object as the origin.

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25. The refractive index of glass with respect to water is $\frac{9}{8}$. If the velocity of wavelength of

light in glass are $2 \times 10^8 m / s$ and 4000 Å respectively, find the velocity and wavelength of light in water.

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26. The wavelength of light in vacuum is λ_0 . When it travels normally through glass of thickness 't'. Then find the number of waves of light in ‘t’ thickness of glass (Refractive index of glass is μ)

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27. When light of wavelength λ_0 in vacuum travels through same thickness 't' in glass and water, the difference in the number of waves is. (Refractive indices ofglass and water are μ_g and μ_w respectively.)

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28. The optical path of a monochromatic light is the same if it travels through 4 cm of glass or 4.5 cm of water . If the refractive index of galss is 1.5, then the refractive index of water is

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29. Find the thickness of a plate which will produce a change in optical path equal to half the wavelength λ of the light passing through it normally. The refractive index of the plate is μ.

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30. Consider slabs of three media A, B and C arranged as shown in figure R.I. of A is 1.5 and that of C is 1.4. If the number of waves in A is equal to the number of waves in the combination of B and C then refractive index of B is:

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31. Two parallel rays are travelling in a medium of refractive index $\mu_1 = \frac{4}{3}$. One of the rays passes through a parallel glass slab of thickness t and refractive index $\mu_2 = \frac{3}{2}$ The path difference between the two rays due to the glass slab will be

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32. A ray of light passes through a glass slab of thickness t and refractive index μ . If the speed of light in air be 'c', the time taken by the ray to cross through the plate is ______

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33. A light ray is incident on a plane glass slab of thickness 't' at an angle of incidence 'i' as shown in the figure. If μ is the refractive index of glass. Then find time taken by the light ray to travel through the slab.

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34. Light of wavelength 4500° in air is incident on a plane boundary between air and another medium at an angle 30° with the plane boundary. As it enters from air into the other medium, it deviates by 15° s towards the normal Find refractive index of the medium and also the wavelength of given light in the medium.

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35. Monochromatic light falls at an angle of incidence i on a slab of a transparent material (refractive index μ). If reflected and refracted

rays are mutually perpendicular, find the relation between μ and i.

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36. A ray of light is incident at the glass-water interface at an angle i as shown in figure, it emerges finally parallel to the surface of water, then the value of μ_g would

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37. A light beam is travelling from region I to region IV- (Refer figure). The refractive index in regions I, II,III and IV are $n_0, \frac{n_0}{2}, \frac{n_0}{6}$ and $\frac{n_0}{8}$ respectively. The angle of incidence θ for which the beam just misses entering region TV is

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38. A ray of light passes through four transparent media with refractive indices μ_1, μ_2, μ_3 and μ_4 as shown in the figure. The surfaces of all media are parallel. If the emergent ray CD is parallel to the incident ray AB, we must have

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39. The x-z plane separates two media A and B of refractive indices $\mu_1 = 1.5$ and $\mu_2 = 2$. A ray of light travels from A to B. Its directions in the two media are given by unit vectors $u_1 = a\hat{i} + b\hat{j}$ and $u_2 = c\hat{i} + a\hat{j}$. Then

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40. A ray of light falls on the surface of a spherical glass paper weight making an angle α with the normal and is refracted in the medium at an angle β. The angle of deviation of the emergent ray from the direction of the incident ray is :

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41. A ray of light falls on a transparent sphere with centre at C as shown in figure. The ray emerges from the sphere parallel to line AB. The refractive index of the sphere is

42. In a tank, a 4cm thick layer of water $\left(\mu = \frac{4}{3}\right)$ floats on a 6 cm thick layer of an organic liquid (μ = 1.5). Viewing at normal incidence, how far below the water surface does the bottom of tank appear to be?

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43. An object is placed in front of a slab (μ = 1.5) pfthickness 6 cm at a distance 28 cm from it Other face of the slab is silvered. Find the position of final image.

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44. An observer can see through a pinhole the top end of a thin rod of height h, placed as shown in figure. The beaker height 3h and its radius h. When the beaker is filled with a liquid upto a height 2h, he can see the lower end of the rod. Find the refractiveindex of the liquid.

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45. A person looking through a telescope focuses the lens at a point on the edge of the bottom of an empty cylindrical vessel Next he fills the entire vessel with a liquid of refractive index μ, without disturbing the telescope. Now, he observes the midpoint of the bottom of the vessel Determine the radius to depth ratio of the vessel

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46. A diverging beam of light from a point source S having divergence angle α falls symmetrically on a glass slab as shown. The

angles of incidence of the two extreme rays are equal If the thickness of the glass slab is t and its refractive index is n, then the divergence angle of the emergent beam is

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47. An observer looks at an object kept at a distance 30 cm in air. If a rectangular glass plate (μ =1.5) is placed between the observer and the object with its thick-ness along the line of observation, the object appears to the observer to be at a distance 25 cm. Find the thickness of glass plate. Position of the glass plate is now shifted (i) from object towards observers (ii) from observer towards the object How does it change the apparent position of the object as seen by the observer?

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48. An air bubble is trapped inside a glass cube of edge 30 cm. Looking through the faceABEH, the bubble appears to be at normal distance 12 cm from this face and when seen from the opposite face CDGF, it appaears to be at normal distance 8 cm from CDGF. Find refractive index of glass and also the actual position of the bubble

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49. A parallel sides glass slab of thickness 4 cm is made of a material of refractive index $\sqrt{3}$.

When light is incident on one of the parallelfaces at an angle of 60° , it emerges from the other parallel face. Find the lateral displacement of the emergent beam.

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50. A ray of light travelling in a rarer medium strikes a plane bouhdary between the rarer medium and a denser medium at an angle of incidence ‘i’ such that the reflected and the refracted rays are mutually perpendicular.

Another ray of light of same frequency is incident on the same boundary from the side of denser medium. Find the minimum angle of incidence at the denser-rarer boundary so that the second ray is totally reflected.

51. 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 n is the refractive index of the medium with respect to air, select the possible value of n from the following.

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52. A liquid of refractive index 1.5 is poured into a cyclindrical jar of radius 20 cm upto a height of 20 cm. A small bulb at the centre of bottom glowing. Find area of the liquid surface through which the light of the bulb passes into air.

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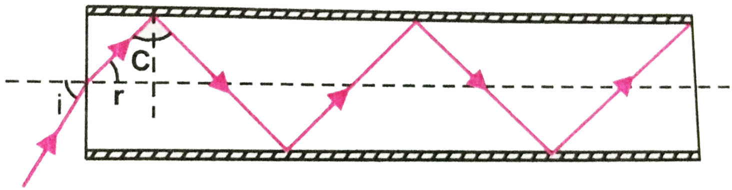
53. (a) Fig. shows a cross-section of a 'light pipe' made of a glass fibre of refractive index 1.68. The outer covering of the pipe is made of a material of refractive index 1.44. What is the axis of the pipe for which total reflection inside the pipe take place as shwon.

(b) What is the answer if there is no outer covering if the pipe ?



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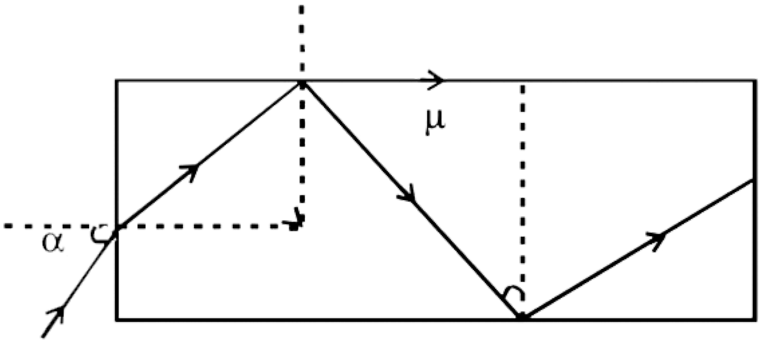
54. Light is incident at an angle α on one planar end of a transparent cylindrical rod of refractive index μ. Determine the least value of μ so that the light entering the rod does not emerge from the curved surface of rod irrespective of the value of α `



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55. A rectangular glass slab ABCD of refractive index n_1 is immersed in water of refractive index $n_2 (n_1 > n_2)$. A ray of light is incident at the surface AB of the slab as shown. The maximum value of the angle of incidence $\alpha_{\max}$ .such that the ray comes out only from the other surface CD, is given by

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56. What will be the minimum angle of incidence such that the total internal reflection occurs on both the surfaces?

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57. A ray of light incident on the horizontal surface of a glass slab at an angle of incidence 'i'just grazes the adjacent vertical surface after reflection. Compute the critical angle and refractive index of glass

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58. Light is incident normally on face AB of a prism as shown in figure. A liquid of refractive index p is placed on face AC of the prism. The prism is made of glass of refractive index 3/2. The limits of p for which total internal reflection takes place on face AC is

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59. What is the value of the refractive index for a $90^\circ - 45^\circ 45^\circ$ prism which is used to deviate a beam through 90° by total internal

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60. A beam of light consisting of red, green and blue colours is incident on a right angle prism. The refractive indices of the material of the prism for the red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The colour of light that comes out of the prism is

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61. White light is incident on the interface of glass and air as shown in the figure. If green light is just totally internally reflected then the emerging ray in air contains:

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62. A rectangular block of glass is placed on a printed page lying on a horizontal surface. Find the minimum value of the refractive index of glass for which the letters on the page are not visible from any of the vertical faces of the block.

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63. A plane mirror is placed at the bottom of a tank containing a liquid of refractive index μ. P is a small object at a heigth h above the mirror. An observer O, vertically above P, outside the liquid, observes P and its image in the mirror. The apparent

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64. A cubic container is filled with a liquid whose refractive index increases linearly from top to bottom. Which of the following represents the path of a ray of light inside the liquid ?

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65. A light ray travelling in a glass medium is incident on glass - air interface at an angle of incidence Q. The reflected (R) and transmitted (T) intensities, both as function of 0, are plotted. The correct sketch is

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66. Find the variation of Refractive index assuming it to be a function of y such that a ray entering origin at grazing incident follows a parabolic path $y = x^2$ as shown in

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67. A ray of light is incident on a glass slab at grazing incidence. The refractive index of the material of the slab is given by $\mu = \sqrt{1 + \sqrt{y}}$. If the thickness of the slab is d, determine the equation ofthe trajectory of the ray inside the slab and the coordinates of the point where the ray exits from the slab. Take the origin to be at the point of entry of the ray.

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68. Due to a vertical temperature gradient in the atmosphere, the index of refraction varies. Suppose index of refraction varies as n $=n_0\sqrt{1+ay}$, where n_0 is the index of refraction at the surface and 'a'= $2.0 \times l0^{-6}$"m^{-1}. A person of height h= 2.0 m stands on a level surface. Beyond what distacne will he not see the run way?

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69. The refraction index of an anisotropic medium varies as p =$\mu = \mu_0\sqrt{(x+1)}$, where 0 $\leq$ x $<$ $=$ a. A ray of light is incident at the origin just along y-axis (shown in figure). Find the equation of ray in the medium.

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70. A vessel of depth 2d cm is half filled with a liquid of refractive index μ_1 and the upper half with a liquid of refractive index μ_2. The apparent depth of the vessel seen perpendicularly is

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71. A ray of ligth enters into a glass slab from air as shown in fig.2.65. If refractive index of glass slab is given by μ = A — Bt where A and B are constants and 't' is the thickness of slab measured from the top surface. Find the maximum depth travelled by ray in the slab. Assume thickness of slab to be sufficiently large

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72. A ray of light travelling in air is incident at a grazing angle on a large transparent slab of thickness t = 2.0m. The point of incidence is the origin.

The medium has a variable refractive index(y) given by $\mu(y) = \sqrt{ky + 1}$

Where y is in m and k = 0.25m^{-1}

Express a relation between the angle of incidence and the slope of the trajectory m, in terms of the refractive index at that point μ (y)

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73. A small object stuck on the surface of a glass sphere $(n = 1.5)$ is viewed from the diametrically opposite position. Find transverse magnification.

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74. A solid glass sphere with radius R and an index of refraction 1.5 is silvered over one hemisphere. A small object is located on the axis of the sphere at a distance 2R to the left of the vertex of the unsilvered hemisphere. Find the position of final image after all refractions and reflection have taken place.

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75. A point object is placed at the centre of a glass sphere of radius 6cm and refractive index 1.5. The distance of virtual image from the surface is

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76. An air bubble in glass (μ = 1.5) is situated at a distance 3 cm from a convex surface of diameter 10 cm as shown in figure. At what distance from the surface will the bubble appear?

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77. One end of a cylindrical glass (μ = 1.5) is given the shape of a concave refracting surface of radius 10 cm. An air bubble is situated in the glass rod at a point on its axis such that it appears to be at distance 10 cm from the surface and inside glass when seen from the other medium. Find the actual location of air bubble.

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78. A transparent thin film of uniform thickness and refractive index n_1 =1.4 is coated on the convex spherical surface of radius R at one end of a long solid glass cylinder of refractive index n_2 = 1.5, as shown in figure. Rays of light parallel to the axis of the cylinder traversing through the film from air to glass get focused at distance f] from the film, while rays of light traversing from glass to air getfocused at distacnce f2 from the film. Then, the magnitudes of f_1, f_2 are

79. A spherical solid glass paper weight of diameter 6 cm has a small air bubble at a distance of 1.5 cm from the centre. If the air bubble be viewed from the side to which it is nearest along the line joining the bubble and the centre, find where will it appear.

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80. A biconvex lens of focal length 15 cm is in front of a plane mirror. The distance between the lens and the mirror is 10 cm. A small object is kept at a distance of 30 cm from the lens. The final image is

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81. A bi-convex lens is formed with two thin plano-convex lenses as shown in the figure. Refractive index 'n ' of the first lens is 1.5 and that of the second lens is 1.2. Both the curved surface are of the same radius of curvature R=14 cm. For this bi-convex lens, for an object distance of 40 cm, the image distance will be

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82. An object is $5.0m$ to the left of a flat screen. A converging lens for which the focal length is $f = 0.8m$ is placed between object and screen.

(a) Show that two lens positions exist that form images on the screen and deremine how far these positions are from the object?

(b) How do the two images differ from each other?

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83. A point object is placed at a distance of $12cm$ from a convex lens of focal length $10cm$. On the other side of the lens, a convex mirror is placed at a distance of $10cm$ from the lens such that the image formed by the combination coincides with the object itself. The focal length of the convex mirror is

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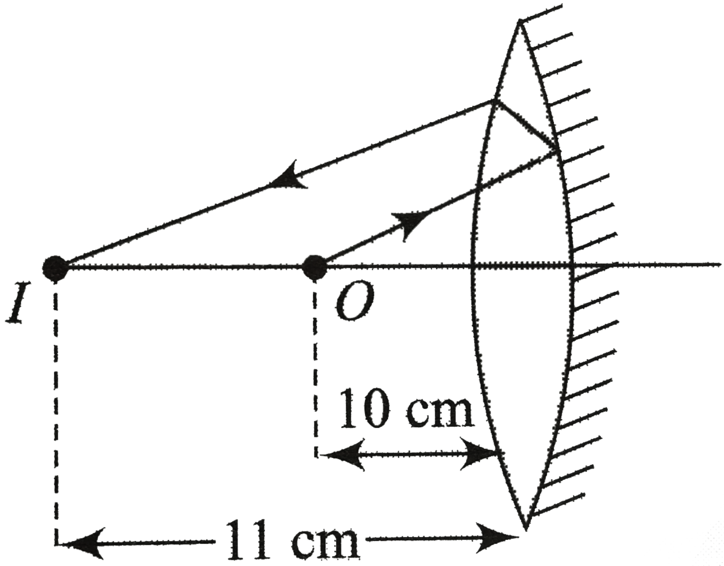
84. A pin is placed 10cm in front of a convex lens of focal length 20cm, made of a material having refractive index 1.5 . The surface of lens farther away from the pin is silvered and has a radius of curvature 22cm. Determine the position of the final image. Is the image real or virtual?



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85. A biconvex thin lens is prepared from glass of refractive index $3/2$. The two bounding surfaces have equal radii of $25cm$ each. One of the surfaces is silvered from outside to make it reflecting. Where should an object be placed before this lens so that the image coincides with the object.

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86. What is the refractive index of material of a plano-convex lens, if the radius of curvature of the convex surface is 10 cm and focal length of the lens is 30 cm ?

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87. A concave lens of glass, refractive index 1.5 has both surfaces of same radius of curvature R. On immersion in a medium of refractive index 1.75, it will behave as a

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88. A hollow convex lens of glass will behave like a

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89. The diagram shows a concavo - convex lens. What is the condition on the refractive indices so that the lens is diverging?

The refractive index of the lens is μ_2

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90. The magnification of an object placed it front of a convex lens of focal length $20cm$ is $+2$. To obtain a magnification of -2 , the object will has to be moved a distance equal to

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91. Two point sources S_1 and S_2 are 24 cm apart. What should a convex lens of focal length 9 cm be placed between them so that the images of both sources formed at the same place ?

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92. An object is placed at $A(OA > f)$. Here, f is the focal length of the lens. The image is formed at B. A perpendicular is erected at O and C is chosen such that $\angle BCA = 90^\circ$. Let OA = a, OB = b and OC = c. Then the value of f is

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93. A magnifying lens has a focal length of 10 cm. (a) Where should the object be placed if the image is to be 30 cm from the lens ? (b) What will be the magnification ?

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94. In the figure, light is incident on the thin lens as shown. The radius of curvature for both the surface is R. Determine the focal length of this system.

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95. The linear magnification of an object placed on the principal axis of a convex lens offocal length 30cm is found to be +2. In order to obtain a magnification of -2, by how much distance should the object be moved?

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96. The distance between the object and the real image formed by a convex lens is d. If the linear magnification is m, find the focal length of the lens in terms of d and m.

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97. A concave lens of focal length f forms an image which is n times the size of the object What is the distance of the object from the lens in terms of f and n?

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98. A glass convex lens of refractive index $\frac{3}{2}$ has got a focal length equal to 0.3 m. Find the focal length of the lens if it is immersed in water of refractive index$4/3$.

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99. As shown in figure a spherical air lens of radii $R_1 = R_2$= 10cm is cut in a glass (μ= 1.5) cylinder. Determine the focal length and nature of air lens. If a liquid of refractive index

2 is filled in the lens, what will happen to its focal length and nature?

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100. A point object O is placed at a . distance of 30 cm from a convex lens of focal length 20cm cut into two halves each of which is displaced by 0.05cm as shown in figure. Find the position of the image? If more than one image is formed, find their number and distance between them?

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101. Two this lenses, when in contact, produce a combination of power $+10$ diopters. When they are 0.25 m apart, the power reduces to $+6$ diopters. The focal length of the lenses are.... m and ...m.

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102. Two plano-concave lenses of glass of refractive index 1.5 have radii of curvature of 20 and 30 cm. They are placed in contact with curved surface towards each other and the space between them is filled with a liquid of refractive index $\frac{4}{3}$, find the focal length of the system.

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103. Two thin sysmmetrical lenses of different nature and of different material have equal raii of curvature $R = 15cm$. The lenses are put close together and immersed in water $(\mu_w = 4/3)$. The focal length of the system ini water is 30cm. The difference between refractive indices of tthe two lenses is

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104. A converging lens of focal length $5.0cm$ is placed in contact

with a diverging lens of focal length $10.0cm$.

Find the combined focal length of the system.

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105. Two thin converging lenses are placed on a common axis, so that the centre of one of them coincides with the focus of the other. An object is placed at a distance twice the focal length from the left hand lens. Where will its image be? What is the lateral magnification? The focal of each lens is f.

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106. An equilateral glass prism is made of a material of refractive index 1.500. Find its angle of minimum deviation.

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107. A prism of refracting angle 4° is made of a material of refractive index 1.652. Find its angle of minimum deviation.

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108. A ray of light is incident normally on one of the faces of a prism of apex angle 30 degree and refractive index sqrt2. The angle of deviation of the ray is...degrees.

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109. A ray of light is incident normally on one of the refracting surfaces of a prism of refracting angle A,. The emergent ray grazes the other refracting surface. Find the refractive index of the material ofprism.

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110. A ray of light passing through a prism having refractive index $\sqrt{2}$ suffers minimum deviation. It is found that the angle of incidence is double the angle of refraction within the prism. What is the angle of prism?

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111. A ray of light is incident at an angle of 60° on the face of a prism having refracting angle 30°. The ray emerging out of the prism makes an angle 30° with the incident ray. Show that the emergent ray is perpendicular to the face through which it emerges and calculate the refractive index of the material of prism.

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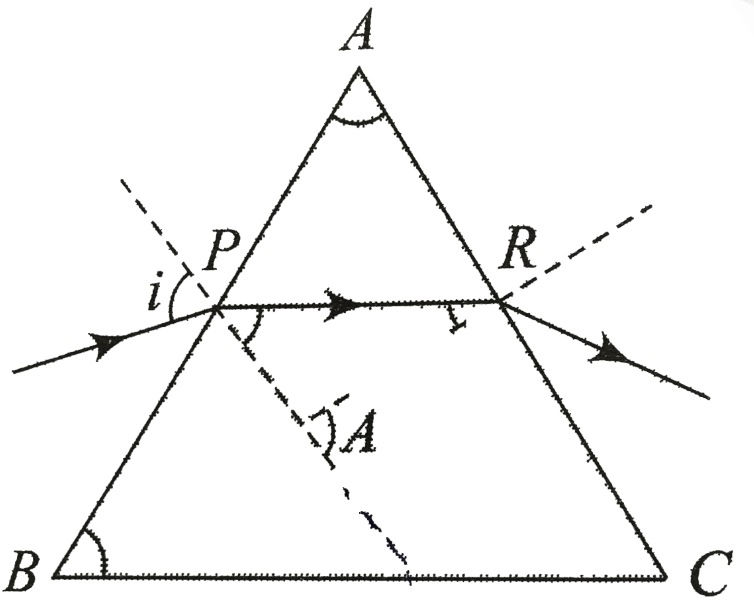
112. A ray of light undergoes a deviation of 30° when incident on an equilateral prism of refractive index $\sqrt{2}$.

What is the angle subtended by the ray inside the prism with the base of the prism?



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113. A 60° prism has a refractive index of 1.5. Calculate (a) the angle of incidence for minimum deviation (b) angle of minimum deviation (c) the angle of emergence of light at maximum deviation (d) angle of maximum deviation.

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114. Monochromatic light falls on a right angled prism at an angle of incidence 450 . The emergent light is found to slide along the face AC. Find the refractive index ofmaterial of prism.

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115. The refractive index of a prism is 2. this prism can have a maximum refracting angle of

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116. For an equilateral prism, it is observed that when a ray strikes grazingly at one face it emerges grazingly at the other. Its refractive index will be

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117. Two identical prisms of refractive index $\sqrt{3}$ are kept as shown in figure. A light ray strikes the first prism at face AB. Find,

i) The angle of incidence, so that the emergent ray from the first prism has minimum deviation

ii) Through what angle of prism DCE should be rotated about C so that the final emergent ray also has minimum deviation.

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118. A beam of white light passing through a hollow prism give no spectrum.

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119. White light is passed through a prism of angle 5°. If the refractive indices for red and blue colours are 1.641 and 1.659 respectively, calculate the angle of dispersion between them.

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120. The refractive indices of flint glass prism for violet, Yellow and Red colours are 1.790, 1.795 and 1.805 respectively, find dispersive power of the flint glass.

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121. A thin prism P_1 with angle $4 degree$ and made from glass of refractive index 1.54 is combined with another thin prism P_2 made from glass of refractive index 1.72 to produce dispersion without deviation. The angle of the prism P_2 is

Watch Video Solution

122. A crown glass prism of refracting angle 8° is combined with a flint glass prism to obtain deviation without dispersion. If the refractive indicates for red and violet rays for the crown glass are 1.514 and 1.524 and for the flint glass are 1.645 and 1.665 respectivey, find the angle of flint glass prism and net deviation.

Watch Video Solution

123. A given ray of light suffers minimum deviation in an equilateral prism P. Addtional prism Q and R of identical shape and of the same material as P are now added as shown in figure. The ray will suffer

1) The greater deviation

2) no deviation

3) same deviation as before

4) total internal reflection

View Text Solution

124. Calculate (a) the refracting angle of a flint glass prism which should be combined with a crown glass prism of refracting angle 6°so that the combination may not have deviation for D line and (b) the angular seperation between C and F lines,given that the refractive indices of the materials are as follows:

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125. A person cannot see distinctly any object placed beyond 40cm from his eye. Find the power of lens whicTFwill enable him to see distant stars clearly is?.

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126. A far sighted person cannot focus distinctly on objects closer than "1m" What is the power of lens that will permit him to read from a distance of "40cm"

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127. A graph sheet divided into squares each of size \mm 2 is kept at a distance of 7cm from a magnifying glass of focal length of 8cm. The graph sheet is viewed through the magnifying lens keeping the eye close to the lens. Find (i) the magnification produced by the lens, (ii) the '(irea of each square in the image formed (iii) the magnifying power of the magnifying lens. Why is the magnification found in (i) different from the magnifying power?

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128. If the focal length of a magnifler is 5cm calculate

a) the power of the lens

b) the magnifying power of the lens for relaxed and strained eye.

Watch Video Solution

129. A man with normal near- point (25c m) reads a book with small print using a magnifying glass L a thin convex lens of focal length 5 cm.

(i) What is the closest and the farthest distance at which he can read the book when viewing thorugh the magnifying glass ?

(ii) What is the maximum and the minimum angular magnification (magnifying power) possible using the above simple microscope ?

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130. A microscope consisting of two convex lenses of focal lengths 2 cm and 5 cm placed 20 cm apart. Where must the object be placed so that the final image (virtual) is at a distance of 25 cm from eye ?

Watch Video Solution

131. Find the magnifying power of a compound microscope whose objective has a focal power of 100D and eye piece has a focal power of 16D when the object is placed at a distance of 1.1cm from the objective. Assume that the final image is formed at the least distance of distinct vision (25cm)

Watch Video Solution

132. In a compound microscope, the objects is $1cm$ from the objective lens. The lenses are $30cm$ apart and the intermediate image is $5cm$ from the eye-piece. What magnification is produced?

Watch Video Solution

133. A compound microscope has a magnifying power 30. The focal length of its eye-piece is $5cm$. Assuming the final to be at the least distance of distinct vision $(25cm)$, calculate the magnification produced by objective.

Watch Video Solution

134. A compound microscope is used to enlarge an object kept at a distance 0.03m from its objective which consists of several convex lenses in contact and has focal length 0.02m. If a lens offocal length 0.1m is removed from the objective, find out the distance by which the eyepiece of the microscope must be moved to refocus the image?

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135. The focal length of the objective and the eye piece of a compound microscope are 2.0 cm and 3.0 cm, respectively. The distance between the objective and the eye piece is 15.0 cm. The final image formed by the eye piece is at infinity. The two lenses are thin. The distance in cm of the object and the image produced by the objective, measured from the objective lens, are respectively

Watch Video Solution

136. The focal length of the objective and the eye piece of a compound microscope are 2.0 cm and 3.0 cm, respectively. The distance between the objective and the eye piece is 15.0 cm. The final image formed by the eye piece is at infinity. The two lenses are thin. The distance in cm of the object and the image produced by the objective, measured from the objective lens, are respectively

Watch Video Solution

137. An astronomical telescope has an angular magnification of magnitude 5 for distant object. The separation between the objective and eyepiece is $36cm$ and the final image is formed at infinity. Determine the focal length of objective and eyepiece.

Watch Video Solution

138. A telescope has an objective of focal length $50cm$ and an eyepiece of focal length $5cm$. The least distance of distinct vision is $25cm$. The telescope is focused for distinct vision on a scale $2m$ away from the objective.

Calculate (a) magnification produced and (b) separation between objective and eyepiece.

Watch Video Solution

139. A telescope objective of focal length 1 m forms a real image of the moon 0.92cm in diameter. Calculate the diameter of the moon taking its mean distance from the earth to be 38×10^4km If the telescope uses an eyepiece of 5cm focal length, what would be the distance between the two lenses for (i) the final image to be formed at infinity (ii) the final image(virtual) at 25 cm form eye.

Watch Video Solution

140. In an astronomical telescope, the focal lengths of the objective and the eye piece are 100cm and 5cm respectively. If the telescope is focussed on a scale 2m from the objective, the final image is formed at 25cm from the eye. Calculate (i) the magnification and (ii) the distance between the objective and the eyepiece

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141. A tower 100m tall at a distance of 3km is seen through a telescope having objective of focal length 140cm and eyepiece of focal length 5cm. What is the size of final image if it is at 25cm from the eye?

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142. The diameter of the moon is $3.5 \times 10^3 km$ and its distance from the earth is $3.8 \times 10^5 km$. It is seen through a telescope having focal lengths of objective and eye-piece as $4m$ and $10cm$ respectively. Calculate (a) magnifying power of telescope (b) length of telescope tube and (c) anngular size of image of moon.

Watch Video Solution

143. An astronomical telescope consisting of an objective of focal length $60cm$ and eye-piece of focal length $3cm$ is focused on the moon so that the final image is formed at least distance vision, i.e. $25cm$ from the eye-piece piece. Assuming the angular diameter of moon as $1/2^{\circ}$ at the objective, calculate (a) angular size and (b) linear size of image seen through the telescope.

Watch Video Solution

CUQ (REFLECTION)

1. A bird flying high up in air does not cast shadow in the ground because

A. the size of the bird is smaller than sun

B. the size of the bird is smaller than earth

C. light rays fall almost normally on the bird

D. none of the above

Answer: A

Watch Video Solution

2. A plane mirror reflects a beam of light to form a real image, The incident beam should be

A. parallel

B. Convergent

C. divergent

D. any one of the above

Answer: B

Watch Video Solution

3. When an object is placed between two parallel mirrors, then number of images formed are

A. 2

B. 4

C. 8

D. Infinite

Answer: D

Watch Video Solution

4. If a number of images of a candle flame are seen in a thick mirror, then

A. The first image is the brightest

B. The second image is the brightest

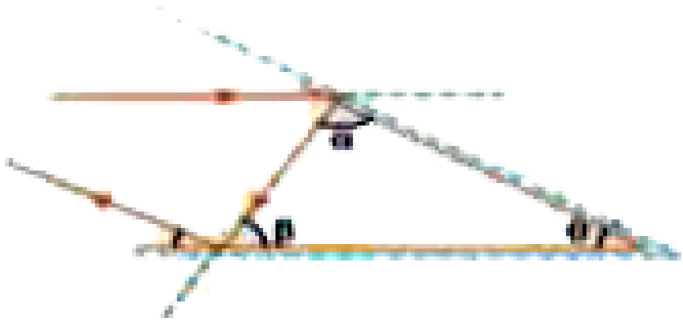
C. The last image is the brightest

D. The image are equally bright

Answer: B

Watch Video Solution

5. If two plane mirrors are inclined at angle 0 to each other as shown, than angle of deviation of incident ray is



A. $360 - 2\theta$

B. $360 - 2\theta$

C. $180 - 2\theta$

D. $180 + 2\theta$

Answer: A

Watch Video Solution

6. A real, inverted and equal in size image is formed by

A. a concave mirror

B. a convex mirror

C. a plane mirror

D. none of these

Answer: A

Watch Video Solution

7. The rear - view mirror of a car is

A. Plane

B. Convex

C. Concave

D. None

Answer: B

Watch Video Solution

8. v31

A. increase

B. decrease

C. remain unchanged

D. depend on the nature of liquid

Answer: C

Watch Video Solution

9. A train is approaching towards a stationary person with a velocity v . The train emits a light signal. The signal will reach the stationary person with a velocity

A. c

B. c+v

C. c-v

D. $\sqrt{c^2 + v^2}$

Answer: A

Watch Video Solution

CUQ (REFRECTION)

1. Light of frequency n, wave length x travelling with a velocity v enters into a glass slab of R.I n then frequency, wave length and velocity of the wave in glass slab respectively are

A. $\dfrac{n}{\mu}, \lambda, \dfrac{v}{u}$

B. $n, \frac{\lambda}{\mu}, \frac{v}{\mu}$

C. $n, \lambda, \frac{v}{\mu}$

D. $\frac{n}{\mu}, \frac{\lambda}{\mu}, v$

Answer: B

Watch Video Solution

2. Absolute refractive index of a material depends upon

A. nature of material

B. nature, wavelength and size of material

C. density, temperature, wavelength of material

D. fiature, temperature, wavelength of material

Answer: D

Watch Video Solution

3. If a ray of light takes t_1 and t_2 times in two media of absolute refractive indices μ_1 and μ_2 respectively to travel same distance, then

A. $\mu_1 t_1 = \mu_2 t_2$

B. $\mu_1 t_2 = \mu_2 t_1$

C. $t_1\sqrt{\mu_1} = t_2\sqrt{\mu_2}$

D. $t_1\sqrt{\mu_2} = t_2\sqrt{\mu_1}$

Answer: B

Watch Video Solution

4. In cold countries, the phenomenon of looming takes place, because refractive index of air decreases with height

A. decreases with height

B. increases with height

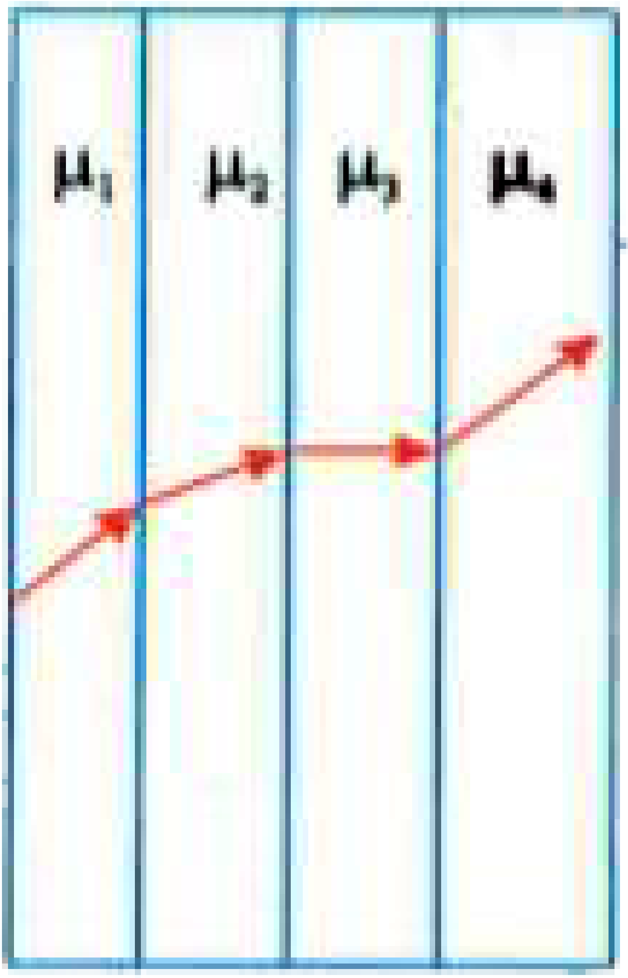
C. does not change with height

D. become infinity at the surface

Answer: A

Watch Video Solution

5. A ray of light passes through four transparent media with refractive indices $\mu_1,\, \mu_2,\, \mu_3$ and μ_4 as shown in figure. The surfaces of all media are parallel. If the emergent ray is parallel to the incident ray, we must hav



A. $\mu_1 = \mu_2$

B. $\mu_2 = \mu_3$

C. $\mu_3 = \mu_4$

D. $\mu_4 = \mu_1$

Answer: D

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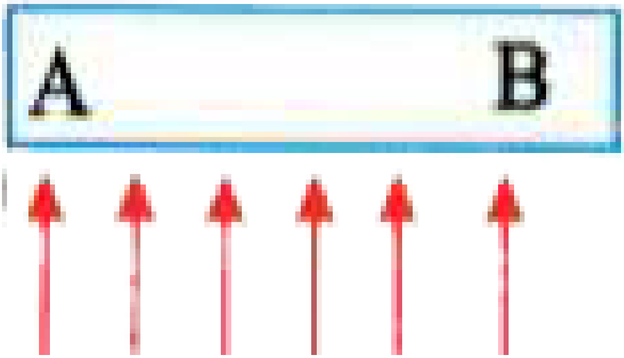
6. Rays of light fall on a glass slab (μgtl)as shown in the figure. If μ at A is maximum and at b it is minimum, then what will happen to these rays?



A. they will tilt towards A

B. they will tilt towards B

C. they will not deviate

D. there will be total internal reflection

Answer: C

Watch Video Solution

7. A hunter desires to shoot a fish whose image could be seen through clear water. His aim should be

A. Above the apparent image of fish

B. Below the apparent image of fish

C. In the line of sight offish

D. Parallel to the surface of water

Answer: B

Watch Video Solution

8. A rectangular solid piece is placed in a liquid whose refractive index is the same as that of the solid

A. The sides of the sohd will appear to be bent inward

B. The sides of the sohd will appear to be bent outward

C. The solid will not be seen at all

D. The solid will appear as in air

Answer: C

Watch Video Solution

9. A plane glass slab is placed over various coloured letters. The letter which appears to be raised the least is

A. violet

B. yellow

C. red

D. green

Answer: C

Watch Video Solution

10. As temperature of medium increases the critical angle

A. Increases

B. Decreases

C. Remains same

D. first increases then decreases

Answer: A

Watch Video Solution

11. A ball coated with 'lamp black' put in a glass tank containing water appears silvery white due to

A. Refraction

B. Diffraction

C. Interference

D. Total internal reflection

Answer: D

Watch Video Solution

12. In an optical fibre

A. Core region is transparent, cladding is opaque

B. Core region is opaque, cladding is transparent

C. Both core and cladding regions are transperent

D. Both core and cladding regions are opaque

Answer: C

Watch Video Solution

13. In an optical fiber during transmission of light

A. Energy increases

B. Energy decreases

C. No loss of propagation of energy takes place

D. Light partially reflects and refracts

Answer: C

Watch Video Solution

14. The focal length of a lens depends on

A. colour of light

B. radius of curvature of the lens

C. material of the lens

D. all the above

Answer: D

Watch Video Solution

15. f_B and f_R are focal lengths of a convex lens for blue and red light respectively and `F_(B_ and Fr are the focal lengths of the concave lens for blue and red light respectively. We must then have

A. $f_B > f_R$ and $f_B < f_R$

B. $f_B < f_R$ and $f_B > f_R$

C. $f_B > f_R$ and $f_B > f_R$

D. $f_B < f_R$ and $f_B f_R$

Answer: D

View Text Solution

16. The graph between the object distance along the X-axis and image distance along Y-axis for a convex lens is

A. Straight line

B. Parabola

C. Circle

D. A hyperbola

Answer: D

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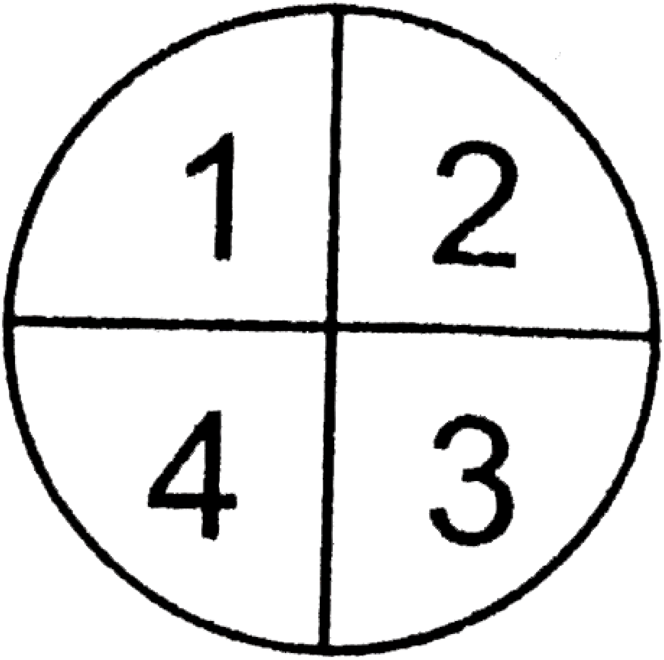
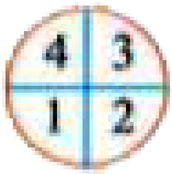


17.

A convex lens is used to form a real image of the object shown in the figure. The real inverted image shown in the following figures is

A. 

B. 

C. 

D. 

Answer: D

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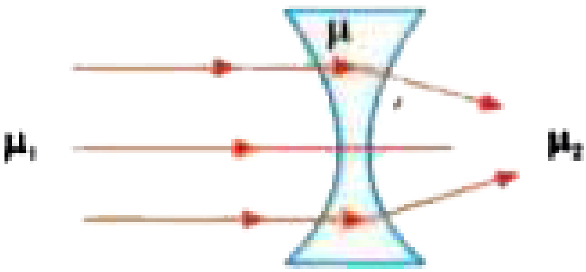
18. The relation between refractive indices u, μ_1, μ_2. if the behaviour of light ray is as shown in figure



A. $\mu > \mu_1 > \mu_2$

B. $\mu < \mu_2 < \mu_1$

C. $\mu < \mu_2, \mu = \mu_1$

D. $\mu_2 < \mu_1, \mu = \mu_2$

Answer: C

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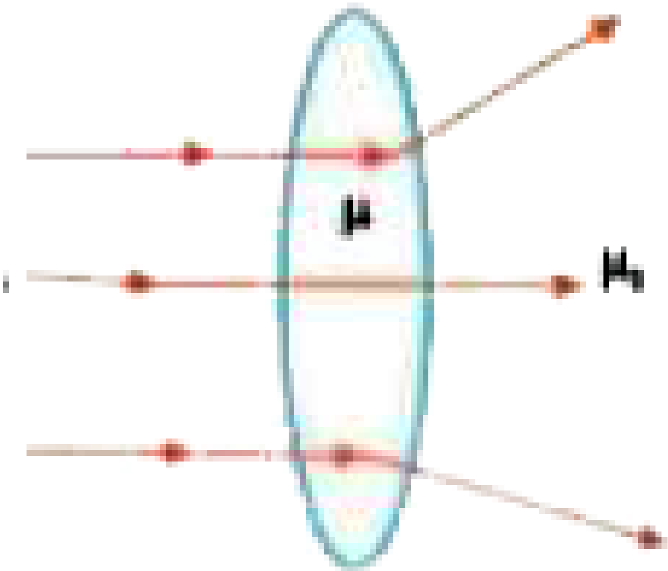
19. If parallel beam of light falls on a convex lens. The path of the rays is shown in fig. It follows that



A. $\mu_1 > \mu > \mu_2$

B. $\mu_1 < \mu < \mu_2$

C. $\mu_1 = \mu < \mu_2$

D. $\mu_1 = \mu > \mu_2$

Answer: C

Watch Video Solution

20. A converging lens is used to form an image on a screen. When the upper half of the lens is covered by an opaque screen.

a) half of the image will disappear

b) no part of image will disappear .

c) Intensity of the image will increased

d. Intensity of the image will decrease

A. a,c are true

B. a,d are true

C. b,c are true

D. b,d are true

Answer: D

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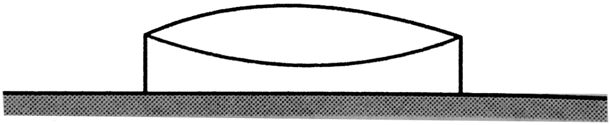
21. A convex lens is placed in contact with a mirrorr as shown. If he space between them is filed with water, its power will



A. decreases

B. increase

C. remain unchanged

D. can increase or decrease depending on the focal length

Answer: B

Watch Video Solution

22. A real image is formed by a convex lens. Then it is put in contact with a concave lens and again a real image is formed. This image will

A. shifts towards the lens system

B. shifts away from the lens sytem

C.) remain in its original position

D. shifts to infinity

Answer: B

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23. A beam of parallel rays is brought to focus by a planoconvex lens. A thin Concave lens of the same focal length is joined to the first lens. The effect of this is

A. the focal point shifts away from the lens by a small distance

B. the focal point shifts towards the lens by a small distance

C. the focal point of lens does not shift at all

D. the focal point shifts to infinity

Answer: D

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24. v33

A. f/2

B. f

C. 2f

D. 4f

Answer: C

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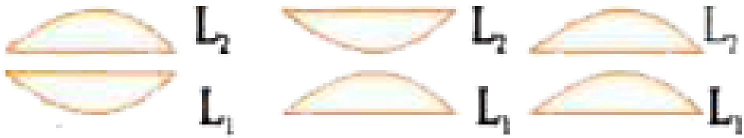
25. If a lens of focal length f is divided into two equal parts and both pieces are put in contact as shown in fig. The resultant focal length of combination is



A. f

B. 2f

C. 3f

D. 4f

Answer: A

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26. If a lens of focal length f is divided into two equal parts and both pieces are put in c o n - tact as shown in fig. The resultant focal length of combination are

A. $0, f, \infty$

B. f,f,0

C. 2f,f,0

D. $f, f/2, \infty$

Answer: D

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27. If we added half part of each convex and concave lens of a focal length f as shown the resolution of focal length will be

A. 0

B. ∞

C. f

D. 2f

Answer: B

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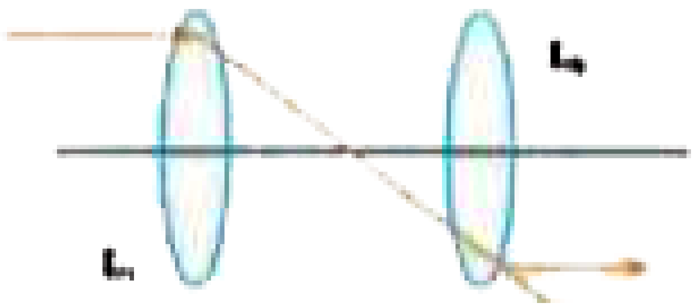
28. In the figure given below there are two convex lenses L1 and L2 having focal lengths F1 and F2 respectively. The distance between L1 and L2 will be



A. F_1

B. F_2

C. $F_1 + F_2$

D. $F_1 - F_2$

Answer: C

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CUQ (LENS MAKER'S FORMULA)

1. Lens maker's formula is applicable to

A. Thin lenses and paraxial rays which subtend very small angles with the principal axis

B. Thick lenses and paraxial rays which subtend very small angels with the principles axis

C. Thin lenses and for marginal rays

D. Thick lenses and for marginal rays

Answer: A

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2. A spherical air bubble in water will act as

A. a convex lens

B. a concave lens

C. Plane glass plate

D. Plano-concave lens

Answer: B

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3. A liquid of refractive index 1.6 is introduced between two identical plano-convex lenses in two ways P and Q as shown. If the lens ma terial has refractive index 1.5, the combina tion is

A. convergent in both

B. divergent in both

C. convergent in Q only

D. convergent in P only

Answer: C

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4. If a convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens, then lens acts like a

A. concave lens

B. plane parallel glass plate

C. piano convex lens

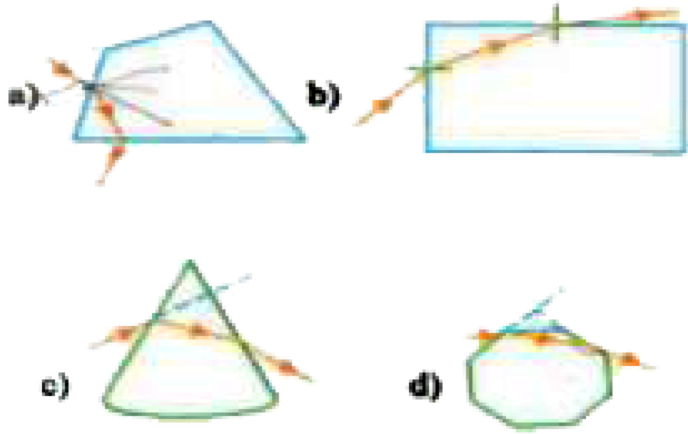
D. piano concave lens

Answer: B

Watch Video Solution

CUQ (PRISM)

1. Recognize the prism (s) among the given figures



A. bandc

B. c, aandb

C. only b

D. a, b, c, and d

Answer: D

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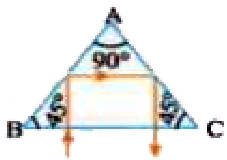
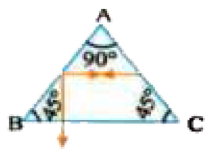
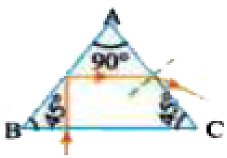
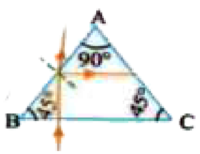
2. The refractive index of a material of a prism of angles $45^\circ - 45^\circ - 90^\circ$ is 1.5. The path of the ray of light incident normally on the hypotenuse side is shown in

A. 

B. 

C. 

D. 

Answer: A

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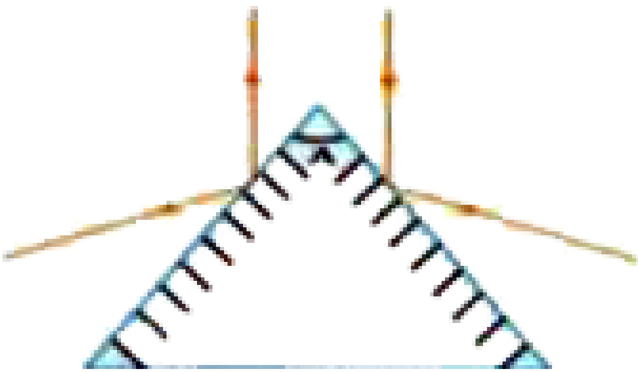
3. In the given figure,the angle between reflected ray is equal to :



A. A

B. 2A

C. 3A

D. 4A

Answer: B

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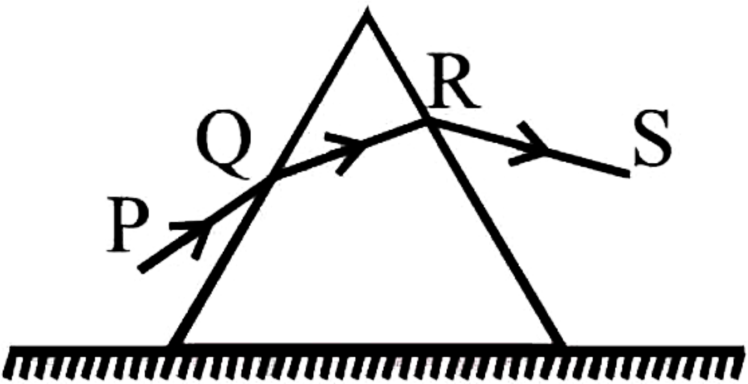
4. An equilateral prism is placed on a horizontal surface. A ray PQ is incident onto it.

For minimum deviation `



A. PQ is horizontal

B. QR is horizontal

C. RS is horizontal

D. Any one will be horizontal

Answer: B

Watch Video Solution

5. A prism produces a minimum deviation § in a light beam. If three such prisms are combined, the minimum deviation produced will be

A. 45

B. 25

C. 5

D. 0

Answer: C

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6. When a ray of light is refracted by a prism such that the angle of deviation is minimum, then

A. the angle of emergence is equal to the angle of incidence

B. the angle of emergence is greater than the angle of incidence

C. the angle of emergence is smaller than the angle of incidence

D. the sum of the angle of incidence and the angle of emergence is equal to 90°

Answer: A

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7. If a small angled prism, made of glass is immersed in a liquid of refractive index 1 and a ray of light is made incident on it, then

A. its deviation will be zero

B. it will suffer total reflection

C. the emergent ray is bent towards the edge of the prism

D. the emergent ray is bent towards the base of prism

Answer: D

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8. Three prisms 1, 2 and 3 have A = 6º, but refractive indices are 1.4, 1.5, 1.6 and their angles of deviation are $\delta_1, \delta_2\delta_3$ respectively. Then

A. $\delta_3 > \delta_2 > \delta_1$

B. $\delta_1 > \delta_2 > \delta_3$

C. $\delta_2 > \delta_1 > \delta_3$

D. $\delta_1 = \delta_2 = \delta_3$

Answer: A

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CUQ (DISPERSION)

1. When white light enters a prism, it gets split into its constituent colours. This is due to

A. high densityofprism material

B. bccause is different for different wavelength

C. diffraction of light

D. interference of light

Answer: B

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2. When a white light passes through a hollow prism, then there is

A. There is no dispersion and no deviation

B. Dispersion but no deviation.

C. Deviation but no dispersion

D. There is dispersion and deviation both

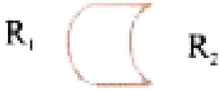
Answer: A

Watch Video Solution

3. Which one of the following does not exhibit dispersion

A. 

B. 

C. 

D. 

Answer: C

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4. In dispersion without deviation

A. The emergent rays of all the colours are parallel to the incident ray.

B. Yellow coloured ray is parallel to the incident ray

C. Only red coloured ray is parallel to the incident ray

D. All the rays are parallel, but not parallel to the incident ray

Answer: B

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5. In the visible region the dispersive powers and the mean angular deviations for crown and flint glass prisms are ω', ω' and d, d

respectively. The condition for getting deviation without dispersion when the two prisms are combined is

A. $\sqrt{\omega d}+\sqrt{\omega' d'}=0$

B. `omega' d + omegad'=0

C. $\omega d+\omega' d'=0$

D. $\omega d^2+(\omega' d')^2=0$

Answer: C

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6. In the achromatic prism, we have

A. deviation without dispersion

B. dispersion without deviation

C. refraction without deviation

D. deviation and dispersion

Answer: A

Watch Video Solution

7. The angular dispersion will be maximum in the following pairs of colours is :-

A. Yellow and green

B. Red and blue

C. Green and red

D. Blue and orange

Answer: B

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CUQ (DEFECTS OF EYE)

1. When objects at different distances are seen by the eye, which of the following remai constant?

A. The focal length of the eye lens

B. The object distance from the eye lens

C. The radii of curvature of the eye lens

D. The image distance from the eye lens

Answer: D

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2. Near and far points of a human eye are

A. 0 and 25 cm

B. 0 and infinity

C. 25cm and 100 cm

D. 25 cm and infinity

Answer: D

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3. The ability of eye to focus on both near and far objects is called

A. Presbyopia

B. Myopia

C. Hypermetropia

D. Power of accommodation

Answer: D

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4. The loss of ability of an eye to focus near and far objects, with the advancing age is called

A. Astigmatism

B. Presbyopia

C. Myopia

D. Hypermetropia

Answer: B

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5. The image formed on the eye retina is

A. virtual and inverted

B. virtual and erect

C. real and erect

D. real and inverted

Answer: D

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6. Myopia occurs due to

A. Increase in the focal length of eye lens

B. Decrease in the distance between retina and lens

C. Decrease in focal length of eye lens

D. Increase in the distance between retina and lens

Answer: C

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7. For a myopic (short-sighted) eye, rays from far distant objects are brought to focus at a point

A. on the retina

B. Behind the retina

C. In between eye lens and retina

D. At any position

Answer: C

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8. In the case of hyper metropia

A. image of a near object is formed behind the retina

B. the image of a distant object is formed inffont of the retina

C. a concave lens should be used for correction

D. a bifocal lens should be used for correction

Answer: A

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9. Long -sighted people who have lost their spectacles can still read a book by looking through a small (3-4mm) hole in a sheet of paper

A. Because the fine hole produces an image of the letters at a longer distance

B. Because in doing so, the distance of the object is increased

C. Because in doing so, the focal length of the eye lens is effectively decreased

D. Because in doing so, the focal length of the eye lens is effectively increased

Answer: C

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CUQ (OPTICAL INSTRUMENTS MICROSCOPES)

1. For which of the following colour, the magnifying power of a microscope will be maximum

A. White colour

B. Red colour

C. Violet colour

D. Yellow colour

Answer: C

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2. The magnifying power of a simple microscope can be increased, if we use eye-piece of

A. Higher focal length

B. Smaller focal length

C. Higher diameter

D. Smallcr diameter

Answer: B

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3. The angular magnification of a simple microscope can be increased by increasing :- 1 focal length of lens 2 size of object 3 aperture of lens 4 power of lens

A. Focal length of lens

B. Size of object

C. Aperture of lens

D. Power of lens

Answer: D

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4. When the length of a microscope tube increases, its magnifying power

A. decreases

B. increases

C. does not change

D. can't say

Answer: B

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5. In a compound microscope the image produced by the objective is

A. real enlarged and errect

B. real enlarged and inverted

C. Virtual enlarged and erect

D. Virtual, enlarged and inverted

Answer: B

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6. The magnifing power of a compoundmicroscope increases when

A. the focal length o fobjective lens is increased and that of eye lens is decreased

B. the focal length of eye lens is increased and that of objective lens in decreased

C. focal lengths of both objective and eye-piece are increased

D. focal lengths of both objective and eye-piece are decreased

Answer: D

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CUQ (OPTICAL INSTRUMENTS : TELESCOPES)

1. The optical instrument with zero power is

A. microscope

B. telescope

C. eyepiece

D. all the above

Answer: B

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2. The image formed by the telescope in normal adjustment position is at

A. D

B. 2D

C. F

D. infinity

Answer: D

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3. If the telescope is reversed .i.e., seen seen from the objective side, then

A. Object will appear very small

B. Object will appear very large

C. There will be no effect on the image formed by the telescope

D. Image will be slightly greater than the earlier one

Answer: A

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4. In an astronomical telescope the focal lengths of objective and eyepiece should respectively be

A. large and small

B. small and large

C. equal

D. too small are too large

Answer: A

Watch Video Solution

5. The magnifying power of an astronomical telescope can be increased, if we-

A. increase the focal length of the objective

B. increase the focal length of the eye-piece

C. decrease the focal length of the objective

D. decrease the focal length of the objective and at the same time increase the focal length of the eye piece

Answer: A

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6. The final image is an astronomical telescope is ....and ....with respect to the object [fill in the blank] .

A. real and errect

B. virtual and inverted

C. real and inverted

D. virtual and ertfect

Answer: B

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7. A photograph of the moon was taken with telescope. Later on, it was found that a housefly was sitting on the objective, lens of the telescope. In photograph A'

A. The image of housefly will be reduced

B. There is a reduction in the intensity of the image.

C. There is an increase in the intensity of the image

D. The image ofthe housefly will be enlarged

Answer: B

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8. In Gallilean telescope, the final image formed is

A. Real, erect and enlarged

B. Virtual, erect and enlarged

C. Real, inverted and enlarged

D. Virtual, inverted and enlarged

Answer: B

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CUQ (ASSERTION & REASON)

1. Assertion : Radius of curvature of a convex mirror is 20 cm. If a real object is placed at 10 cm from pole of the mirror, image is formed at infinity.

Reason : When object is placed at focus, its image is formed at infinity

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: D

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2. The angle of a prism is 60° and its refractive index is $\sqrt{2}$. The angle of minimum deviation suffered by a ray of light in passing through it is

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: B

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3. Assertion:Image formed by concave lens is not always virtual.

Reason:Image formed by a lens is real if the image is formed in the direction of ray of light with respect to the lens.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: B

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4. Assertion : Minimum deviation for a given prism does not depend on the refractive index μ, of the prism.

Reason : Deviation by a prism is given by $\delta = (i_1 + i_2 + A)$ and does not have the term μ.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: C

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5. Assertion : Critical angle of light while passing from glass to air is minimum for violet colour.

Reason : The wavelength of violet li^ht is greater than that of other colours

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation

of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: B

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6. Assertion: Different colours of light have same velocity in vacuum, but they have different t velocities in in any other transparent medium.

Reason : v = c/μ, where symbols have standard meanings. For different colours, refractive index, oftransparent medium has different values. Therefore, v is different

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: D

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7. Assertion : The minimum distance between an object and its real image formed by a convex lens is 2f.

Reason : The distance between an object and its real image is minimum when its magnification is - 1.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: D

Watch Video Solution

8. Assertion : A lens has tow principal focal lengths which may differ.

Reason : Light can fall on either surface of the lens. The two principal focal lengths differ when medium on the two sides have different refractive indices

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: A

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9. Assertion : The twinkling of star is due to rcfiectiop of light

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

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: D

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10. Assertion : In an electromagnetic wave, the elecric field E is much larger than magnetic field B.

Reason : The electromagnetic waves get

deflected in perpendicular electric field but not in a perpendicular magenetic field

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: C

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11. Assertion : If a convex lens of glass is immersed in water its power decreases.

Reason : In water it behaves as a concave lens.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: C

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12. STATEMENT-1 For observing traffic at our back, we prefers to use a convex mirror

$STATEMENT2$ A convex mirror has a more larger field of view than a plane mirror or concave mirror.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation

of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: A

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13. Assertion : A concave mirror of focal length f in air is used in a medium of refractive index 2. Then the focal length of mirror in medium becomes double.

Reason: The radius of curvature of a mirror is double of the focal length.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: D

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14. Assertion : When monochromatic light is incident on a surface separting two media, the reflected and refracted light both have the same frequency as the incident frequency.

Reason: The frequency of monochromatic light depends on media.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: C

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15. Assertion : The images formed by total internal reflections are much brighter than those formed by mirrorrs or lenses.

Reason : There is no loss of intensity in total internal reflection.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: A

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16. Assertion : The blue colour of sky is on account of scattering of sun light.

Reason : The intensity of scattered light varies inversely as the & fourth power of wavelength of the light.

A. If both assertion and reason are true and\ reason is a correct explanation of the assertion

B. If both assertion and reason are true but the reason is not a correct explanation

of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true

Answer: A

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EXERCISE - 1 (C.W)(REFLECTION)

1. Two plane mirrors are at 45° to each other. If an object is placed between them, then the number of images will be

A. 5

B. 9

C. 7

D. 8

Answer: C

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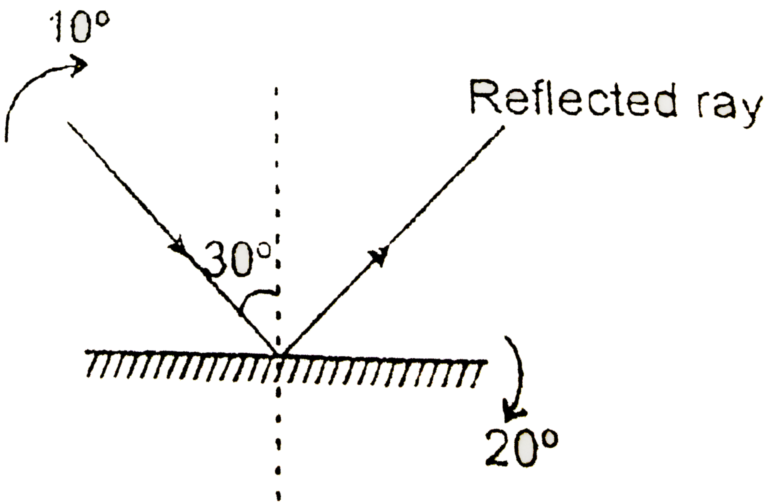
2. Figures shows a plane mirror on which a light ray is incident, if the incident light ray is turned by 10° and the mirror by 20° as shown, find the angle turned by the reflected ray.



A. 30º clockwise

B. 30º anticlockwise

C. 50° clockwise

D. 50° anticlock wise

Answer: A

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3. A small object is placed $10cm$ in front of a plane mirrorr. If you stand behind the object $30cm$ from the mirrorr and look at its image, the distance focused for your eye will be

A. 60 cm

B. 20 cm

C. 40 cm

D. 80 cm

Answer: C

Watch Video Solution

4. A concave mirror gives an image three times as large as the object placed at a distance of

20 cm from it . For the image to be real , the focal length should be-

A. 10 cm

B. 15 cm

C. 20 cm

D. 30 cm

Answer: B

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5. An object is placed at 20 cm from a convex mirror of focal length 10 cm. The image formed by the mirror is

A. Real and at 20 cm from the mirror

B. Virtual and at 20 cm from the mirror

C. Virtual and at $\frac{20}{3}$ cm from the mirror

D. Real and at $\frac{20}{3}$ cm from the mirror

Answer: C

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6. An object is placed at 10 cm infront of a concave mirror of radius of curvature 15 cm. The position of image(v) and its magnification (m) are

A. v = 30 cm, m=3 (real, inverted)

B. v = 20 cm, m = 3 (virtual, erect)

C. v = 10 cm, same size (real, inverted)

D. v= 10 cm, same size (virtual, erect)

Answer: A

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7. A 4.5 cm needle is placed 12 cm away from a convex mirror of focal length 15 cm. The position of image and the magnification respectively are

A. $3.33, \frac{5}{7}$

B. $6.7cm, 1.8$

C. 0.15 cm, 1.8

D. $6.7cm, \frac{5}{9}$

Answer: D

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8. A candle is placed 20cm from the surface of a convex mirror and a plane mirror is also placed so that the virtual images in the two mirrors coincide. If the plane mirror is 12 cm away from the object, what is the focal length of the convex mirror?

A. 5 cm

B. 10 cm

C. 20 cm

D. 40 cm

Answer: A

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9. The distance of real object when a concave mirror produces a real image of magnification 'm' is (f is focal length)

A. $\left(\frac{m-1}{m}\right)f$

B. $\left(\frac{m+1}{m}\right)f$

C. (m-1)f

D. (m+1)f

Answer: B

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EXERCISE - 1 (C.W)(REFRACTION)

1. If $._{i}\,\mu_{j}$ represents refractive index when a light ray goes from mefium i to medium j, then the product $._{2}\,\mu_{1} \times ._{3}\,\mu_{2} \times ._{4}\,\mu_{3}$ is equal to

A. ${}_{3}\mu_{1}$

B. ${}_{3}\mu_{2}$

C. $\dfrac{1}{{}_{1}\mu_{4}}$

D. ${}_{4}\mu_{2}$

Answer: C

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2. The refractive index of glass with respect to water is $\frac{9}{8}$. If the velocity and wavelength of light in water are $2.25 \times 10^{8} ms^{-1}$ and 5400 $\overset{o}{A}$, then the velcoity and wavelength of light in glass are

A. $2 \times 10^{8} ms^{-1}, 4800\overset{o}{A}$

B. $1 \times 10^{8} ms^{-1}, 6075\overset{o}{A}$

C. $2 \times 10^{8} ms^{-1}, 6075\overset{o}{A}$

D. $1 \times 10^{8} ms^{-1}, 4800\overset{o}{A}$

Answer: A

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3. A ray of light passes normally through a slab $\mu = 1.5$ of thickness t. If the speed of light in vaccum be c, then time taken by the ray to go across the slab will be

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

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

C. $\frac{2t}{3c}$

D. $\frac{4t}{9c}$

Answer: B

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4. The angle of incidence on the surface of a diamond of refractive index 2.4, if the angle between the reflected and refracted rays is 90° is

A. $\tan^{-1}(2.4)$

B. $2\sin^{-1}\left(\frac{1}{2.4}\right)$

C. $\tan^{-1}\left(\frac{1}{2.4}\right)$

D. $\cos^{-1}\left(\frac{1}{2.4}\right)$

Answer: A

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5. A bird in air is at a height 'y' from the surface of water. A fish is at a depth 'x' below the surface of water. The apparent distance of fish from the bird is (The refractive index of water is n)

A. $x+\frac{y}{\mu}$

B. $\mu x+y$

C. $\frac{x}{\mu}+y$

D. $\frac{x}{\mu}-y$

Answer: C

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6. A ray of light incident on a transparent block at an angle of incident 60°. If the refractive index of the block is 1.732, the angle of deviation of the refracted ray is

A. 15°

B. 25°

C. 30°

D. 45°

Answer: C

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

A. $\frac{36}{\sqrt{5}}$

B. $4\sqrt{5}$

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

D. $37\sqrt{7}$

Answer: C

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8. When a light ray is refracted from one medium into another, the wavelength changes from $4500\overset{o}{A}$ to $3600\overset{o}{A}$. The critial angle for a ray from second medium to first medium is

A. $\sin^{-1}\left(\frac{2}{13}\right)$

B. $\cos^{-1}\left(\frac{2}{3}\right)$

C. $\tan^{-1}\left(\frac{3}{2}\right)$

D. $\tan^{-1}\left(\frac{2}{\sqrt{5}}\right)$

Answer: D

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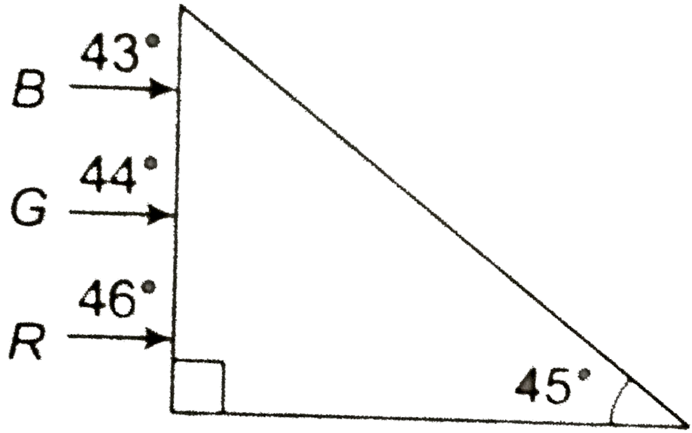
9. Figure shows a mixture of blue, green and red coloured rays incident normally on a right angled prism. The critical angles of the material of the prism for red, green and blue are 46°, 44° and 43° respectively. The arrangement will separate



A. Red from Green and Blue

B. Blue from Green and Red

C. Green from Red and Blue

D. All the colours

Answer: A

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10. A ray of light is incident at an angle of 60 ^ ○ on a $\sqrt{3}$cm thick plate (μ=$\sqrt{3}$) The shift in the path of the ray as it emerges out from the plate is (in cm)

A. 1

B. 1.2

C. 0.5

D. 1.8

Answer: A

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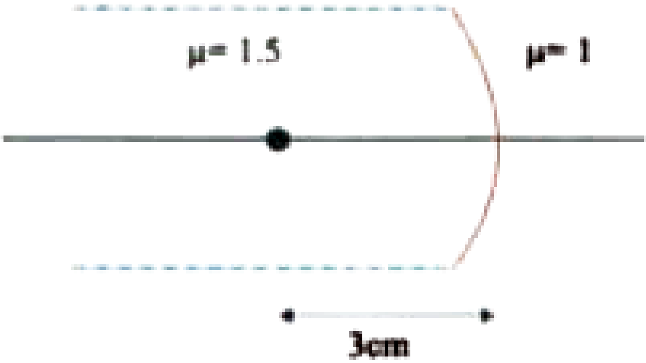
EXERCISE - 1 (C.W)(REFRACTION THROUGH SPHERICAL SURFACES)

1. An air bubble in glass (μ = 1.5) is situated at a distance 3 cm from a convex surface of diameter 10 cm as shown. The distance from surface at which the image of bubble appears is



A. 2.5cm

B. 5cm

C. 4cm

D. 1.5cm

Answer: A

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EXERCISE - 1 (C.W)(LENSES)

1. Two thin lenses of powers $2D$ and $3D$ are placed in contact. An object is placed at a distance of 30 cm from the combination The distance in cm of the image from the combination is

A. 30

B. 40

C. 50

D. 60

Answer: D

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2. A symmetric doule convex lens is cut in two equal parts by a plane containing the pricipal axis. If the power of the original lens was 4D, the power of a cut lens will be

A. 2D

B. 3D

C. 4D

D. 5D

Answer: A

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3. A parallel beam of monochromatic light falls on a combination of a convex lens and a concave lens of focal lengths 15 cm and 5 cm respectively. What is the distance between the two lenses to obtain a parallel beam of light from the concave lens ?

A. 20cm

B. 3cm

C. 10cm

D. 45cm

Answer: C

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4. Two thin lenses, when in contact, produce a combination of power $+10$ dioptres. When they are $0.25m$ apart, the power is reduced to $+6$ dioptres. The power of the lenses in dioptres, are

A. 1 and 9

B. 2 and 8

C. 4 and 6

D. 5,5

Answer: B

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5. A beam of light converges at a point P. Now a convex lens of focal length 30 cm placed in the path of the convergent beam 12 cm from P. The point at which the beam converges now is

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6. a convex lens of power $+6$ dioptre is placed in contact with a concave lens of power -4

dioptre. What will be the nature and focal length of this combination?

A. Concave, 25 cm

B. Convex, 50 cm

C. Concave, 20 cm

D. Convex, 100 cm

Answer: B

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7. The radius of curvature of the convex surface of a thin plano-convex lens is 15 cm and the refractive index of its material is 1.6. The power of the lens is

A. $+1D$

B. -2D

C. $+3D$

D. $+4D$

Answer: D

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8. v31

A. 9 cm

B. 18 cm

C. 20 cm

D. 22 cm

Answer: D

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9. The refractive index of the material ofa double convex lens is 1.5 and its focal length is 5 cm. If the radii of curvature are equal, the value of the radius of curvature (in cm) is

A. 5

B. 6.5

C. 8

D. 9.5

Answer: A

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10. A diverging meniscus lens of 1.5 refractive index has concave surfaces of radii 3 and 4 cm. The position of image if an object is placed 12cm infront of the lens is

A. $-24cm$

B. $-8cm$

C. $8cm$

D. 24cm

Answer: B

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EXERCISE - 1 (C.W)(REFRACTION THROUGH PRISM)

1. A prism has a refracting angle of 60°. When placed in the position of minimumm deviation, it produces a deviation of 30°. The angle of incidence is,

A. 30°

B. 45°

C. 15^{o}

D. 60^{o}

Answer: B

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2. Light falls at normal incidence on one face of a glass prism of refractive index $\sqrt{2}$. Then the angle of emergence when the angle of the prism is 45°

A. 45°

B. 60°

C. 15°

D. 90°

Answer: D

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3. If a light ray incidents normally on one of the faces of the prism of refractive index 2 and the emergent ray just grazes the second face of the prism, then the angle of deviation is

A. 0°

B. 30°

C. 60°

D. 90°

Answer: C

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4. A ray of light passes through an equilateral prism (refractive index 1.5) such that angle of incidence is equal to angle of emergence and the latter is equal to $3/4th$ of the angle of prism. Calculate the angle of deviation.

A. 0º

B. 30º

C. 60º

D. 45º

Answer: D

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5. 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.

A. $2.121 \times 10^{8} ms^{-1}$

B. $1.50 \times 10^{8} ms^{-1}$

C. $1.25 \times 10^{8} ms^{-1}$

D. $1.75 \times 10^{8} ms^{-1}$

Answer: A

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6. A prism of angle 4° gives a deviation of 2.4°. The refractive index of the material of the prism is

A. 1.6

B. 1.7

C. 1.8

D. 1.9

Answer: A

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EXERCISE - 1 (C.W)(DISPERSION BY A PRISM)

1. A thin prism P_1 of angle 4^0 and refractive index 1.54 is combined with another thin prism P_2 of refractive index 1.72 to produce dispersion without deviation.The angle of prism P_2 is

A. 4°

B. 5.33

C. 2.6°

D. 3°

Answer: D

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2. A crown glass prism with refracting angle 5° is to be achromatised for red and blue light with flint glass prism. Angle of the flint glass prism should be (Given for grown glass μ_r -1.513, μ_b= 1.523, for flint glass $\mu_r = 1.645, \mu_b = 1.665)$

A. 1.5°

B. 3°

C. 2.4°

D. 4.5°

Answer: B

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3. If the ratio of dispersive powers of the materials of two prism is 2:3 and ratio of angular dispersions produced by them is 1:2 then the ratio of mean deviation produced by them is

A. $4:3$

B. $3:4$

C. $1:3$

D. $3:1$

Answer: B

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4. Dispersive power of the material of prism is 0.0221 . If the deviation produced by it for yellow colour is 38^ ○ then the angular dispersion between red and violet colours is

A. 0.65°

B. 0.84°

C. 0.48°

D. 1.26°

Answer: B

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EXERCISE - 1 (C.W)(DEFECTS OF THE EYE)

1. A person can see clearly upto 1 m. The nature and power of the lens which will enable him to see things at a distance of 3 m is

A. concave, -0.66 D

B. convex, -0.66 D

C. concave, -0.33D

D. convex, -0.33D

Answer: A

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2. The far point of a myopic eye is 10 cm from the eye. The focal length of a lens for reading at normal distance (25cm) is

A. $-8.55cm$

B. $-16.7cm$

C. $-35.4cm$

D. $-32.7cm$

Answer: B

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3. A person can see clearly objects between 15 and 100 cm from his eye. The range of his vision if he wears close fitting spetancles having a power of -0.8 diopter is

A. 5 to 500 cm

B. 12 to 250 cm

C. 17 to 500 cm

D. 17 to 250 cm

Answer: C

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EXERCISE - 1 (C.W)[OPTICAL INSTRUMENTS (MICROSCOPES)]

1. Which of the following quantities can be measured using only a trayelling microscope

A. Refractive index of a glass slab

B. Refractive index of a prism

C. Refracting angle of a prism

D. Refractive index a small drop of water

Answer: A

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2. The focal length of a convex lens is "10cm.Find its magnifying power when it is used as a magnifying glass to form the image at (i) near point and (ii) far point

A. 3.5, 2.5

B. 2.5,3.5

C. 2.5,1.5

D. 1.5,2.5

Answer: A

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3. A magnifying glass is made of a combination of a convergent lens of power 20D and divergent lens of power 4D. If the least distance of distinct vision is 25cm. The magnifying power is

A. 7

B. 5

C. 3

D. 4

Answer: B

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4. Four lenses A, B, C and D power +100D, -50 D, 20 D and 5 D. Which lenses will you use to design a compound microscopefbr best v? ' magnification ?

A. A and C

B. B and D

C. C and D

D. Aand B

Answer: A

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5. The objective lens of a compound microscope produces magnification of 10. In order to get an overall magnification of 100 when image is formed at $25cm$ from the eye, the focal length of the eye lens should be

A. 4

B. 10

C. $\frac{25}{9}$

D. 9

Answer: C

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6. A compound microscope has a magnifying power of 100 when the image is formed at infinity. The objective has focal length $0.5cm$

and the tube length is $6.5cm$. Find the focal length of the eye-piece.

A.)2 cm

B. 2.5 cm

C. 3.25 cm

D. 4cm

Answer: C

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EXERCISE - 1 (C.W)[OPTICAL INSTRUMENTS (TELESCOPES)]

1. The focal lengths of the eyepiece and the objective of an astronimical telescope are 2 cm and 100 cm respectively. The magnifying power of the telescope for normal adjustment and the length of the telescope is

A. 50, 102 cm

B. 100, 204 cm

C. 25, 62 cm

D. 75, 125 cm

Answer: A

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2. The magnifying power of an astronomical telescope is 5, the focal power of its eye piece is 10 diopters. The focal power of its objective (in diopters) is

A. 1

B. 2

C. 3

D. 4

Answer: B

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3. The magnifying power of terrestrial telescope is 25 when it is in normal adjustment and the length of the telescope is 124 cm. If the focal length of the erecting lens is 5 cm, the focal lengths of the objective and the eye-piece are respectively.

A.) 50 cm, 2 cm

B. 50 cm, 2.5 cm

C. 100 cm, 4 cm

D. 100 cm, 5 cm

Answer: C

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EXERCISE-1 (H.W)(REFLECTION)

1. A ray reflected successively from two plane mirrors inclined at a certain angle $(< 90^\circ)$ undergoes a deviation of 300° . The number of images observable are:

A. 60

B. 12

C. 11

D. 5

Answer: C

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2. If a plane mirror is rotated in its ownplane through an angle of 20^{o} keeping the incident ray direction fixed, then the angle through which the reflected ray turns is

A. 40°

B. 0°

C. 20°

D. 10°

Answer: B

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3. A man runs towards a mirror at a rate of 6m s^{-1}. If the mirror is at rest, his image will have a velocity (with respect to man)

A. $+12ms^{-1}$

B. $-6ms^{-1}$

C. $6ms^{-1}$

D. $-12ms^{-1}$

Answer: D

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4. A real image formed by a concave mirror is 4.5 times the size of the object. If the mirror is 20 cm from the object, its focallength is

A. $\frac{90}{11}$ cm

B. $\frac{120}{11}$ cm

C. $\frac{150}{11}$ cm

D. $\frac{180}{11}$ cm

Answer: D

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5. A point object is placed at a distance of 30 cm from a convex mirror of focal length 30 cm. The image will form at

A. Infinty

B. Focus

C. Pole

D. 15 cm behind the mirror

Answer: D

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6. An obj ect is placed at 5 cm infront of a concave mirror of radius of curvature 15 cm. The position of image (v) and its magnification (m) are

A. v = 15 cm, m = 3 (virtual, erect)

B.) v = 5 cm, same size (virtual, erect)

C. v = 5 cm, same size (real, inverted)

D. v = 15 cm, m = 3 (real, inverted)

Answer: A

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7. An obejct is placed at a distance $2f$ from the pole of a convex mirror of focal length f. The linear magnification is

A. $\frac{1}{3}$

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

C. $\frac{3}{4}$

D. 1

Answer: A

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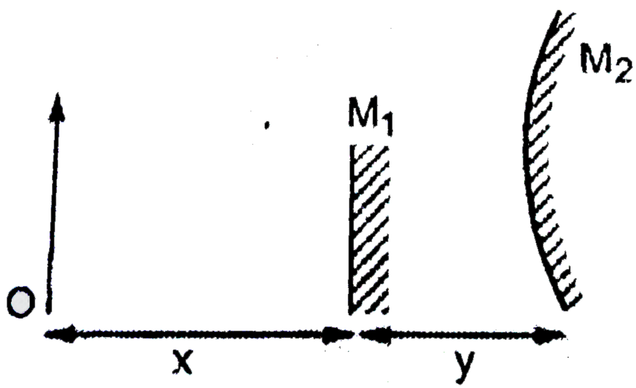
8. 

An object O is placed in front of a small plane mirror M_1 and a large convex mirror M_2 of focal length f. The distance between O and M_1 is x, and the distance between M_1 and M_2 is y. The images of O forned by M_1 and M_2 coincide. The magnitude of f is

A. x-y

B. $\frac{x^2 - y^2}{2y}$

C. $x^2 + y^2 \frac{)}{2y}$

D. $\frac{x^2 + y^2}{x + y}$

Answer: B

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EXERCISE-1 (H.W)(REFRACTION)

1. The refractive indices of glass and water are $\frac{3}{2}$ and $\frac{4}{3}$ respectively. The refractive index of glass with respect to water is

A. 2

B. $\frac{8}{9}$

C. $\frac{9}{8}$

D. $\frac{5}{3}$

Answer: C

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2. Velocity of light in glass whose refractive index with respect to air is 1.5 is $2 \times 10^8 m / s$ and in certain liquid the velocity of light found to be $2.5 \times 10^8 m / s$. The refractive index of the liquid with respect to air is

A. 0.64

B. 0.8

C. 1.2

D. 1.44

Answer: C

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3. The optical path of monochromatic light is the same if it goes through 2 cm of glass or x cm of ruby. If the refractiveTndex of glass is 1.510 and that of ruby is 1.760, then x is

A. 1.716cm

B. 1.525cm

C. 2.716cm

D. 2.525cm

Answer: A

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4. The reflected and refracted rays are observed to be perpendicular to each other, when ray of light is incident at an angle of 60°

on a transparent block. The refractive index of the block is

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

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

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

D. $\sqrt{3}$

Answer: D

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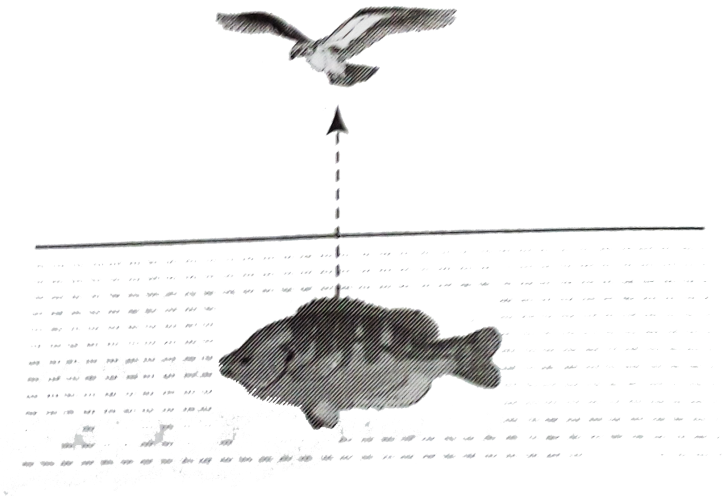
5. A fish rising up vertically toward the surface of water with speed $3ms^{-1}$ observes a bird diving down vertically towards it with speed $9ms^{-1}$. The actual velocity of bird is



A. $9.2ms^{-1}$

B. $4.5ms^{-1}$

C. $9ms^{-1}$

D. $3.2ms^{-1}$

Answer: B

Watch Video Solution

6. If angle of incidence is twice the angle of refraction in a medium of refractive index μ, then angle of incidence is

A. $\cos^{-1}\left(\frac{\mu}{2}\right)$

B. $\sin^{-1}\left(\frac{\mu}{2}\right)$

C. $2\sin^{-1}\left(\frac{\mu}{2}\right)$

D. $2\cos^{-1}\left(\frac{\mu}{2}\right)$

Answer: D

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7. A glass cube of edge 1 cm and μ =1.5 has a sopt at the centre. The area of the cube face that must be covered to prevent the spot from being seen is (in cm^2)

A. $\sqrt{5}\pi$

B. 5π

C. $\frac{\pi}{\sqrt{5}}$

D. $\frac{\pi}{5}$

Answer: D

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8. The velocities of light in two different media are 2*10^8m/s and 2.5 * 10^8m/s respectively.The critical angle for these media is sin^(-1)((1)/(5))

sin^(-1)((4)/(5))

A. $\sin^{-1}\left(\frac{1}{5}\right)$

B. $\sin^{-1}\left(\frac{4}{5}\right)$

C. $\sin^{-1}\left(\frac{1}{2}\right)$

D. $\sin^{-1}\left(\frac{1}{4}\right)$

Answer: B

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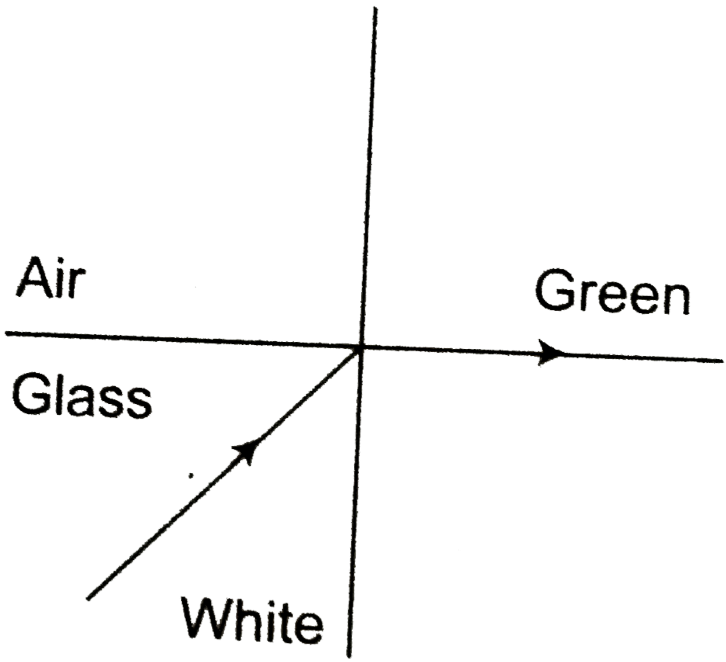
9. White light is incident on the interface of glass and air as shown in figure. If green ligth is just totally internally reflected then the emerging ray in air contains



A. Yellow, orange, red

B. Violet, indigo, blue

C. All colours

D. All colours except green

Answer: A

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10. A ray of light is incident on a glass plate. The light ray travels distance of 5 cm inside the glass plate before emerging out of the glass plate. If the incident ray suffers a deviation of 30^{o}, the perpendicular distance between incident and the emergent ray is

A. 5cm

B. 2.5cm

C. 7.5cm

D. 10cm

Answer: B

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EXERCISE-1 (H.W)(REFRACTION THROUGH SPHERICAL SURFACES)

1. Light from a point source in air falls on a spherical glass surface. If $\mu = 1.5$, and radius of curvature $= 20cm$, the distance of light source from the glass surface is $100cm$, at what position will the image be formed ? (NCERT Solved Example)

A. 50cm

B. 100cm

C. 125cm

D. 25cm

Answer: B

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EXERCISE-1 (H.W)(LENSES)

1. A divergent lens produces an image of magnification 0.5 when the object distance is 10 cm. The focal power of the lens (in diopters)

A. $+4$

B. -4

C. $+10$

D. -10

Answer: D

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2. A symmetrical biconvex lens of focal length f is cut into four identical pieces along its principal axis and to the perpendicular to principal axis. The focal length of one of four pieces is

A. $\frac{f}{4}$

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

C. $2f$

D. $4f$

Answer: C

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3. A convex lens of focal length 20cm and a concave lens of focal length f are mounted coaxially 5cm apart. Parallel beam of light incident on the convex lens emerges from the concave lens as a parallel beam. Then, f in cm is

A. 30 cm

B. 25 cm

C. 15 cm

D. 50 cm

Answer: C

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4. Two lenses of power $-15D$ and $+5D$ are in contact with each other. The focal length of the combination is

A. $+10cm$

B. $-20cm$

C. $-10cm$

D. $+20cm$

Answer: C

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5. A beam of light converges at a point P. Now a concave lens of focal length -16 cm is placed in the path of the convergent beam 12 cm from P The point at which the beam converges now is

A. 6.86cm right side of the lens

B. 6.86cm left side of the lens

C. 48cm right side of the lens

D. 48cm left side of the lens

Answer: C

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6. If in a plano-convex lens, the radius of curvature of the convex surface is 10 cm and the focal length of the lens is 30 cm , then the refractive index of the material of lens will be

A. 3

B. 1.5

C. 1.66

D. 1.33

Answer: D

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7. Focal length of a lens is 0.12 m and refractive index is 1.5. Focal length of the same lens for blue colour is 0.1m. Theh refractive index of the lens for blue colour is

A. 1.51

B. 1.25

C. 1.49

D. 1.6

Answer: D

8. The focal length of a biconvex lens is 20 cm and its refractive index is 1.5. If the radii of curvatures of two surfaces of lens are in the ratio 1:2, then the larger radius of curvature is (in cm)

A. 10

B. 15

C. 20

D. 30

Answer: D

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9. The radii of curvature of the two surfaces of a lens are 20 cm and 30 cm and the refractive index of the material of the lens is 1.5. If the lens is concave -convex, then the focal length of the lens is

A. 24 cm

B. 10 cm

C. 20 cm

D. 24cm

Answer: C

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EXERCISE-1 (H.W)(REFRACTION THROUGH PRISM)

1. The angle of a prism is 30°. The rays incident at 60° on one refracting face suffer a deviation of 30°. Then the angle of emergence is :

A. 0°

B. 30°

C. 60°

D. 90°

Answer: A

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2. Light falls on a prism grazing along first surface of a prism and the emergent ray is normal to the 2nd face of the prism. If D is angle of deviation then the refracting angle of the prism i

A. 90-2D

B. 90-D

C. $90 - \frac{D}{2}$

D. $180 - 2D$

Answer: B

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3. A ray of light is incident normally on one of the refracting surfaces of a prism of refracting angle A,. The emergent ray grazes the other refracting surface. Find the refractive index of the material ofprism.

A. 1.155

B. 1.75

C. 1.33

D. 1.66

Answer: A

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4. A ray of light is incident at 60° on one face of a prism of angle 30° and the emergent ray makes 30° with the incident ray. The refractive index of the prism is

A. $\frac{\sqrt{3}}{4}$

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

C. $\sqrt{3}$

D. $2\sqrt{3}$

Answer: C

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5. When light rays are incident on a prism at an angle of 45°, the minimum deviation is obtained. If refractive index of the material of prism is $\sqrt{2}$, then the angle of prism will be

A. 30°

B. 45°

C. 60°

D. 90°

Answer: C

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6. A thin prism deviates an incident ray by 3.2°. If the refractive index of the prism is 2.6 then the angle of prism is

A. 1°

B. 2°

C. 3°

D. 4°

Answer: B

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EXERCISE-1 (H.W)(DISPERSION BY A PRISM)

1. A crown glass prism and a flint glass prism are combined to produce dispersion without deviation. Mean refractive indices of crown , and flint glass are respectively 1.5 and 1.6. Ratio of angle of crown glass prism to that of flint prism is

A. 1.06

B. 0.9375

C. 1.2

D. 1.5

Answer: C

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2. A crown glass prism of angle 5 0 is to be combined with a flint glass prism in a such a way that the dispersion is zero.The refractive indices for violet and red lights are 1.523 and 1.514 respectively for crown glass and for flint glass are 1.632 and 1.614, then the angle of the flint glass prism is

A. 10°

B. 2.5°

C. 2°

D. 5.45°

Answer: B

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3. In an achromatic combination of two prisms, the ratio of the mean deviations produced by V the two prisms is 2:3, the ratio of their dispersive power is

A. $3:2$

B. $3:2$

C. $1:1$

D. $4:9$

Answer: B

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4. The angles of minimum deviations are 530 and 51° for blue and red colours respectively produced in an equilateral glass prism. The dispersive power is

A. $\frac{51}{26}$

B. $\frac{1}{26}$

C. $\frac{1}{52}$

D. $\frac{1}{51}$

Answer: B

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EXERCISE-1 (H.W)(DEFECTS OF THE EYE)

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

A. 2D

B. 4D

C. 8D

D. 1D

Answer: A

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2. A person wears glasses of power $-2.5D$. Is the person short sighted or long sighted ? What is the far point of the person without glasses ?

A. long-sighted, -40 cm

B. near-sightcd, -40 cm

C. near-sighted, -20 cm

D. long-sighted, -20 cm

Answer: B

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3. A long sighted person has a least distance of distinct vision of 50 cm. He wants to reduce to 25 cm. He should use a

A. concave lens of focal length 50 cm

B. convex of focal length 25 cm

C. convex lens of focal length 50 cm

D. concave lens of focal length 25 cm

Answer: C

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EXERCISE-1 (H.W)(OPTICAL INSTRUMENTS(MICROSCOPES))

1. The maximum magnification that can be obtained with a convex lens of focal length 2.5 cm is (the least distance of distinct vision is 25 cm)

A. 10

B. 0.1

C. 62.5

D. 11

Answer: D

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2. A convergent lens of power 16D is used as a simple microscope. The magnification produced by the lens, when the final image is formed at least distance of distinct vision is

A. 6

B. 4

C. 7

D. 5

Answer: D

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3. The compound microscope is of magnifying power is 100.The magnifying power of its eyepiece " is 4.Then magnifying power of objective is

A. 25

B. 20

C. 15

D. 30

Answer: A

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4. The magnification produced by the objective lens of a compound microscope is 25. The focal length of eye piece is 5 cm and it forms find image at least distance of distinct vision. The magnifying power of the compound microscope is

A. 19

B. 31

C. 150

D. $\sqrt{150}$

Answer: C

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5. The length of the tube of a compound microscope 15 cm. The focal length of objective and eye lenses are 1 cm and 5 cm respectively. The magnifying power of microscope for relaxed vision is

A. 50

B. 75

C. 25

D. 100

Answer: B

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EXERCISE-1 (H.W)(OPTICAL INSTRUMENTS(TELESCOPES))

1. The magnifying power of an astronomical telescope for relaxed vision is 16. On adjusting, the distance between the objective and eye lens is 34 cm . Then the focal length of objective and eye lens will be respectively

A. 17 cm, 17 cm

B. 20 cm, 14 cm

C. 32 cm, 2 cm

D. 30 cm, 4 cm

Answer: C

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2. Astronomial telescope has two lenses of focal power 0.5D and 20D. Then its magnifying power is:

A. 40

B. 30

C. 20

D. 8

Answer: A

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3. The objective of a small telescope has focal length 120 cm and diameter 5 cm. The focal length of the eye piece is 2 cm. The magnifying power of the telescope for distant object is -

A. 12

B. 24

C. 60

D. 300

Answer: C

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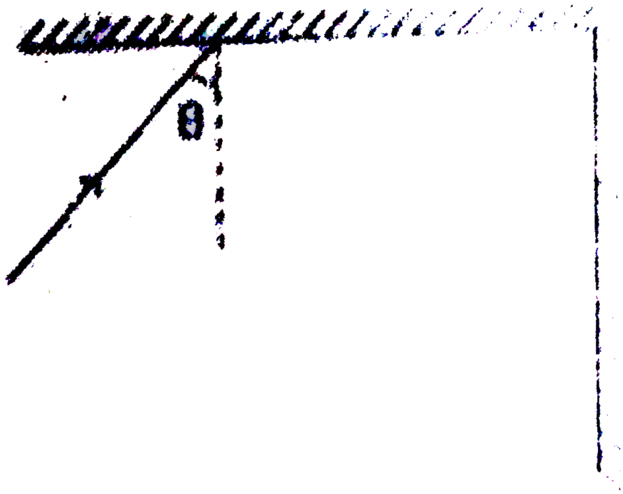
EXERCISE-2 (C.W)(REFLECTION)

1. Two plane mirrors are arranged at right angles to each other as shown in figure.A ray of light is incident on the horizontal mirror at an angle θ. For what value of $\theta$the ray emerges parallel to the incoming ray after reflection from the vertical mirror ?



A. 60°

B. 30°

C. 45°

D. all of these

Answer: D

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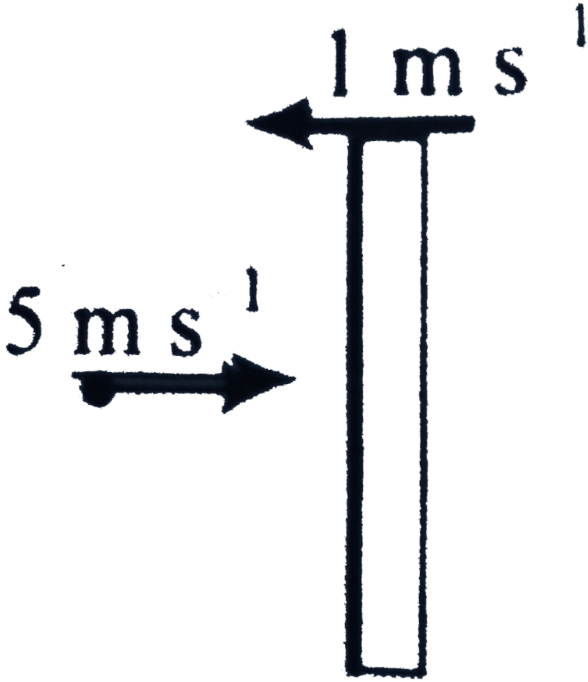
2. An object moves with $5ms^{-1}$ toward right while the mirror moves with $1ms^{-1}$ toward the left as shown in Figure. Find the velocity of image.



A. 7m/s towards left

B. 7m/s towards right

C. 5 m/s towards right

D. 5 m/s towards left

Answer: A

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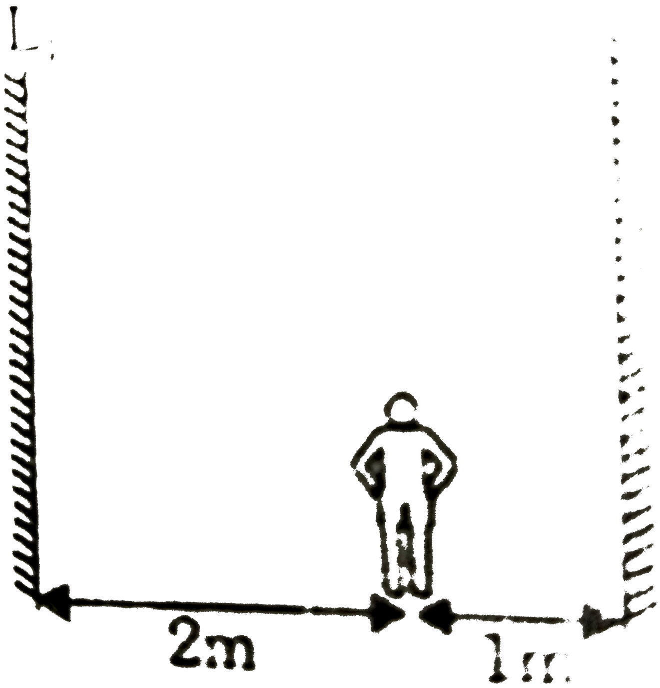
3. Two mirror labelled L_1 for left mirror and L_2 for right mirror (L_2) looks into this mirror and sees a series of images. The second nearest image seen in the right mirror is situated at a distance:



A. 2.0 m from the person

B. 4.0 m from the person

C. 6.0 m from the person

D. 8.0 m from the person

Answer: C

Watch Video Solution

4. A ray of light is incident at 50° on the middle of one of the two mirrorrs arranged at an angle of 60° between them . The ray then touches the second mirrorr, get reflected back to the first mirrorr, making an angle of incidence of

A. 50°

B. 60°

C. 70°

D. 80°

Answer: C

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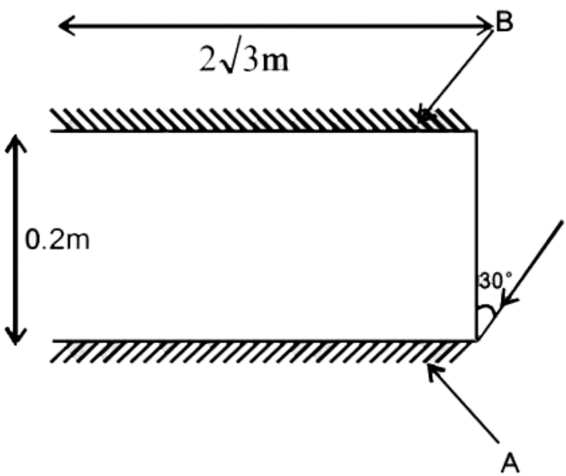
5. Two plane mirrors A and B are aligned parallel to each other, as shown in the figure. A light ray is incident at an angle 30degree at a point just inside one end of A. The plane of incidence coincides with the plane of the figure. The maximum number of times the ray undergoes reflections (including the first one) before it emerges out is



A. 28

B. 30

C. 32

D. 34

Answer: B

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6. With a concave mirror, an object is placed at a distance x_1 from the princiipal focus, on the principal axis. The image is formed at a distance x_2 from the principal focus. The focal length of the mirror is

A. x_1x_2

B. $\frac{x_1 + x_2}{2}$

C. $\sqrt{\frac{x_1}{x_2}}$

D. $\sqrt{x_1x_2}$

Answer: D

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7. A short linear object of length b lies along the axis of a concave mirror or focal length f at a distance u from the pole of the mirror. The size of the image is approximately equal to

A. $b\left(\frac{u-f}{f}\right)^{\frac{1}{2}}$

B. $b\left(\frac{f}{u-f}\right)^{1/2}$

C. $\left(\frac{u-f}{f}\right)$

D. $b\left(\frac{f}{u-f}\right)^{2}$

Answer: D

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8. A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that the end closer to the pole is 20 cm away from it. Find the length of the image.

A. 5 cm

B. 10 cm

C. 15 cm

D. 20 cm

Answer: A

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9. A car is fitted with a convex side-view mirror of focal length 20 cm. A second car 2.8m behind the first car is overtaking the first car at a relative speed of 15 $\frac{m}{s}$. The speed of the image of the second car as seen in the mrror of the first one is:

A. $\frac{1}{15}m/s$

B. 10m/s

C. 15m/s

D. $\frac{1}{10}\frac{m}{s}$

Answer: A

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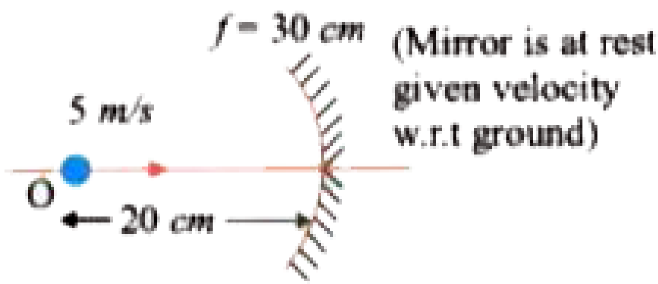
10. The velocity of image w.r.t ground in the below figure is



A. 45 m/s and approaches the mirror

B. 45 m/s and moves away from the mirror

C. 60 m/s and approaches the mirror

D. 60 m/s and moves away from the mirror

Answer: A

Watch Video Solution

11. A square wire of side $3.0cm$ is placed $25cm$ away from a concave mirror of focal length $10cm$. What is the area enclosed by the image of the wire ? The centre of the wire is on the axis of the mirror, with its two sides normal to the axis.

A. $7.5cm^2$

B. $6.0cm^2$

C. $4.0cm^2$

D. $3.0cm^2$

Answer: C

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12. An object is moving towards a concave mirror of focal length 24 cm. When it is at a distance of 60 cm from the mirror, its speed is $9 cm / s$. The speed of its image at that instant , is

A. 4 cm/s towards the mirror

B. 9 cm/s towards the mirror

C. 4 cm/s away from the mirror

D. 9 cm/s away from the mirror

Answer: C

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13. The distance between an object and its doubly magnified image by a concave mirror is: [Assume f= focal length]

A. 3 f/2

B. 2 f/3

C. 3f

D. depends on whether the image is real or virtual

Answer: A

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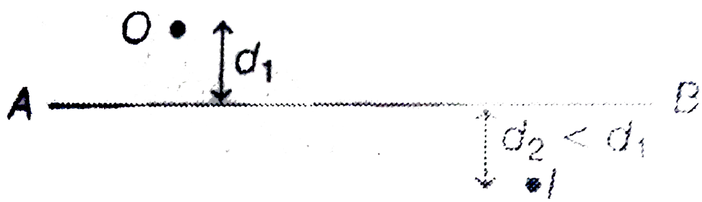
14. In the figureshownm the image of a real object is formed at point I. AB is the principal axis of the mirror. The mirror must be



A. concave and placed towards right of I

B. concave and placed towards left of O

C. convex and placed towards right of 1

D. convex and placed towards left of I

Answer: B

Watch Video Solution

15. A ray of light is incident on a plane mirror along a vector $\hat{i}+\hat{j}-\hat{k}$.

The normal on incidence point is along $\hat{i}+\hat{j}$ .Find a unit vector along the reflected ray.

A. $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$

B. $-\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$

C. $\frac{1}{\sqrt{3}}\left(-\hat{i}-\hat{j}+\hat{k}\right)$

D. $\frac{1}{\sqrt{3}}\left(-\hat{i}+\hat{j}+\hat{k}\right)$

Answer: B

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16. A plot of modulus of image distance versus object distance for a spherical mirror is a:

A. Straight Line

B. Circle

C. Parabola

D. Hyperbola

Answer: D

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17. A small plane mirror kept at the centre of a sphere of diameter 3 m, makes 12 revolution per second. A thin light beam is made incident on the mirror. The linear speed of the light spot on the sphere, formed after reflection-from the mirror is:

A. 18π m/s

B. 36π m/s

C. 72πm/s

D. 144πm/s

Answer: C

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18. A man 'A' stands at the position shown in the figure and a second man 'B' approaches the mirror along the line perpendicular to it which passes through its centre. At the moment when 'A' and 'B' first see each other in the mirror, the distance of B from the mirror is:

A. 0.25 m

B. 0.5m

C. 0.75m

D. lm

Answer: B

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EXERCISE-2 (C.W)(REFRACTION)

1. A monochromatic light passes through a glass slab $\left(\mu = \frac{3}{2}\right)$ of thickness 90 cm in time t_1. If it takes a time t_2 to travel the same distance through water $\left(\mu = \frac{4}{3}\right)$. The value of $(t_1 - t_2)$ is

A. 5×10^{-11} sec

B. 5×10^{-8}sec

C. 2.5×110^{-10} sec

D. 5×10^{-10} sec

Answer: A

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2. A glass slab of thickness 4cm contains the same number of waves as 5 cm of water when both are traversed by the same monochromatic light. If the refractive index of water is $\frac{4}{3}$, then hat of glass is

A. $\frac{5}{3}$

B. $\frac{5}{4}$

C. $\frac{16}{15}$

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

Answer: A

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3. When light of wavelength $4000\overset{o}{A}$ in vacuum travels through the same thickness in air and vacuum the difference in the number of waves is one. Find the thickness (μ_{air} =1.0008).

A. 0.5mm

B. 1mm

C. 18cm

D. 24cm

Answer: A

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4. The refractive index denser medium with respect to rarer medium is 1.125 The difference between the velocities of light in the two media is $0.25 \times 10^8 \frac{m}{s}$.Find the velocities of light in the two media and their refractive indices $c = 3 \times 10^8 \frac{m}{s}$

A. $2.0 \times 10^{0}8m / s, 2.25 \times 10^{8}m / s$

,1.500,1.333

B. $2.5 \times 10^{0}8m / s, 2.25 \times 10^{8}m / s$

,1.500,1.333

C. $2.0 \times 10^{0}8m / s, 2.25 \times 10^{8}m / s$

,1.333,1.500

D. $2.5 \times 10^{0}8m / s, 2.0 \times 10^{8}m / s$

,1.500,1.333

Answer: A

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5. A ray of light is travelling from medium 'A' into a rarer medium B. The angle of incidence ^siS 45° and the angle of deviation is 15° . The refractive index of medium A w.r.to B is

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

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

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

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

Answer: A

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6. The x-z plane separates two media A and B of refractive indices $\mu_1 = 1.5$ and $\mu_2 = 2$. A ray of light travels from A to B. Its directions in the two media are given by unit vectors $u_1 = a\hat{i} + b\hat{j}$ and $u_2 = c\hat{i} + a\hat{j}$. Then

A. $\dfrac{a}{c} = \dfrac{4}{3}$

B. $\dfrac{a}{c} = \dfrac{3}{4}$

C. $\dfrac{b}{d} = \dfrac{4}{3}$

D. $\frac{b}{d} = \frac{3}{4}$

Answer: A

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7. A cube of side 15 cm is having an air bubble. The bubble appears at 6 cm from one face and at 4 cm from opposite face. The refractive index of cube is

A. $\frac{5}{2}$

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

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

D. $\frac{2}{5}$

Answer: B

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8. Refractive index of a rectangular glass slab is $\mu = \sqrt{3}$. Alight ray incident at an angle 60° is displaced laterally through 2.5 cm. Distance travelled by light in the slab is

A. 4 cm/s towards the mirror

B. 5cm

C. $2.5\sqrt{3}$ cm

D. $3cm$

Answer: B

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9. A beaker contains water up to a height h_1 and kerosene of height h_2 above water so that the total height of (water + kerosene) is

$(h_1 + h_2)$. Refractive index of water is μ_1 and that of kerosene is μ_2 . The apparent shift in the position of the bottom of the beaker when viewed from above is :-

A. $\left(1 - \frac{1}{\mu_1}\right)h_1 + \left(1 - \frac{1}{\mu_2}\right)h_2$

B. $\left(1 + \frac{1}{\mu_1}\right)h_2 - \left(1 + \frac{1}{\mu_2}\right)h_1$

C. $(1 - 1\mu_1)h_2 + \left(1 - \frac{1}{\mu_2}\right)h_1$

D. $\left(1 + \frac{1}{\mu_1}\right)h_1 - \left(1 + \frac{1}{\mu_2}\right)h_2$

Answer: A

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10. Light ray is travelling from a denser medium into a rarer medium. The velocity of light in the denser and rarer medium is 2×10^8 m/sec and 2.5×10^8 m / sec. The critical angle of the two media is

A. $\sin^{-1}\left(\frac{5}{4}\right)$

B. $\sin^{-1}\left(\frac{4}{5}\right)$

C. $\sin^{-1}\left(\frac{1}{2}\right)$

D. $\sin^{-1}\left(\frac{3}{5}\right)$

Answer: B

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11. Light takes t_1 second to travel a distance x cm in vacuum and the same light takes t_2 second to travel 10x cm in medium. The critical angle for the corresponding medium is

A. $\sin^{-1}\left(\frac{x_2 t_2}{x_1 t_1}\right)$

B. $\sin^{-1}\left(\frac{x_1 t_2}{x_2 t_1}\right)$

C. $\sin^{-1}\left(\frac{x_1 t_1}{x_2 t_2}\right)$

D. $\sin^{-1}\left(\frac{x_2 t_1}{x_1 t_2}\right)$

Answer: D

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12. An under water swimmer looks upward at an unobstructed overcast sky. The vertex angle does the sky appear to subtend at the eye of swimmer is (critical angle for water air interface is C)

A. C

B. C/2

C. 2C

D. 3C

Answer: C

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13. A point source of light is placed at the bottom of a water lake. If the area of the illuminated circle on the surface is equal to 3 times the square of depth of the lake, the refractive index of water.

A. $\sqrt{\pi + 1}$

B. $\sqrt{\frac{\pi}{3} + 1}$

C. $\frac{\pi}{3} + 1$

D. $\frac{\pi}{4} + 1$

Answer: B

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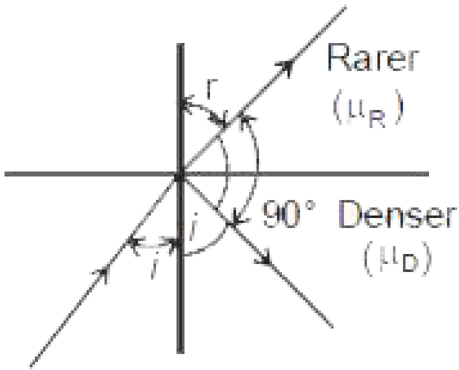
14. A ray of light from a denser medium strikes a rarer medium at an angle of incidence i. if the reflected and the refracted rays are mutually perpendicular to each other, what is the value of the critical angle ?



A. $\sin^{-1}(\tan i)$

B. $\cos^{-1}(\tan i)$

C. $\cot^{-1}(\tan i)$

D. $\operatorname{cos}ec^{-1}(\tan i)$

Answer: A

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15. A prism of RI = 1.5 is immersed in water of R.I = $\frac{4}{3}$ as shown in the figure. For the total internal reflection the correct choice is

A. $\sin\theta < \frac{8}{9}$

B. $\sin\theta > \frac{8}{9}$

C. $\sin\theta = \frac{8}{9}$

D. $\sin\theta \leq \frac{8}{9}$

Answer: B

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16. A light ray is incident at an angle 45∘ on parallel sided glass slab and emerges out grazing the vertical surface. The refractive index of the slab is

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

B. $\sqrt{\frac{5}{2}}$

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

D. $\frac{\sqrt{5}}{2}$

Answer: A

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17. The critical angle for refraction from medium -1 to air is θ_1 and that from medium _2 to air is θ_2 . If medium _2 is denser than medium _1. The critical angle for refraction from medium _2 to medium _ 1 is

A. $\sin^{-1}\left(\frac{\sin\theta_2}{\sin\theta_1}\right)$

B. $\sin^{-1}\left(\frac{\sin\theta_1}{\sin\theta_2}\right)$

C. $\sin^{-1}(\sin\theta_2)$

D. $\sin^{-1}(\sin\theta_1)$

Answer: A

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18. 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 the figure. The incident angle θ for which the light ray grazes along the wall of the rod is

A. $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

B. $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$

C. $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

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

Answer: C

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19. A ray of light refracts from medium 1 into a thin layer of medium 2, crosses the layer and is incident at the critical angle on the interface between the medium 2 and 3 shown in the figure. If the angle of incidence of ray is θ, the value of θ is

A. $\sin^{-1}\left(\frac{8}{9}\right)$

B. $\sin^{-1}\left(\frac{13}{18}\right)$

C. $\sin^{-1}\left(\frac{13}{16}\right)$

D. $\sin^{-1}\left(\frac{8}{13}\right)$

Answer: C

20. A ray of light enters a rectangular glass slab of refractive index $\sqrt{3}$ at an angle of incidence 60°. It travels a distance of 5cm inside the slab and emerges out of the slab. The perpendicular distance between the incident and the emergent rays is

A. $5\sqrt{3}cm$

B. $\frac{5}{2}$ cm

C. $5\sqrt{3/2}$ cm

D. 5cm

Answer: B

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EXERCISE-2 (C.W)(REFRACTION THROUGH SPHERICAL SURFACES)

1. A spherical surface of radius of curvature R separates air (refractive index 1.0) from glass (refractive index 1.5). The centre of curvature is in the glass. A point object P placed in air is found to have a real image Q in the glass. The line PQ cuts the surface at a point O, and $PO = OQ$. The distance PO

A. 5R

B. 3R

C. 2R

D. 1.5R

Answer: A

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2. A denser medium of refractive index 1.5 has a concave surface of radius of curvature 12 cm. An object is situated in the denser medium at a distance of 9 cm from the pole. Locate the image due to refraction in air.

A. A real image at 8 cm

B. a virtual image at 8 cm

C. A real image at 4.8 cm

D. A virtual image at 4.8 cm

Answer: D

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3. The human eye can be regarded as a single spherical refractive surface of curvature of cornea 7.8 mm. If a parallel beam of light comes to focus at 3.075 cm behind the refractive surface, the refractive index of the eye is

A. 1.34

B. 1.72

C. 1.5

D. 1.61

Answer: A

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4. A glass sphere (μ =1.5) of radius 20 cm has small air bubble 4 cm below its centre. The sphere is viewed from outside and along vertical line through the bubble. The apparent depth of the bubble below the surface of sphere is (in cm)

A. 13.33

B. 26.67

C. 15

D. 30

Answer: B

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5. A spherical surface of radius R separates two media of refractive indices μ_1 and μ_2 respectively. When a parallel beam is incident from medium A along the axis, the focal length is f. When a parallel beam is incident from medium B along the axis, the focal length is f_2

Then $\dfrac{f_1}{f_2}$ is

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

B. $\dfrac{\mu_2}{\mu_!}$

C. $\dfrac{\mu_1 \mu_2}{(\mu_1 - \mu_2)^2}$

D. $\dfrac{(\mu_1 - \mu_2)^2}{\mu_1 \mu_2}$

Answer: B

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6. The sun subtends an angle of $(1/2)^{\circ}$ on earth. The image of sun is obtained on the screen with the help of a convex lens of focal length 100 cm the diameter of the image obtained on the screen will be

A. 18 cm

B. 1 mm

C. 50 cm

D. 73 mm

Answer: D

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7. An object is placed first at infinity and then at 20 cm from the object side focal plane of a convex lens. The two images thus formed are 5 cm apart the focal length of the lens is

A. 5 cm

B. 10 cm

C. 15 cm

D. 20 cm

Answer: B

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8. The image of a square hole in a screen illuminated by light is obtained on another screen with the help of converging lens. The distance of the hole from the lens is 40 cm. If the area of the image is nine times that of the hole, the focal length of the lens is

A. 30cm

B. 50cm

C. 60cm

D. 75cm

Answer: A

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9. A plano-convex lens of focal length 30 cm has its plane surface silvered. An object is placed 40 cm from the lens on the convex side.

The distance of the image from the lens is

A. 18cm

B. 24cm

C. 30cm

D. 40cm

Answer: B

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10. The graph shows the variation of magnifictaion y'-. m produced by convex lens with image distance v. The focal length of the lens is used is :

A. $\frac{b}{c}$

B. $\frac{b}{ca}$

C. $\frac{bc}{a}$

D. $\frac{c}{b}$

Answer: D

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11. A convex lens of focal length f is placed somewhere in between an object and a screen. The distance between the object and the screen is x. If the numerical value of the magnification produced by the lens is m, then the focal lnegth oof the lens is .

A. $\dfrac{mx}{(m+1)^2}$

B. $\dfrac{mx}{(m-1)^2}$

C. $(m+1)^{2/mx}$

D. $\frac{(m-1)^2}{m}x$

Answer: A

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12. The distance between an object and the screen is 100cm. A lens produces an image on the screen when the lens is placed at either of the positions 40cm apart. The power of the lens is nearly

A. $\approx 3D$

B. $\approx 5D$

C. $\approx 7D$

D. $\approx 9D$

Answer: B

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13. Three lenses in contact have a combined focal length of 12 cm. When the third lens is removed, the combined focal length is $\frac{60}{7}$ cm.

The third lens is

A. Aconverging lens of focal length 30 cm

B. Aconverging lens offocalelngth 60 cm

C. A diverging lens of focal length 30 cm

D. A diverging lens o f focal length 60 cm

Answer: C

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14. Arrange the following combinations in the increasing order of focal length

a) Two piano convex lenses of focal lengths 20 cm and 30 cm in contact

b) Two convex lens of focal lengths 20 cm and 10 cm in contact

Two convex lenses of focal length 25 cm separated by 5 cm.

A. a, b, c

B. b, a, c

C. a, c, b

D. c, b, a

Answer: B

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15. A thin converging lens forms the real image of certain real object magnified m times.The magnification of real image become n when lens is moved nearer to object by distance x . find focal length of the lens

A. $\frac{xm}{m-n}$

B. $\dfrac{xmn}{m-n}$

C. $\dfrac{xmn}{n-m}$

D. $\dfrac{n-m}{xn}$

Answer: C

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16. When an object is at distances x and y from a lens, a real image and a virtual image is formed respectively having same magnification. The focal length of the lens is

A. $\mu_1 + \frac{\mu_2}{2}$

B. $\frac{\mu_1 - \mu_2}{2}$

C. $\frac{\mu_1 + \mu_2}{2}$

D. $\mu_1 + \mu_2$

Answer: C

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17. Two thin convex lenses of focal lengths f_1 and f_2 are arranged coaxially with 'd' as the reparation between them. The equivalent lens of the combination with focal length 'F' to be replaced for the combination is to be placed

A. midway between the lenses

B. between the lenses positions at stance

$\frac{dF_1}{f_1}$ from position of first lens

C. between the lenses positions at distance

$\frac{dF_1}{f_1}$ from position of second lens

D. Between the lenses positions at distance

$\frac{dF_1}{f_1 + f_2}$ from position of first lens

Answer: A

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18. A plano-convex lens, when silvered at its plane surface is equivalent to a concave mirror of focal length $28cm$. When its curved surface is silvered and the plane surface not silvered, it is equivalent to a concave mirror of focal length $10cm$ then the refractive index of the mateiral of the lens is:

A. 1.5

B. 55

C. 1.6

D. 1.65

Answer: B

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19. A thin equiconvex lens has focal length 10 cm and refractive index 1.5 . One of its faces is now silvered and for an object placed at a distance u in front of it, the image coincides with the object. The value of u is

A. 10cm

B. 5cm

C. 20cm

D. 15cm

Answer: B

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20. Four lenses are made from the same type of glass, the radius of curvature of each face is given below. Which will have the greatest positive power

A. 10 cm convex and 15 cm convex

B. 5 cm convex and 10 cm concave

C.) 15 cm convex and plane

D. 20 cm convex and plane

Answer: A

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21. 4 A thin liquid convex lens is formed in glass. Refractive index of liquid 4/3 is and that of glass is 3/2 If 'f' is the focal length of the liquid lens in air its focal length and nature in the glass is

A. f, convex

B. f, concave

C. 2f, concave

D. 3f, concave

Answer: D

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22. A thin converging lens of refractive index 1.5 has a focal power of 5 D. When this lens is immersed in a liquid, it acts as a diverging lens of focal length 100 cm. The refractive index of the liquid is

A. $\frac{11}{6}$

B. $\frac{9}{5}$

C. 5/3

D. 2

Answer: C

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23. The focal lengths of a lens are in the ratio 8:3 when it is immersed in two different liquids refractive indices 1.6 and 1.2 respectively. The refractive index of the material of the lens i

A. 1.25

B. 1.5

C. 1.8

D. 2

Answer: D

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24. v22

A. $\sin^{-1}\left(\frac{3}{4}\right)$

B. $\sin^{-1}\left(\frac{4}{5}\right)$

C. $\sin^{-1}\left(\frac{7}{13}\right)$

D. $\sin^{-1}\left(\frac{7}{8}\right)$

Answer: D

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25. A plano convex lens has a thickness of 6cm. Its radius of curvature is 25 cm. When its curved surface is kept on a horizontal surface and viewed from the top, its bottom appears to be raised by 2 cm. The focal power of lens is

A. 1D

B. 4D

C. 2D

D. 3D

Answer: C

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26. Two plano-concave lenses of glass of refractive index 1.5 have radii of curvature of 20 and 30 cm. They are placed in contact with curved surface towards each other and the space between them is filled with a liquid of refractive index $\frac{4}{3}$, find the focal length of the system.

A. 48cm

B. 72cm

C. 12cm

D. 24cm

Answer: B

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27. The power of a double convex lens of radius of curvature R each is Y. The power of a plano convex lens of same material and of radius of curvature 2R is

A. $\frac{Y}{4}$

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

C. $2Y$

D. 4Y

Answer: A

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28. A thin glass (refractive index 1.5) lens has optical power of $-8D$ in air, its optical power in a liquid medium with refractive index 1.6 will be

A. 25D

B. 1D

C. $-25D$

D. $-1D$

Answer: B

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29. v34

A. 0.04

B. 0.02

C. 0.06

D. 0.08

Answer: C

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EXERCISE-2 (C.W)(REFRACTION THROUGH A PRISM)

1. The refractive index of a prism for a monochromatic wave is $\sqrt{2}$ and its refracting angle is 60° for minimum deviation, the angle of indidence will be

A. 30°

B. 45°

C. 60°

D. 75°

Answer: B

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2. The minimum deviation produced by a hollow prism filled with a certain liquid is found to be 30°. The light ray is also found to be refracted at angle of 30°. The refractive index of the liquid is

A. $\sqrt{2}$

B. $\sqrt{3}$

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

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

Answer: A

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3. Under minimum deviation condition in a prism, if a ray is incident at an angle 30°, the angle between the emergent ray and the second refracting surface of the prism is

A. 0°

B. 30°

C. 45°

D. 60°

Answer: D

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4. The angle of minimum deviation by prism is (180^(0)-2A) .Its critival angle will be

A. $\sin^{-1}\left(\tan\left(\frac{A}{2}\right)\right)$

B. $\sin^{-1}\left(\cot\left(\frac{A}{2}\right)\right)$

C. $\cos^{-1}\left(\cot\left(\frac{A}{2}\right)\right)$

D. $\cos^{-1}\left(\tan\left(\frac{A}{2}\right)\right)$

Answer: A

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5. ACB is right-angled glass prism of refractive index 1.5 . $\angle A$ $\angle B$ and $\angle C$ are 60° 30° and 90° respectively.A thin layer of liquid is on the AB. For a ray of light which is incident normally on AC to be totally reflected at AB the refractive index of the liquid on AB should be

A. 1.5

B. 1.4

C. 1.3

D. 1.2

Answer: D

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6. A parallel beam of monochromatic light is incident on one surface of an equilateral prism. Angle of incidence is 55° and angle of emergence is 46°. The angle of minimum deviation will be

A. 41°

B. lt41°

C. $> 41^\circ$

D. $\geq 41^\circ$

Answer: B

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7. The maximum refractive index of a prism which permits passage of the light, through it when the refract iii»auglc of the prism is 90º, is

A. $\sqrt{3}$

B. $\sqrt{2}$

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

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

Answer: B

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8. The refractive index of the material of prism is 72 and Its refracting angle is 30°. One of the refracting surfaces of the prism is made a mirror in wards. A beam of monochromatic light enters the prism from the other surface and the ray retraces from the mirrored surface. The angle of incidence is

A. 30°

B. 45°

C. 60°

D. 0°

Answer: B

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EXERCISE-2 (C.W)(DISPERSION BY A PRISM)

1. A glass prism A deviates the red and blue rays through 10° and 12° respectively . A second prism (B) deviates them through 8° and 10° respectively . What is the ratio of their dispersive powers ?

A. $11 : 9$

B. $9 : 11$

C. $3 : 2$

D. $1 : 1$

Answer: B

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2. A parallel beam of white light falls on a convex lens. Images of blue, yellow and red light are formed on other side of the lens at a distance of $0.20m, 0.205m$ and $0.214m$ respectively. The dispersive power of the material of the lens will be

A. $\frac{629}{1000}$

B. $\frac{9}{200}$

C. $\frac{14}{208}$

D. $\frac{5}{214}$

Answer: C

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3. The refractive indices of crown glass prism for C, D and F lines are 1.527, 1.530 and I.535

respectively. The dispersive power of the crown glass prism is

A. 0.01509

B. 0.05109

C. 0.02108

D. 0.03402

Answer: A

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4. White light is passed through a prism of angle 5^o. If the refractive indices for red and blue colours are 1.641 and 1.659 respectively, calculate the angle of dispersion between them.

A. 0.08°

B. 0.06°

C. 0.09°

D. 0.1°

Answer: C

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EXERCISE-2 (C.W)(DEFECTS OF THE EYE)

1. A person cannot see an object lying beyond 80 cm, where as a normal person can easily see the object distant 160 cm. The focal length and nature of the lens used to rectify this defect will be

A. 160 cm, cancave

B. 160 cm, convex

C. 60 cm, concave

D. 60 cm, convex

Answer: A

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2. The near point of a person is 50 cm and the far point is 1.5m. The spectacles required for reading purpose and for seeing distant objects are respectively.

A. $+2D, \ -\left(\frac{2}{3}\right)D$

B. $+\left(\frac{2}{3}\right)D, \ -2D$

C. $-2D, \ +\left(\frac{2}{3}\right)D$

D. $-\left(\frac{2}{3}\right)D, 2D$

Answer: A

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EXERCISE-2 (C.W)(OPTICAL INSTRUMENTS (MICROSCOPES))

1. The two lenses of a compound microscope are of focal lengths 2 cm and 5 cm. If an object is placed at a distance of 2.1 cm from (he objective of focal length 2 cm the final image forms at the least distance of distinct vision of a normal eye. Find the distance between the objective and eyepiece

A. 46.17cm

B. 42cm

C. 4.17cm

D. 40cm

Answer: A

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2. The separation L between the objective (f_0 =0.5 cm) and the eye piece (f_e =5cm) of a compound microscope is 7.0 cm. Where should a small object be placed so that the eye is least strained ?

A. 0.5cm

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

C. $\frac{2}{3}$ cm

D. $\frac{1}{3}$ cm

Answer: C

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3. The focal lengths of obj ective and eyepiece of a compound microscope are 5 cm, 6.25 cm respectively. When an object is placed infyrnt of the objective at a distance of 6.25 cm, the final image is formed at least distance of distinct vision. The length of microscope is

A. 22.5cm

B. 25cm

C. 30cm

D. 31.25cm

Answer: C

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4. The magnifying powerof a compound microscope is 20 and the distance between its two lenses is 30 cm when the final image is at the near point of the eye If the focal length of eye-pfece is 6.25 cm, the focal length of objective is

A. 2.5 cm

B. 3.5 cm

C. 4.5 cm

D. 5.0 cm

Answer: D

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5. The focal length of objective and eye-piece of a compound microscope are 1 cm and 5 cm respectively. The microscope magnification is equal to 50. If the distance between two lenses is increased by 2 cm then the magnification is

A. 31

B. 60

C. 16

D. 83

Answer: B

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EXERCISE-2 (C.W)(OPTICAL INSTRUMENTS (TELESCOPES))

1. The focal length of objective and eyelens of a astonomical telescope are respectively 20 cm and 5 cm. Final image is formed at least distance of distinct vision. The magnifying power will be

A. -4.8

B. -4

C. 4.8

D. 4

Answer: A

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2. A simple telescope, consisting of an objective of focal length $60cm$ and a single eye lens of focal length $5cm$ is focused on a distant object in such a way that parallel rays emerge form the eye lens. If the object makes an angle of 2° at the objective, the angular width if the image is

A. 10°

B. 24°

C. 50°

D. 60°

Answer: B

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3. Four convergent lenses have focal lengths $100cm$, $10cm$, $4cm$ and $0.3cm$. For a telescope with maximum possible magnification, we choose the lenses of focal lengths

A. 10 cm, 0.3 cm

B. 10cm, 4cm

C. 100 cm, 4 cm

D. 100 cm, 0.3cm

Answer: D

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4. Opera glass have a minimum length of 20 cm and a magnifying power of 5 when viewing distant objects. The focal lengths of lenses used are

A. 25 cm, 5 cm

B. 25 cm, -5 cm

C. $\left(\frac{10}{5}\right)cm, \left(\frac{50}{3}\right)cm$

D. 15 cm, -10cm

Answer: B

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5. A telescope has an objective lens of focal length $200cm$ and an eye piece with focal length $2cm$. If this telescope is used to see a 50 meter tall building at a distance of $2km$, what is the height of the image of the building formed by the objective lens?

A. 5mm

B. 10mm

C. 1mm

D. 2mm

Answer: A

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6. The focal length of the objective of an astronomical telescope is 1 m and it is in normal adjustment. Initially the telescope is focussed to a heavenly body. If the same telescope is to be focussed to an object at a distance of 21 m from the objective, then identify the correct choice

A. eye piece should be displaced by 2 cm away from the objective

B. eye piece should be displaced by 2 cm towards the objective

C. eye piece should be displaced by 5 cm towards from the objective

D. eye piece should be displaced by 5 cm away from the objective

Answer: D

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EXERCISE-2 (H.W)(REFLECTION)

1. Two plane mirrors are inclined at angle 'theta' as shown in figure. If a ray parallel to OB strikes the other mirror at P and finally emerges parallel to OA after two reflections then θ is equal to

A. 90°

B. 60°

C. 45°

D. 30°

Answer: B

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2. A plane mirrorr is approaching you at a speed of $10cm/\sec$.You can see your image in it. At what speed will your image approach you

A. 5 cm/s

B. 10 cm/s

C. 15 cm/s

D. 20 cm/s

Answer: D

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3. Two plane mirrors parallel to each other and an object O parallel between them. Then the distance of the first three images from the mirror M_2 willbe(in cm)

A. 5,10,15

B. 5,15,30

C. 5,25,35

D. 5,15,25

Answer: C

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4. Two vertical plane mirrors are inclined at an angle of 60° with each other. A ray of light travelling horizontally is reflected first from one mirror and then from the other. The resultant deviation is

A. 60°

B. 120°

C. 180°

D. 240°

Answer: D

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5. If an object is placed between two plane mirrors a distance 2b, apart, the object is situated at mid point between mirrors, the position of nth image formed by the one of the mirrors with respect to the object is

A. nb

B. 2nb

C. 3nb

D. 4nb

Answer: B

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6. With a concave mirror, an object is placed at a distance 9cm from the principal focus, on the principal axis. The image is formed at a distance 16cm from the principal focus. The focal length of the mirror is

A. 12cm

B. 11cm

C. 40cm

D. 30cm

Answer: A

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7. An infinitely long rod lies along the axis of a concave mirror of focal length f. The near end of the rod is distance $u > f$ from the mirror. Its image will have length

A. $\dfrac{uf}{u-f}$

B. $\dfrac{uf}{u+f}$

C. $\dfrac{f^2}{u+f}$

D. $\dfrac{f^2}{u-f}$

Answer: D

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8. A 2.0 cm high object is placed on the principal axis of a concave mirror at a distance of 12 cm from the pole. Ilf the image is inverted, real and 5.0 cm high, find the location of the image the focal length of the mirror.

A. 30 cm, 8.6 cm

B. 8.6 cm 30 cm

C. 30 cm, 10 cm

D. 10 cm, 30 cm

Answer: A

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9. At what distance from a convex mirror of focal length 2.5 m should a body stand so that his image has a height equal to half the original height ? The principal exis is perpendicular to the height.

A. 2.5 m from the mirror

B. 5 m from the mirror

C. 7.5 m from the mirror

D. 10 m from the mirror

Answer: A

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10. The velocity of image w.r.t tround in the below figure is

A. 10 m/s moving downwards

B. 10 m/s moving upwards

C. 20 m/s moving downwarda

D. 20 m/s moving upwards

Answer: A

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11. A rectangular wire of length 2.0 cm, breadth 1.5 cm is placed 25 cm in front of a concave mirror of focal length 10 cm with its centre on the axis of the mirror and its plane normal to the axis. The area enclosed by the image of the wire is

A. $7.5cm^2$

B. $6cm^2$

C. $4cm^2$

D. $1.33cm^2$

Answer: D

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12. An image of a candle on a screen is found to be double its size. When the candle is shifted by a distance of 5cm, then the image becomes triple its size. Find the nature and radius of curvature of the mirror.

A. concave, 60 cm

B. convex, 60 cm

C. concave, 30 cm

D. convex 30 cm

Answer: A

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13. A point source of light is placed in front of a plane mirror as shown in figure. Determine the length of reflected part of light on the screen

A. L

B. 2L

C. 3L

D. L/2

Answer: C

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14. Two points P and Q lie on either side of an axis XY as shown. It is desired to produce an image of a real object placed at P at Q using a spherical mirror, with XY as the optic axis. The mirror must be

A. Converging

B. Diverging

C. Plane mirror

D. positioned to the right of Q

Answer: A

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15. Magnification produced by astronominal telescope for normal adjustment is 10 and length of telescope is 1.1m. The magnification when the image is formed at least distance of distinct vision $(D = 25cm)$ is-

A. 6

B. 14

C. 18

D. 16

Answer: C

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EXERCISE-2 (H.W)(REFRACTION)

1. The same colour of light takes t_1 sec and t_2 sec to travel the same distance 'x' in two media ‘A’ and ‘B’ respectively. Refractive index of medium ‘A’ w.r.t to ‘B’ is

A. $\frac{xT_1}{t_2}$

B. $\frac{t_2}{xt_1}$

C. $\frac{t_2}{t_1}$

D. $\frac{t_1}{t_2}$

Answer: D

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2. The refractive index of glass plate is $\frac{3}{2}$. Then the correct thickness of glass plate that will permit the same number of wavelengths as that by an 18 cm long column of water is

$$\left(\mu_w = \frac{4}{3}\right)$$

A. 12cm

B. 16cm

C. 18cm

D. 24cm

Answer: B

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3. The wavelength of light in vacuum is 5000 $\overset{o}{A}$. When it travels normally through diamond of thickness 1.0 mm find the number of waves of light in 1.0 mm of diamond. (Refractive index of diamond = 2.417

A. 4834 waves

B. 5834 waves

C. 4384 waves

D. 6834 waves

Answer: A

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4. If the refractive index of diamond is 2.4 find the velocity of light in diamond.(c=3×10^8m/s)

A. 1.25×10^8m/s

B. 2.25×10^8 m/s

C. 1.5×10^8 m/s

D. 4.5×10^8 m/s

Answer: A

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5. Refractive index of water with respect to air is $\sqrt{2}$. Alight ray is incident on the surface at an angle 30° travelling through water. The deviation of light ray is

A. 30°

B. 120°

C. 15°

D. 60°

Answer: D

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6. If $\hat{i}$ denotes a unit vector along incident light ray, $\hat{r}$ a unit vector along refracted ray into a medium of refractive index μ and $\widehat{n}$ unit vector normal to boundary of medium directed towards incident medium, then law of refraction is

A. $\hat{i} \times \widehat{n} = \mu(\widehat{n} \times \hat{r})$

B. $\hat{i} \times \widehat{n} = \mu(\widehat{n} \times \hat{r})$

C. $\hat{i} \times \widehat{n} = \mu(\hat{r} \times \widehat{n})$

D. $\mu\left(\hat{i} \times \widehat{n}\right) = \hat{r} \times \widehat{n}$

Answer: C

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7. A small air bubble is inside a transparent cube of side length 24 cm and of refractive index $\frac{4}{3}$ If the apparent distance air bubble from a face is 9 cm then its apparent distance from opposite face is

A. 6cm

B. 8cm

C. 9cm

D. 12cm

Answer: C

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8. A ray of light is incident upon a parallel sided transparent slab of thickness 9 cm at an angle of incidence 60° • If the angle of refraction is 30°, the lateral displacement of the light ray is

A. $\sqrt{3}cm$

B. $3\sqrt{3}cm$

C. $3cm$

D. $\frac{2}{\sqrt{3}}$ cm

Answer: B

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9. A vessel of depth d is half filled with a liquid of refractive index μ_1 and the other half is filled with a liquid of refractive index μ_2. The apparent depth of the vessel, when looked at normally, is

A. $d\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}\right)$

B. $d(\mu_1 + \mu_2)$

C. $\frac{d}{2}\left(\frac{1}{\mu_1} + \frac{1}{\mu_2}\right)$

D. $\frac{d}{2}(\mu_1 + \mu_2)$

Answer: C

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10. The critical angle for light going from medium X into medium Y is θ . The speed of light in medium X is v. The speed of light in medium Y is

A. $\dfrac{v}{\sin\theta}$

B. $v\sin\theta$

C. $\dfrac{v}{\tan\theta}$

D. $v\tan\theta$

Answer: A

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11. Light takes t_1 second to travel a distance x cm in vacuum and the same light takes t_2

second to travel 10x cm in medium. The critical angle for the corresponding medium is

A. $\sin^{-1}\left(\frac{10t_1}{t_2}\right)$

B. $\sin^{-1}\left(\frac{t_2}{10t_1}\right)$

C. $\sin^{-1}\left(\frac{10t_2}{t_1}\right)$

D. $\sin^{-1}\left(\frac{t_1}{10t_2}\right)$

Answer: A

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12. A fish looks upward at an unobstructed overcast sky. What total angle does the sky appear to subten?(Take refractive index of water as $\sqrt{2}$.)

A. 180°

B. 90°

C. 75°

D. 60°

Answer: B

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13. In a swimming pool, a person is viewing outside objects by keeping an eye at a depth h inside water. If the critical angle for water is 'θ_c', then the value of the diameter of the circle of view for outside objects will be

A. $2h\sin\theta_c$

B. $2h\cos\theta_c$

C. $2h\tan\theta_c$

D. $2h\cot\theta_c$

Answer: C

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14. A ray of light from a rarer medium strikes a denser medium at angle of incidence 60º. The reflected and refracted rays are perpendicular to each other. The refractive index of denser medium and angle of deviation respectively are

A. $\sqrt{3}, 30^{\circ}$

B. $\sqrt{2}, 45^{\circ}$

C. $\sqrt{3}, 60^{\circ}$

D. $\sqrt{2}, 30^{\circ}$

Answer: A

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15. A light ray is incident perpendicularly to one face of a 90° prism and is totally internally reflected at the glass air interface. If the angle of reflection is 45° , we conclude that the refractive index n

A. $n > \frac{1}{\sqrt{2}}$

B. $n > \sqrt{2}$

C. $n < \frac{1}{\sqrt{2}}$

D. $n < \sqrt{2}$

Answer: B

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16. Word ‘Newton’s printed on a paper and is placed on a horizontal surface below a cubical glass. The minimum value of refractive index of a cubical glass for which letters are not visible from any vertical faces, of the glass, is (Critical angle =45º)

A. $\sqrt{3}$

B. 0.5

C. 1

D. $\sqrt{2}$

Answer: D

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17. The critical angle for refraction from glass to air is 30° and that from water to air is 37° . Find the critical angle for refraction from glass to water

A. $\sin^{-1}\left(\frac{5}{6}\right)$

B. $51^{\circ}3'$

C. $61^{\circ}2'$

D. $63^{\circ}3'$

Answer: A

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18. The refractive index of the core of an optical fibre is μ_2 and that of the cladding is μ_1 .The angle of incidence on the face of the core so that the light ray just under goes total internal reflection at the cladding is

A. $\sin^{-1}\left(\frac{\mu_1}{\mu_2}\right)$

B. $\sin^{-1}\sqrt{\mu_2^2 - \mu_1^2}$

C. $\sin^{-1}\sqrt{\mu_2 - \mu_1}$

D. $\sin^{-1}\sqrt{\mu_1^2 + \mu_2^2}$

Answer: B

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19. When a ray of light enters from one medium to another then its velocity in second medium becomes doubled. The maximum value of angle of incidence so that total internal reflection may not take place will be

A. 60°

B. 90°

C. 30°

D. 180°

Answer: C

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20. A ray of light passes through four transparent media with refractive indices μ_1, μ_2, μ_3 and μ_4 as shown in the figure, the surfaces of all media are parallel. If the emergent ray CD is parallel to the incident ray AB, we must have

A. $\mu_1 = \mu_2$

B. $\mu_2 = \mu_3$

C. $\mu_3 = \mu_4$

D. $\mu_4 = \mu_1$

Answer: D

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21. How much water should be filled in a container of height $21cm$, so that it appears half filled to the observer when viewed from the top of the container $(\mu = 4/3)$.

A. 8 cm

B. 10.5 cm

C. 12 cm

D. 14 cm

Answer: D

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EXERCISE-2 (H.W)(REFRACTION THROUGH SPHERICAL SURFACES)

1. 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 n is the refractive index of the medium with respect to air, select the possible value of n from the following.

A. 1.3

B. 1.4

C. 1.5

D. 1.9

Answer: C

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2. A mark is made on the surface of a glass sphere of diameter 10 cm and refractive index 1.5. It is viewed through the glass from a portion directly opposite. The distance of the image of the mark from the centre of the sphere will be

A. 15 cm

B. 17.5 cm

C. 20 cm

D. 22.5 cm

Answer: A

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3. In a medium of refractive index 1.6 and having a convex surface has a point object in it at a distance of 12 cm from the pole. The radius of curvature is 6 cm. Locate the image as seen from air

A. Areal image at 30 cm

B. A virtual image at 30 cm

C. Areal image at 4.28 cm

D. A virtual image at 4.28 cm

Answer: B

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4. Parallel rays are incident on a transparent sphere along its one diameter. After refraction, these rays converge at the other end of this diameter. The refractive index for the material of sphere is

A. 1

B. 1.5

C. 1.6

D. 2

Answer: D

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5. A mark of the surface of sphere $\left(\mu = \frac{3}{2}\right)$ is viewed from a diametrically opposite position. It appears to be at a distance 15 cm from its actual position.Find the radius of sphere.

A. 5 cm

B. 10 cm

C. 15 cm

D. 25 cm

Answer: A

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EXERCISE-2 (H.W)(LENSES & THEIR COMBINATIONS)

1. A ray incident at a point at an angle of incidence of 60° enters a glass sphere with refractive index $\sqrt{3}$ and it is reflected and refracted at the farther surface of the sphere.

The angle between the reflected and refracted

rays at this surface is:

A. 90°

B. 60°

C. 70°

D. 40°

Answer: A

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2. The sun subtends an angle of $(1/2)^{\circ}$ on earth. The image of sun is obtained on the screen with the help of a convex lens of focal length 100 cm the diameter of the image obtained on the screen will be

A. 0.13 mm

B. 0.9 mm

C. 1.8mm

D. 0.6mm

Answer: A

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3. A convex lens forms an image of a distant object at distance of 20 cm from it. On keeping another lens in contact with the first, if the image is formed at a distance of $\frac{40}{3}$ cm from the combination, then the focal length of the second lens is

A. $-20cm$

B. $-40cm$

C. $40cm$

D. $13.33cm$

Answer: C

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4. A slide projector gives magnification of 10. If it projects a slide of 3 cm $\times$ 2 cm on a screen, the area of image on screen is :

A. $6000cm^2$

B. $600cm^2$

C. $3600m^2$

D. $2000m^2$

Answer: B

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5. The radius of curvature of a thin planoconvex lens is 10 cm and the refractive index of its glass is 1.5. If the plane surface is silvered, then it will behave like a

A. concave mirror of focal length 10 cm

B. concave mirror of focal length 20 cm

C. convex mirror of focal length 10 cm

D. convex mirror offocal length 20 cm

Answer: A

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6. The graph between object distance u and image distance v for a lens given below. The focal length of the lens

A. 5±0.1

B. 5±0.05

C. 0.5 ±0.1

D. 0.5 ±0.05

Answer: B

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7. In the displacement method a conves lens is placed in between an object and a screen. If the magnificaiton in the two position are m_1 and m_(2)(m_(1) $> m_2$), and the distance between the two positions of the lens is x, the focal length of the lens is

A. $\dfrac{x}{m_1 + m_2}$

B. $\dfrac{x}{m_1 - m_2}$

C. $\dfrac{x}{(m_1 - m_2)^2}$

D. $\dfrac{x}{(m_1 + m_2)^2}$

Answer: B

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8. A convex lens makes a real image 4 cm long on a screen. When the lens is shifted to a new position without disturbing the object, we again get a real image on the screen which is 16 cm tall. The length of the object must be

A. 8 cm

B. 10 cm

C. 12 cm

D. 6 cm

Answer: A

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9. A convex lens of focal length 50 cm, a concave lens of focal length 50 cm and a concave lens focal lens 20 cm are placed in contact. The power of this combination in diopters will be

A. $-4.67D$

B. $-5D$

C. $-3.21D$

D. $-3D$

Answer: B

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10. Arrange the following combinations in the increasing order of focal length

Two piano convex lenses of focal lengths 15 cm and 30 cm in contact

Two convex lens of focal lengths 40 cm and 50 cm in contact

Two convex lenses of focal length 20 cm separated by 5 cm

A. a, b, c

B. b, a, c

C. a, c, b

D. c, a, b

Answer: C

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11. The image of an object, formed by a plano-convex lens at a distance of 8 m behind the lens, is real is one-third the size of the object. The wavelength of light inside the lens is 2/3 times the wavelength in free space. The radius of the curved surface of the lens is

A. 1m

B. 2m

C. 3m

D. 43

Answer: C

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12. The radius of curvature of the convex surface of a planoconvex lens is 12 cm and its refractive index 1.5. If the plane face of the lens is silvered, then the distance from the lens at which parallel rays incident on its convex surface converge is

A. 12 cm

B. 18 cm

C. 24 cm

D. 30 cm

Answer: A

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13. An equiconcave lens having radius of curvature of each surface 20 cm has one surface silvered. If the refractive index of the lens is 1.5, then the magnitude of the focal length is

A. 2.5cm

B. 0.4cm

C. 0

D. 5cm

Answer: D

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14. If R_1 and R_2 are the radii of curvature of double convex lens made of same material, the lens with more focal length is

A. $R_1 = 20cm, R_2 = 10cm$

B. $R_1 = R_2 = 20cm$

C. $R_1 = R_2 = 10cm$

D. $R_1 = R_2 = 5cm$

Answer: B

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15. A concave lens of glass, refractive index 1.5 has both surfaces of same radius of curvature R. On immersion in a medium of refractive index 1.75, it will behave as a

A. Convergent lens of focal length 3.5 R

B. Convergent lens of focal length 3.0 R

C. Divergent lens of focal length 3.5 R

D. Divergent lens of focal length 3.0 R

Answer: A

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16. A thin equi-convex lens is made of glass of refractive index 1.5 and its length is $0.2m$. If it acts as a concave lens of $0.5m$ focal length when dipped in a liquid, the refractive index of the liquid is

A. $\frac{17}{8}$

B. $\frac{15}{8}$

C. $\frac{13}{8}$

D. $\frac{9}{8}$

Answer: B

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17. A convex Lens of focal Length "0.15m" is made of refractive "(3)/(2)" .When it is placed in liquid,its focal Length increases by "0.225m" . Find the refractive index of the liquid.

A. $\frac{7}{4}$

B. $\frac{5}{4}$

C. $\frac{9}{4}$

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

Answer: B

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18. A diverging lens of focal length 10 cm having refractive index 1.5 is immersed in a liquid of refractive index 3. The focal length and nature of the lens in liquid is

A.)10 cm, convergent

B. 10 cm divergent

C. 18 cm, convergent

D. 72 cm, divergent

Answer: A

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19. A plano convex lens a thickness of 4 cm. Its radius of curvature is 20 cm, When its curved surface is kept on a horizontal surface and viewed from the top, its bottom appears to be raised by 1 cm. The focal length of the lens is

A. 40 cm

B. 50 cm

C. 60 cm

D. 70 cm

Answer: C

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20. Two equi convex lenses each of focal lengths 20 cm and refractive index 1.5 are placed in & contact and space between them is filled with water of refractive index $\frac{4}{3}$. The combination works as

A. converging lens of focal length 30 cm

B. diverging lens of focal length 15 cm

C. converging lens of focal length 15 cm

D. diverging lens of focal length 40 cm

Answer: C

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21. If R1 and R2 are the radii of curvature of a double convex lens. The largest power will be for

A. $R_1 = \infty, R_2 = 10cm$

B. $R_1 = 10cm, R_2 = \infty$

C. $R_1 = 10cm, R_2 = 10cm$

D. $R_1 = 5cm, R_2 = 5cm$

Answer: D

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22. A thin convergent glass lens $(\mu_g = 1.5)$ has a power of $+5.0D$. When this lens is immersed in a liquid of refractive index μ_1, it acts as a divergent lens of focal length $100cm$. The value of μ_1 is

A. $\frac{5}{3}$

B. $\frac{4}{3}$

C. $\frac{5}{4}$

D. $\frac{6}{5}$

Answer: A

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23. The refractive index of a material of a plano concave lens is $\frac{5}{3}$. Its radius of curvature is 0.3 m. Focal length of the lens in air is

A. 0.45 m

B. -0.6m

C. $0.7m$

D. $1m$

Answer: A

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EXERCISE-2 (H.W)(REFRACTION THROUGH A PRISM)

1. The angle of minimum deviation measured with a prism is 30° and the angle of prism is

60°. The refractive index of prism material is

A. $\sqrt{2}$

B. 2

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

D. $\frac{4}{3}$

Answer: A

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2. When light of wavelength λ on an equilateral prism, kept on its minimum deviation position, it is found that the angle of deviation equals the angle the angle of the prism itself. The refractive index of the material of the prism for the wavelength λ is

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

B. $\sqrt{3}$

C. 2

D. $\sqrt{2}$

Answer: B

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3. A ray incident a 15° on one refracting surface of a prism of angle 60° , suffers a deviation of 55° . What is the angle of emergence

A. 95°

B. 45°

C. 30°

D. 100°

Answer: D

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4. A prism of critical angle 45° is immersed water of critical angle 50º. The critical angle of prism inside water will be (sin70º =0.94)

A. 70°

B. 90°

C. 130°

D. 100°

Answer: A

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5. A glass prism of refractive index 1.5 is placed in water of refractive index 1.33. The minimum value of the angle of the prism so that it will not be possible to have any emergent ray is

A. 150°

B. 125°

C. 165°

D. 180°

Answer: B

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6. A certain prism is that to produce minimum deviation of 3 8°. It produces a deviation of 44° when the angle ofincidence is either 42° or

62^{o} . The refractive index of material of prism is

A. 1.51

B. 1.33

C. 1.62

D. 1.732

Answer: A

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7. The maximum value of index of refraction of a material of a prism which allows the passage of light through it when the refracting angle of prism is A is

A. $\sqrt{1+\sin^2\left(\frac{A}{2}\right)}$

B. $\sqrt{1+\cos^2\left(\frac{A}{2}\right)}$

C. $\sqrt{1+\tan^2\left(\frac{A}{2}\right)}$

D. $\sqrt{1+\cot^2\left(\frac{A}{2}\right)}$

Answer: D

8. The prism shown silvered. The angle of the prism is 30° and $\mu = \sqrt{2}$. If the incident ray retraces its initial path the angle of incidence is

A. 50°

B. 45°

C. 60°

D. 75°

Answer: B

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9. A ray of light is incident on an equilateral glass prism placed on a horizontal table. For minimum deviation which of the following is true?

A. PQ is horizontal

B. QR is horizontal

C. RS is horizontal

D. Either PQ or RS is horizontal

Answer: B

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EXERCISE-2 (H.W)(DISPERSION BY A PRISM)

1. Two small angled prisms A and B deviate the blue rays by 7 0 and 9 0 and the red rays by 5

0 and 7 0 respectively. Which prism has a greater . p dispersive power ?

A. Prism A

B. Prism B

C. same for both Prism A & B

D. none of these

Answer: A

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2. The refractive index of the material of the prism for violet colour is 1.69 and that for red is 1.65. If the refractive index for mean colour is 1.66, the dispersive power of the material of the prism

A. 0.66

B. 0.06

C. 0.65

D. 0.69

Answer: B

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3. The refractive indices of flint glass prism for violet, Yellow and Red colours are 1.790, 1.795 and 1.805 respectively, find dispersive power of the flint glass.

A. 0.01587

B. 0.01887

C. 0.01187

D. 0.01387

Answer: B

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4. Refracting angle of a prism is 2 radians. Refractive indices of its material for violet and red are respectively 1.62 and 1.5 Dispersion produced by it is

A. 0.24

B. 0.06

C. 1.66

D. 1.12

Answer: A

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EXERCISE-2 (H.W)(DEFECTS OF THE EYE)

1. A man cannot see clearly the objects beyond a distance of 20 cm from his eyes. To see distant objects clearly he must use which kind of lenses and of what focal length

A. 100 cm, convex

B. 100 cm concave

C. 20 cm convex

D. 20 cm concave

Answer: D

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2. A short sighted person can see objects most distinctly at a distance of 16 cm. If he wears spectacles at a distance of 1 cm from the eye, then their focal length to see distinctly at a distance of 26 cm

A. 25 cm, convex

B. 25 cm, concave

C. 37.5 cm, convex

D. 37.5 cm, concave

Answer: D

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3. An eye specialist prescribes spectacles having combination of convex lens of focal length 40 cm in contact with a concave lens of focal length 25 cm. The power of this lens combination in diopters is

A. $+1.5$

B. -1.5

C. $+6.67$

D. -6.67

Answer: B

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EXERCISE-2 (H.W)(OPTICAL INSTRUMENTS (MICROSCOPES))

1. The two lenses of a compound microscope are of focal lengths 2 cm and 5 cm. If an object is placed at a distance of 2.1 cm from the objetive of focal length 2 cm the final image forms at the least distance of distinct vision of a normal eye. Find the frnagnifying powerjof the microscope

A. 20

B. 6

C. 120

D. 60

Answer: C

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2. If the focal length of objective and eye lens are $1.2 cm$ and $3 cm$ respectively and the object is put $1.25 cm$ away from the objective lens and the final image is formed at infinity. The magnifying power of the microscope is

A. 150

B. 200

C. 250

D. 400

Answer: B

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3. The focal lengths of the objective and the eyepiece of a compound microscope are 1.0 cm and 5.0 cm respectively. An object, placed at a distance of 1.1 cm from the objective, has its final image formed at a distance of 25 cm from the eye. Find the magnifying power of the microscope.

A. 20

B. 30

C. 50

D. 60

Answer: D

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4. A compound microscope has an objective of focal length $2.0cm$ and an eye-piece of focal length $6.25cm$ and distance between the objective and eye-piece is $15cm$. If the final image is formed at the least distance vision

$(25cm)$, the distance of the object form the objective is

A. 1.5cm

B. 2.5cm

C. 3.0cm

D. 4.0cm

Answer: B

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5. The focal length of the objective and the eye piece of a compound microscope are 2.0 cm and 3.0 cm, respectively. The distance between the objective and the eye piece is 15.0 cm. The final image formed by the eye piece is at infinity. The two lenses are thin. The distance in cm of the object and the image produced by the objective, measured from the objective lens, are respectively

A. 2.4 and 12

B. 2.4 and 15

C. 2.4 and 3.0

D. 2.3 and 12

Answer: A

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EXERCISE-2 (H.W)(OPTICAL INSTRUMENTS (TELESCOPES))

1. The magnifying power of an astronomical telescope for normal adjustment is 10 and the length of the telescope is 110 cm. Find the magnifying power of the telescope when the image is formed at the least distance of distinct vision for normal eye

A. 14

B. 48

C. 28

D. 52

Answer: A

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2. The eyepiece of a refracting telescope has f = 9 cm. In the normal setting, separation betweeen objective and eyepiece is 1.8 m. Find the magnification

A. 20

B. 19

C. 18

D. 21

Answer: B

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3. Four lenses of focal length $+15cm, +20cm, +150cm$ and $+250cm$ are available for making an astronomical telescope. To produce the largest magnification, the focal length of the eye-piece should be

A. $+15cm$

B. $+20cm$

C. $+150cm$

D. $+250cm$

Answer: A

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4. An opera glass (Galilean telescope) measures $9cm$ from the objective to the eyepiece. The focal length of the objective is $15cm$. Its magnifying power is

A. 2.5

B. 43953

C. 43895

D. 0.4

Answer: A

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5. A small telescope has an objective lens of focal length 140 cm and eye piece of focal length 5.0 cm. The telescope is used to view a 100 m tall tower 3 km away. The height of the image ' of the tower formed by objective lens

is

A. $\frac{14}{3}$cm

B. $\frac{11}{3}$ cm

C. $\frac{17}{3} cm$

D. $\frac{8}{3}$ cm

Answer: A

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EXERCISE- 3

1. Air bubble in water behaves as

A. sometimes concave, somethimes convex lens

B. concavc lens

C. convex lens

D. always refraction surface

Answer: 2

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2. The position of final images formed by the given lens combination from the third lens will be at a distance of

$f_1 = +10 \text{ cm } f_2 = -10\text{cm } f = +30\text{cm}$

A. 15 cm

B. infinity

C. 45 cm

D. 30 cm

Answer: 4

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3. The focal length of the objective and eye lenses of a microscope are 1.6 cm and 2.5 cm respectively. The distance between the two lenses is 21.7 cm. If the final image is formed at infinity. What is the linear magnification ?

A. 11

B. 110

C. 1.1

D. 44

Answer: 2

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4. The frequency of a light wave in a material is $2 \times 10^{14} Hz$ and wavelength is 5000Å. The refractive index of material will be

A. 1.5

B. 3

C. 1.33

D. 1.4

Answer: 2

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5. A small coin is resting on the bottom of a beaker filled with liquid. A ray of light from the coin travels up to the surface of the liquid and moves along surface. How fast is the light travelling in the liquid?

A. 2.4×10^5 m/s

B. 3.0×10^8 m/s

C. 1.2×10^8 m/s

D. 1.8×10^8 m/s

Answer: 4

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6. Two thin lenses of focal length f_1 and f_2 are in contact and coaxial. The power of the combination is

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

B. $\sqrt{\dfrac{f_1}{f_2}}$

C. $\sqrt{\dfrac{f_2}{f_1}}$

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

Answer: 1

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7. A boy is trying to start a fire by focusing sunlight on a piece of paper using an equiconvex lens of focal length $10cm$. The diameter of the sun is $1.39 \times 10^{9} m$ and its mean distance from the earth is $1.5 \times 10^{11} m$. What is the diameter of the sun's image on the paper ?

A. $12.4x10^{-4}$ m

B. $9.2x10^{-4}$ m

C. 6.5×10^{-4} m

D. $6.5 \times 1O^{-5}$ m

Answer: 2

Watch Video Solution

8. A converging lens forms a real image I on its optic axis. A rectangular galss slab of refractive index μ and thickness t is introduced between the lens and I. I will move

A. towards the lens (μ-l)x

B. towards the lens by $\left(1 - \frac{1}{\mu}\right)$x

C. away from the lens by (μ -1) x

D. away from the lens by $\left(1 - \frac{1}{\mu}\right)$x

Answer: 4

Watch Video Solution

9. When white light passes through a prism, the devination is maximum for

A. violet light

B. green light

C. red light

D. yellow light

Answer: 1

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10. An object 5 cm tall is placed 1 m from a concave spherical mirror which has a radius of curvature of 20 cm. The size of the image is

A. 0.11cm

B. 0.50 cm

C. 0.55 cm

D. 0.60 cm

Answer: 3

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11. Two point white dots are 1mm apart on a black paper. They are viewed by eye of pupil diameter 3mm. Approximately, what is the maximum distance at which these dits can be resolved by the eye? [Take wavelelngth of light =500nm]

A. 5 m

B. 1 m

C. 6 m

D. 3 m

Answer: 1

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12. The refractive index of a glass is 1.520 for red light and 1.525 for blue light. Let D_1 and D_2 be angles of minimum deviation for red and blue light respectively in a prism of this glass. Then,

A. $D_1 < D_2$

B. $D_1 = D_2$

C. D_1 can be less than or greater than D_2 depending upon the angle of prism

D. $D_1 > D_2$

Answer: 1

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13. In a laboratory four convex lenses L_1, L_2, L_3 and L_4 of focal lengths $2, 4, 6$ and $8cm$ respectively are available. Two of these lenses form a telescope of length $10cm$ and magnifying power 4 . The objective and eye lenses are

A. L_2, L_3

B. L_1, L_4

C. L_1, L_2

D. L_4, L_1

Answer: 4

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14. The velocities of light in two different mediums are $2 \times 10^8 ms^{-1}$ and $2.5 \times 10^8 ms^{-1}$ respectively. The critical angle for there mediums is

A. $\sin^{-1}\left(\frac{1}{5}\right)$

B. $\sin^{-1}\left(\frac{4}{5}\right)$

C. $\sin^{-1}\left(\frac{1}{2}\right)$

D. $\sin^{-1}\left(\frac{1}{4}\right)$

Answer: 2

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15. The critical angle for total internal reflection in diamond is 24.5° The refractive index of the diamond is

A. 2.41

B. 1.41

C. 2.59

D. 1.59

Answer: 1

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16. When a glass lens with $\mu = 1.47$ is immersed in a trough of liquid, it looks to be disappeared. The liquid in the trough could be

A. Water

B. Kerosene

C. Glycerin

D. Alcohol

Answer: 3

Watch Video Solution

17. A convex lens of refractive index 3/2 has a power of 2.5°. If it is placed in a liqud of refractive index 2,the new power of the lens is

A. -1.25D

B. -1.5D

C. 1.25 D

D. 1.5D

Answer: 1

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18. The position of an object placed 5 cm in front of concave mirror of radius of curvature 15 cm is

A. 7.5 cm

B. 15 cm

C. 20 cm

D. 27.5 cm

Answer: 2

Watch Video Solution

19. The speed of light in media M_1 and M_2 are $1.5 \times 10^8 m/s$ and $2.0 \times 10^8 m/s$ respectively. A ray of light enters from medium

M_1 to M_2 at an incidence angle i. If the ray suffers total internal reflection, the value of i is.

A. Equal to $\sin^{-1}\left(\frac{2}{3}\right)$

B. Equal to or less than $\sin^{-1}\left(\frac{3}{5}\right)$

C. Equal to or greater than $\sin^{-1}\left(\frac{3}{4}\right)$

D. Less than $\sin^{-1}\left(\frac{2}{3}\right)$

Answer: 3

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20. A ray of light is incident on a 60° prism at the minimum deviation position. The angle of refraction at the first face (i.e. incident face) of the prism is-

A. zero

B. 30°

C. 45°

D. 60°

Answer: 2

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21. A lens haivng focal length and aperture of diameter d forms an image of intensity I. Aperture of diameter $\frac{d}{2}$ in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively.

A. f and $\frac{1}{4}$

B. $\frac{3f}{4}$ and $\frac{I}{2}$

C. f and $\frac{3I}{4}$

D. $\frac{f}{2}$ and $\frac{I}{2}$

Answer: 3

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22. A Galilean telescope has objective and eye $-$ piece of focal lengths $200cm$ and $2cm$ respectively. The magnifying power of the telescope for normal vision is

A. 92

B. 100

C. 108

D. 198

Answer: 2

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23. A far sighted person has his near point 50 cm. Find the power of lens he should use to see at 25 cm, clearly.

A. + 1 D

B. $+$ 2 D

C. $-2D$

D. $-1D$

Answer: 2

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24. A plano-convex lens fits exactly into a plano-concave lens. Their plane surfaces are parallel to each other. If the lenses are made of different material of refractive indices μ_1 and μ_2 and R is the radius of curvature of the curved surface of the lenses, then focal length of the combination is

A. $\frac{R}{2(\mu_1 - \mu_2)}$

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

C. $\frac{2R}{\mu_2 - \mu_1}$

D. $\frac{R}{2(\mu_1 + \mu_2)}$

Answer: 2

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25. For a normal eye, the cornea of eye provides a converging power of $40D$ and the least converging power of the eye lens behind the cornea is $20D$. Using this information, the distance between the retina and the cornea eye lens can be estimated to be

A. 2.5 cm

B. 1.67 cm

C. 1.5 cm

D. 5 cm

Answer: 2

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26. If the focal length of the objective lens is increased then

A. microscope will decrease but that of telescope will increase

B. microscope will increase but that of telescope decrease

C. microscope and telescope both will increase

D. microscope and telescope both will decrease

Answer: 1

Watch Video Solution

27. The angle of a prism is A . One of its refracting surfaces is silvered. Lihgt 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. tanA

B. 2 sinA

C. cos A

D. $\frac{1}{2}$ cosA

Answer: 3

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28. In an astronomical telescope in normal adjustment a straight black line of length L is drawn on inside part of objective lens. The eye piece forms a real image of this line. The length of this image is I. The magnification of the telescope is

A. $\dfrac{L}{I}$

B. $\dfrac{L}{I}+I$

C. $\dfrac{L}{I}-I$

D. $\dfrac{L+I}{I-I}$

Answer: 1

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29. A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive index of the material of the prism for the above red green and blue wavelength are 1.39, 1.44 and 1.47 respectively, the prism will:

A. separate the red colour part from the green and blue colours.

B. Separate the blue colour part from the red and green colours.

C. Separate all three colours from one another

D. Not separate the three colours al all.

Answer: 1

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30. Two identical thin planoconvex glass lenses (refractive index 1.5) each having radius of curvature of $20cm$ are placed with their convex surfaces in contact at the centre. The intervening space is filled with oil of refractive index 1.7. The focal length of the combination is

A. -50 cm

B. 50 cm

C. -20 cm

D. -25 cm

Answer: 1

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

A. $90^{\circ} - A$

B. $180^{\circ} + 2A$

C. $180^{\circ} - 3A$

D. $180^{\circ} - 2A$

Answer: 4

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32. 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 suffers minimum deviation through the prism, the angle of minimum deviation and refractive index of the material of the prism respectively, are :

A. $45^\circ, \frac{1}{2}$

B. $30^\circ, \sqrt{2}$

C. $45^\circ, \sqrt{2}$

D. $30^\circ, \frac{1}{\sqrt{2}}$

Answer: 2

Watch Video Solution

33. An astronomical telesope has objective and eyepiece of focal lengths $40cm$ and $4cm$ respectively. To view an object $200cm$ away from the objective, the lenses must be separated by a distance :

A. 37.3 cm

B. 46.0 cm

C. 50.0 cm

D. 54.0 cm

Answer: 4

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EXERCISE- 4

1. A ray of light incident at an angle θ on a refracting face of a prism emerges from the other face normally. If the angle of the prism is 5° and the prism is made of a material of refractive index 1.5, the angle of incidence is.

A. 7.5°

B. 5°

C. 15°

D. 2.5°

Answer: 1

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2. A short pulse of white light is incident from air to a glass slab at normal incidence. After travelling through the slab, the first colour to emerge is.

A. blue

B. green

C. violet

D. red

Answer: 4

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3. An object appraches a convergent lens from the left of the lens with a uniform speed $5m/s$ and stops at the focus. The image

A. moves away from the lens with an uniform speed 5m/s

B. moves away from the lens with an uniform acceleration

C. moves away from the lens with a non-uniform acceleration

D. moves towards the lens with a non-uniform accelration

Answer: 3

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4. A passenger in an Aeroplan shall

A. never see a rainbow

B. may see a primary and a secondary rainbow as concentric circles

C. may see a primary and a secondary rainbow as concentric arcs

D. shall never see a secondary rainbow

Answer: 2

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5. You are given four sources of light each one providing a light of a 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 folowing statements is correct it the source of yellow light is replaced with that of other lights without changing the angle of incidence ?

A. The beam ofered light would undergo total internal reflection

B. The beam of red light would bend towards the niormal 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: 3

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6. The radius of curvature of the curved surface of a plano-convex lens is $20cm$. If the refractive index of the material of the lens be 1.5, it will

A. act as a convex lens only for the objects that lie on its curved side

B. act as a concave lens for the objects that lie on its curved side

C. act as a convex lens irrespective of the side on which the object lies

D. act as a concave lens irrespective of side on which the object lies

Answer: 3

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7. The phenomena involved in the reflected of radiowaves by ionosphere is similar to.

A. reflection of light by a plane mirror

B. total internal reflection of light in air during a mirage

C. dispersion of light by water molecules during the formation of a rainbow

D. scattering of light by the particles of air

Answer: 2

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8. The direction of ray of light incidnet on concave mirror is shown by PQ while direction in which the ray would travel after reflection is shown by four rays marked 1,2,3 and 4 (figure). Which of the four rays correctly shows the direction of reflected ray?

A. 1

B. 2

C. 3

D. 4

Answer: 2

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9. The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in figure, the path shown is correct?

A. 1

B. 2

C. 3

D. 4

Answer: 2

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10. A car is moving with a constant speed of $60 kmh^{-1}$ on a straight road. Looking at the rear view mirror, the driver finds that the car following him is at a distance of $100 m$ and is approaching with a speed of $5 kmh^{-1}$. In order to keep track of the car in the rear, the driver begins to glane alternatively at the rear and side mirror of his car after every $2 s$ till the other car overtakes. If the two cars were maintaining their speeds, which of the following statement (s) is/are correct ?

A. The speed of the car in the rear is 65kmh

B. In the side mirror, the car in the rear would appear to approach with a speed of 5km hr* to the driver of the leading car

C. In the rear view mirror, the speed of the approaching car would appear to decrease as the distance between the cars decreases

D. In the side mirror, the speed of the approaching car would appear to increase as the distance between the cars decreases

Answer: 4

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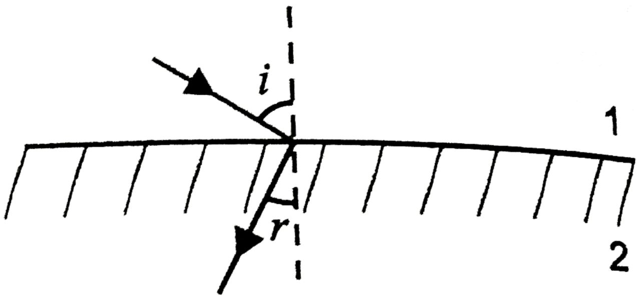
11. There are certain materials developed in laboratories which have a negative refractive index, Fig. A ray incident from air (medium 1) into such a medium (medium 2) shall follow a path given by

(a)



.

A.

B.

C.

D.

Answer: 1

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12. The near vision of an average person is $25cm$. To view an object with an angular magnification of 10, what should be the power of the microscope ?

A. 30D

B. 40D

C. 20D

D. 50D

Answer: 2

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13. Three immiscible liquids of densities $d_1 > d_2 > d_3$ and refractive indices $\mu_1 > \mu_2 > \mu_3$ are put in a beaker. The height of each liquid column is $\frac{h}{3}$. A dot is made at the bottom of the beaker. For near normal vision, find the apparent depth of the dot.

A. $\frac{h}{3}\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}+\frac{1}{\mu_3}\right)$

B. $\frac{3}{h}\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}+\frac{1}{\mu_3}\right)$

C. $\frac{1}{h}\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}+\frac{1}{\mu_3}\right)$

D. $h\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}+\frac{1}{\mu_3}\right)$

Answer: 1

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14. For a prism of refractive index 1.732, the angle of minimum deviation is equal to the angle of the prism. The angle of the prism is

A. 45°

B. 30°

C. 60°

D. 90°

Answer: 3

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15. A thin convex lens of focal length $25cm$ is cut into two pieces $0.5cm$ above the principal axis. The top part is placed at (0,0) and an object placed at $(-50cm, 0)$. Find the coordinates of the image.

A. (0 cm,50cm)

B. (50 cm,-1cm)

C. (50 cm, 1cm)

D. (50 cm,0)

Answer: 2

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16. A myopic adult has a far point at $0.1m$. His power of accomodation is 4 diopters.

(i) What power lenses are required to see distant objects ?

(ii) What is his near point without glasses ?

(iii) What is his near point with glasses ? (Take the image distance from the lens of the eye to the retina to be 2 cm).

A. -20D

B. -10D

C. -30D

D. $-40D$

Answer: 2

Watch Video Solution

17. AinyopicadulthasafarpointatO.l m. His power of accomodation is 4D. What is his near point with out glasses? (Take the image distance from the lens of the eye to the retina to be 2 cm)

A. 0.07 m

B. 0.7 m

C. 7 m

D. 0.007m

Answer: 1

View Text Solution

18. A myopic adult has a far point at $0.1m$. His power of accomodation is 4 diopters.

(i) What power lenses are required to see distant objects ?

(ii) What is his near point without glasses ?

(iii) What is his near point with glasses ? (Take the image distance from the lens of the eye to the retina to be 2 cm).

A. 25m

B. 0.25 m

C. 2.5 m

D. 20 m

Answer: 2

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EXERCISE- 4 One or more than one correct answer type

1. Consider an extended object immersed in water contained in a plane through. When seen from close to the edge of the through, the object looks distorted because.

A. the apparent depth of the points close to the edge are nearer the surface of the water compared to the points away from the edge

B. the angle subtended by the image of the object at the eye is smaller than the actual angle subtended by the object in air

C. some of the points of the object far away from the edge may not be visible becuse of total internal reflection

D. water in a trough acts as a lens and magnifies the object

Answer: 1,2,3

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2. A rectangular block of glass ABCD has a refractive index 1.6. A pin is placed midway on the face AB of figure. When observed from the face AD, the pin shall

A. appear to be near A

B. appear to be near D

C. appear to be at the centre of AZ)

D. not be seen at all

Answer: 1,4

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3. Between the primary and secondary rainbows, there is a dark band known as Alexander's dark band. This is because

A. light scattered into this region interfere destructively

B. there is no light scattered into this region

C. light is absorbed in this region

D. angle made at the eye by the scattered rays with respect to the incident light of the sun lies between approximately 42° and 50°

Answer: 1,4

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4. A magnifying glass is used, as the object to be viewed can be brought closer to the eye than the normal near point. This results in.

A. a larger angle to be subtended by the object at the eye and hence, viewed in greater detail

B. the formation of a virtual erect image

C. increase in the field of view

D. infinite magnification at the near point

Answer: 1,2

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5. An astronomical refractive telescope has an objective of focal length $20m$ and an eyepiece of focal length $2cm$.

A. The length ofthe telescope tube is 20.02 m

B. The magnification is 1000

C. The image formed is inverted

D. An objective of a larger aperture will increase the brightness and reduce chromatic aberration of the image

Answer: 1,2,3

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6. The box of a pin hole camera, of length L, has a hole of radius a . It is assumed that when the hole is illuminated by a parallel beam of light of wavelength λ the spread of the spot (obtained on the opposite wall of the camera) is the sum of its geometrical spread and the spread due to diffraction. The spot would then have its minimum size (say b_(min)) when:

A. a = $\frac{\lambda^2}{L}$ and b_(min) = $\left(\frac{2\lambda^2}{L}\right)$

B. a = $\sqrt{\lambda L}$ and b_(min) = $\left(\frac{2\lambda^2}{L}\right)$

C. a = $\sqrt{\lambda L}$ and b_(min) = $\sqrt{4\lambda L}$

D. a = $\frac{\lambda^2}{L}$ and b_(min) =$\sqrt{4\lambda L}$

Answer: 3

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7. In an experiment for determination of refractive index of glass of a prism by i -δ ,plot, it was found that a ray incident at angle 35° , suffers a deviation of 40° and that it emerges an 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: 1

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8. An object 2.4 m in front of a lens forms a sharp image on a film 12 cm behind the lens. A glass plate 1 cm thick, of refractive index 1.50 is interposed between lens and film with its plane faces parallel to film. At what distance (from lens) should object shifted to be in sharp focus of film?

A. 7.2m

B. 2.4m

C. 3.2m

D. 5.6m

Answer: 4

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9. The graph between angle of deviation (δ) and angle of incidence (i) for a triangular prism is represented by

A. 

B. 

C.

D.

Answer: 2

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10. The diameter of a plano convex lens is $6cm$ and thickness at the centre is $3mm$. If the speed of light in the material of the lens is $2 \times 10^8 m/s$, what is the focal length of the lens ?

A. 20cm

B. 30cm

C. 10cm

D. 15cm

Answer: 2

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11. A thin convex lens made from crown glass $(\mu = 3/2)$ has focal length f. When it is measured in two different liquids having refractive indiced $4/3$ and $5/3$, it has the focal length f_1 and f_2 respectively. The correct ralation between the focal lengths is

A. $f_2 > f$ and f_1 becomes negative

B. $f_1$and f_2 both become negative

C. $f_1 = f_2 < f$

D. $f_1 > f$ and f_2 becomes negative

Answer: 4

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12. A green light is incident from the water to the air-water interface at the critical angle (θ). Select the correct statement

A. The spectrum of visible light whose frequency is more than that of green light will come out to the air medium

B. The entire spectrum of visible fight will come out ofthe water at various angles to the normal

C. The entire spectrum of visible fight will come out of the water at an angle of 90° to the normal

D. The spectrum of visible light whose frequency is less than that of green light will come out to the air medium

Answer: 4

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13. Monochromatic light is incident on a glass prism ABC of angle A. If the refractive index of the material of the prism is μ, a ray, incident at angle θ, on the face AB would get transmitted through the face AC of the pristn 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. $\theta > \sin^{-1}\left[\mu \sin\left(A + \sin^{-1}\left(\frac{1}{\mu}\right)\right)\right]$

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

Answer: 1

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