PHYSICS

BOOKS - NCERT FINGERTIPS PHYSICS (HINGLISH)

RAY OPTICS AND OPTICAL INSTRUMENTS

Reflection Of Light By Spherical Mirrors

1. A boy of height 1m stands in front of a convex mirror. His distance from the mirror is equal to its focal length. The height of his image is

A. $0.25m$

B. $0.33m$

C. $0.5m$

D. $0.67m$

Answer: C

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2. A concave shaving mirror has a radius of curvature of $35.0cm$. It is positioned so that the (upright) image of man's face is 2.50 times the size of the face. How far is the mirror from the face ?

A. $5.25cm$

B. $21.0cm$

C. $10.5cm$

D. $42cm$

Answer: C

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3. 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. $10cm$

B. $15cm$

C. $2.5cm$

D. $5cm$

Answer: D

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4. An object $2cm$ high is placed at a distance of $16cm$ from a concave mirror, which produces a real image $3cm$ high. What is the focal length of the mirror ? Find the position of the image ?

A. $-9.6cm$

B. $-3.6cm$

C. $-6.3cm$

D. $-8.3cm$

Answer: A

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5. When an object is kept at a distance of $30cm$ from a concave mirror, the image is formed at a distance of $10cm$. If the object is

moved with a speed of $9cms^{-1}$ the speed with which the image moves is

A. $10ms^{-1}$

B. $1ms^{-1}$

C. $9ms^{-1}$

D. $0.9ms^{-1}$

Answer: B

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Refraction

1. A microscope is focused on a mark on a piece of paper and then a slab of glass of thickness $3cm$ and refractive index 1.5 is placed over the mark. How should the microscope be moved to get the mark in focus again ?

A. $4.5cm$ downward

B. $1cm$ downward

C. $2cm$ downward

D. $1cm$ upward

Answer: D

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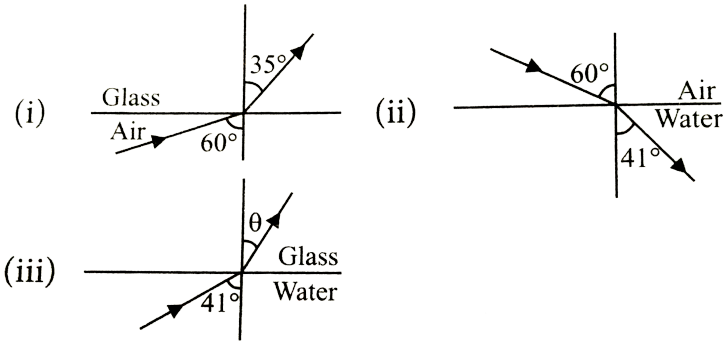
2. Refraction of light from air to glass and from air to water are shown in figure (i) and figure (ii) below. The value of the angle θ in the case of refraction as shown in figure (iii) will

be



A. 30°

B. 35°

C. 60°

D. 41°

Answer: B

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3. A ray of light strikes a transparent rectangular slab of refractive index $\sqrt{2}$ at an angle of incidence of 45°. The angle between the reflected and refracted rays is

A. 75°

B. 90°

C. 105°

D. 120°

Answer: C

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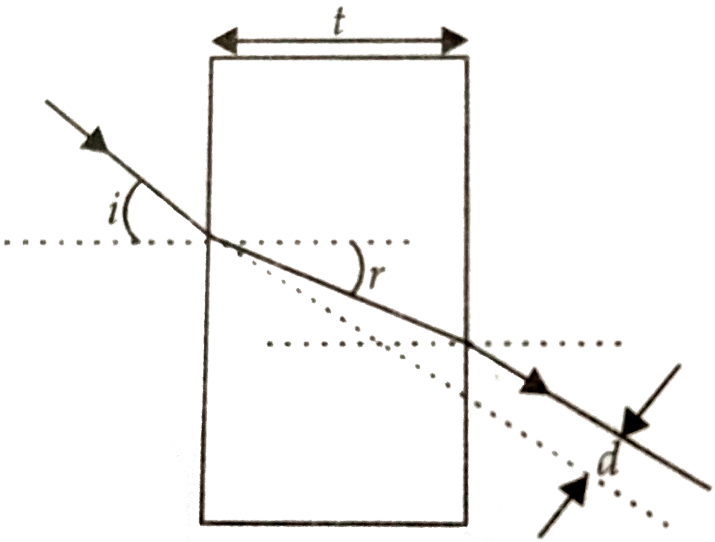
4. A rays of light is incident on a thick slab of glass of thickness t as shown in figure. The emergent ray is parallel to the incident ray but displaced sideways by a distance d. If the

angles are small then d is



A. $t\left(1+\frac{i}{r}\right)$

B. $rt\left(1-\frac{i}{r}\right)$

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

D. $t\left(1+\frac{r}{i}\right)$

Answer: C

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5. 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. 50°

B. 60°

C. 90°

D. 40°

Answer: C

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6. The apparent depth of a needle laying at the bottom of the tank, which is filled with water of refractive index 1.33 to a height of 12.5 cm is measured by a microscope to be $9.4cm$. If

water is replaced by a liquid of refractive index 1.63 up to the same height. What distance would the microscope have to be moved to focus on the needle again ?

A. $1.73cm$

B. $2.13cm$

C. $1.5cm$

D. $2.9cm$

Answer: A

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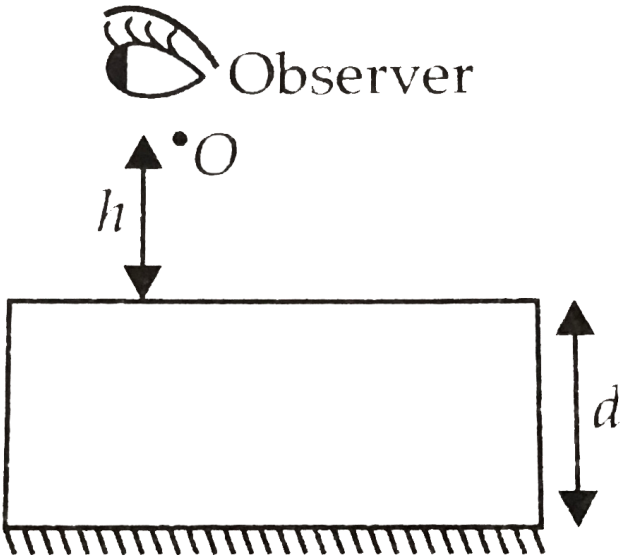
7. A point luminous object (O) is at a distance h from front face of a glass slab of width d and of refractive index μ. On the back face of slab is a refracting plane mirror. An observer sees the image of object in mirror as shown in figure. Distance of image from front face as

seen by observer will be



A. $h + \frac{2d}{\mu}$

B. $2h + 2d$

C. $h + d$

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

Answer: A

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8. A vessel of depth x is half filled with oil of refractive index μ_1 and the other half is filled with water of refractive index μ_2. The apparent depth of the vessel when viewed above is

A. $\frac{x(\mu_1+\mu_2)}{2\mu_1\mu_2}$

B. $\frac{x\mu_1\mu_2}{2(\mu_1+\mu_2)}$

C. $\frac{x\mu_1\mu_2}{(\mu_1+\mu_2)}$

D. $\frac{2x(\mu_1+\mu_2)}{\mu_1\mu_2}$

Answer: A

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9. 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. $\frac{h}{6}\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}+\frac{1}{\mu_3}\right)$

B. $\frac{h}{6}\left(\frac{1}{\mu_1}-\frac{1}{\mu_2}-\frac{1}{\mu_3}\right)$

C. $\frac{h}{3}\left(\frac{1}{\mu_1}-\frac{1}{\mu_2}-\frac{1}{\mu_3}\right)$

D. $\frac{h}{3}\left(\frac{1}{\mu_1}+\frac{1}{\mu_2}+\frac{1}{\mu_3}\right)$

Answer: D

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10. A tank is filled with water to a height of $15.5cm$. The apparent depth of a needle lying at the bottom of the tank is measured by a

microscope to be $8.5cm$. If water is replaced by a liquid of refractive index 1.94 up to the same height by what distance would the microscope have to be moved to focus on the needle again ?

A. $1.00cm$

B. $2.37cm$

C. $0.51cm$

D. $3.93cm$

Answer: C

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Total Internal Reflection

1. For a total internal reflection, which of the following is correct ?

A. Light travel from rarer to denser medium.

B. Light travel from denser to rarer medium.

C. Light travels in air only.

D. Light travels in water only.

Answer: B

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2. Light travels in two media A and B with speeds $1.8 \times 10^8 ms^{-1}$ and $2.4 \times 10^8 ms^{-1}$ respectively. Then the critical angle between them is

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

B. $\tan^{-1}\left(\frac{3}{4}\right)$

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

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

Answer: D

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3. Critical angle of glass is θ_1 and that of water is θ_2. The critical angle for water and glass surface would be $\left(\mu_g = 3/2, \mu_w = 4/3\right)$

A. less than θ_2

B. between θ_1 and θ_2

C. greater than θ_2

D. less than θ_1

Answer: C

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4. Critical angle for light going from medium (i) to (ii) is θ . The speed of light in medium (i) is v then speed in medium (ii) is

A. $v(1-\cos\theta)$

B. $\frac{v}{\sin\theta}$

C. $\frac{v}{\cos\theta}$

D. $\frac{v}{(1-\sin\theta)}$

Answer: B

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5. A ray of light travelling in a transparent medium f refractive index μ, falls on a surface separating the medium from air at an angle of

incidence of 45°. For which of the following value of μ the ray can undergo total internal reflection ?

A. $\mu = 1.33$

B. $\mu = 1.40$

C. $\mu = 1.50$

D. $\mu = 1.25$

Answer: C

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6. A point source of light is placed at a depth of h below the surface of water of refractive index μ. A floating opaque disc is placed on the surface of water so that light from the source is not visible from the surface. The minimum diameter of the disc is

A. $\frac{2h}{(\mu^2-1)^{1/2}}$

B. $2h(\mu^2-1)^{1/2}$

C. $\frac{h}{2(\mu^2-1)^{1/2}}$

D. $h(\mu^2-1)^{1/2}$

Answer: A

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7. Mirage' is a phenomenon due to

A. refraction of light

B. reflection of light

C. total internal reflection of light

D. diffraction of light.

Answer: C

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Reflection At Spherical Surfaces And By Lenses

1. From a point source a light falls on a spherical glass surface ($\mu = 1.5$ and radius of curvature $= 10cm$). The distance between point source and glass surface is $50cm$. The position of image is

A. $25cm$

B. $50cm$

C. $100cm$

D. $150cm$

Answer: B

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2. An air bubble in a glass sphere $(\mu = 1.5)$ is situated at a distance $3cm$ from a convex surface of diameter $10cm$. At what distance from the surface will the bubble appear ?

A. $2.5cm$

B. $-2.5cm$

C. $5cm$

D. $-5cm$

Answer: B

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3. A convex refracting surface of radius of curvature $20cm$ separates two media of refractive indices $4/3$ and 1.60. An object is

placed in the first medium $(\mu = 4/3)$ at a distance of $200cm$ from the refracting surface. Calculate the position of image formed.

A. $120cm$

B. $240cm$

C. $100cm$

D. $60cm$

Answer: B

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4. 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. $25cm$

B. $50cm$

C. $100cm$

D. $200cm$

Answer: C

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5. A mark placed on the surface of a sphere is viewed through glass from a position directly opposite. If the diameter of the sphere is $10cm$ and refractive index of glass is 1.5, find the position of the image.

A. $-20cm$

B. $30cm$

C. $40cm$

D. $-10cm$

Answer: A

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6. A biconvex lens has focal length $\frac{2}{3}$ times the radius of curvature of either surface. Calculate refractive index of material of the lens.

A. 1.75

B. 1.33

C. 1.5

D. 1.0

Answer: A

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

$(\mu = 1.33)$. Find the change in the focal length of the lens.

A. $5.8m$

B. $0.58cm$

C. $0.58m$

D. $5.8cm$

Answer: C

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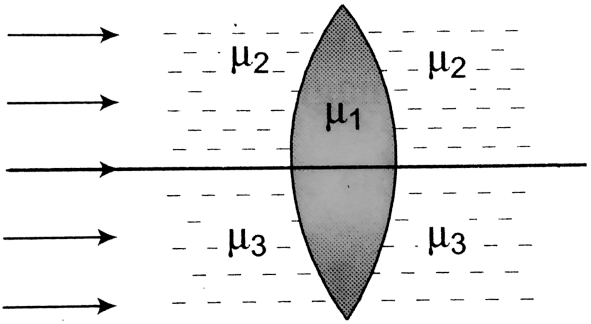
8. A double convex lens, lens made of a material of refractive index μ_1, is placed inside two liquids or refractive indices μ_2 and μ_3, as shown. $\mu_2 > \mu_1 > \mu_3$. A wide, parallel beam of light is incident on the lens from the left. The lens will give rise to



A. a single convergent beam

B. two different convergent beams

C. two different divergent beams

D. a convergent and a divergent beam.

Answer: D

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

A. $11cm$

B. $22cm$

C. $7cm$

D. $6cm$

Answer: B

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10. 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 ?

A. $\frac{6}{5}$

B. $\frac{7}{4}$

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

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

Answer: D

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11. The radii of curvature of the surfaces of a double convex lens are $20cm$ and $40cm$ respectively, and its focal length is $20cm$. What is the refractive index of the material of the lens ?

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

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

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

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

Answer: C

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12. A convex lens is dipped in a liquid whose refractive index is equal to the refractive of the lens. Then its focal length will

A. become zero

B. become infinite

C. remain small, but non-zero

D. remain unchanged

Answer: B

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

A. $0.12m$

B. $0.6m$

C. $0.3m$

D. $0.15m$

Answer: A

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14. Radii of curvature of a converging lens are in the ratio $1:2$. Its focal length is $6cm$ and refractive index is 1.5. Then its radii of curvature are

A. $9cm$ and $18cm$

B. $6cm$ and $12cm$

C. $3cm$ and $6cm$

D. $4.5cm$ and $9cm$

Answer: D

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15. A man 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 the diameter of the sun's image on the paper is

A. $3.1 \times 10^{-4} cm$

B. $6.5 \times 10^{-5} cm$

C. $6.5 \times 10^{-4} m$

D. $9.2 \times 10^{-4} m$

Answer: D

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16. A square card of side length 1 mm is being seen through a magnifying lens of focal length 10 cm. The card is placed at a distance of 9 cm from the lens. The appaent area of the card thorugh the lens is

A. $1cm^2$

B. $0.81cm^2$

C. $0.27cm^2$

D. $0.60cm^2$

Answer: A

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17. 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 the image will disappear

B. complete image will disappear

C. intensity of water will decrease

D. intensity of water will increase

Answer: C

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18. Which of the following form(s) a virtual and erect image for all position of the object?

A. Concave lens

B. Concave mirror

C. Convex mirror

D. Both (a) and (c)

Answer: D

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19. A real image of a distant object is formed by a plano-convex lens of its principal axis. Spherical aberration

A. absent

B. smaller, if the curved surface of the lens face the object.

C. smaller, if the plane surface of the lens faces the object.

D. same, which ever side of the lens faces the object.

Answer: B

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

A. $1m$

B. $0.5m$

C. $0.24m$

D. $2m$

Answer: C

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21. The image of a needle placed $45cm$ from a lens is formed on a screen placed $90cm$ on the

other side of lens. Find displacement of image if object is moved $5cm$ away from lens.

A. $10cm$, towards the lens

B. $15cm$, away from the lens

C. $15cm$, towards the lens

D. $10cm$, away from the lens

Answer: C

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22. A tree is $18.0m$ away from $2.0m$ high from a concave lens. How high is the image formed by the given lens of focal length $6m$?

A. $1.0m$

B. $1.5m$

C. $0.75m$

D. $0.50m$

Answer: D

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23. A luminous object is separated from a screen by distance d. A convex lends is placed between the object and the screen such that it forms a distinct image on the screen. The maximum possible focal length of this convex lens is.

A. $4d$

B. $2d$

C. $d/2$

D. $d/4$

Answer: D

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24. A screen is placed $90cm$ from an object. The image of the object on the screen is formed by a convex lens at two different location separated by $20cm$. Determine the focal length of the lens.

A. $42.8cm$

B. $21.4cm$

C. $10.7cm$

D. $5.5cm$

Answer: B

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25. A lens having focal length f and aperture of diameter d forms an image of intensity I. Aperture of diameter $d/2$ 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 $\frac{I}{4}$

B. $\frac{3f}{4}$ and $\frac{I}{2}$

C. f and $\frac{3I}{4}$

D. $\frac{f}{2}$ and $\frac{I}{2}$

Answer: C

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26. 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. $(50cm, -2cm)$

B. $(50cm, -1cm)$

C. $(3cm, -50cm)$

D. $(60cm, -25cm)$

Answer: B

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

A. 22.86 same side of the object

B. 22.86 opposite side of the object

C. 44.89 same side of the object

D. 44.89 opposite side of the object.

Answer: A

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28. The power of a biconvex lens is 10 dioptre and the radius of curvature of each surface is 10 cm. Then the refractive index of the material of the lens is

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

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

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

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

Answer: A

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29. 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. $1D$

B. $-1D$

C. $25D$

D. $-25D$

Answer: A

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30. The radius curvature of each surface of a convex lens of refractive index 1.5 is 40 cm. Calculate its power.

A. $2.5D$

B. $2D$

C. $1.5D$

D. $1D$

Answer: A

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31. Two lenses of focal lengths $20cm$ and $-40cm$ are held in contact. The

image of an object at infinity will be formed by the combination at

A. $10cm$

B. $20cm$

C. 40 cm

D. infinity

Answer: C

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32. An eye specialist prescribes spectacles having combination of convex lens of focal length 40cm in contact with a concave lens of focal length 25cm. The power of this lens combination in diopters is

A. $+1.5D$

B. $-1.5D$

C. $+6.67D$

D. $-6.67D$

Answer: B

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33. Two lenses of power $+10D$ and $-5D$ are placed in contact,

(i) Calculate the focal length of the combination

(ii) where should an object be held from the combination so as to obtain a virtual image of magnification 2 ?

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34. A real image of an object is formed at a distance of $20cm$ from a lens. On putting another lens in contact with it, the image is shifted $10cm$ towards the combination, Determine the power of the second lens.

A. 2D

B. 5D

C. 6D

D. 10 D

Answer: B

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35. A concave lens is placed in contact with a convex lens of focal length $25cm$. The combination produces a real image at a distance of $80cm$, when an object is at a distance of $40cm$. What is the focal length of concave lens ?

A. $-400cm$

B. $-200cm$

C. $+400cm$

D. $+200cm$

Answer: A

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36. Two identical glass $(\mu_g = 3/2)$ equiconvex lenses of focal length f are kept in contact. The space between the two lenses is filled with water $(\mu_w = 4/3)$. The focal length of the combination is

A. f

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

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

D. $\frac{3f}{4}$

Answer: D

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37. A convex lens of focal length 15 cm is placed on a plane mirror. An object is placed at 30 cm from the lens. The image is

A. real, at 30 cm in front of the mirror

B. real, at 30 cm behind the mirror

C. real, at 10 cm in front of the mirror

D. virtual, at 10 cm behind the mirror

Answer: C

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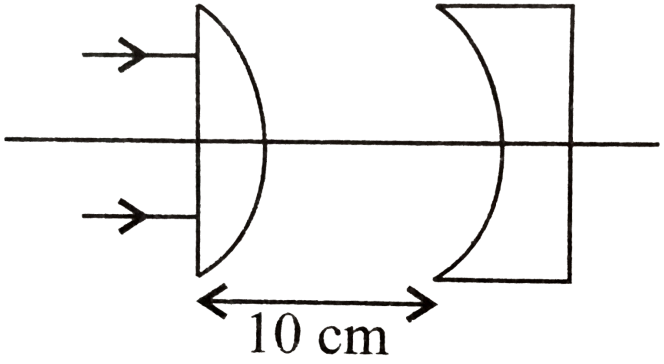
38. In the given figure, the radius of curvature of curved surface for both the plano-convex and plano-concave lens is 10 cm and refractive

index for both is 1.5. The location of the final image after all the refractions through lenses is



A. 15 cm

B. 20 cm

C. 25 cm

D. 40 cm

Answer: B

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39. A convex lens of radii of curvature 20cm and 30 cm respectively. It is silvered at the surface which has smaller radius of curvature. Then it will behave as $\left(\mu_g = 1.5\right)$

A. concave mirror with equivalent focal length $\frac{30}{11} cm.$

B. concave mirror with equivalent focal length $\frac{60}{11} cm.$

C. convex mirror with equivalent focal length $\frac{30}{11} cm.$

D. convex mirror with equivalent focal length $\frac{60}{11} cm.$

Answer: B

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40. A concave mirror of focal length f_1 is placed at a distance of d from a convex lens of focal length f_2. A beam of light coming from infinity and falling on this convex lens-concave mirror combination returns to infinity. The distance d must equal.

A. $f_1 + f_2$

B. $-f_1 + f_2$

C. $2f_1 + f_2$

D. $-2f_1 + f_2$

Answer: C

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41. A plano convex lens has focal length $f = 20cm$. If its plane surface is silvered, then new focal length will be

A. $20cm$

B. 40 cm

C. 30 cm

D. 10 cm

Answer: D

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Refraction Through A Prism

1. Two beam of red and violet colors are made to pass separately through a prism (angle of the prism is 60°). In the position of minimum deviation, the angle of refraction will be

A. 30° for both the colors

B. greater for the violet color

C. greater for the red color

D. equal but not 30° for both the colors

Answer: A

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2. 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. 60°

B. 30°

C. 45°

D. 120°

Answer: B

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3. A ray of light is incident at small angle I on the surface of prism of small angle A and emerges normally from the opposite surface. If the refractive index of the material of the prism is μ, the angle of incidence is nearly equal to

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

B. $\frac{A}{2\mu}$

C. μA

D. $\frac{\mu A}{2}$

Answer: C

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4. The angle of minimum deviation for prism of angle $\pi/3$ is $\pi/6$. Calculate the velocity of light in the material of the prism if the velocity of light in vacuum is $3 \times 10^8 ms^{-1}$.

A. $2.12 \times 10^8 ms^{-1}$

B. $1.12 \times 10^8 ms^{-1}$

C. $4.12 \times 10^8 ms^{-1}$

D. $5.12 \times 10^8 ms^{-1}$

Answer: A

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5. The angle of minimum deviation for a glass prism with $\mu = \sqrt{3}$ equals the refracting angle of the prism. What is the angle of the prism?

A. 45°

B. 30°

C. 90°

D. 60°

Answer: D

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6. 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. 1.732

B. 1.414

C. 1.5

D. 1.33

Answer: A

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7. A small angled prism $(\mu = 1.62)$ gives a deviation of 4.8. Calculate the angle of prism.

A. 5°

B. 6.36°

C. 3°

D. 7.74°

Answer: D

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8. Which of the following colours of white light deviated most when passes through a prism ?

A. Red light

B. Violet light

C. Yellow light

D. Both (a) and (b)

Answer: B

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9. White light is incident normally on a glass slab. Inside the glass slab,

A. red light travels faster than other colours

B. violet light travels faster than other colours

C. yellow light travels faster than other colours

D. all colours travels with the same speed.

Answer: A

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Some Natural Phenomena Due To Sunlight

1. Which light rays undergoes two internal reflection inside a raindrop, which of the rainbow is formed?

A. Primary rainbow

B. Secondary rainbow

C. Both (a) and (b)

D. Cant's say

Answer: B

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2. Which of the following satatment is correct ?

A. At sunset of sunrise, the sun's rays have to pass through a small distance in the atmosphere .

B. At sunset of sunrise the sun's rays have to pass through a larger distance in the atmosphere.

C. Rayleigh scattering which is proportional to $(1/\lambda_2)$

D. Most of the blue and other shorter wavelengths are not removed by scattering.

Answer: B

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Optical Instruments

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

A. the focal length of the eyes lens

B. the objects 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. An under-water swimmer cannot see very clearly even in absolutely clear water because of

A. absorption of light in water

B. scattering of light in water

C. reduction of speed of light in water

D. change in the focal length of eye lens

Answer: D

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3. The nearer point of hypermetropic eye is 40 cm. The lens to used for its correction should have the power

A. $+1.5D$

B. $-1.5D$

C. $+2.5D$

D. $+0.5D$

Answer: C

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4. When a telescope is in normal adjusment, the distance of the objective from the eyepiece is found to $100cm$. If the magnifying power of the telescope, at normal adjusment, is 24 focal lengths of the lenses are

A. 96 cm, 4 cm

B. 48 cm, 2 cm

C. 50 cm, 50 cm

D. 80 cm, 20 cm

Answer: A

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5. A compound microscope consists of an objective lens with focal length $1.0cm$ and eye piece of the focal length 2.0 cm and a tube $20cm$ from eye lens, the distance between the two lenses is

A. $6.00cm$

B. $7.75cm$

C. $9.25cm$

D. $11.0cm$

Answer: C

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6. In a compound microscope, the focal lengths of two lenses are $1.5cm$ and $6.25cm$ an object is placed at $2cm$ form objective and the final image is formed at $25cm$ from eye lens. The distance between the two lenses is

A. $6.00cm$

B. $7.75cm$

C. $9.25cm$

D. $11.0cm$

Answer: D

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7. A person with a normal near point $(25cm)$ using a compound microscope with an objective of focal length $8.0mm$ and eye piece of focal length $2.5cm$ can bring an object

placed $9.0cm$ from the objective in sharp focus. What is the separation between the two lenses ? Calculate the magnifying power of the microscope ?

A. $9.47cm, 88$

B. $3.36cm, 44$

C. $6.00cm, 22$

D. $4.79cm, 11$

Answer: A

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8. The final image in an astronomical telescope adjustment, a straingt black line of length L is drawn on the objective lens. The eyepiece forms a real image of this line. The length of this image is l. The magnification of thed telescope is

A. virtual and erect

B. real and erect

C. real and inverted

D. virtual and inverted

Answer: D

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9. 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. $\frac{L}{l}$

B. $\frac{L}{l}+1$

C. $\frac{L}{l}-1$

D. $\frac{L+l}{L-l}$

Answer: A

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10. The focal length of the lensese of an astronomical telescope are 50 cm and 5 cm. The length of the telescope when the image is

formed at the least distance of distinct vision is

A. $45cm$

B. $55cm$

C. $\frac{275}{6}cm$

D. $\frac{325}{6}cm$

Answer: D

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11. A small telescope has an objective lens of focal length $144cm$ and an eye-piece of focal length $6.0cm$. What is the magnifying power of the telescope ? What is the separation between the objective and the eye-piece ?

A. $0.75cm$

B. $1.38cm$

C. $1.0m$

D. $1.5m$

Answer: D

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12. An astronomical refractive telescope has an objective of focal length 20 m and an eyepiece of focal length 2 cm. Then

A. the magnification is 1000

B. the length of the telescope tube is 20.02 m

C. the image formed is inverted

D. all of these.

Answer: D

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13. A gaint refrecting telescope at an observatory has an objective lens of focal length $15m$. If an eye piece lens of focal length $1cm$ is used, find the angular magnification of the telescope.

If this telescope is used to view the moon, what is the diameter of image of moon formed by objective lens ? The diameter of the moon

is $3.42 \times 10^6 m$ and radius of lunar orbit is $3.8 \times 10^8 m$.

A. 1000

B. 1500

C. 2000

D. 3000

Answer: B

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14. A small telescope has an objective lens of focal length 140 cm and an eyepiece of focal length 5.0 cm. what is the magnifying power of the telescope for viewing distant objects when

(a) the telescope is in normal adjustment (i.e, when the final image is at infinity),

(b) The final image is formed at the least distance of distinct vision (25 cm)

A. 33.6

B. 66.12

C. 22.6

D. 11.6

Answer: A

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15. A reflecting type telescope has a large concave spherical mirror of radius of curvature $80cm$ as objective. What is the magnifying power of telescope if eye piece used has a focal length of $1.6cm$?

A. 100

B. 50

C. 25

D. 5

Answer: C

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16. A giant telescope in an observatory has an objective of focal length 19 m and an eye-piece of focal length $1.0cm$. In normal adjustment, the telescope is used to view the moon. What

is the diameter of the image of the moon formed by the objective? The diameter of the moon is $3.5 \times 10^6 m$. and the radius of the lunar orbit round the earth is $3.8 \times 10^8 m$.

A. $10cm$

B. $12.5cm$

C. $15cm$

D. $17.5cm$

Answer: D

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Miscellaneous

1. 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 reflection, it travels along the direction $\frac{1}{2}\left(\hat{i} - \sqrt{3}\hat{j}\right)$. The angle of incidence is

A. 30°

B. 45°

C. 60°

D. 75°

Answer: A

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2. The number of capital letters such as $A, B, C, D \ldots$. which are not laterally inverted by a plane mirror ?

A. 6

B. 7

C. 11

D. 13

Answer: C

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3. Two mirrors at an angle θ° produce 5 images of a point. The number of images produced when θ is decreased to $\theta^\circ - 30^\circ$ is

A. 9

B. 10

C. 11

D. 12

Answer: C

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4. A man stands symmetrically between two large plane mirrors fixed to two adjacent walls of a rectangular room. The number of images formed as

A. 4

B. 3

C. 2

D. 6

Answer: B

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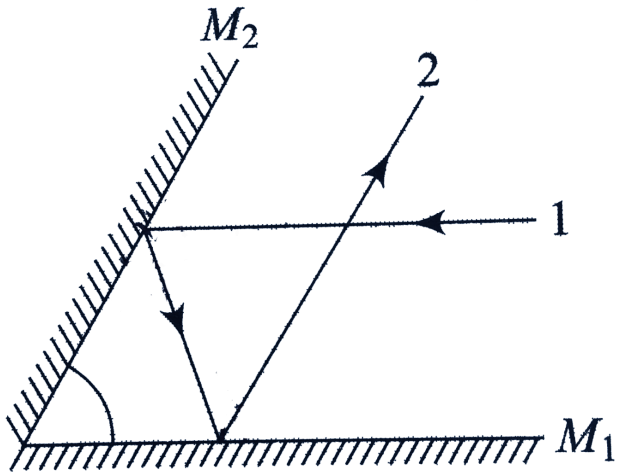
5. Two plane mirrors M_1 and M_2 are inclined at angle as shown in Figure . A ray of light1, which is parallel to M_1 , strike M_2 and after two reflections, ray 2 becomes parallel to M_2.

Find the angle θ .



A. 0°

B. 30°

C. 45°

D. 60°

Answer: D

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6. Two plane mirrors are placed parallel to each other at a distance L apart. A point object O placed between them, at a distance $L/3$ from the mirror. Both mirrors form multiple image. The distance between any two images cannot be

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

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

C. $2L$

D. L

Answer: A

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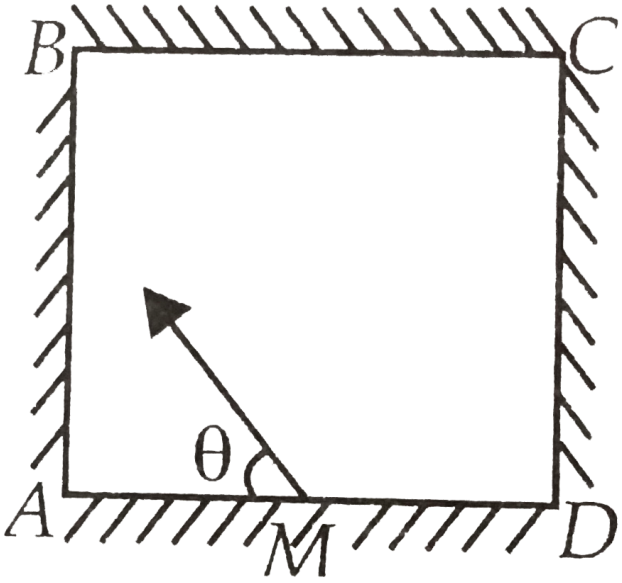
7. Four identical mirror are made to stand vertically to form a square arrangement as shown in a top view. A ray starts from the midpoint M of mirror AD and after two reflections reaches corner D. Then, angle θ

must be



A. $\tan^{-1}(0.75)$

B. $\cot^{-1}(0.75)$

C. $\sin^{-1}(0.75)$

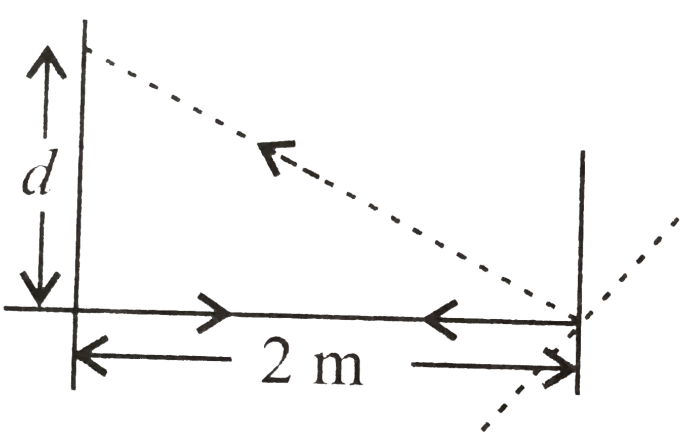
D. $\cos^{-1}(0.75)$

Answer: B

View Text Solution

8. Light incident normally on a plane mirror attached to a galvenometer coil reflects backward as shown in figure. A current in the coil produes a deflection of 3.5° if the mirror. The displacement of the reflected spot of light

on a screen placed $1.0m$ away is



A. $27.5m$

B. $48.9cm$

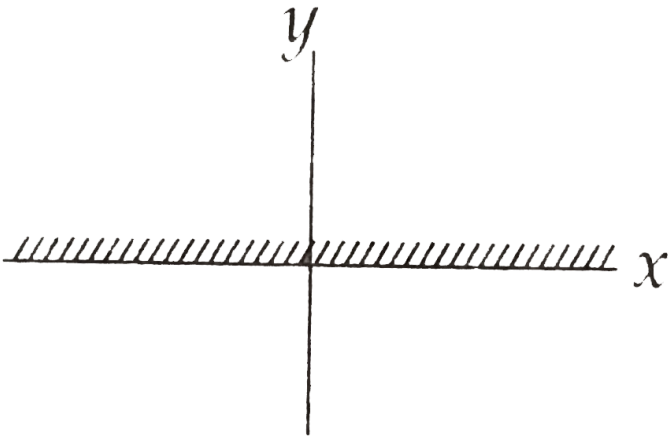
C. $24.5cm$

D. $12.2m$

Answer: C

View Text Solution

9. A plane mirror is placed along the x-axis facing negative y-axis. The mirror is fixed, A point object is moving with $3\hat{i} + 4\hat{j}$ in front of the plane mirror. The relative velocity of image with respect to its object is



A. $-8\hat{j}$

B. $8\hat{j}$

C. $3\hat{i} - 4\hat{j}$

D. $-6\hat{i}$

Answer: A

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Higher Order Thinking Skills

1. A point object O is placed at a distance of 20 cm is front of a equiconvex lens $\left(.^{a}\mu_{g}=1.5\right)$ of focal length 10 cm. The lens is placed on a liquid of refractive index 2 as shown in figure. Image will be formed at a distance h from lens the value of h is

A. 5 cm

B. 10 cm

C. 20 cm

D. 40 cm

Answer: D

View Text Solution

2. A ray of light travelling in a medium of refractive index μ is incident at an angle θ on a composite transparent plate consisting of 50 plates of R.I. $1.0\mu, 1.02\mu, 1.03\mu, \ldots\ldots, 1.50\mu$. The ray emerges from the composite plate into a medium of refractive index 1.6μ at

angle $'x'$. Then

A. $\sin x \left(\frac{1.01}{1.5}\right)^{50} \sin\theta$

B. $\sin x = \frac{5}{8}\sin\theta$

C. $\sin x = \frac{8}{5}\sin\theta$

D. $\sin x = \left(\frac{1.5}{1.01}\right)^{50} \sin\theta$

Answer: B

View Text Solution

3. A linear object of size $1.5cm$ is placed at 10 cm from a lens of focal length 20 cm. The optic centre of lens and the object are displaced are displaced a distance Δ. Thed magnification of the image formed is m. (Take optic centre of origin). The coordinates of image of A and B are (x_1, y_1) and (x_2, y_2) respectively then

A. $(x_1, y_1) = (-20cm, -2cm)$

B. $(x_2, y_2) = (-20cm, 2cm)$

C. $m = 5$

D. $m = 4$

Answer: B

View Text Solution

4. The size of the image of an object, which is at infinity, as formed by a convex lens of focal length 30 cm is 2 cm. If a concave lens of focal length 20 cm is placed between the convex lens and the image at a distance of 26 cm from

the convex lens, calculate the new size of the image.

A. $1.25cm$

B. $2.5cm$

C. $1.05cm$

D. $2cm$

Answer: B

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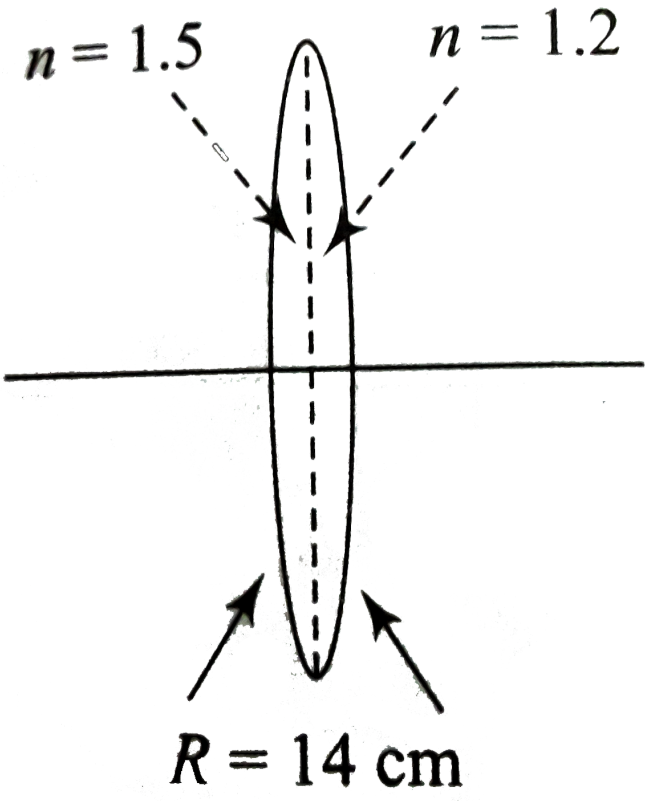
5. A bi-convex lens is formed with two thin plano-convex lenses as shown in the figure. Refractive index n of the first lens is 1.5 and that of the second lens if 1.2 Both the curved surfaces are of the same radius of curvature $R = 14cm$. For this bi-convex lens, for an object distance of 40cm, the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

will be



A. $-280.0cm$

B. $40.0cm$

C. $21.5cm$

D. $13.3cm$

Answer: B

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6. A ray of light moving along the vector ($-i-2j$)undergoes refraction at an interface two media, which is the x-z plane. The refractive index for $y>0$ is 2 and below it is

$\sqrt{5}/2$.the unit vector along which the refracted ray moves is:

A. $\frac{-3\hat{i}-5\hat{j}}{\sqrt{34}}$

B. $\frac{-\left(4\hat{i}-5\hat{j}\right)}{5}$

C. $\frac{-3\hat{i}-4\hat{j}}{5}$

D. $\frac{4\hat{i}-3\hat{j}}{5}$

Answer: D

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7. A small bulb (assumed to be a point source) is placed at the bottom of a tank containing water to a depth of $80cm$. Find out the area of the surface of water through which light from the bulb can emerge. Take the value of refractive index of water to be $4/3$.

A. $2.6m^2$

B. $3.6m^2$

C. $4.2m^2$

D. $5.8m^2$

Answer: A

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8. The mixture of a pure liquid and a solution in a along vertical column (i.e., horizontal dimensions $<<$ vertical dimensions) produces diffusion of solute particles and hence a refractive index gradient along the vertical dimension. A ray of light entering the column at right angles to the vertical is deviated from its original path. Find the

deviation in travelling a horizontal distance $d < < h$, the height of the column.

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Ncert Exemplar

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: A

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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: D

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3. An object approaches 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 $5ms^{-1}$

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 acceleration.

Answer: C

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4. A passenger in an aeroplane shall

A. never see a rainbow

B. may see a primary and a secondary rainbow is concentric arcs.

C. may see a primary and a secondary rainbow as concentric arcs.

D. shall never see a secondary rainbow.

Answer: B

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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 of red light would undergo total internal reflection.

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

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

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

Answer: C

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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: C

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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 particles of air.

Answer: B

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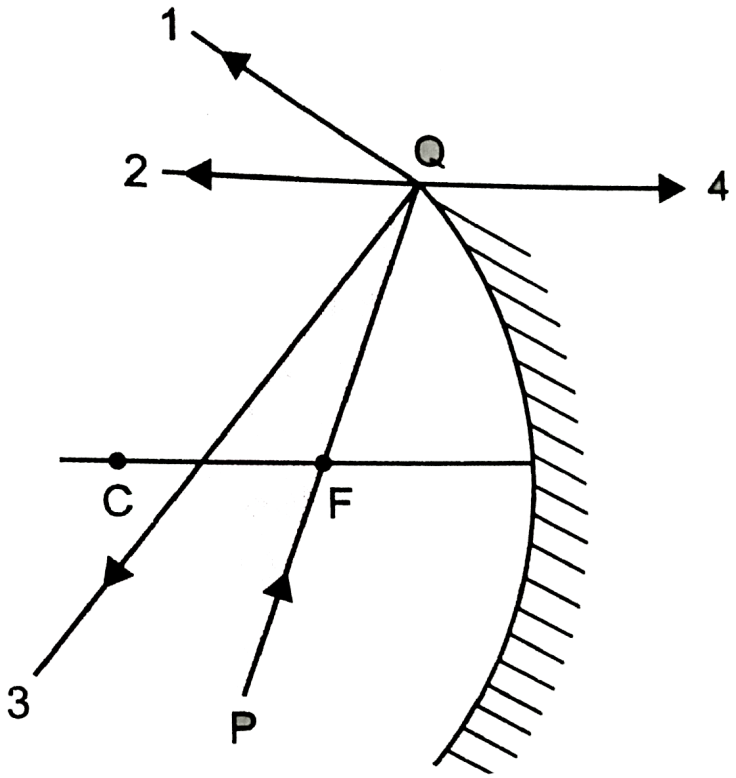
8. The direction of ray of light incident on a concave mirror is shown by PQ while directions in which the ray would travel after reflection is shown by four rays marked $1, 2, 3$ and 4, Fig. Which of the four rays correctly

shows the direction of reflected ray ?



A. 1

B. 2

C. 3

D. 4

Answer: B

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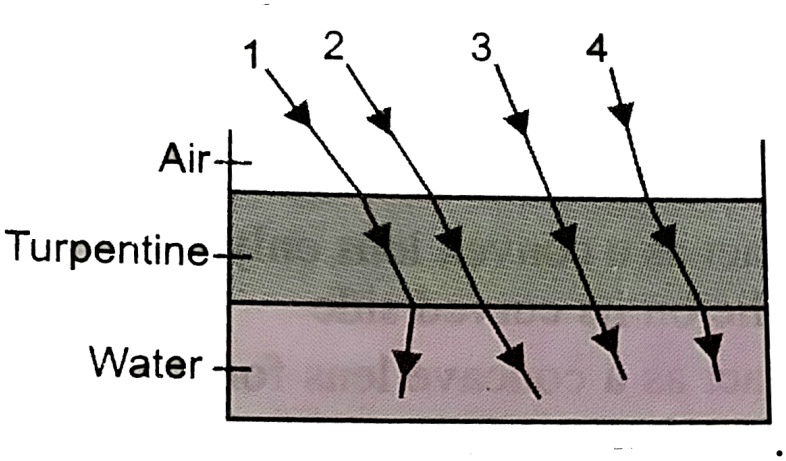
9. The optical density of turpentine is higher than that of water, while its mass density is lower. Fig. shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in Fig., the

path shows is correct ?



A. 1

B. 2

C. 3

D. 4

Answer: B

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10. A car is moving with a constant speed of $60kmh^{-1}$ on a straight road. Looking at the rear view mirror, the driver finds that the car following him is at a distance of $100m$ and is approaching with a speed of $5kmh^{-1}$. In order to keep track of the car in the rear, the driver begins to glance alternatively at the rear and side mirror of his car after every $2s$ 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 $65kmh^{-1}$.

B. In the side mirror the car in the rear would appear to approach with a speed of $5kmh^{-1}$ 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: D

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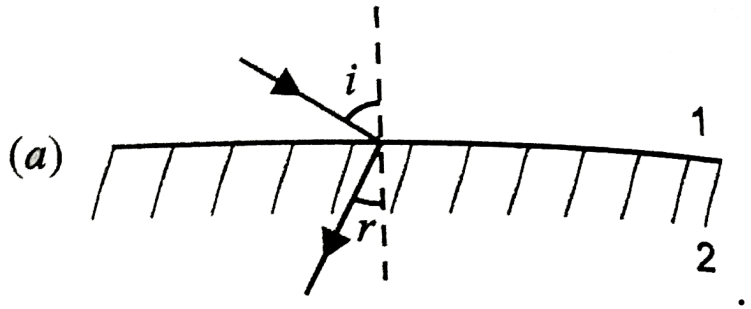
11. There are certain materials developed in laboratories which have a negative refractive index, Fig. A ray incident from air (medium 1) into such a medium (medium 2) shall follow a path given by



A.

B.

C.

D. 

Answer: A

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Assertion And Reason

1. Assertion : A convex mirror is preferred over a plane mirror in vehicles to observer traffic coming from behind.

Reason : Images formed by convex mirrors are erect and diminished in size.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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2. Assertion : The size of the mirror affect the nature of the image.

Reason : Small mirrors always forms a virtual image.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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3. Assertion : All the materials always have the same colour, whether viewed by reflected light or through transmitted light.

Reason : The colour of material does not depend on nature of light .

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

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

explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: D

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

Reason : 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 2f.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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

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

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

assertion.

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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6. Assertion : Optical fibers make use of total internal reflection.

Reason : Light undergoes successive total internal reflections as it moves through an optical fiber.

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

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

explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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7. Assertion : Diamond are known for their spectacular brilliance, but diamonds found in nature rarely exhibit the brilliance.

Reason : By cutting the diamond suitably,

multiple total internal reflections can be made to occur.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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8. Assertion : A convex lens of glass $(\mu = 1.5)$ behave as a diverging lens when immersed in carbon disulphinde of higher refractive index $(\mu = 1.65)$.

Reason : A diverging lens is thinner in the middle and thicker at the edges.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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9. Assertion : Combination of lenses helps to obtain diverging or converging lenses of desired magnification.

Reason : It enhances sharpness of the image.

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

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

explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

View Text Solution

10. Assertion : Angle of deviation depends on the angle of prism.

Reason : For thin prism, $\partial = (\mu - 1) - A$.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

 Watch Video Solution

11. Assertion : A beam of the white light shows no dispersion on emerging from a glass slab.

Reason : Dispersion in a glass slab is zero.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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12. Assertion : Bluish colour predominates in a clear sky, since blue has a shorter wavelength and is scattered strongly.

Reason : Blue has the shortest wavelength among all colours.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

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13. Assertion : The rainbow is an example of the dispersion of sunlight by the water drops in the atmosphere.

Reason : No reflection or refraction of light is involved in the formation of rainbow.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: C

 Watch Video Solution

14. Assertion : Sun looks reddish at sunrise and sunset.

Reason : Sun rays have to pass through larger distance in atmosphere.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: A

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15. Assertion : The focal length of an equiconvex lens placed in air to radius of curvature of either face.

Reason : For an equiconvex lens radius of curvature of both the faces is same.

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

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

C. If assertion is true but reason is false.

D. If both assertion and reason are false.

Answer: B

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