PHYSICS

BOOKS - DC PANDEY ENGLISH

RAY OPTICS

Only One Option Is Correct Jee Main

1. A person's eye is at a height of 1.5 m . He stands infront of a 0.3 m long plane mirror whose lower

end is 0.8m above the ground. The length of the image he sees of himself is

A. 1.5 m

B. 1.0 m

C. 0.8 m

D. 0.6 m

Answer: D

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2. Two plane mirrors A and B are parallel to each other and spaced 20 cm apart. An object is kept in between them at 15 cm from a. Out of the following, at which point, image is not formed in mirror a (distance measured from mirror A)

A. 15 cm

B. 25 cm

C. 45 cm

D. 55 cm

Answer: C

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3. A point object is kept between a plane mirror and a concave mirror facing each other. The distance between the mirrors is 22.5 cm . The distance between the mirrors is 20 cm. what should be the distance of the object from the concave mirror so that after two successive reflections the final image is formed on the object itself ? (consider first reflection from concave mirror).

A. 5 cm

B. 15 cm

C. 10 cm

D. 7.5 cm

Answer: B

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4. A luminous point object is moving along the principal axis of a concave mirror of focal length 12 cm towards it. When its distance from the mirror is 20 cm its velocity is 4 cm/s. the velocity of the image in cm/s at that instant is

A. 6, towards the mirror

B. 6, away from the mirror

C. 9, away from the mirror

D. 9,towards the mirror

Answer: C

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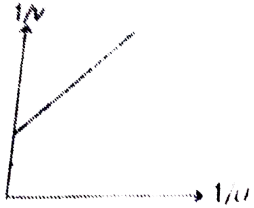
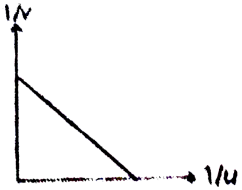
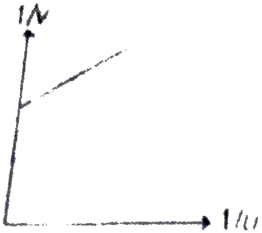
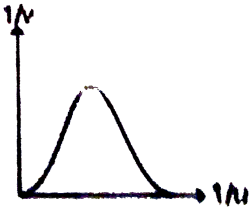
5. An object is placed at a distance u from a concave mirror and its real image is received on a screen placed at a distance of v from the mirror. If

f is the focal length of the mirror, then the graph between 1/v versus 1/u is

A. 

B. 

C. 

D. 

Answer: B

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6. A ray of light passes from vaccum into a medium of refractive index n. If the angle of incidence is twice the angle of refraction, then the angle of incidence is

A. $\cos^{-1}(n/2)$

B. $\sin^{-1}(n/2)$

C. $2\cos^{-1}(n/2)$

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

Answer: C

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7. 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. 120°

B. 90°

C. 60°

D. 150°

Answer: B

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8. The critical angle of light from medium A to medium B is θ. The speed of light in medium A is v. the speed of light in medium B is

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

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

C. $v\sin\theta$

D. $v\cos\theta$

Answer: A

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9. A ray of monochromatic light is incident on one refracting face of a prism of angle 75°. It passes thorugh the prism and is incident on the other

face at the critical angle. If the refractive index of the material of the prism is $\sqrt{2}$, the angle of incidence on the first face of the prism is

A. 30°

B. 45°

C. 60°

D. None of these

Answer: B

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

A. A / μ

B. $A / (2\mu)$

C. μA

D. $\mu A / 2$

Answer: C

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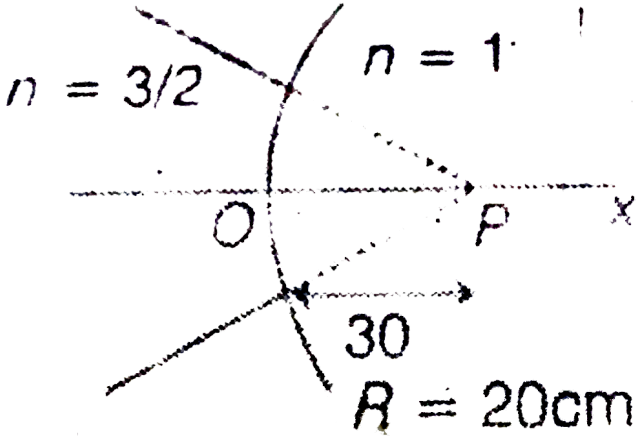
11. The image for the converging beam after refraction through the curved surface is formed at



A. 40 cm

B. $\frac{40}{3}$ cm

C. 20 cm

D. $\frac{180}{7}cm$

Answer: A

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12. A convex-concave diverging lens is made of glass of refractive index 1.5 and focal length 24 cm. radius of curvature for one surface is double that of the other. Then radii of curvature for the two surfaces are (in cm)

A. 6,12

B. 12,24

C. 3,6

D. 18,36

Answer: A

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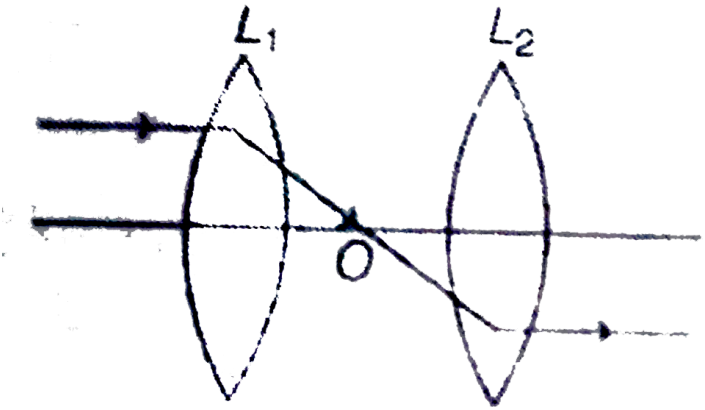
13. In the figure shown, there are two convex lenses L_1 and L_2 having focal. Lengths f_1 and f_2 respectively. The distance between L_1 and L_2 will

be



A. f_1

B. f_2

C. $f_1 + f_2$

D. $f_1 - f_2$

Answer: C

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14. The focal length of a plano-concave lens is -10 cm , then its focal length when its palne surface is polished is

A. 20 cm

B. $-5cm$

C. 5 cm

D. $-20cm$

Answer: C

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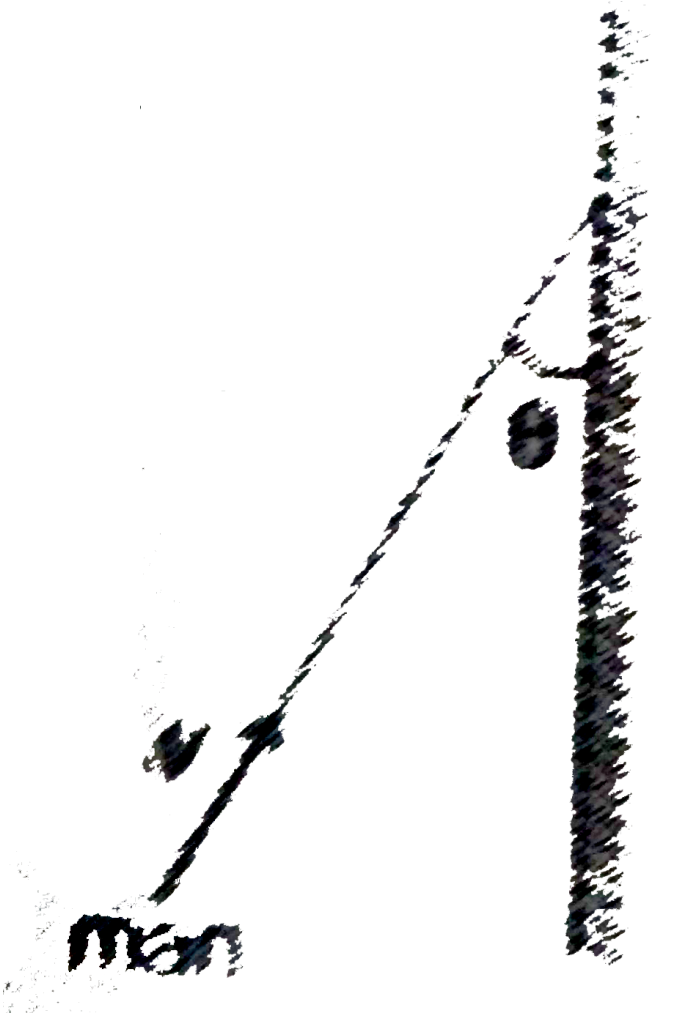
15. A person walks at a velocity v in a straight line forming an angle θ with the plane of a plane mirror. With what velocity v_{rel} the apporaches his

image ?



A. $2v \sin \theta$

B. $v \sin\left(\frac{\theta}{2}\right)$

C. $2v\cos\theta$

D. $v\cos\left(\frac{\theta}{2}\right)$

Answer: A

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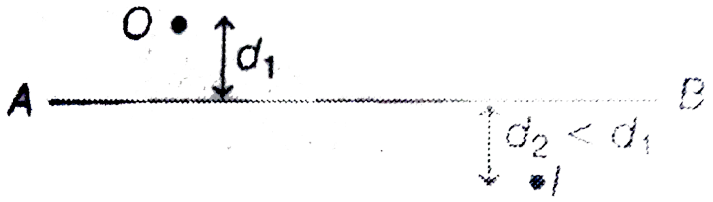
16. In the figureshownm the image of a real object is formed at point I. AB is the principal axis of the mirror. The mirror must be



A. concave and placed towards right of I

B. concave and placed towards left of I

C. convex and placed towards right of I

D. Convex and placed twowards left of I

Answer: A

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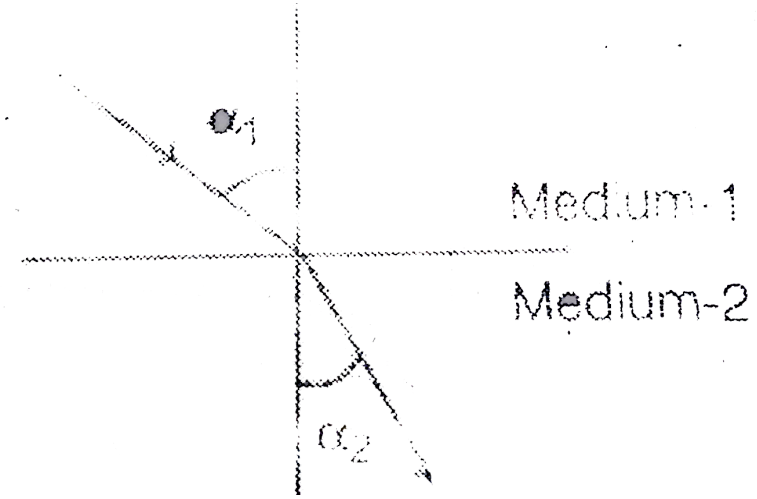
17. A beam of light propagation through a medium -1 and falls onto another medium-2, at an angle α_1 as shown. After that it propagates in

medium -2 at an angle α_2 as shown. The light's wavelength medium-1 is λ_1. What is the wavelength of light medium -2 ?



A. $\frac{\sin \alpha_1}{\sin \alpha_2} \lambda_1$

B. $\frac{\sin \alpha_2}{\sin \alpha_1} \lambda_1$

C. $\frac{\cos \alpha_1}{\cos \alpha_2} \lambda_1$

D. $\frac{\cos \alpha_2}{\cos \alpha_1} \lambda_1$

Answer: B

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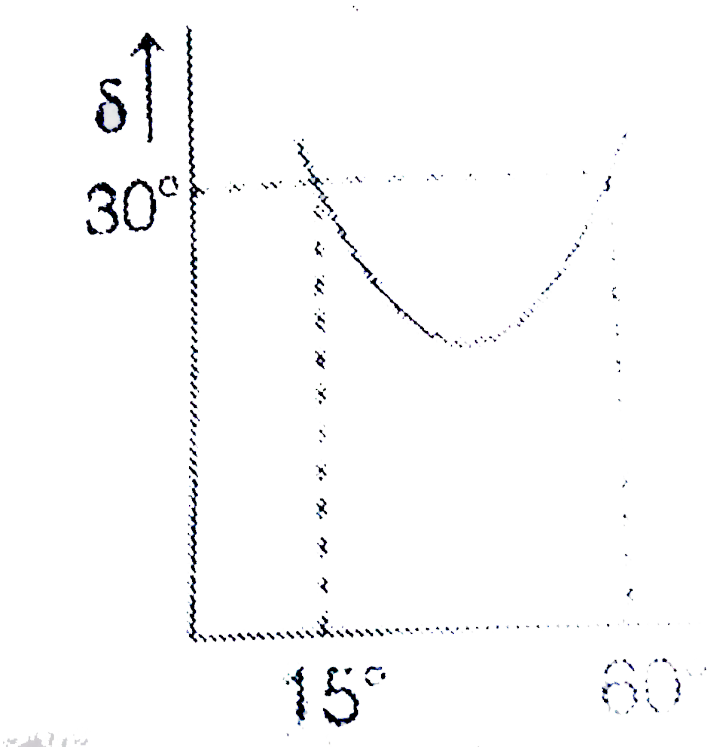
18. Figure shows graph of deviation δ versus angle of incidence for a light ray striking a prism.

Angle of prism is



A. 30°

B. 45°

C. 60°

D. 75°

Answer: B

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19. A screen is placed 90 cm away from an object. The image of the object on the screen is formed by a convex lens at two different locations separated by 20 cm. Find the focal length of lens.

A. 18 cm

B. 21.4 cm

C. 60 cm

D. 96.25 cm

Answer: B

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20. Light ray is incident on a prism of angle $A = 60^\circ$ are refractive index $\mu = \sqrt{2}$. The angle of incidence which the emergent rays grazes the surface is given

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

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

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

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

Answer: A

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21. A ray of light is incident at an angle α on the boundary separating two transparant media. It transmited in other medium. If the angle incidence is increased very slightly, the ray gets reflected in the same medium. The different

between angles of deviation in the two cases will close to

A. 2α

B. $90^\circ - \alpha$

C. $180^\circ - \alpha$

D. $180^\circ - \alpha$

Answer: B

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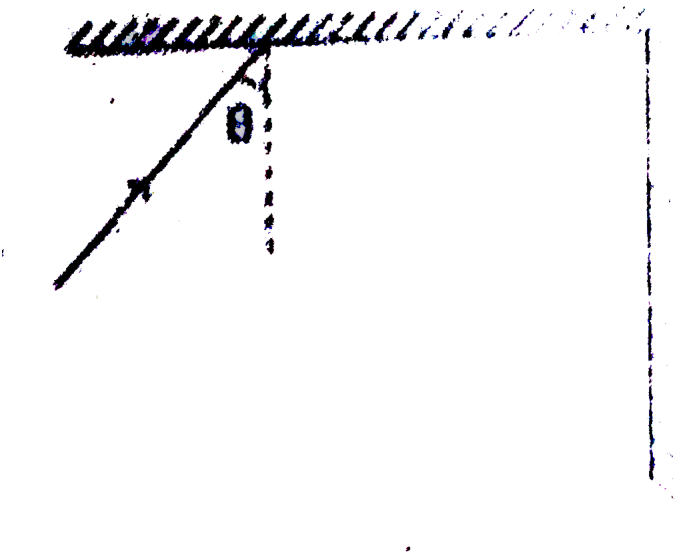
22. Two plane mirrors are arranged at right angles to each other as shown in figure.A ray of light is incident on the horizontal mirror at an angle θ. For what value of $\theta$the ray emerges parallel to the incoming ray after reflection from the vertical mirror ?



A. 60°

B. 30°

C. 45°

D. All of these

Answer: D

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23. 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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24. A hollow convex lens of glass will behave like a

A. convex lens

B. concave lens

C. glass plate

D. mirror

Answer: C

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25. A plane mirror is made of glass slab ($\mu_g = 1.5$) 2.5 cm thick and silvered on back. A point object is placed 5 cm in front of the unsilvered face of the mirror. What will be the position of final image ?

A. 12 cm from unsilvered face

B. 14.6 cm from unsilvered face

C. 5.67 cm from unsilvered face

D. 8.33 cm from unsilvered

Answer: D

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

A. 90°

B. 60°

C. 45°

D. 30°

Answer: B

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27. A ray of light undergoes deviation of 30° when incident on an equilateral prism of refractive index $\sqrt{2}$. The angle made by the ray inside the prism with the base of the prism is

A. 15°

B. 0°

C. 45°

D. 30°

Answer: B

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28. Two identical glass $\left(\mu_g = 3/2\right)$ equiconvex lenses of focal length f are kept ini contact. The space between the two lenses is filled with water

$(\mu_w = 4/3)$. The focal length of the combination is

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29. The magnification of an object plac ed in front of a convex lens of focal length 20 cm is +2. to obtain a magnification of -2. the object will have to be moved a distance equal to

A. 10 cm

B. 20 cm

C. 30 cm

D. 40 cm

Answer: B

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30. A cocave lens forms the image of an object such that the distance between the object and image is 10 cm and the magnification produced is 1/4. the focal length of the lens will be

A. 8.6 cm

B. 6.2 cm

C. 10 cm

D. 4.4 cm

Answer: D

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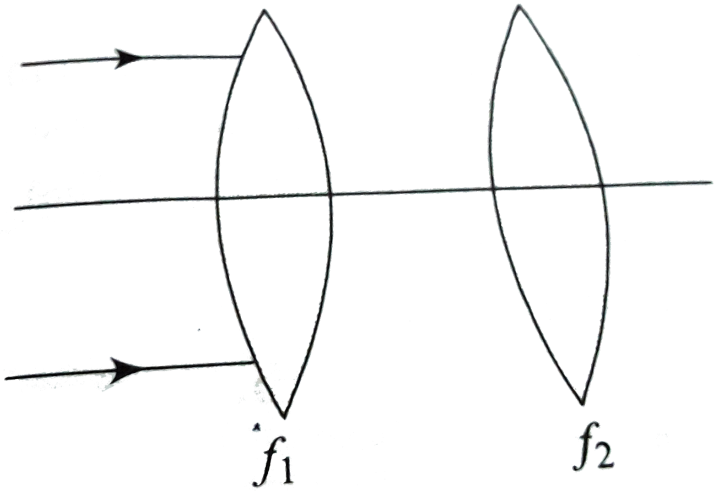
31. A parallel beam of light is incident on the system of two convex lenses of focal length $f_1 = 20cm$ and $f_2 = 10cm$. What should be the distance between the two lenses so that rays after refraction from both the lenses pass

undeviated?



A. 60 cm

B. 30 cm

C. 90 cm

D. 40 cm

Answer: B

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32. A point object is placed at a diatance of 25 cm from a convex lens of focal length 20 cm. If a glass slab of thickness t and refractive index 1.5 is inserted between the lens and the object, the image is formed at infinity. The thickness t is

A. (a)10 cm

B. (b)5 cm

C. (c)20 cm

D. (d)15 cm

Answer: D

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33. The angle of incidance for an equilateral prism is 60°. What should be the refractive index of prism so that the ray is parallel to the base inside the prism ?

A. $\sqrt{2}$

B. $\sqrt{3}$

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

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

Answer: B

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34. When an object is at distance 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. $\frac{x+y}{2}$

B. $x-y$

C. $\sqrt{x+y}$

D. $x+y$

Answer: A

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35. If the distances of an object and its virtual image from the focus of a convex lens of focal length f are 1 cm each, then f is

A. $4cm$

B. $\left(\sqrt{2}+1\right)cm$

C. $2\sqrt{2}cm$

D. $\left(2+\sqrt{2}\right)cm$

Answer: B

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36. Focal length of a convex mirror is 10 cm

A. image of an object placed at 20 cm is also at 20 cm

B. image of an object placed at 10 cm is at infinity

C. both (a) and (b) are wrong

D. both (a) and (b) are correct

Answer: C

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37. A concave mirror has a focal length 20 cm. The distance between the two positions of the object

for which the image size is double of the object size is

A. 20 cm

B. 40 cm

C. 30 cm

D. 60 cm

Answer: A

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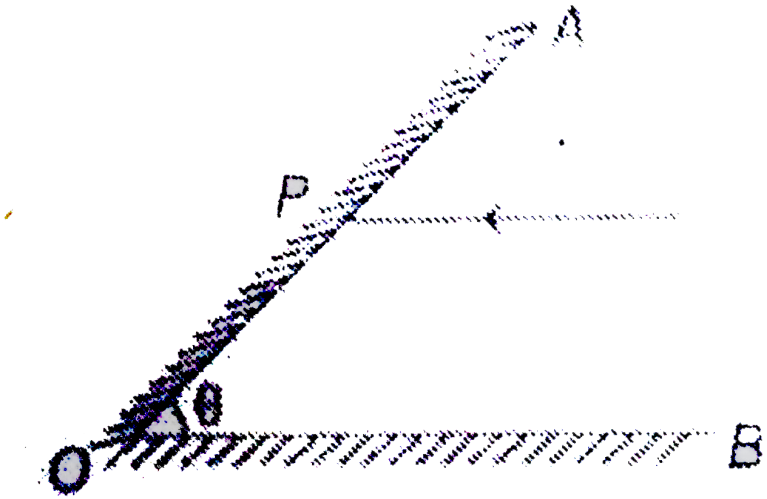
38. Two plane mirrors are inclined at angle θ as shown in figure. If a ray parallel to OB strikes the other mirror at P and finally emerges parallel to OA after two reflections then θ is equal to



A. 90°

B. 60°

C. 45°

D. 30°

Answer: B

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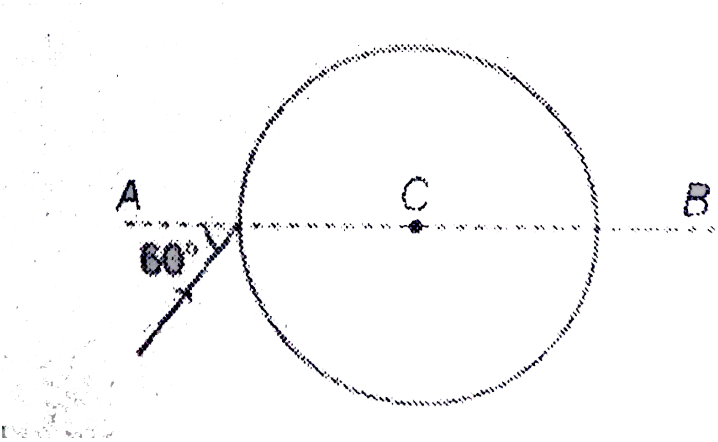
39. A ray of light falls on a transparent sphere with centre at C as shown in figure. The ray emerges from the sphere parallel to line AB. The

refractive index of the sphere is



A. $\sqrt{2}$

B. $\sqrt{3}$

C. $3/2$

D. $4/3$

Answer: B

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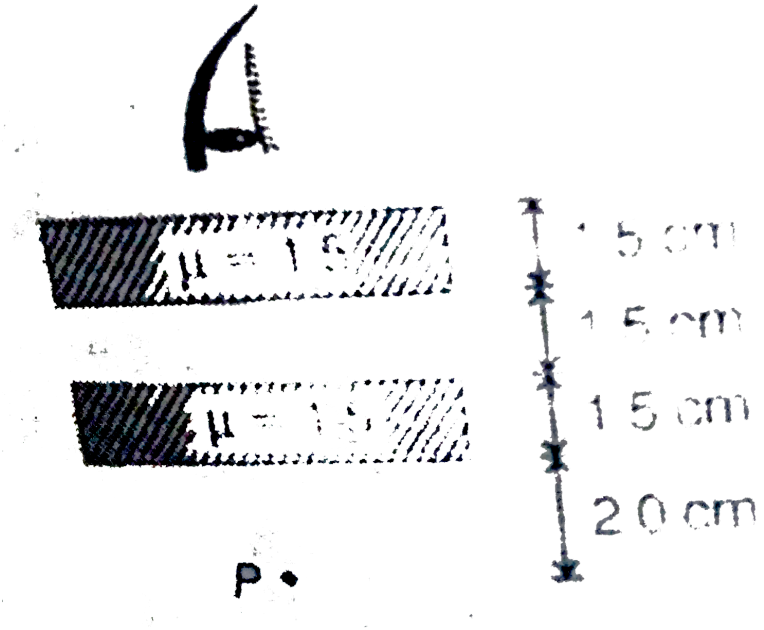
40. The image of point P when viewed from top of the slabs will be



A. 2.0 cm above P

B. 1.5 cm above P

C. 2.0 cm below P

D. 1 cm above P

Answer: D

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41. An equiconvex lens of glass $\left(\mu_g = 1.5\right)$ of focal length 10 cm is silvered on one side. It will behave like a

A. concave mirror of focal length 10 cm

B. convex mirror of focal length 5.0 cm

C. concave mirror of focal length 2.5 cm

D. convex mirror of focal length 20cm

Answer: C

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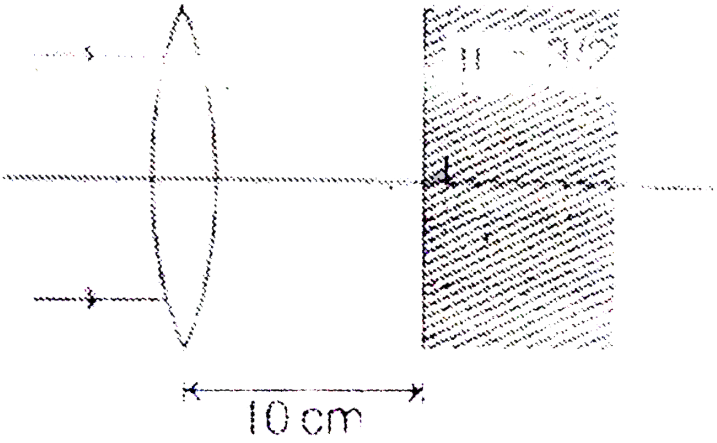
42. Focal length of a thin convex lens is 30 cm. At distance of 10 cm from the lens there is a plan refracting surface of refractive index $3/2$. Where

w the parallel rays incident on lens converge ?



A. At a distance of 27.5 cm from the lens

B. At a distance of 25 cm from the lens

C. At a distance of 45 cm from the lens

D. At a distance of 40 cm from the lens

Answer: D

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43. Distance of an object from the first focus of an equiconvex lens is 10 cm and the distance of its reimage from second focus is 40 cm. The focal length the lens is

A. 25 cm

B. 10 cm

C. 20 cm

D. 40 cm

Answer: C

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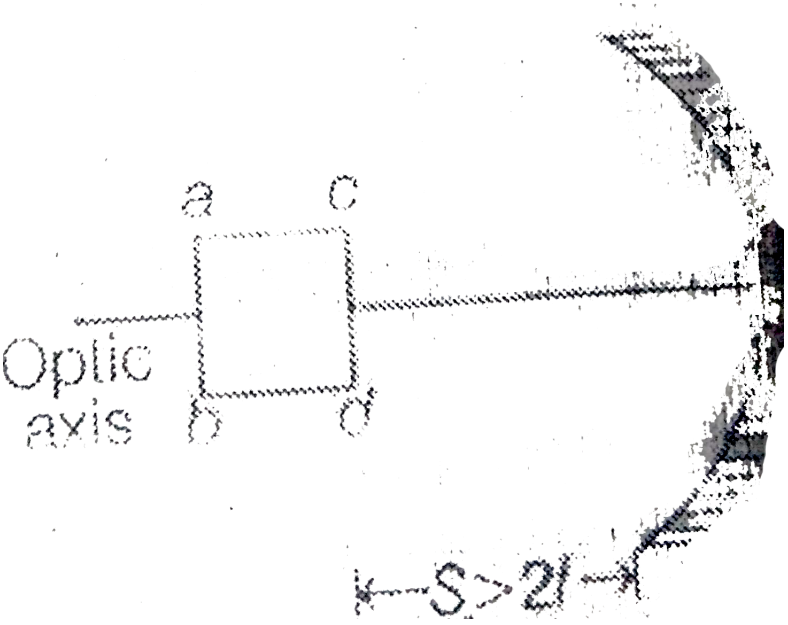
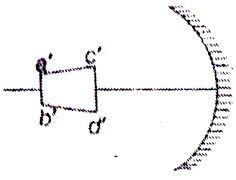
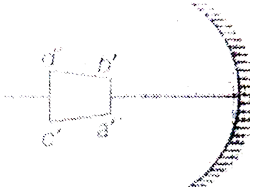
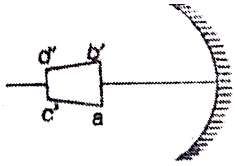
44. An object is placed in front of a concave mirror of focal length f as shown in figure. Choose the correct shape of the image.

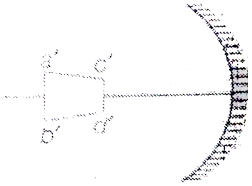


A.



B. 

C. 

D. 

Answer: B

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45. When a ray of light enters a glass slab from air

A. its wavelength decreases

B. its wavelength increases

C. its frequency increases

D. neither its wavelength nor its frequency changes

Answer: A

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46. One of the refracting surfaces of a prism of angle of 30° is silvered. A ray of light incident at

an angle of 60° retraces its path. The refractive index of the material of prism is

A. $\sqrt{2}$

B. $\sqrt{3}$

C. $3/2$

D. 2

Answer: B

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47. Angle of minimum deviation is equal to the angle prism A of an equilateral glass prism. The angle incidence at which minimum deviation will be obtained is

A. 60°

B. 30°

C. 45°

D. $\sin^1(2/3)$

Answer: A

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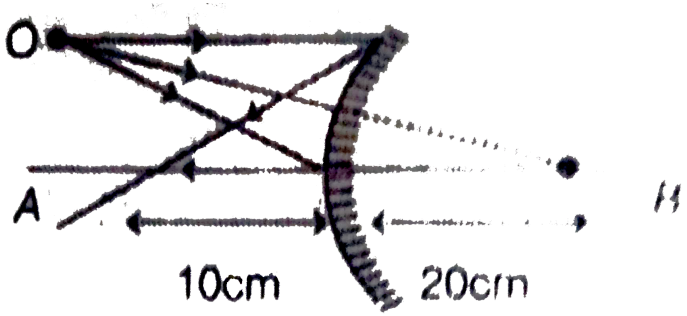
48. In the figure , a convex mirror of radius of curvature 20 cm is shown. An object O is placed in front of this mirror. Its ray diagram is shown. How many mistakes are there in the diagram (AB is its principal axis)



A. 3

B. 2

C. 1

D. 0

Answer: B

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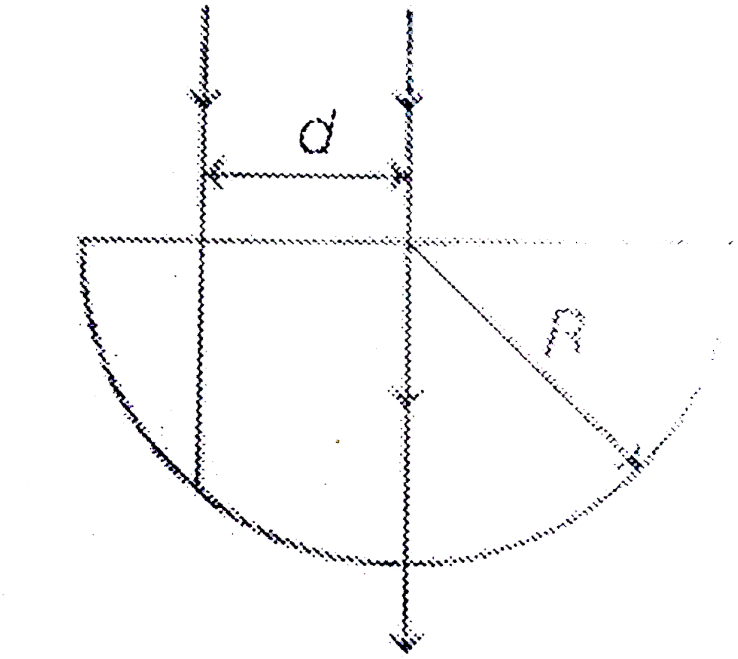
49. As shown, a narrow beam of light is incident onto a semi-circular glass cylinder of radius R. Light can exit the cylinder when the beam is at the centre. When the beam is moved parallel to a maximum distance d from the central line, no light can exit the cylinder from its lower surface.

Find the refractive index of the glass.



A. $\frac{R}{d}$

B. $\frac{d}{R}$

C. $\frac{R}{\sqrt{R^2 - d^2}}$

D. $\frac{\sqrt{R^2 - d^2}}{R}$

Answer: A

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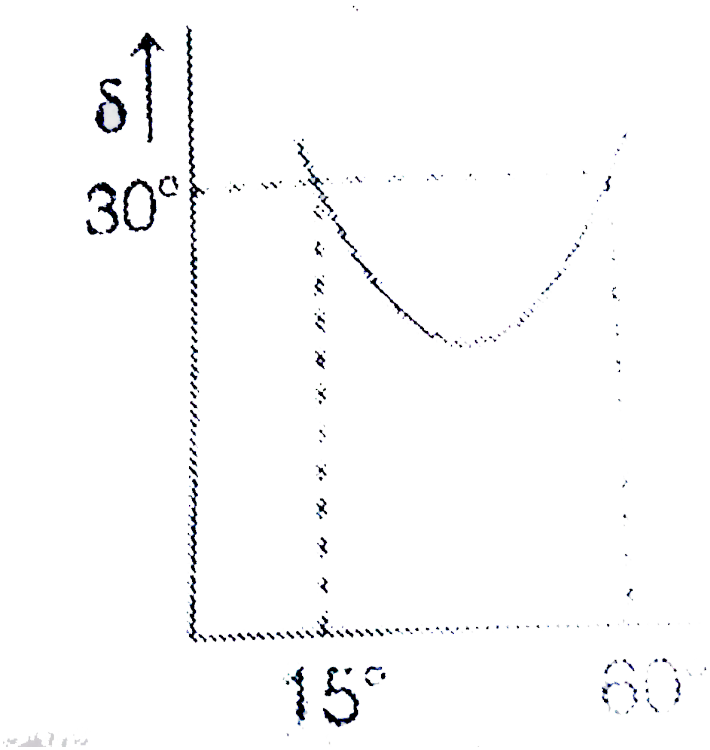
50. Figure shows graph of deviation δ versus angle of incidence for a light ray striking a prism.

Angle of prism is



A. 30°

B. 45°

C. 60°

D. 75°

Answer: B

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51. A convex lens of focal length 30 cm forms an image of height 2 cm for an object situated at infinity. If a concave lens of focal length 20 cm is placed coaxially at a distance of 26 cm from convex lens then size of image would be

A. (A)$2.5cm$

B. (B)$5.0cm$

C. (C)$1.25cm$

D. (D)$4cm$

Answer: A

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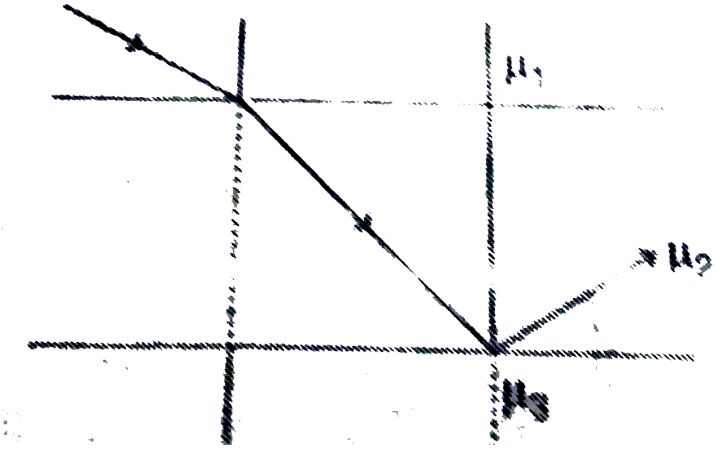
52. Light travelling through three transparent substances follows the path shown in the figure. Assuming that total internal reflection does take place on the bottom surface of medium 2, arrange the refractive index in the increasing

order.



A. $\mu_1 < \mu_2 < \mu_3$

B. $\mu_2 < \mu_1 < \mu_3$

C. $\mu_1 < \mu_3 < \mu_2$

D. $\mu_3 < \mu_1 < \mu_2$

Answer: D

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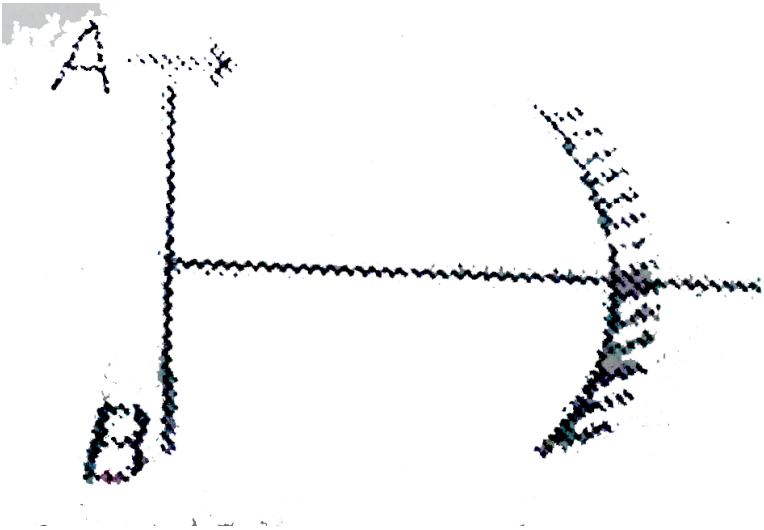
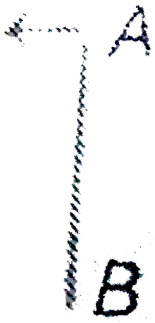
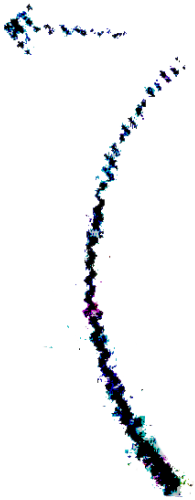
53. A plane wavefront AB is incident on a concave mirror as shown. Then,the reflected wavefront will be



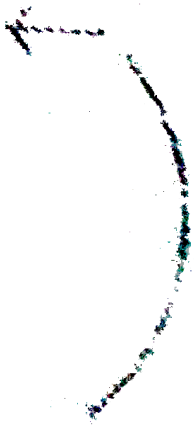
A.



B.



C.



D. None of these

Answer: C

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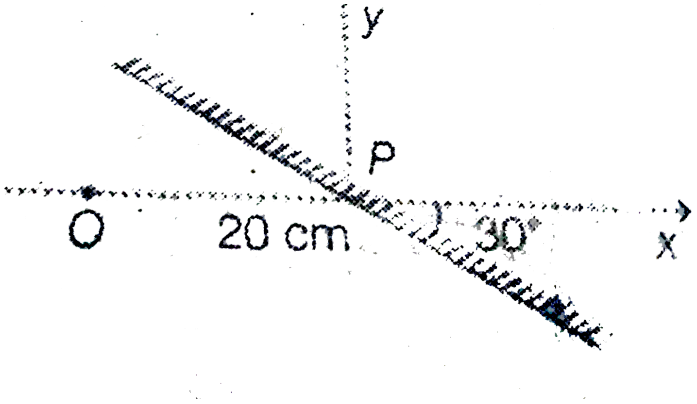
54. Consider the point P as the origin and time OP as the x-axis in the situation shown in the figure. Which of the following represents the coordinates of the image of the point object O.

(Take $OP = 20cm$)



A. $(20cm, 0cm)$

B. $\left(10cm, 10\sqrt{3}cm\right)$

C. $\left(-10cm, 10\sqrt{3}cm\right)$

D. $\left(10cm, -10\sqrt{3}cm\right)$

Answer: C

Watch Video Solution

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

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

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

C. 2

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

Answer: C

Watch Video Solution

56. An optical instrument uses a 25 D objective and 20 D eyepeice with a tube length of 25 cm when eye is least strained

A. (a)The instrument is a telescope with angular magnification 20.

B. (b)The instrument is a microscope with angular magnification 20.

C. (c)The instrument is a telescope with angular magnification 24.

D. (d)The instrument is a microscope with angular magnification 24.

Answer: B

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A Only One Option Is Correct Jee Advance

1. 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

A. positive x-axis

B. negative x-axis

C. positive y-axis

D. negative y-axis

Answer: B

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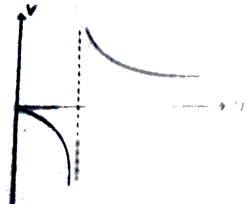
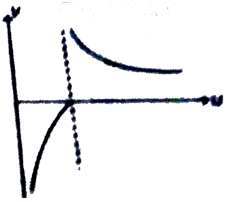
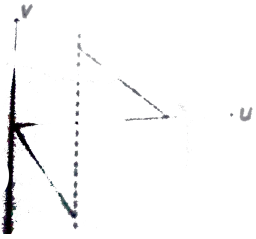
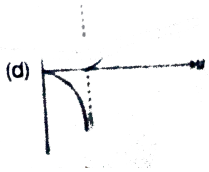
2. As the position of an object (u) reflected from a concave mirror is varied, the position of the image (v) also varies. By latting the u changes from 0 to $+\infty$ the graph between v versus u will be

A. 

B. 

C. 

D. 

Answer: A

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3. A 2 cm diameter coin rests flat on the bottom of a bowl in which the water is 20 cm deep $(\mu_w = 4/3)$. If the coin is viewed directly from above, what is its apparent diameter ?

A. 2 cm

B. 1.5 cm

C. $2.67cm$

D. $1.67cm$

Answer: A

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4. Refraction takes place at a convex spherical boundary separating air-glass medium. For the image to be real, the object distance $(\mu_g = 3/2)$

Note Object lying in the glass.

A. should be greater than three times the radius of curvature of the refracting surface

B. should be greater than two times the radius of curvature of the refracting surface

C. should be greater than the radius of curvature of the refracting surface.

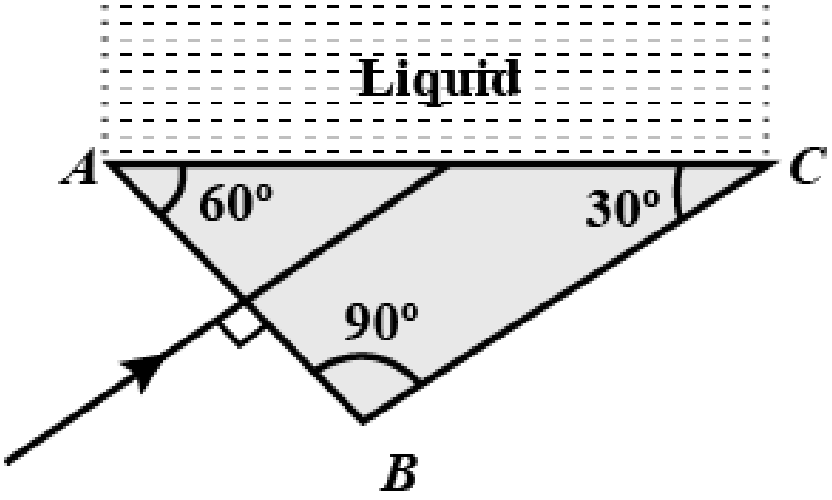
D. is independent of the radius of curvature of the refracting surface

Answer: A

 Watch Video Solution

5. Light is incident normally on face AB of a prism as shown in Figure. A liquid of refractive index μ is placed on face AC of the prism. The prism is made of glass of refractive indes $3/2$. Find the limits of μ for which total internal reflection takes place on the face AC.

(A)$\mu > \frac{\sqrt{3}}{2}$ (B)$\frac{3\sqrt{3}}{4} > \mu$ (C)$\mu > \sqrt{3}$ (D) $\mu < \frac{\sqrt{3}}{2}$



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

B. $\frac{3\sqrt{3}}{4} > \mu$

C. $\mu > \sqrt{3}$

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

Answer: B

Watch Video Solution

6. 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. $\frac{uf}{u-f}$

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

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

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

Answer: D

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7. 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 ?

A. 6 cm from S_1

B. 15 cm from S_1

C. 10 cm from S_1

D. 12 cm from S_1

Answer: A

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8. Two identical thin planoconvex lenses of refractive index n are silvered, one on the plane side and other on the convex side. The ratio of their for lengths is

A. $n/(n-1)$

B. $(n-1)/n$

C. $(n+1)/n$

D. n

Answer: A

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9. A refracting surface is represented by the equation $x^2 + y^2 = a^2$. A ray travelling in negative x-directed towards positive y-direction after reflection from the surface at point P. Then

co-ordinates of point P are

A. (0.8 a, 0.6 a)

B. (0.6 a, 0.8 a)

C. $\left(\frac{a}{2}, \frac{a}{2}\right)$

D. None of these

Answer: D

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10. An object infront of a concave mirror of focal length f. A virtual image is formed with a magnification of 2. To obtain a real image of same

magnification the object has to be moved by a distance

A. f

B. f/2

C. 3f/2

D. 2f/3

Answer: A

Watch Video Solution

11. 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

A. $\sqrt{3}$

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

C. 2

D. Data not sufficient

Answer: C

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12. A convex lens of focal length 30 cm forms a real image three times larger than the object on a screen. Object and screen are moved until the image becomes twice the size of the object. If the shift of the object is 6 cm. The shift of screen is

A. 36 cm

B. 72 cm

C. 18 cm

D. 9 cm

Answer: A

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13. 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

shift towards the lens system

shift away from the lens system

remain in its original position

shift to infinity

A. shift towards the lens system

B. shift away from the lens system

C. remain in its original position

D. shift to infinity

Answer: B

Watch Video Solution

14. A convex lens is in contact with a concave lens. The magnitude of the ratio of their powers is $\frac{3}{2}$. Their equivalent focal length is 30 cm. What are their individual focal lengths?

A. $-75, 50$

B. $-10, 15$

C. $-75, 25$

D. $-15, 10$

Answer: D

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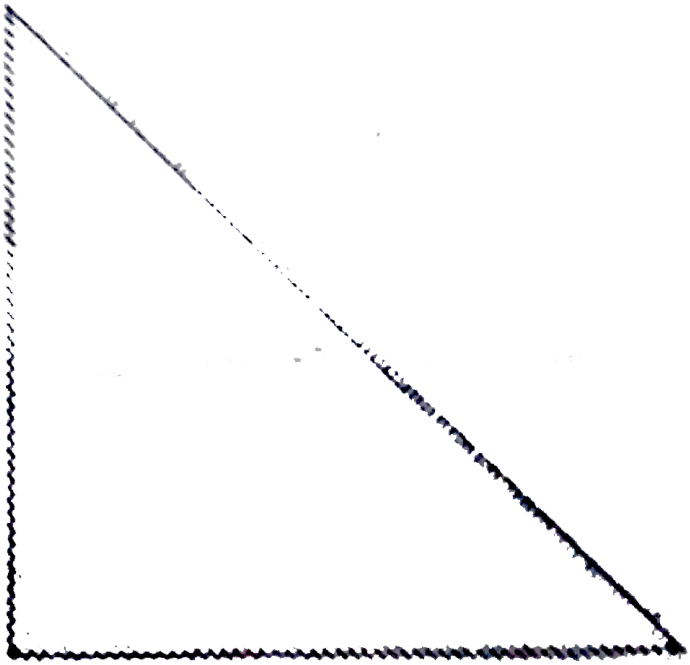
15. What is the minimum value of the refractive index for a $90^\circ - 45^\circ - 45^\circ$ prism which is used to deviate a beam through 90° by total internal

reflection ?



A. $3/2$

B. $\sqrt{3}$

C. $\sqrt{2}$

D. $5/3$

Answer: C

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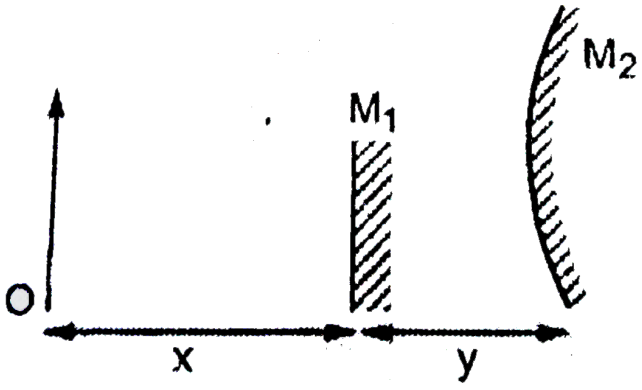
16.



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

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

Answer: B

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17. An object is kept at a distance of $16cm$ from a thin lens and the image formed is real. If the object is kept at a distance of $6cm$ from the lens, the image formed is virtual. If the sizes of the images formed are equal, the focal length of the lens will be

A. 8 cm

B. 5 cm

C. 11 cm

D. $\sqrt{96}cm$

Answer: C

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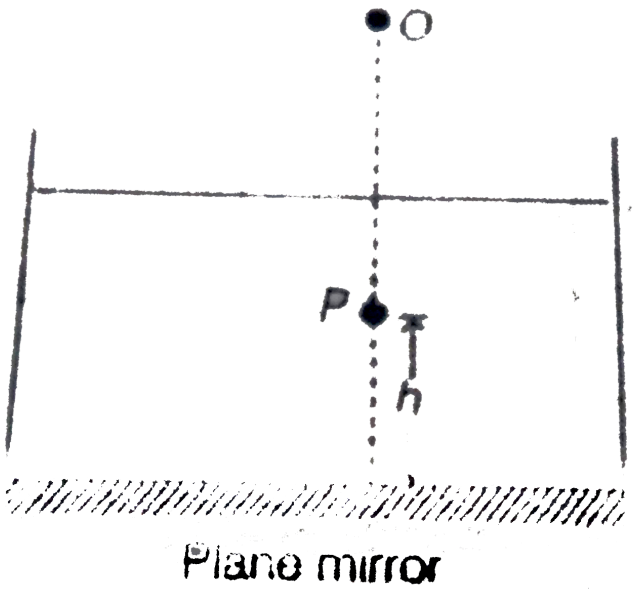
18. A plane mirror is placed at the bottom of a tank containing a liquid of refractive index μ. P is a small object at a height h above the mirror. An observer observes P and its image in the mirror. The apparent distance between two will be



A. $2\mu h$

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

C. $\frac{2h}{\mu - 1}$

D. $h\left(1 + \frac{1}{\mu}\right)$

Answer: B

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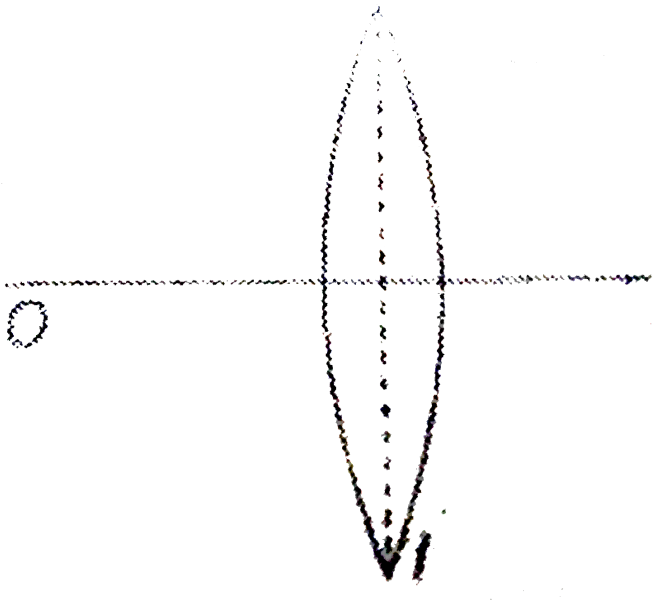
19. A real image of a point object O was formed by an equi-convex lens of focal length f and the magnification was found to be unity. Now the lens

is cut into two symmetrical pieces as shown by the dotted line and the right part is removed. The position of the image formed by the remaining part is at



A. f

B. 2f

C. $-2f$

D. Infinity

Answer: D

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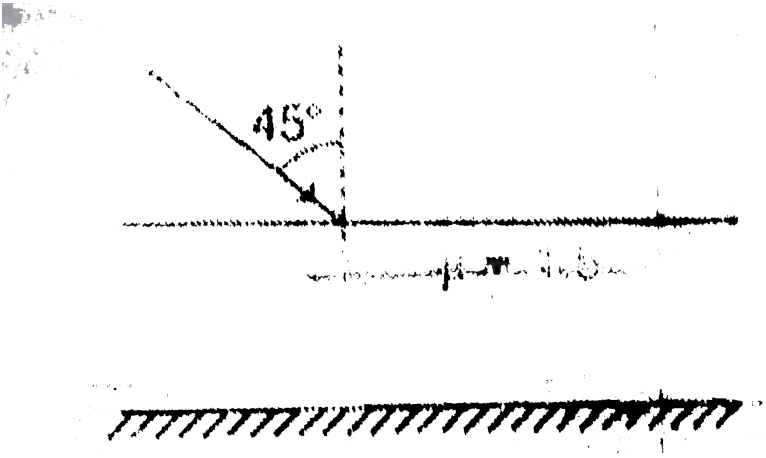
20. One side of a glass slab is silvered as shown. A ray of light is incident on the other side at angle of incidence $i = 45^\circ$. Refractive index of glass a is given as 1.5. The diviation of the ray of light from

its initial path when it comes out of the slab is



A. 90°

B. 180°

C. 120°

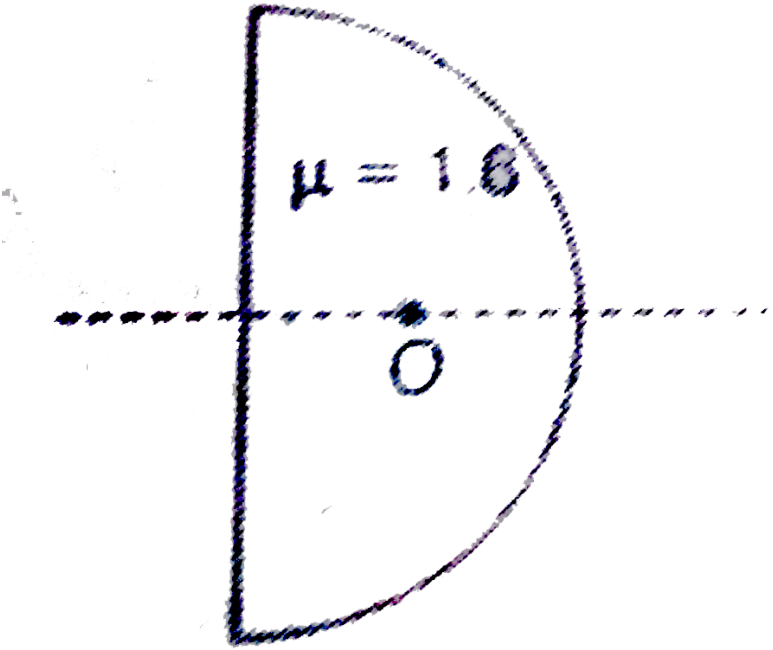
D. 45°

Answer: A

Watch Video Solution

21. A plastic hemisphere has a radius of curvature of 8 cm and an index of refraction of 1.6. ON the axis halfway between the plane surface and the spherical one (4 cm from each) is a small object O. The distance between the two images when viewed along the axis from the two sides of the

hemisphere is approximately



A. $1.0cm$

B. $1.5cm$

C. $3.75cm$

D. $2.5cm$

Answer: D

Watch Video Solution

22. A circular beam of light of diameter $d = 2cm$ falls on a plane refractive of glass. The angle of incidence is 60° and refractive index of glass is $\mu = 3/2$. The diameter of the refracted beam is

A. $4.00cm$

B. $3.0cm$

C. $3.26cm$

D. $2.52cm$

Answer: C

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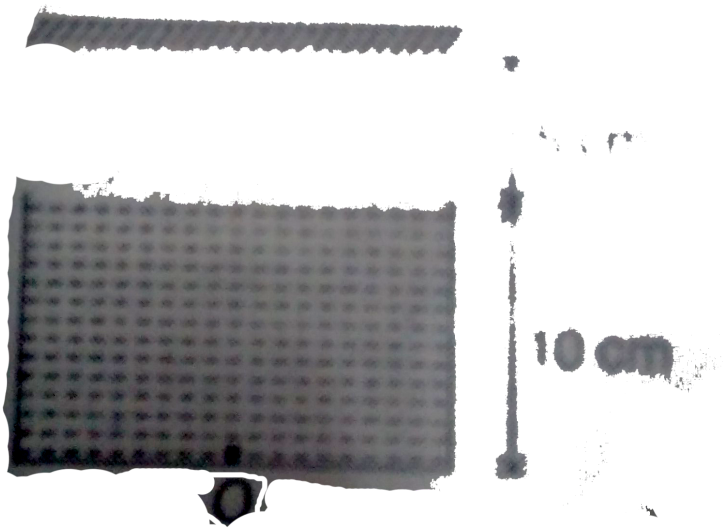
23. Consider the situation shown in figure. Water $\left(\mu_w = \frac{4}{3}\right)$ is filled in a breaker upto a height of 10 cm. A plane mirror is fixed at a height of 5 cm from the surface of water. Distance of image from the mirror after reflection from it if an object O at

the bottom of the beaker is



A. 15 cm

B. $12.5cm$

C. $7.5cm$

D. 10 cm

Answer: B

Watch Video Solution

24. A ray of light is incident on a glass sphere of refractive index 3/2. What should be the angle of incidence so that the ray which enters the sphere does not come out of the sphere ?

A. $\tan^{-1}(2/3)$

B. $\sin^{-1}(2/3)$

C. 90°

D. $\cos^{-1}(1/3)$

Answer: C

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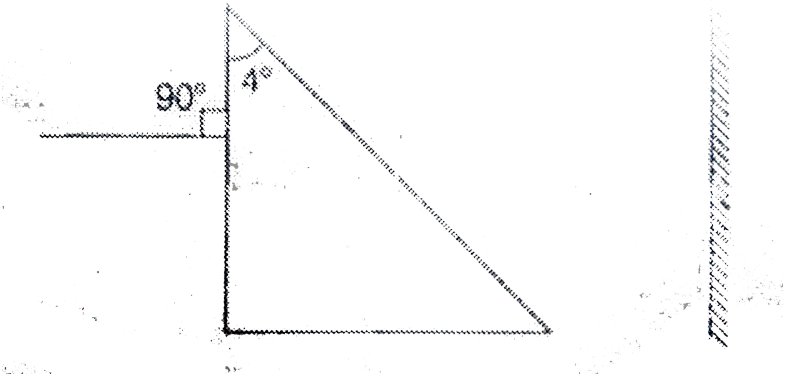
25. A prism having an apex angle 4° and refractive index 1.5 is located in front of a vertical plane mirror as shown in figure. Through what total angle is the ray is deviated after reflection from the mirror ?



A. 176°

B. 4°

C. 178°

D. 2°

Answer: C

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26. 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

materials refractive indices μ_1 and μ_2 and R is the radius curvature of the curved surface of the lenses, the focal length of the combination is

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

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

C. $\frac{R}{2(\mu_1 - \mu_2)}$

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

Answer: A

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27. Optic axis of a thin equiconvex lens is the x-axis. The co-rodinates of a point object and its image axis $(-40cm, 1cm)$ and $(50cm, -2cm)$ respectively. Lens is located at

A. $x = +20cm$

B. $x = -30cm$

C. $x = -10cm$

D. origin

Answer: C

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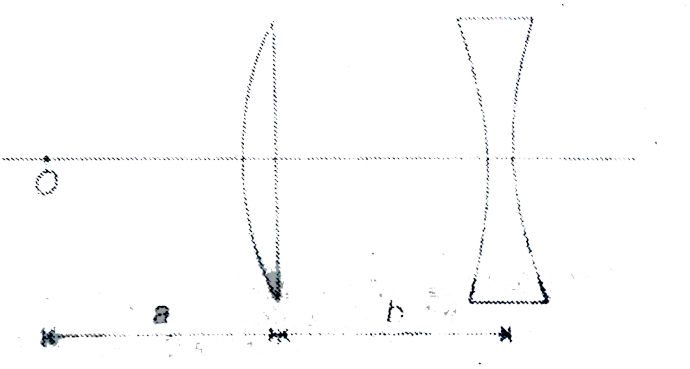
28. A plano convex glass lens $\left(\mu_g = 3/2\right)$ of radius curvature $R = 10cm$ is placed at a distance of b from a concave lens of focal length 20 cm. what should the distance 'a' of a point object O from the plat convex lens so that the position of final image always at same distance from concave lens



A. 40 cm

B. 60 cm

C. 30 cm

D. 20 cm

Answer: D

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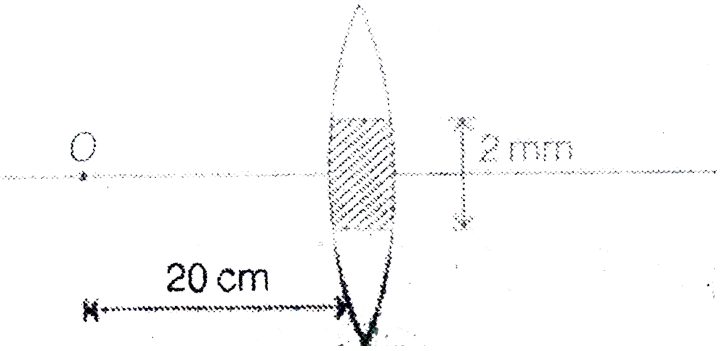
29. A convex lens of focal length 10 cm is painted black at the middle portion as shown in figure. An object placed at a distance of 20 cm from the

lens. Then



A. only one image will be formed by the lens

B. the distance between the two images formed by such a lens is 6 mm

C. the distance between the images is 4 mm

D. the distance between the images is 2mm

Answer: A

Watch Video Solution

30. A point object is placed on the optic axis of a convex lens of focal length f at a distance of 2f to the left it. The diameter of the lens d. An eye is placed are distance of 3f to the right of the lens and a distance below the optic axis. The maximum value of h to the image is

A. d

B. $d/2$

C. $d/3$

D. $d/4$

Answer: D

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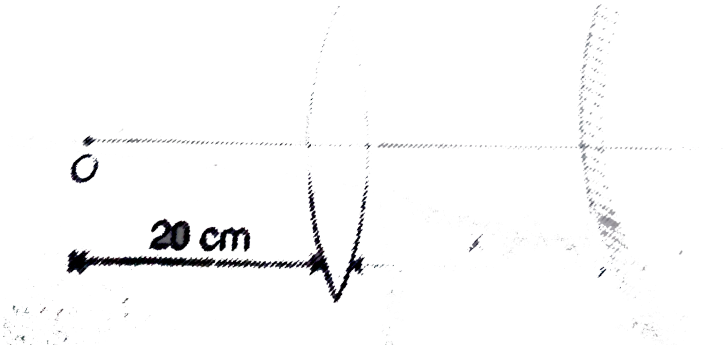
31. A point object O is placed at a distance of 20 cm from a convex lens of focal length 10 cm as shown in figure. At what distance x from the lens should a concave mirror of focal length 60 cm, placed so that final image coincides with the

object ?



A. 10 cm

B. 40 cm

C. 20 cm

D. final image can never coincide with the object in the given conditions

Answer: C

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32. Two thin symmetrical lenses of different nature and of different material have equal radii of curvature $R = 15cm$. The lenses are put close together and immersed in water $\left(\mu_w = \frac{4}{3}\right)$. The focal length of the system in water is 30 cm. The difference between refractive indices of the two lenses is

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

B. $\frac{1}{4}$

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

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

Answer: C

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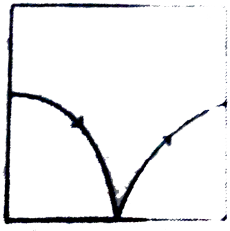
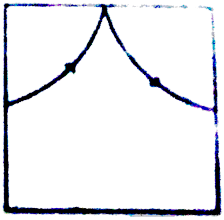
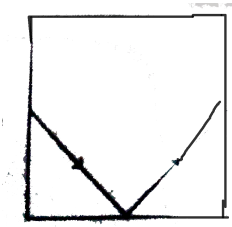
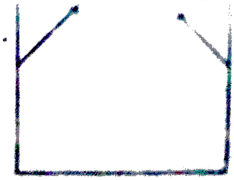
33. A cubic container is filled with a liquid whose refractive index increases linearly from top to bottom. Which of the following represents the path of a ray of light inside the liquid ?

A. 

B. 

C. 

D. 

Answer: A

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34. 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

A. $\frac{(a+b)^3}{c^2}$

B. $\frac{(a+b)c}{(a+c)}$

C. $\frac{c^2}{a+b}$

D. $\frac{a^2}{a+b+c}$

Answer: C

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35. 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. $\frac{a}{c} = \frac{4}{3}$

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

C. $\frac{b}{c} = \frac{4}{3}$

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

Answer: A

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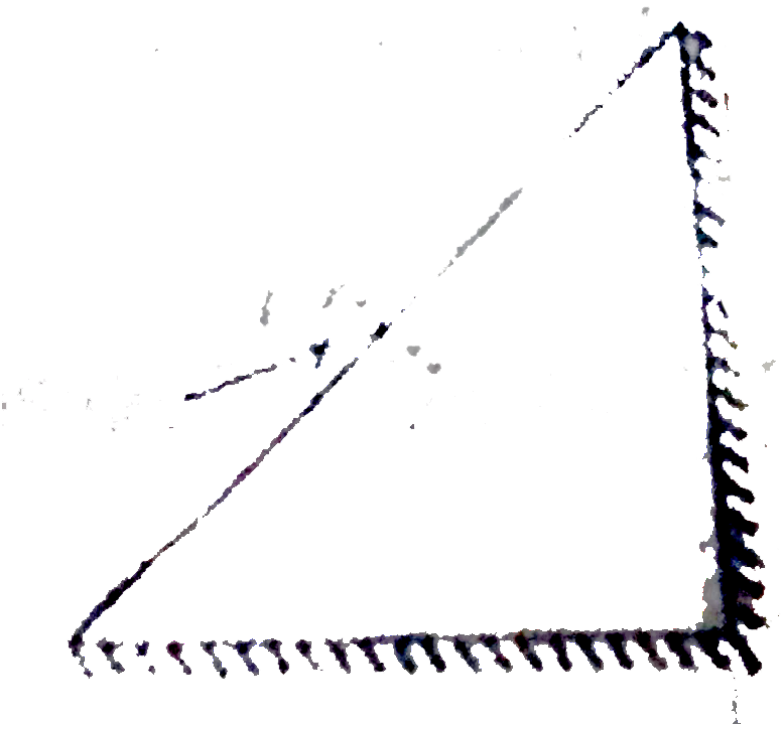
36. The sides of an isosceles right prism are coated with a reflecting coating. A ray of light falls on the hypotenuse at an arbitrary angle i. For what value of i the ray leaving the prism is

parallel to the incident ray ?



A. 30°

B. 60°

C. $\tan^{-1}(2)$

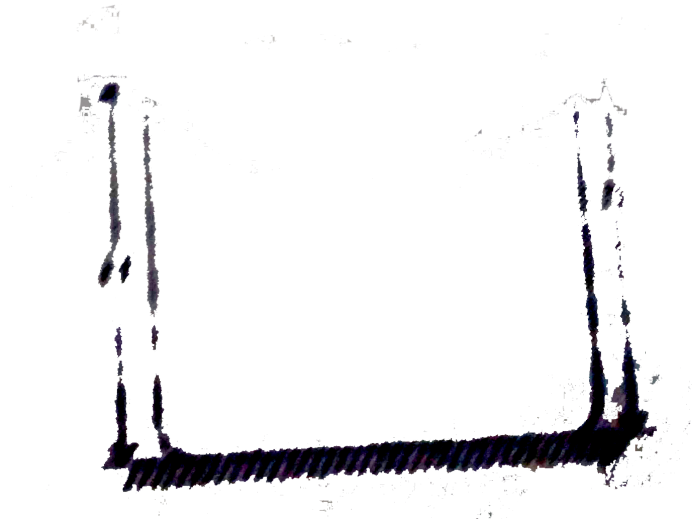
D. Any arbitrary angle

Answer: D

Watch Video Solution

37. A point object is placed at a distance of 20 cm from a glass slab, H=18cm, half immersed in water as shown in figure. The distance between two images when seen from the other side of the slab

is $\left(\mu_g = \frac{3}{2} \text{ and } \mu_w = \frac{4}{3}\right)$



A. 4 cm

B. 2 cm

C. 6 cm

D. Only one image is formed

Answer: B

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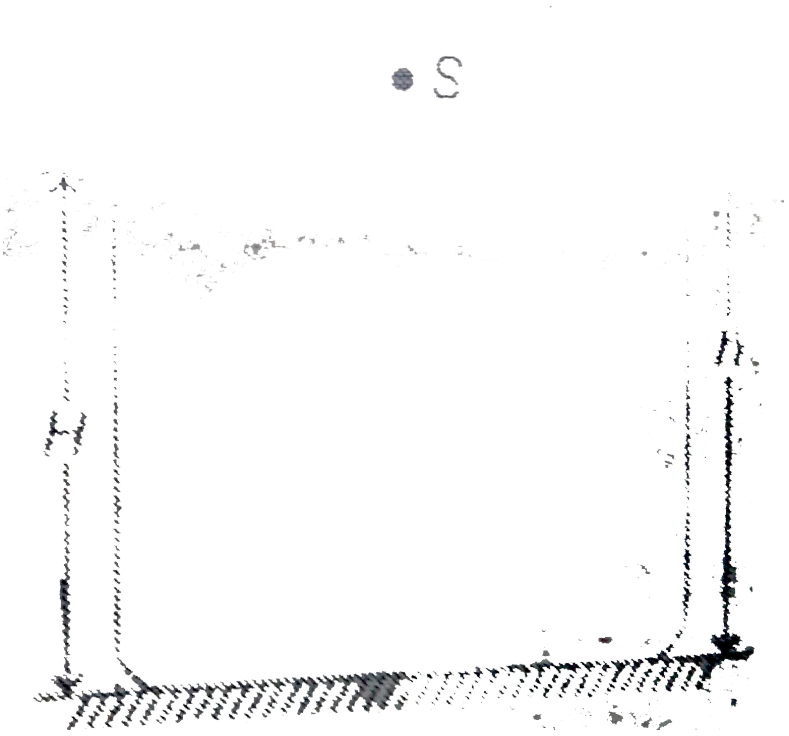
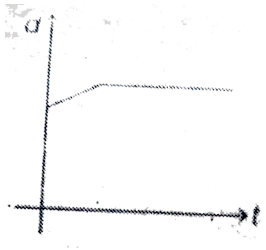
38. A point source S is placed at a height h from the bottom of a vessel of height $H(<h)$. The vessel is polished at the base. Water is polished at the base. Water is gradually filled in the vessel at a constant rate $\alpha m^3/s$. The distance d of image of the source after reflection from mirror from the bottom of the vessel varies with time t

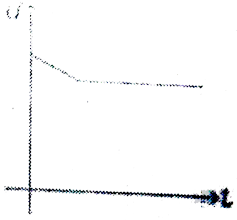
as

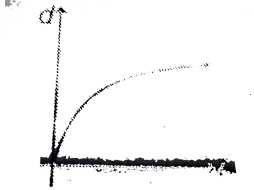


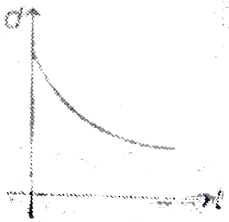
A.



B.



C. 

D. 

Answer: B

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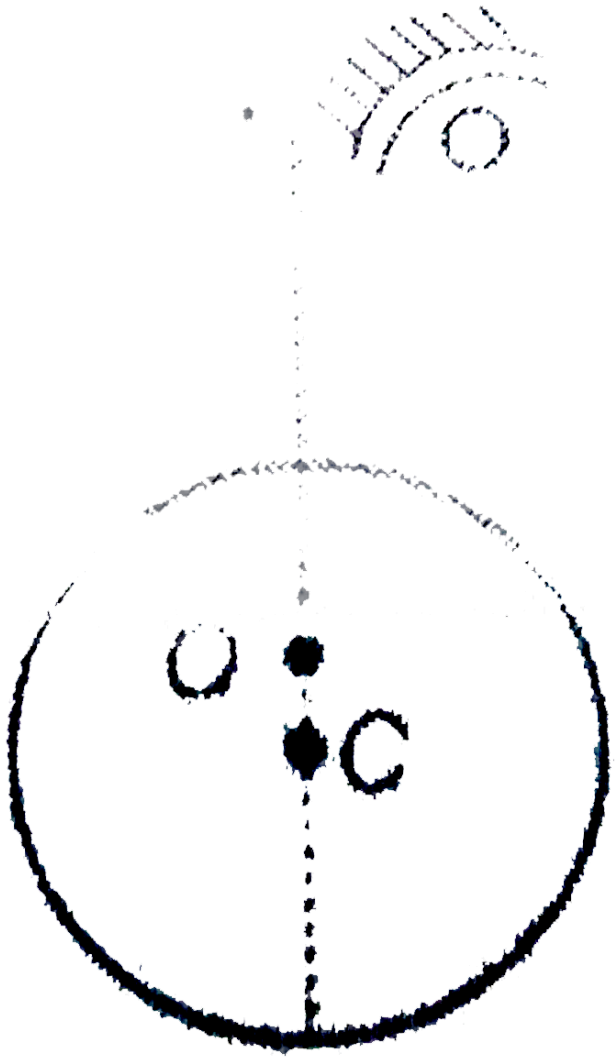
39. A point object O is placed slightly above the centre C of a glass sphere as shown in figure. If it is viewed almost normally from above the sphere,

its image is seen



A. at C

B. above C

C. below C

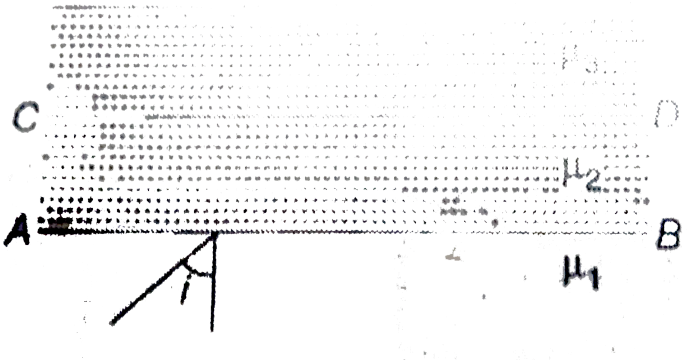
D. may be above of below C

Answer: B

Watch Video Solution

40. In the figure shown, $\mu_1 > \mu_2 > \mu_3$. What are the limits of angle i so that it is neither get total

internal reflection at AB nor at CD ?



A. $\sin i < \frac{\mu_2}{(\mu_2)}$

B. $\sin i < \frac{\mu_3}{(\mu_1)}$

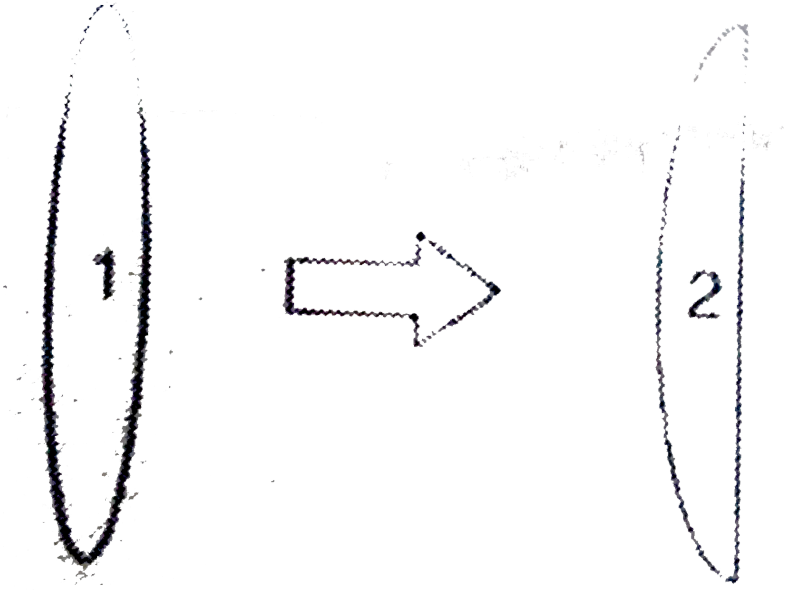
C. $\sin i < \frac{\mu_3}{(\mu_2)}$

D. None of these

Answer: B

Watch Video Solution

41. A bi-convex lens is cut from the middle as shown in figure. Refractive index of material of lens is $\frac{3}{2}$. Now lens-1 (as shown in figure) is immersed in a liquid of refractive index μ_0. By doing so it is observed that its focal length becomes equal to lens-2. What is the value of μ_0 ?



A. 1.3

B. 1.1

C. 1.4

D. 1.2

Answer: D

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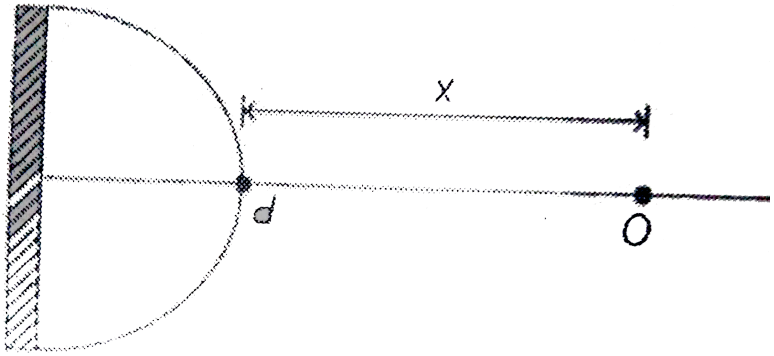
42. A hemishperical surface of radius R and refractive index $\mu = 1.5$ is polished as shown. At what distance x from point P a point object O be

placed so that its image coincides with the object itself?



A. R

B. $1.5R$

C. 2R

D. 3R

Answer: C

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43. A ray is travelling along x-axis in negative x-direction. A plane mirror is placed at origin facing the ray. What should be the angle of plane mirror with the x-axis so that the ray of light after reflecting from the plane mirror passes through point $(1m, \sqrt{3}m)$?

A. 30°

B. 60°

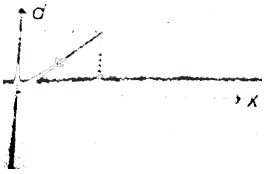
C. 45°

D. 90°

Answer: B

Watch Video Solution

44. Liquid is filled vessel of height $\frac{2H}{3}$. At the bottom of the vessel there is a spot P and a hole from which liquid is coming out. Let d be the distance of image of P from an eye at height H from bottom at an instant when level of liquid in vessel is x. If we plot a graph between d and x it be like

A. 

B. 

C. 

D. 

Answer: C

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45. In displacement method distance of object from convex lens of focal length 20 cm in one position 60 cm. Then

A. in the other position distance of object from convex lens will be 30 cm

B. distance between object and screen is 90 cm

C. Both (a) and (b) are correct

D. Both (a) and (b) are wrong

Answer: C

Watch Video Solution

46. Two mirrors are inclined at angle θ as shown in figure. Light rays are incident parallel to one of mirrors. Light will start retracing its path after the reflection if

A. $\theta = 45^\circ$

B. $\theta = 30^\circ$

C. $\theta = 60^\circ$

D. all three

Answer: B

Watch Video Solution

47. A plane mirror is moving with velocity $4\left(\hat{i}\right)+4\left(\hat{j}\right)+8\left(\hat{k}\right)$. A point object in front of the mirror moves with a velocity $3\left(\hat{i}\right)+4\left(\hat{j}\right)+5\left(\hat{k}\right)$. Here, $\hat{k}$ is along the normal to the plane mirror and facing towards the object. The velocity of the image is

A. $-3\hat{i}-4\hat{j}+5\hat{k}$

B. $3\hat{i}+4\hat{j}+11\hat{k}$

C. $-3\hat{i}-4\hat{j}+11\hat{k}$

D. $7\hat{i}+9\hat{j}+11\hat{k}$

Answer: B

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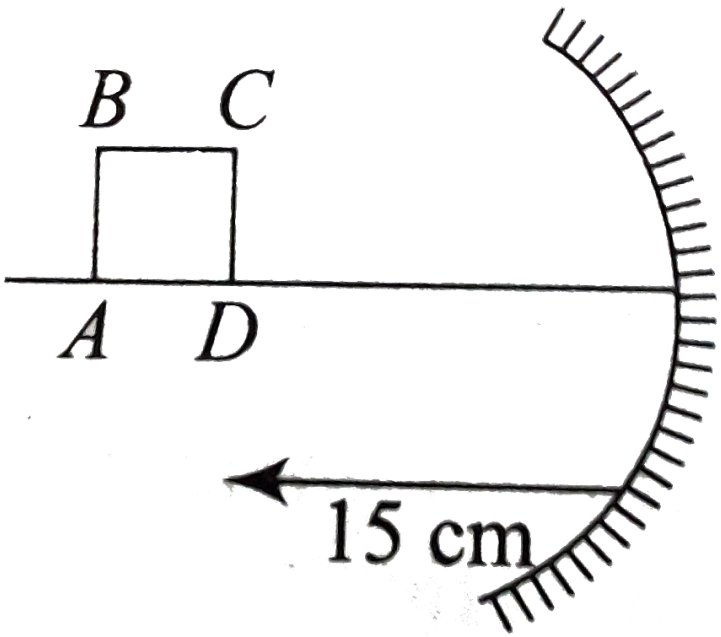
48. A square ABCD of side 1mm is kept at distance 15cm in front of the concave mirror as shown in Figure. The focal length of the mirror is 10cm. The

length of the perimeter of its image will be

d. 10 m



A. 8mm

B. 2mm

C. 12mm

D. 6mm

Answer: C

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49. A point object on the principal axis at a distance 1.5 cm in front of concave mirror of radius of curvature 20 cm has velocity 2mm/s is perpendicular to the principal axis. The velocity of image at that instant will be

A. 2.34mm/s

B. 4 mm/s

C. 8.26 mm/s

D. 16 mm/s

Answer: B

 Watch Video Solution

50. A ray of light is incident on a parallel slab of thickness t and refractive index n. If the angle of incidence θ is small, than the lateral displacement in the incident and emergent ray will be

A. $\frac{t\theta(n-1)}{n}$

B. $\frac{t\theta}{n}$

C. $\frac{t\theta n}{n-1}$

D. $\frac{t\theta(n+1)}{n}$

Answer: A

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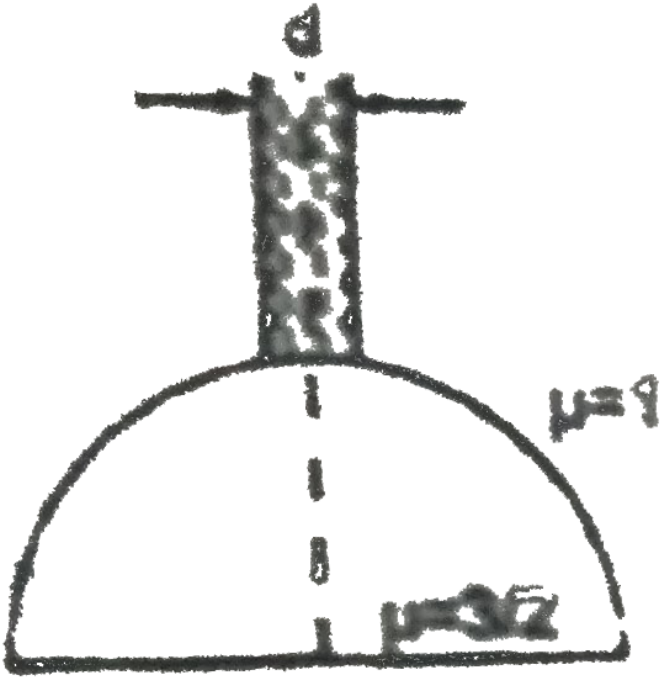
51. A beam of diameter 'd' is incident on a glass hemisphere as shown. If the radius of curvature of the hemisphere is very large in comparison to

d, then the diameter of the beam at the base of the hemisphere will be



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

B. d

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

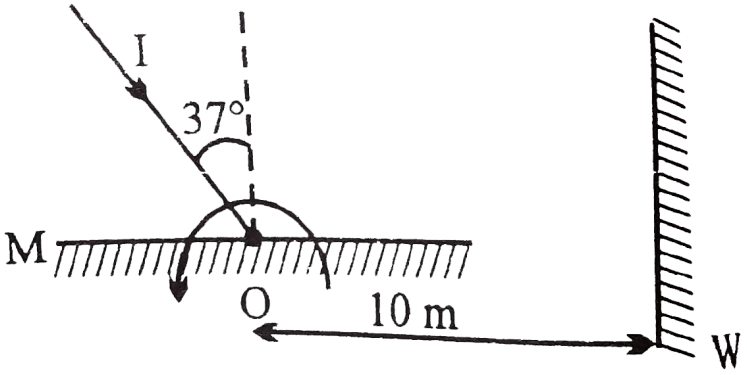
D. $\frac{2}{3}d$

Answer: C

Watch Video Solution

52. A light ray I is incident on a plane mirror M .The mirror is rotated in the direction as shown in the figure by an arrow at frequency $\frac{9}{\pi}\text{rev}/\text{sec}$,The light reflected by the mirror is received on the wall W at a distance $10m$from the axis of rotation .When the angle of incidence becomes 37° find the speed of the spot (a point) on the

wall?



A. 10 m/s

B. 1000 m/s

C. 500 m/s

D. 20 m/s

Answer: C

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53. A bird is flying up at an angle $\sin^{-1}(3/5)$ with the horizontal. A fish in a pond looks at that bird when it is vertically above the fish. The angle at which the bird appears to fly (to the fish) is $[\mu_w = 4/3]$

A. $\sin^{-1}(3/5)$

B. $\sin^{-1}(4/5)$

C. 45°

D. $\sin^{-1}(9/16)$

Answer: C

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54. A man of height 'h' is walking away from a street lamp with a constant speed 'v'. The height of the street lamp is 3h. The rate at which the length of the man's shadow is increasing when he is at a distance 10 h from the base of the street lamp is

A. v/2

B. v/3

C. 2v

D. v/6

Answer: A

Watch Video Solution

55. A man is walking under an inclined mirror at a constant velocity v along the x-axis. If the mirror is inclined at an angle θ with the horizontal then what is the velocity of the image ?

A. $\left(v\sin\theta\hat{i}\right)+\left(v\cos\theta\hat{j}\right)$

B. $\left(v\cos\theta\hat{i}\right)+\left(v\sin\theta\hat{j}\right)$

C. $\left(v\sin 2\theta\hat{i}\right)+\left(v\cos 2\theta\hat{j}\right)$

D. $\left(v\cos 2\theta\hat{i}\right)+\left(v\sin 2\theta\hat{j}\right)$

Answer: D

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56. A parallel sided block of glass of refractive index 1.5 which is 36 mm thick rests on the floor of a tank which is filled with water (refractive index = 4/3). The difference between apparent depth of floor at A and B when seen from

vertically above is equal to

A. 2mm

B. 3mm

C. 4mm

D. 6mm

Answer: B

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57. An object is placed at a distance of 15cm from a convex lenx of focal length 10cm. On the other side of the lens, a convex mirror is placed at its focus such that the image formed by the combination coincides with the object itself. The focal length of the convex mirror is

A. 20 cm

B. 10 cm

C. 15 cm

D. 30 cm

Answer: B

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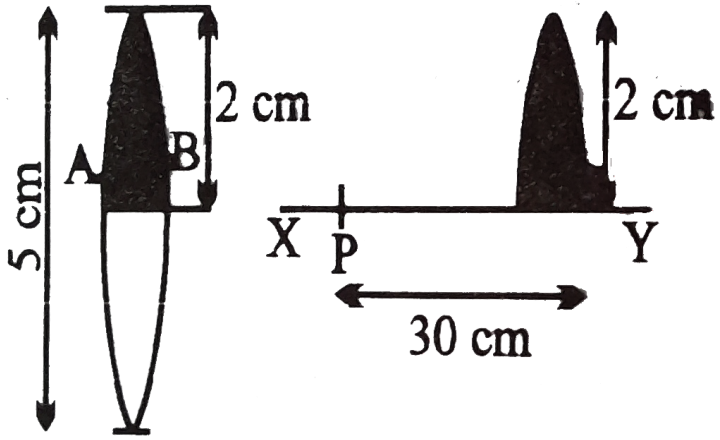
58. A converging lens of focal length $20cm$ and diameter $5cm$ is cut along the line AB. The part of the lens shown shaded in the diagram is now used to form an image of a point P placed $30cm$ away from it on the line XY. Which id perpendicualr to the plane of the lens. The image

of P will be formed.



A. 0.5 cm above XY

B. 1 cm below XY

C. on XY

D. 1.5 cm below XY

Answer: D

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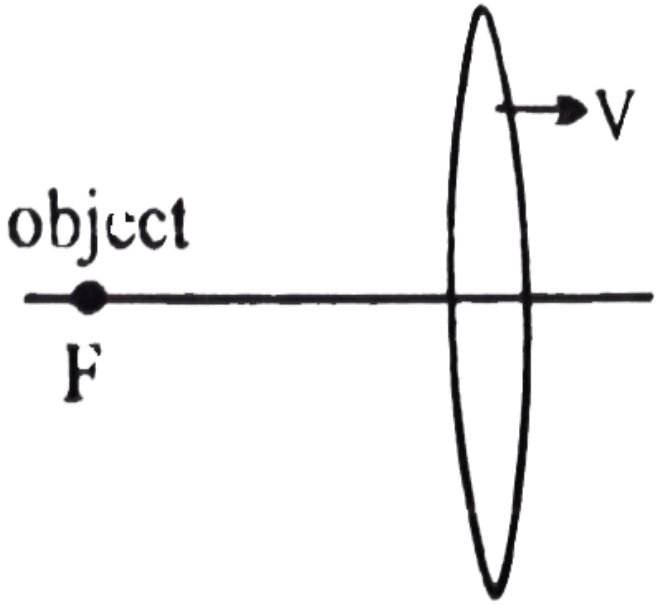
59. A point object is kept at the first focus of convex lens ,if the lens starts moving towards right will a constant velocity,th image will



A. always move towards right

B. always move towards left

C. first move towards right and then towards left

D. first move towards left and then towards right

Answer: D

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60. A convex lens of focal length f and a plane mirror are y distance apart. An object O is kept on the principal axis of the lens at a distance x from the lens. The values of x and y for the final image of O to fall exactly (position and size) on the object O are :

A. $x = f, y = f$

B. $x = f, y = 2f$

C. $x = 2f, y = f$

D. $x = 2f, y = 2f$

Answer: D

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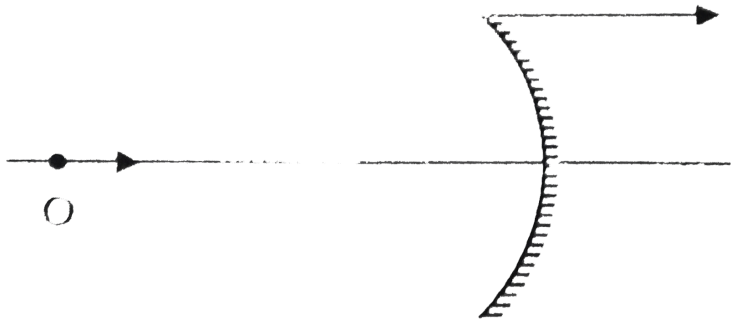

61.

An object kept on the principle axis is moving in the sme directions as that of mirror as shown in the figure. Speed of object and mirror is $10\frac{m}{s}$ and $\frac{40}{13}\frac{m}{s}$. Radius of the curvature of the mirror is 20 cm. If the distance of object from the mirror

at this instant is 5x cm, velocity of image at this instant is found to be zero. Find x.

A. $\sqrt{109}$

B. $\sqrt{58}$

C. 5

D. $\sqrt{85}$

Answer: A

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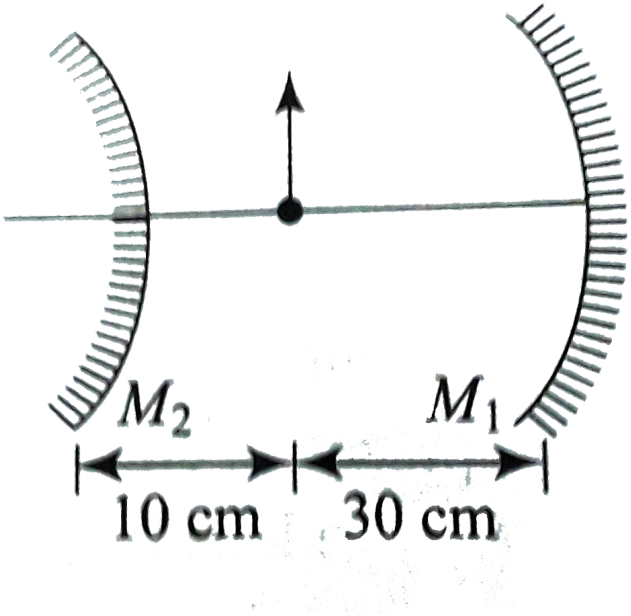
62. In Figure, find the total magnification after two successive reflections first ono M_1 and then on M_2.



A. $+6$

B. -6

C. $+3$

D. -3

Answer: B

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63. 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.

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

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

C. $\frac{2\sqrt{5}}{3}$

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

Answer: A

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64. The electric potential $V(z, y, z)$ for a planar charge distribution is given by:

$$V(x,y,z) = \begin{cases} 0 & \text{for } x < -d \\ -V_0\left(1+\frac{x}{d}\right)^2 & \text{for } -d \le x \le 0 \\ -V_0\left(1+2\frac{x}{d}\right) & \text{for } 0 \le x < d \\ -3V_0 & \text{for } x > d \end{cases}$$

where $-V_0$ is the potential at the origin and d is a distance. Graph of electric field as a function of position is given as

A. α is independent of k

B. α is independent of l

C. α is independent of both k and l

D. None of the above

Answer: A

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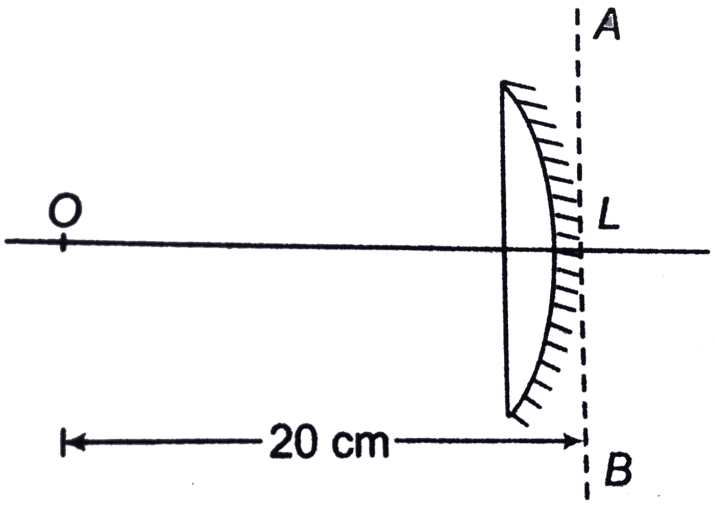
65. A point object is placed at a distance of $20cm$ from a thin plano-convex lens of focal length $15cm(\mu = 1.5)$. The curved surface is silvered. The image will form at



A. 2 cm right to the optical centre

B. 2 cm left to the optical centre

C. 5 cm right to the optical centre

D. 5 cm left to the optical centre

Answer: A

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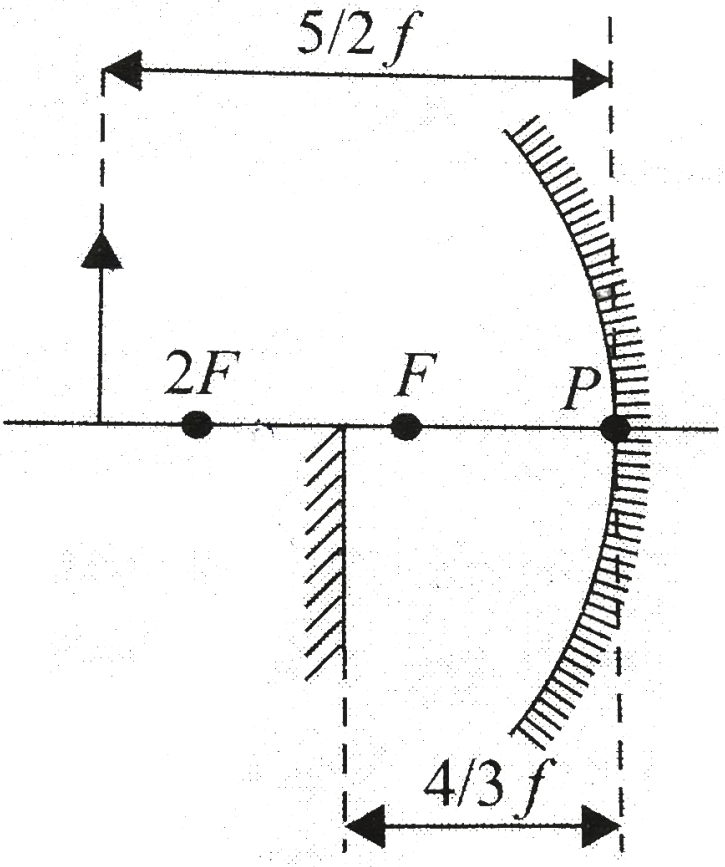
66. Shown in Fig. is a vertically erect object placed on the optic axis at a distance $(5/2)f$ from a concave mirror of focal length f. If a plane mirror is placed perpendicular to the optic axis at a distanc $(4/3)f$ from the pole, facing concave

mirror, find the position and nature of the final image formed.



A. $\sqrt{\frac{3fg}{16}}$

B. $\sqrt{\frac{27fg}{16}}$

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

D. $\sqrt{\frac{fg}{16}}$

Answer: B

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67. A ray of light moving along the vector ($-i-2j$)undergoes refraction at an interface two media,which is the x-zplane. The refracive 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. $\frac{-4\hat{i}-3\hat{j}}{5}$

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

D. $\frac{3\hat{i}+5\hat{j}}{\sqrt{34}}$

Answer: B

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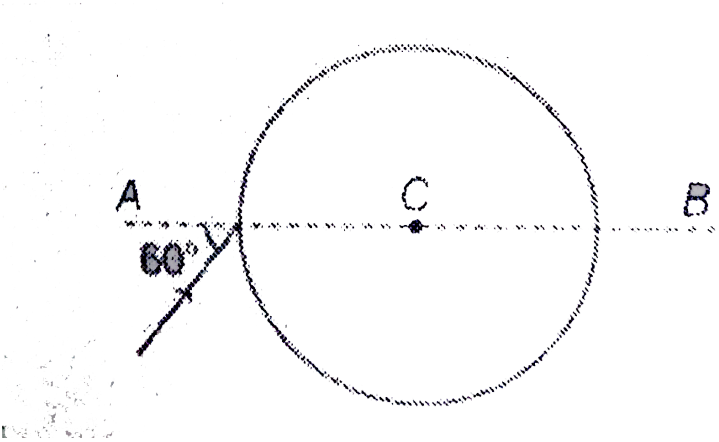
68. A ray of light falls on a transparent sphere with centre at C as shown in figure. The ray emerges from the sphere parallel to line AB. The

refractive index of the sphere is



A. $\sqrt{3}$

B. $\sqrt{2}$

C. 3/2

D. 4/3

Answer: C

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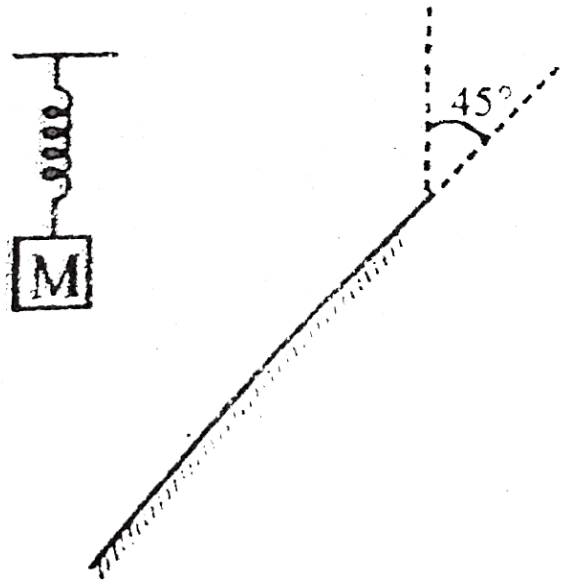
69. An insect of negligible mass is sitting on a block of mass M, tied with a spring of force constant K. The block performs simple harmonic motion with amplitude A infront of a plane mirror placed as shown. The maximum speed of insect relative to its image will be



A. $A\sqrt{\frac{2K}{M}}$

B. $6A\sqrt{\frac{K}{M}}$

C. $\frac{4}{\sqrt{\frac{K}{M}}}$

D. $\frac{8}{5}A\sqrt{\frac{K}{M}}$

Answer: D

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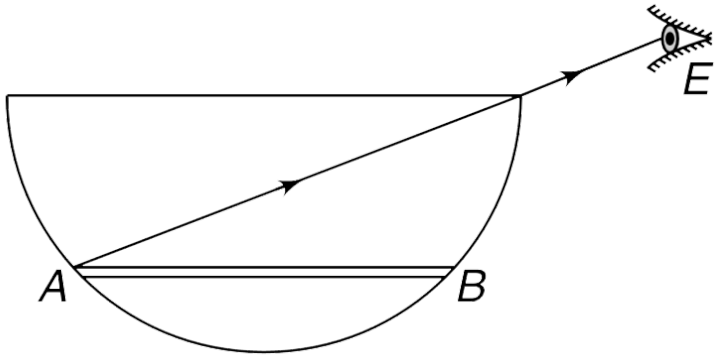
70. A stick is placed inside a hemispherical bowl as shown in Figure. The stick is horizontal and has a length of 2a. Eye of an observer is located at E

such that it can just see the end A of the stick. A liquid is filled upto edge of the bowl and the end B of the stick becomes visible to the observer. Radius of the bowl is R. Find the refractive index (μ) of the liquid.



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

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

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

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

Answer: D

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71. At a particular instant velocity and acceleration of a particle are $\left(-\hat{i}+\hat{j}+2\hat{k}\right)m/s$ and $\left(3\hat{i}-\hat{j}+\hat{k}\right)m/s^2$ respectively at the given instant particle's speed is :

A. $\hat{j}+\hat{k}$

B. $\hat{i} + 2\hat{j} - 3\hat{k}$

C. $-\hat{j} - \hat{k}$

D. None of these

Answer: B

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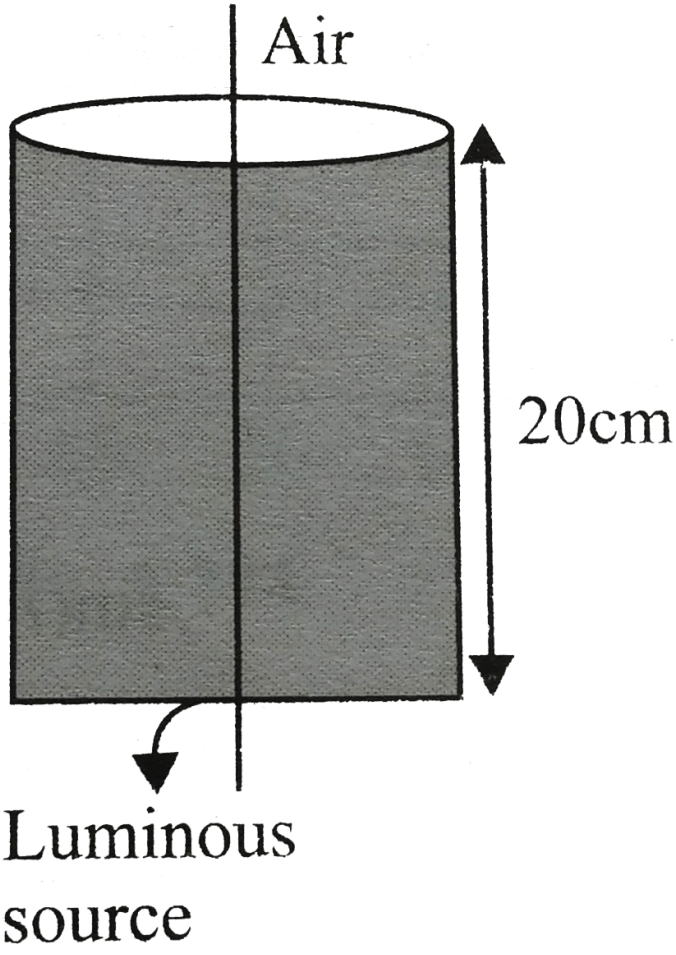
72. A thin equiconvex glass lens $\left(\mu_g = 1.5\right)$ is beign placed on the top of a vessel of height $h = 20cm$ as shown figure. A luminous point source is beign placed at the bottom of vessel on the principal axis of the lens. When the air is on

both the side of the lens the image of luminous source is formed at a distance of 20cm from the lens out side the vessel. When the air inside the vessel is being replaced by a liquid of refractive index μ_l the image of the same source is being formed at a distance 30cm from the lens outside

the vessel. Find the μ_l.



A. $\frac{10}{9}$

B. $\frac{20}{9}$

C. $\frac{15}{9}$

D. $\frac{12}{9}$

Answer: A

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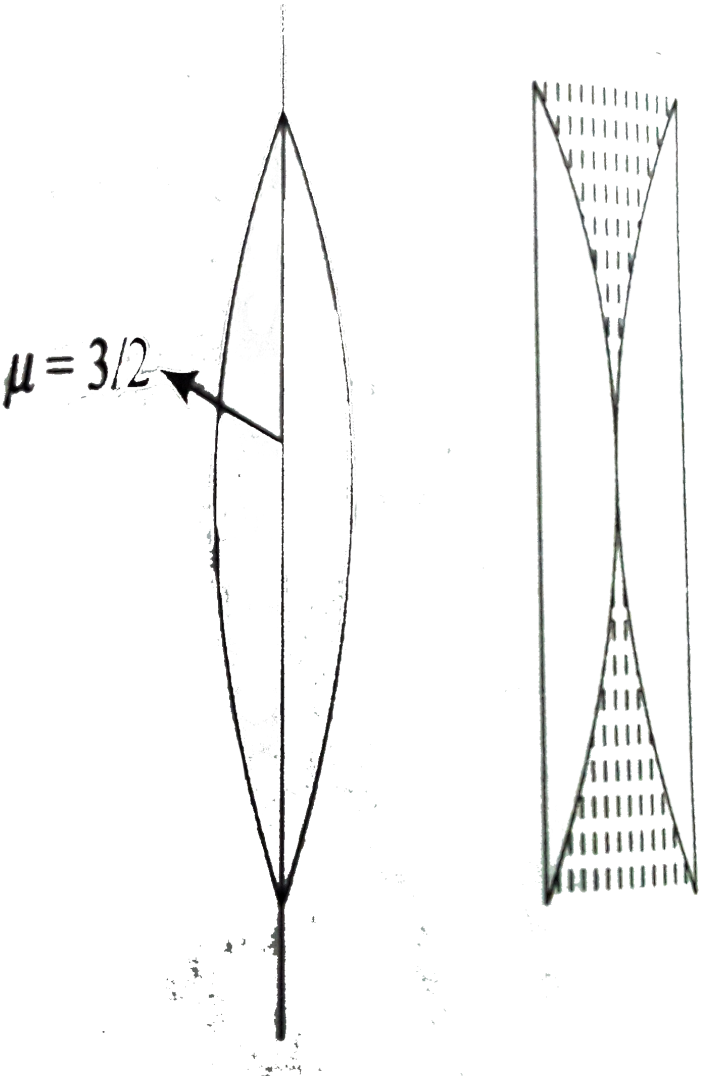
73. A thin equiconvex lens $(\mu = 3/2)$ of focal length 10cm is cut and separated and a material of refractive index 3 is filled between them. What

is the focal length of the combination?



A. $2.5cm$

B. $10cm$

C. $-2.5cm$

D. $-10cm$

Answer: A

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B More Than One Option Is Correct

1. A point object is placed at 30 cm from a convex glass lens $\left(\mu_g = \frac{3}{2}\right)$ of focal length 20 cm. The final image of object will be formed at infinity if

A. another concave lens of focal length 60 cm is placed in contact with the previous lens

B. another convex lens of focal length 60 cm is placed at a distance of 30 cm from the first lens

C. the whole system is immersed in a liquid of refractive index 4/3

D. the whole system is immersed in a liquid of refractive index 9/8

Answer: A::D

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2. For a concave mirror of focal length f, image is 2 times larger. Then the object distance from the mirror can be

A. virtual image is always larger in size

B. real image is always smaller in size

C. real image is always larger in size

D. real image may be smaller or larger in size

Answer: A::D

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3. For a concave mirror

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

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

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

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

Answer: A::B

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4. Focal length of a lens in air is f. Refractive index of the lens is μ. Focal length changes to f_1 if lens is immersed in a liquid of refractive index $\frac{\mu}{2}$ and it becomes f_2 if the lens is immersed in a liquid of refractive index 2μ. Then

A. $f_1 = \frac{f}{2}$

B. $f_2 = -2f$

C. $f_2 = -\frac{3f}{2}$

D. Data is insufficient

Answer: D

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5. For what position of an object, a concave mirror forms a real image equal in size to the object?

A. $u = -10cm, f = 20cm$

B. $u = -20cm, f = -30cm$

C. $u = -45, f = -10cm$

D. $u = -60cm, f = -30cm$

Answer: D

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6. Refractive index of an equilateral prism is $\sqrt{2}$.

A. minimum deviation from this prism can be 30°

B. minimum deviation from this prism can be 45°

C. at angle of incidence $= 45^\circ$, deviation is minimum

D. at angle of incidence $= 60^\circ$, deviation is minimum

Answer: A::C

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7. Write laws of refraction. Explain the same with the help of ray diagram, when a ray of light passes through a rectangular glass slab.

A. medium on both sides is same

B. angle of incidence is 90°

C. angle of incidence is 0°

D. medium on other side is rarer

Answer: A::C

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8. A ray of light of wavelength u_0 and frequency v_0 enters a glass slab of refractice index μ from air. Then

A. $f = \frac{f_0}{\mu}$

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

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

D. $f = f_0$

Answer: B::C::D

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9. There are three optical media 1,2 and 3 with the refractive indices $\mu_1 > \mu_2 > \mu_3$.

(TIR $\rightarrow$ total internal reflection)

A. when a ray of light travels from 3 to 1 no TIR will place

B. critical angle between 1 and 2 is less than the critical angle between 1 and 3

C. critical angle between 1 and 2 is more than the critical angle between 1 and 3

D. chances of TIR are move when ray of light travels from 1 to 3 as compared to the case when it travel from 1 to 2

Answer: A::C::D

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10. Parallel rays of light are falling on convex sphere surface of radius of curvature R = 20 cm as

show. Refractive index of the medium is $\mu = 1.5$. A refraction from the spherical surface parallel rays

A. actually meet at some point

B. appear to meet after extending the refracted rays backwards

C. meet (or appear to meet) at a distance of 30 cm from the spherical surface

D. meet (or appear to meet) at a distance of 60 cm from the spherical surface.

Answer: A::D

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11. For a mirror linear magnification m comes out to $+2$. What conclusions can be drawn from this ?

A. mirror is concave

B. mirror can be convex or concave but it can not be place

C. object lies between pole and focus

D. object lies between focus

Answer: A::C

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12. A convex lens made of glass $\left(\mu_g = 3/2\right)$ has focal length f in air. The image of an object placed in front of it is inverted, real and magnified. Now the whole arrangement distance between object and lens. Then

A. the new focal length will become 4f

B. the new focal length will become $\frac{f}{4}$

C. new image will be virtual and magnified

D. new image will be real inverted and smaller in size

Answer: A::C

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13. 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. complete image will be formed

C. intensity of the image will increases

D. intensity of the image will decreases

Answer: B::D

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14. 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. 1.6

Answer: C::D

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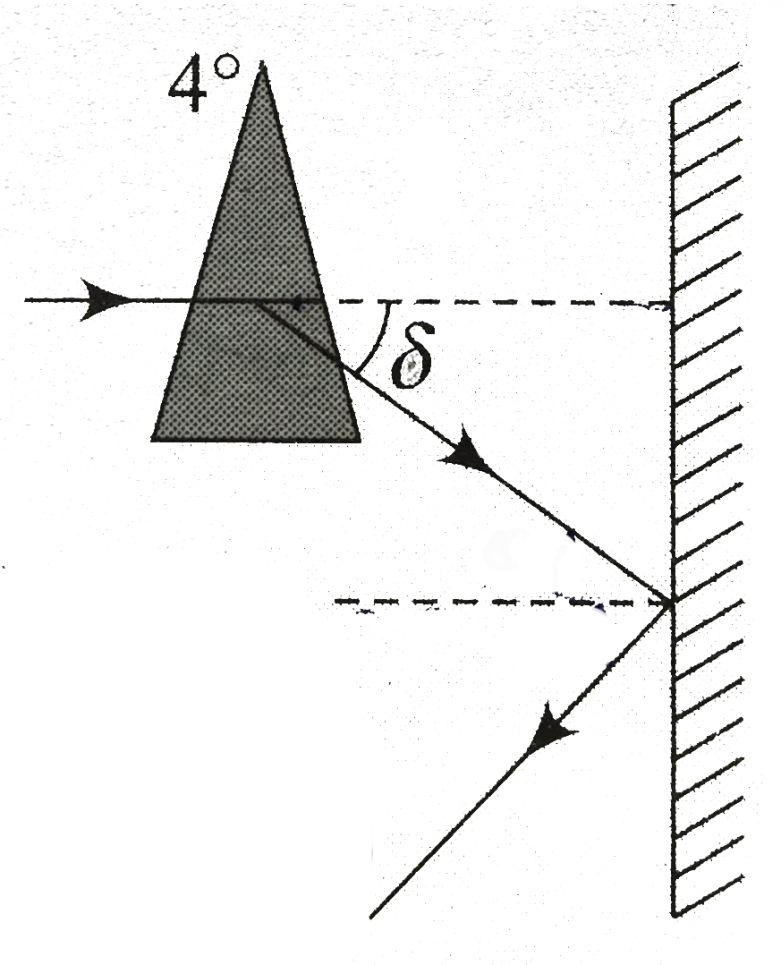
15. A horizontal ray of light passes through a prism whose apex angle is 4° and then strikes a vertical mirror M as shown in Figure. For the ray to become horizontal after reflection, Find the

angle by which the mirror must be rotated.



A. 2°

B. 3°

C. 4°

D. 1°

Answer: A::D

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16. The image formed by a concave mirror is twice the size of the object. The focal length of the mirror is 20 cm. The distance of the object from the mirror is / are

A. $10cm$

B. $30cm$

C. $25cm$

D. $15cm$

Answer: A::B

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17. Two refracting media are separated by a spherical interface as shown in the figure.

A. If $\mu_2 > \mu_1$, then there cannot be real image of real object.

B. If $\mu_2 > \mu_1$, then there cannot be real image of virtual object.

C. If $\mu_1 > \mu_2$, then there cannot be a virtual image of virtual object.

D. If $\mu_1 > \mu_2$, then there cannot be a real image of real object.

Answer: A::C

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18. A small air bubble is trapped inside a transparent cube of size $12cm$. When viewed from one of the vertical faces, the bubble apears to be at $5cm$. From it. When viewed from opposite face, it appears at $3cm$ from it.

A. The distance of the air bubble from the first face is 7.5 cm

B. The distance of the air bubble from the second face is 6 cm

C. Refractive index of the material of the prism is $\frac{5}{3}$

D. Refractive index of the material of the prism is 1.5

Answer: A::D

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19. A plane mirror placed at the origin has $\hat{i}$ as the normal vector to its reflecting surface. The mirror beings to translate with a velocity $\hat{i}+\hat{j}+\hat{k}$. At the same time an object which was initially at $\hat{i}+\hat{j}$ starts moving with a velocity $\left(\hat{i}+\hat{j}\right)m/s$ Now choose the correct options.

A. Initial position of the image will be $-\hat{i}+\hat{j}$

B. The velocity of the image will be $\hat{i}+\hat{j}$

C. The velocity of the imahe relative to the object will be zero

D. The velocity of the image relative to the mirror will be $-\hat{k}$

Answer: A::B::C::D

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20. A ray of light moving along a vector $\left(3\sqrt{2}\hat{i} - 3\hat{j} - 3\hat{k}\right)$ undergoes refraction at an interface of two media which is y-z plane. The refractive index for $x \leq 0$ is 1 while for $x \geq 0$ it is $\sqrt{2}$. Then,

A. Refracted ray bend towards y-axis

B. Refracted ray bend towards x-axis

C. The unit vector along the refracted ray is $\frac{\sqrt{3}\hat{i} - \hat{j} - \hat{k}}{2}$

D. The unit vector along the refracted ray is $\frac{\sqrt{6}\hat{i} - \hat{j} - \hat{k}}{\sqrt{8}}$

Answer: B::D

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C Comprehension Type Question

1. A ray of light falls on an equilateral prism ABC as shown. Face AC of the prism is polished.

What is the refractive index μ of the material of the prims so that when the ray falls on face BC (after reflecting from AC) it makes an angle 60° with it.?

A. $\sqrt{3}$

B. $\sqrt{2}$

C. 2

D. 1.5

Answer: B

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2. A ray of light falls on an equilateral prism ABC as shown. Face AC of the prism is polished.

Calculate 'mu' when the ray falls on BC after reflecting from AC it make angle 60 with it .With the value of μ calculated above find total deviation, when the ray of light finally emerges from BC

A. 120°

B. 180°

C. 150°

D. 90°

Answer: C

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3. Magnification by a lens of an object at distance 10 cm from it is -2. now a seconnd lens is placed exactly at the same positon where first was kept, without changing the distance between object and lens. The magnification by this second lens is -3.

Now both the lenses are kept in contact at the same place. what will be the new magnification ?

A. $-\frac{13}{5}$

B. $-\frac{12}{7}$

C. $-\frac{6}{11}$

D. $-\frac{5}{7}$

Answer: C

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4. Magnification by a lens of an object at distance 10 cm from it is -2. now a seconnd lens is placed exactly at the same positon where first was kept, without changing the distance between object and lens. The magnification by this second lens is -3.

What is the focal length of the combination when both lenses are in contact ?

A. $\frac{60}{17} cm$

B. $\frac{5}{17} cm$

C. $\frac{12}{7} cm$

D. $\frac{13}{9} cm$

Answer: A

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5. In case of convex lense, when object is moved from f to 2f, its image is real, inverted and magnified. It moves from infinity to 2f on other side.

Focal len is 10 cm. when the object is moved from 15 cm to 25 cm , the magnitude of liner magnification.

A. will increases

B. will decreases

C. will first increases the decreases

D. will first decreases then increases

Answer: B

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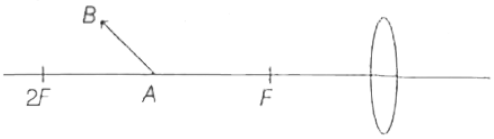
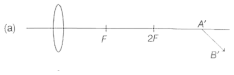
6. In case of convex lense, when object is moved from f to 2f, its image is real, inverted and magnified. It moves from infinity to 2f on other side.

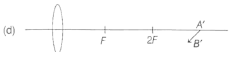
Image of object AB shown in figure will be like



A. 

B. 

C. 

D. 

Answer: C

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7. A convex lens of focal length 20 cm and a concave lens of focal length 10 cm are placed 20 cm apart. In between them an object placed at distance x from the convex lens.

What is the value of x (in cm) so that images from by both the lenses coincides ?

A. $20\left(\sqrt{3}-1\right)$ and $\frac{1}{\sqrt{3}}$

B. $10\left(\sqrt{3}-1\right)$

C. $\frac{20}{\sqrt{3}}$

D. none of these

Answer: D

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8. A convex lens of focal length 20 cm and a concave lens of focal length 10 cm are placed 20 cm apart. In between them an object placed at distance x from the convex lens.

What will be the linear magnification produced convex lens and concave lens individually ?

A. $\left(\sqrt{3}+1\right)$ and $\frac{1}{\sqrt{3}}$

B. $\sqrt{3}$ and $\frac{1}{\sqrt{3}}$

C. $\left(\sqrt{3}+1\right)$ and $\left(\sqrt{3}-1\right)$

D. $\sqrt{3}$ and $\left(2\sqrt{3}-3\right)$

Answer: D

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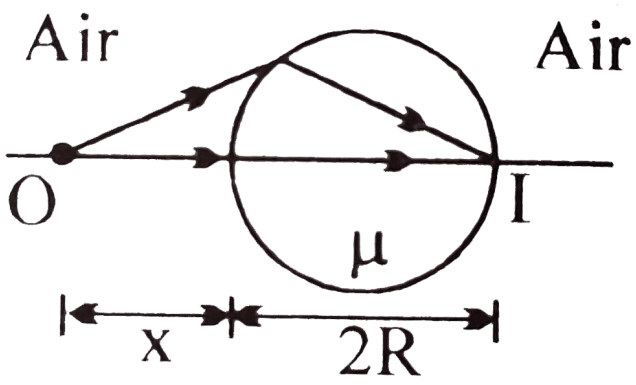
9. The figure ,shows a transparent sphere of radius$R$and refractive indexμ.An object $O$is placed at a distance x from the pole of the first surface so that a real image is formed at the pole of the exactly opposite surface.



If $x = 2R$,then the value of $\mu$is

A. 1.5

B. 2

C. 3

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

Answer: C

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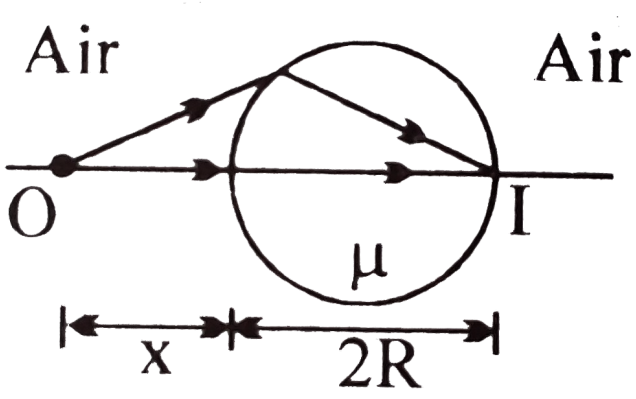
10. The figure ,shows a transparent sphere of radius $R$and refractive indexμ.An object $O$is placed at a distance x from the pole of the first

surface so that a real image is formed at the pole of the exactly opposite surface.



If $x = \infty$,then the value of μ is

A. 1.5

B. 2

C. 3

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

Answer: B

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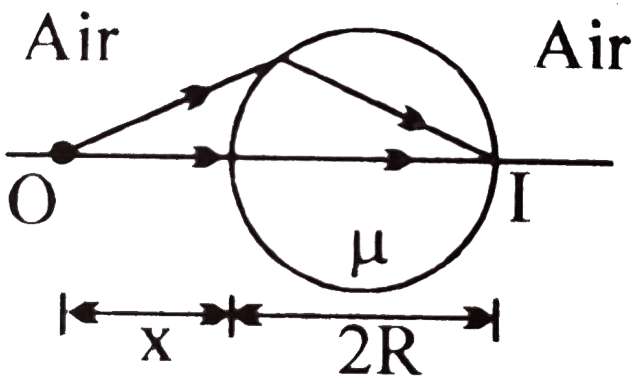
11. The figure ,shows a transparent sphere of radius $R$and refractive indexμ.An object $O$is placed at a distance x from the pole of the first surface so that a real image is formed at the pole of the exactly opposite surface.



if an

object is Placed at a distance$R$ from the pole of first surface ,then the real image is formed at a distance $R$from thepole of the second surface.The refractive indexμ of the spher is given by

A. 1.5

B. $\sqrt{2}$

C. 3

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

Answer: B

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12. A point object at a distance 5R/3 from the pole of a concave mirror. R is the radius of curvature of mirror. Point object oscillates with amplitude of 1mm perpendicular to the principal axis.

The amplitude of image is

A. 3/7 mm

B. 2/7 mm

C. 4/3 mm

D. 11/7 mm

Answer: A

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13. A point object at a distance 5R/3 from the pole of a concave mirror. R is the radius of curvature of mirror. Point object oscillates with amplitude of 1mm perpendicular to the principal axis.

Phase difference between motion of object and image when object crosses the principal axis is

A. π

B. 0

C. $\pi / 2$

D. none of these

Answer: A

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14. A point object at a distance 5R/3 from the pole of a concave mirror. R is the radius of curvature of mirror. Point object oscillates with amplitude of 1mm perpendicular to the principal axis.

Position of image when object is at O is :

(3/7)R

(5/7)R

(2/7)R

(4/7)R

A. (3/7)R

B. (5/7)R

C. (2/7)R

D. (4/7)R

Answer: B

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Matrix Matching Type Q

1. Match the following

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2. Match the followings for real object .

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3. For a concave mirror of focal length 20 cm, match the following

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4. An object is placed at the focus of an equiconvex lens. Match the following

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5. Match the following

Watch Video Solution

6. AB is the optic axis of a lens. Lens is not shown in the figure. O and I are the position of object and image. Then match of following.

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7. Four indicident rays of light parallel to optic axis and their path after passing through an optical system are shown in table-1. match the corresponding optical instrument from table 2.

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8. A small particle is placed at the pole of a concave mirror and then moved along the principal axis to a large distance. During the motion, the distance between the pole of the

mirror and the image is measured. The prodedure is them repeated with convex mirror, a concave lens and a convex lens. the object is plotted between image distance versus shown in graph with the mirror or lens that is corresponding it. (curve 1 has two segments)

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Integer Type Q

1. When an object is kept at a distance of 30cm from a concave mirror, the image is formed at a distance of 10 cm. if the object is moved with a speed of 9 cm/s, find the speed (in cm/s) with which image moves.

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2. A point object O is placed on the principal axis of a convex lens of focal length 10 cm at 12 cm from the lens. When object is displaced 1mm along the principal axis magnitude of

displacement of image is x_1. When the lens is displaced by 1mm perpendicular to the principal axis displacement of image is x_2 in magnitude. find the value of $\frac{x_1}{x_2}$

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3. A convex lens of focal length 30 cm forms a real image three times larger than the object on a screen. Object and screen are moved until the image becomes twice the size of the object. If the shift of the object is 6 cm. the shift of screen is (7x) cm. find value of x

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4. In a plano-convex lens radius of curvature of the lens is 10 cm. if the plane side polished, then the magnitude of the focal length of the mirror so formed will be (refractive index =1.5) (2x) cm . Find value of x.

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5. 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 $(\mu = 4/3)$.

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6. A plane mirror is placed along the y-axis such that x-axis is normal to the plane of the mirror. The reflecting surface of the mirror is towards negative x-axis. The mirror moves in positive x-direction with uniform speed of 5 m/s and a point object P is moving with constant speed 3m/s in negative x-direction. find the speed of image with respect to mirror in m/s.

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7. A ray of light travelling in glass $(\mu = 3/2)$ is incident on a horizontal glass air surface at the critical angle θ_C. If a thin layer of water $(\mu = 4/3)$ is now poured on the glass air surface, the ray of light emerge into air at the water air surface at an angle of π/k, radians find the value of k.

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8. Assume that you are sitting in a car at rest. You see a person in the rear view mirror of radius of curvature 2m running towards you at t=0. if person is running with velocity 5m/s and it is at 9m distance from mirror at this instant, the average velocity (in mm/sec) of image of man in first second is found to be 20x. find the value of x

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9. A point source of light is placed inside water and a thin converging lens of focal length f is

placed just outside the surface of water. The image of source is formed at a distance of 50 cm from the surface of water. When the lens is placed just inside the water surface the image is formed at a distance of 40 cm from the surface of water. if focal length of the lens in air is $f = \frac{100k}{8}$ cm, then find the value of k. (given refractive index of lens is 3/2 and that of water is 4/3 and in both cases image is formed inside water for the viewer in air).

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10. Image distance |v| vs object distance |u| curve for two biconvex lenses with same radii of curvatures is shown in the figure. If refractive index of lens 1 is $\frac{5}{2}$, then refractive index of lens 2 is.

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11. Two identical equi-concave lenses made of magnitude of combined glass of refractive index 1.5, placed in contact has magnitude of combined

power p. when a liquid of refractive index μ is filled in the gap between the concave lenses, the power becomes $+\frac{p}{3}$. the value of μ is $\frac{K}{3}$. find the value of K

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12. Find the magnitude of velocity of image of a point object O with respect to object, which is moving with velocity 2m/s in vertical direction as shown in the figure. The plane mirror that is inclined to horizontal at 45° is alos moving

horizontally with velocity 2m/s towards left.

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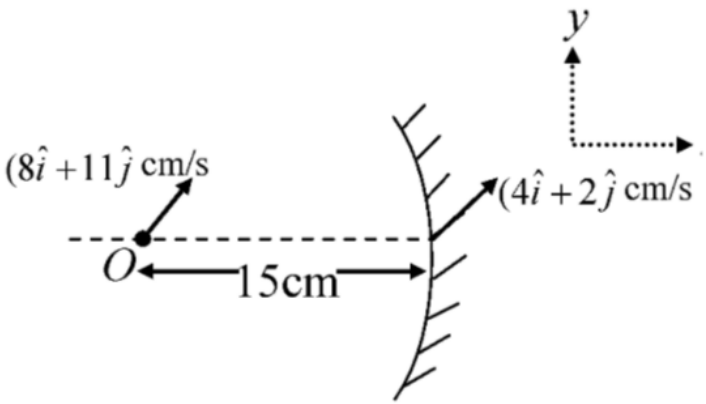
13. A point object located at a distance of 15 cm from the pole of concave mirror of focal length 10 cm on its principal axis is moving with velocity $\left(8\hat{i}+11\hat{j}\right)$ cm/s. the velocity of mirror is $\left(4\hat{i}+2\hat{j}\right)$ cm/s. if the speed of the image in cm/s

4k, find the value of k.



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14. A light ray is incident on face AB of a prism ABC as shown in figure. The second prims is ketp in such a manner the emergent ray from prism ABC is falling normally on face A'B' of prism A'B'C'. The net deviation by optical system two prisms is

(8k) degree. find the value of k.

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