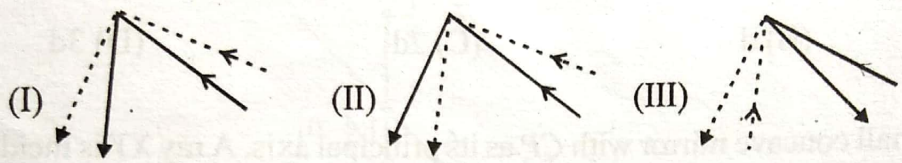
***Plane mirror :***

1. Each of these diagrams is supposed to show two different rays being reflected from the same point on the same mirror. Which option is correct :-

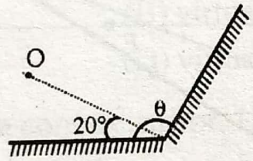



(A) Only I (B) Only II (C) Only III (D) All

2. If two mirrors are kept at 60° to each other, then the number of images formed by them is :- **[AIEEE- 2002].**

(A) 5 (B) 6 (C) 7 (D) 8

3. If $\theta = 110°$ then total number of images formed by the mirror system will be :-






(A) 2 (B) 3 (C) 4 (D) 5

4. A point object approaches a plane mirror with a speed of 10 $ms^{-1}$, while the image recedes away from the mirror with a speed of 6 $ms^{-1}$ (as seen by stationary observer). The direction and magnitude of the velocity of mirror is :-

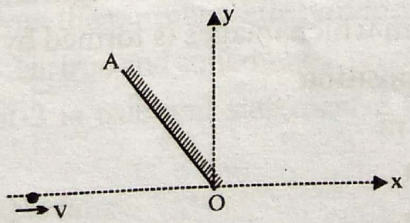
(A) towards the object, 8 $ms^{-1}$ (B) towards the image, 6 $ms^{-1}$

(C) away from the object, 8 $ms^{-1}$ (D) away from the object, 2 $ms^{-1}$

5. A boy of TOA3 batch is 1.8m tall and can see his image in a plane mirror fixed on a wall. His eyes are 1.6m from the floor level. The minimum length of the mirror to see his full image is :-

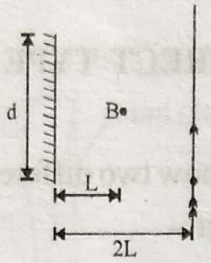
(A) 0.9 m (B) 0.85 m (C) 0.8 m (D) Can't be determined

6. A plane mirror OA of length 2 m is kept along the line $y = -x$ as shown in the figure. An insect having velocity of $4\hat{i}$ cm/s is moving along the x-axis from far away. The time span for which the insect can see its image will be :-




(A) 50 sec (B) 25 sec (C) $25\sqrt{2}$ sec (D) $50\sqrt{2}$ sec

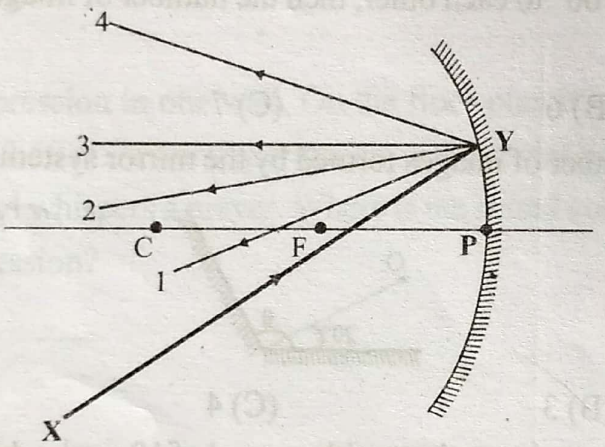
7. A point source of light $B$ is placed at a distance $L$ in front of the centre of a mirror of width $d$ hung vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror at a distance $2L$ from it as shown. The greatest distance over which he can see the image of the light source in the mirror is :- **[IIT-JEE '2000 (Scr)]**




(A) d/2 (B) d (C) 2d (D) 3d

***Spherical mirror :***

8. Figure shows a small concave mirror with $CP$ as its principal axis. A ray $XY$ is incident on the mirror. Which of the four rays can be the reflected ray.




(A) 1 (B) 2 (C) 3 (D) 4

9. The distance of an object from a spherical mirror is equal to the focal length of the mirror. Then the image:

(A) must be at infinity (B) may be at infinity

(C) may be at the focus (D) none

10. An object is placed in front of a spherical mirror whose 2 times magnified image is formed on screen. Then choose **CORRECT** option :-

(A) Mirror is concave m = +2 (B) Mirror is concave m = –2

(C) Mirror is convex m = +2 (D) Mirror is convex m = –2

11. The table below lists object and image positions for four objects placed in front of mirrors, using Cartesian sign convention with pole of the mirror as origin and direction of incident rays as positive. In the following cases, the case in which images is formed by a convex spherical mirror, is :-

| | **Object position** | **Image position** |
|---|---|---|
| (A) | – 25.0 cm | – 16.7 cm |
| (B) | – 5.0 cm | 10.0 cm |
| (C) | – 20.0 cm | 5.71 cm |
| (D) | – 40.0 cm | 80.0 cm |

12. A particle approaches from very large distance towards concave mirror along the principal axis. By the time the particle reaches the mirror the distance between the particle and its image :-

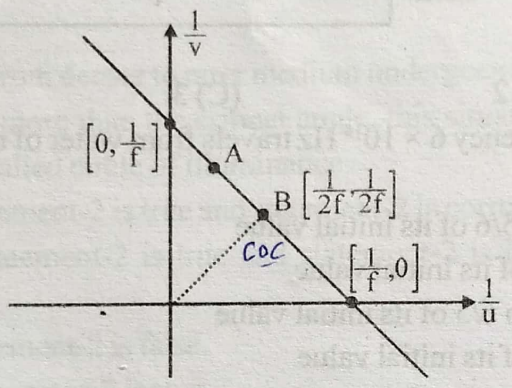
(A) first decreases then increases

(B) first increases then decreases

(C) first increases then decreases and then again increases

(D) first decreases then increases and then again decreases

13. Figure shows $\frac{1}{v}$ vs $\frac{1}{u}$ curve for convex mirror. Nature of image at point A is :-




(A) Real, erect, magnified

(B) virtual, inverted, magnified

(C) virtual, inverted, diminished

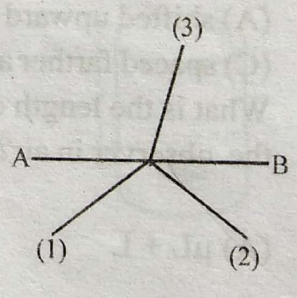
(D) virtual, erect, diminished

14. A boy of height 1 m stands in front of a convex mirror. His distance from the mirror is equal to its focal length. The height of his image is :- (Assume paraxial ray approximation holds)

(A) 0.25 m (B) 0.33 m (C) 0.5 m (D) 0.67 m

***Refraction at plane surface :***

15. AB is a boundary separating two media of different refractive indices. A ray is incident on the boundary is partially reflected and partially transmitted. Choose the **CORRECT** statement.




(A) 3 is incident ray and 1 is refracted ray

(B) 2 is incident ray and 1 is partially reflected ray

(C) 1 is incident ray and 3 is refracted ray

(D) 3 is incident ray and 2 is partially reflected ray

16. **Statement-1:** You see a geostationary satellite above the horizon. You desire to communicate with the satellite by sending a beam of laser light. You should aim your laser slightly higher than the line of sight of the satellite.

**Statement-2:** Light bends away from the normal while moving from denser to rarer medium.

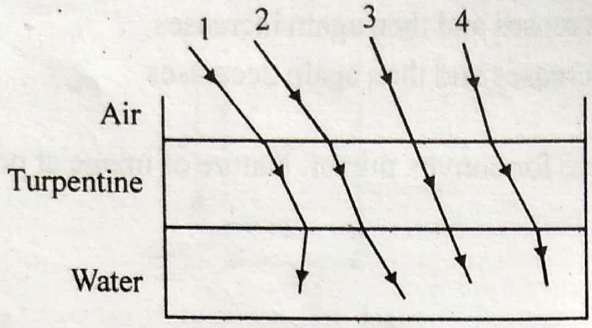
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

17. The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in figure, the path shown is **CORRECT** ?




(A) 1 (B) 2 (C) 3 (D) 4

18. When a ray of light of frequency $6 \times 10^{14}$ Hz travels from water of refractive index 4/3 to the glass of refractive index 8/5, its :-

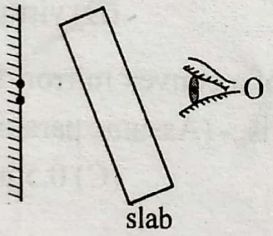
(A) frequency decreases to 5/6 of its initial value

(B) speed decreases to 5/6 of its initial value

(C) wavelength decreases to 6/5 of its initial value

(D) speed increases to 6/5 of its initial value

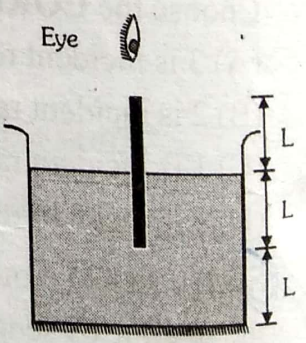
19. The observer at O views two closely spaced spots on a vertical wall through an angled glass slab as shown. As seen by observer, the spots appear.




(A) shifted upward (B) shifted downward

(C) spaced farther apart (D) spaced closer together

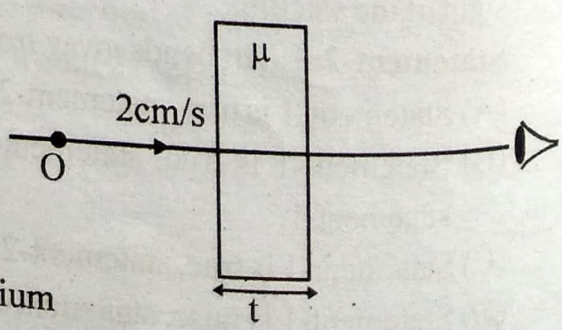
20. What is the length of the image of the rod in mirror, according to the observer in air? ( refractive index of the liquid is $\mu$)




(A) $\mu L + L$ (B) $L + \frac{L}{\mu}$

(C) $L\mu + \frac{L}{\mu}$ (D) None of these

21. A glass slab of width '$t$', refractive index '$\mu$' is placed as shown in the figure. If the point object, moves with a speed 2 cm/s towards the slab the speed observered will be :-



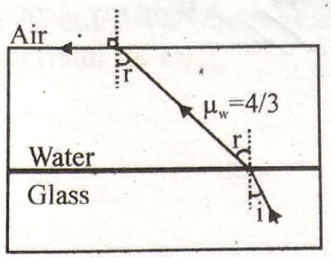

(A) 2 cm/s

(B) less than 2 cm/s

(C) greater than 2 cm/s

(D) dependent on the refractive index of surrounding medium

22. A ray of light is incident at the glass–water interface at an angle i, it emerges finally parallel to the surface of water, then the value of $\mu_g$ would be :– **[IIT-JEE 2003]**




(A) (4/3) sin i
(B) 1/sin i
(C) 4/3
(D) 1

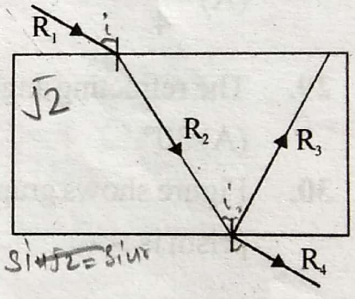
***Total internal reflection :***

23. **Statement-1**: A point source of light is placed inside water. A light detector present out side, in air can detect light only in a conical region, with the apex at the source and circumscribing the circle of illuminance.

**Statement-2**: Ray incident from denser to rarer medium undergoes total internal reflection when their angle of incidence become more than the critical angle, this situation create a circular region from which light escapes and is called circle of illuminance.

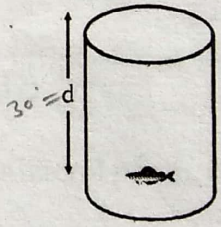
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

24. A ray $R_1$ is incident on the plane surface of the glass slab (kept in air) of refractive index $\sqrt{2}$ at an angle of incidence equal to the critical angle for this air glass system. The refracted ray $R_2$ undergoes partial reflection and refraction at the other surface. The angle between reflected ray $R_3$ and the refracted ray $R_4$ at that surface is :




(A) 45°
(B) 135°
(C) 105°
(D) 75°

25. A fish floats in liquid with its eye at the centre of an opaque walled full tank of liquid of circular cross section. When the fish look upwards, it can see a fish-eye view of the surrounding scene i.e. it is able to view the entire space above the liquid surface. The diameter of the tank is 30 cm, and the critical angle for liquid is 37°. At what maximum depth below the surface of the liquid, d, must the fish be floating? $\left(\sin 37° = \frac{3}{5}\right)$




(A) 16 cm
(B) 20 cm
(C) 11.25 cm
(D) 25 cm

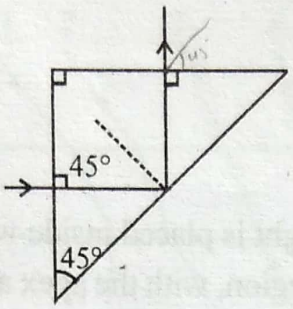
26. **Statement-1**: When light falls on a sphere made of diamond total internal reflection takes place which makes it shine more than a similar sphere made of common glass.

**Statement-2**: Refractive index for diamond is more than refractive index of cheap glass.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

**27.** A light ray is incident perpendicular to one face of a 90° prism and is totally internally reflected at the glass-air interface. If the angle of reflection is 45°, we conclude that the refractive index n :

**[AIEEE-2004]**




(A) $n < \frac{1}{\sqrt{2}}$ (B) $n > \sqrt{2}$ (C) $n > \frac{1}{\sqrt{2}}$ (D) $n < \sqrt{2}$

***Prism :***

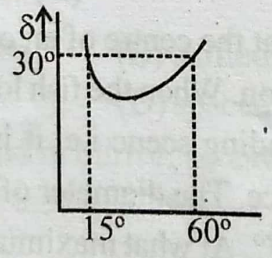
**28.** A ray of light is incident at 60° on a prism of refracting angle 30°. The emerging ray is at an angle 30° with the incident ray. The value of refractive index of the prism is:-

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

**29.** The refracting angle of the prism is 60° and minimum deviation of 30°, then the angle of incidence is:-

(A) 30° (B) 45° (C) 25° (D) 60°

**30.** 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°

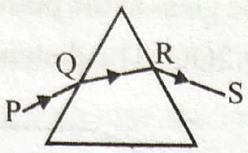
**31.** There is a prism with refractive index equal to $\sqrt{2}$ and the refracting angle equal to 30°. One of the refracting surface of the prism is polished. A beam of monochromatic light will retrace its path if its angle of incidence over the first refracting surface of the prism is :-

(A) 0° (B) 30° (C) 45° (D) 60°

**32.** The refractive index for the material of a 60° prism is 1.50. Then the angle of incidence for minimum deviation is nearly. ( $\sin 42° \approx \frac{2}{3}$ and $\sin 49° \approx \frac{3}{4}$ )

(A) 30° (B) 49° (C) 38° (D) 28°

33. A ray of light is incident on an equilateral glass prism placed on a horizontal table. For minimum deviation which of the following is true ?




(A) PQ is horizontal
(B) QR is horizontal
(C) RS is horizontal
(D) Either PQ or RS is horizontal

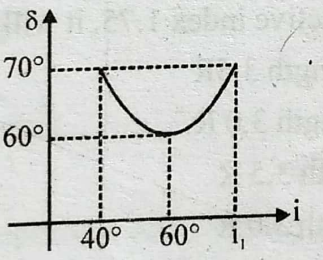
34. An isosceles glass prism having refractive index μ has one of its faces coated with silver. A ray of light is incident normally on the other face (which is equal to the silvered face). The ray of light is reflected twice on the same sized faces and then emerges through the base of the prism perpendicularly. The angles of prism are :-

(A) 40°, 70°, 70°
(B) 50°, 65°, 65°
(C) 36°, 72°, 72°
(D) data insufficient

35. A given ray of light suffers minimum deviation in an equilateral prism P. If refractive index increases slightly then the ray will now suffer :-

(A) greater deviation
(B) no deviation
(C) same deviation as before
(D) Lesser deviation

36. The curve of angle of incidence versus angle of deviation shown has been plotted for prism. The value of refractive index of the prism used is :




$\delta = i + r + (r_1 + r_2)$

$60 = 120 + (r_1 + r_2)$ ... (3)

$r_1 + r_2 = 60$

$70 = 40 + r + 60$

(A) $\sqrt{3}$
(B) $\sqrt{2}$
(C) $\frac{\sqrt{3}}{\sqrt{2}}$
(D) $\frac{2}{\sqrt{3}}$

37. A beam of monochromatic light is incident at i = 50° on one face of an equilateral prism, the angle of emergence is 40°, then the angle of minimum deviation is :

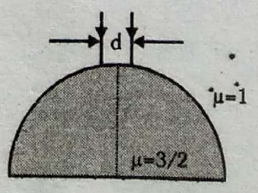
(A) 30°
(B) < 30°
(C) ≤ 30°
(D) ≥ 30°

38. The angle of a prism is 6° and its refractive index for green light is 1.5. If a green ray passes through it, the deviation will be :-

(A) 30°
(B) 15°
(C) 9°
(D) 3°

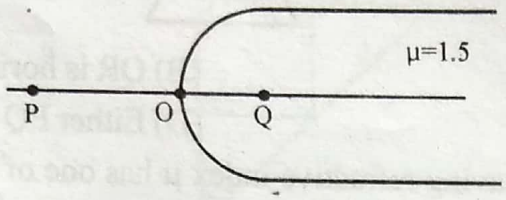
***Refraction at curved surface :***

39. 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) $\frac{2}{3}d$

**40.** One end of a glass rod of refractive index n = 1.5 is a spherical surface of radius of curvature R. The centre of the spherical surface lies inside the glass. A point object placed in air on the axis of the rod at the point P has its real image inside glass at the point Q (see fig.). A line joining the points P and Q cuts the surface at O such that OP = 2OQ. The distance PO is :-




(A) 8 R (B) 7 R (C) 2 R (D) None of these

**41.** An air bubble is inside water. The refractive index of water is 4/3. At what distance from the air bubble should a point object be placed so as to form a real image at the same distance from the bubble:

(A) 2R (B) 3R

(C) 4R (D) The air bubble cannot form a real image

**42.** A point object is placed at the centre of a glass sphere of radius 6 cm and refractive index 1.5. The distance of the virtual image from the surface of the sphere is :- **[IIT-JEE 2004 (Scr)]**

(A) 2 cm (B) 4 cm (C) 6 cm (D) 12 cm

***Lens :***

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

(A) convergent lens of focal length 3.5R

(B) convergent lens of focal length 3.0 R.

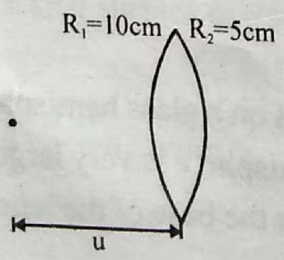
(C) divergent lens of focal length 3.5 R

(D) divergent lens of focal length 3.0 R

**44.** A convergent (biconvex) lens is placed inside a jar filled with a liquid. The lens has focal length 20cm, when in air and its material has a refractive index of 1.5. If the liquid has a refractive index of 1.6, the focal length of the lens while in the jar, is :-

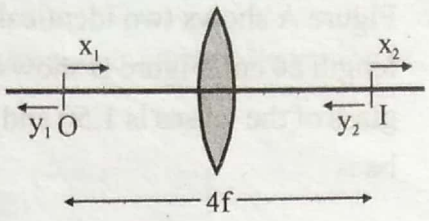
(A) –110 cm (B) –130 cm (C) –160 cm (D) –180 cm

**45.** A thin convex lens is made of a material of refractive index 1.6. An object is kept at a distance of u from the lens on the principal axis as shown in the figure. The radius of curvature of the surfaces are 10 cm and 5cm. Now, the lens is reversed such that the face having radius of curvature 5cm lies close to the object. The difference in image position as obtained for both the cases is equal to :-




(A) 0.4 u (B) 0.6 u (C) 0.8 u (D) 0

**46.** In a converging lens of focal length f and the distance between real object and its real image is $4f$. If the object moves $x_1$ distance towards lens its image moves $x_2$ distance away from the lens and when object moves $y_1$ distance away from the lens its image moves $y_2$ distance towards the lens, then choose the correct option:-




(A) $x_1 > x_2$ and $y_1 > y_2$ (B) $x_1 < x_2$ and $y_1 < y_2$

(C) $x_1 < x_2$ and $y_1 > y_2$ (D) $x_1 > x_2$ and $y_2 > y_1$

**47.** A point object is placed on the principal axis of a converging lens and its image ($I_1$) is formed on its principal axis. If the lens is rotated by an small angle θ about its optical centre such that its principal axis also rotates by the same amount then the image ($I_2$) of the same object is formed at point P. Choose the correct option.

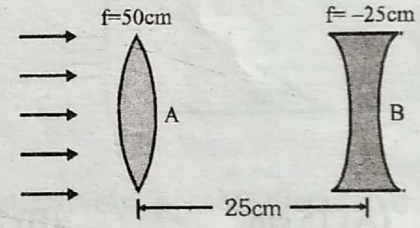
(A) Point P lies on the new principal axis.

(B) Point P lies on the old principal axis.

(C) Point P is anywhere between the two principal axes

(D) None of these

**48.** The two lenses shown are illuminated by a beam of parallel light from the left. Lens B is then moved slowly toward lens A. The beam emerging from lens B is :



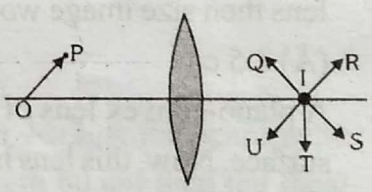

(A) Initially parallel and then diverging

(B) Always diverging

(C) Initially converging and finally parallel

(D) Always parallel

**49.** A point object O moves from the principal axis of a converging lens in a direction OP. I the image of O, will move initially in the direction :



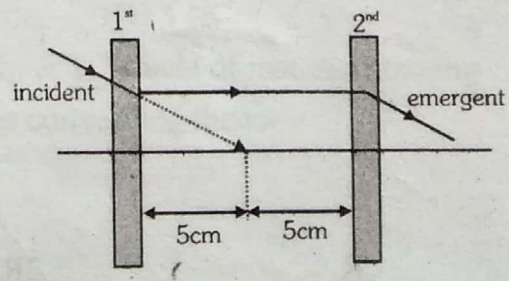

(A) IQ (B) IR

(C) IS (D) IU

**50.** When the object is at distances $u_1$ and $u_2$ the images formed by the same lens are real and virtual respectively and of the same size. Then focal length of the lens is :

(A) $\frac{1}{2}\sqrt{u_1 u_2}$ (B) $\frac{u_1 + u_2}{2}$ (C) $\sqrt{u_1 u_2}$ (D) $\sqrt{(u_1 + u_2)}$

**51.** Look at the ray diagram shown, what will be the focal length of the 1st and the 2nd lens, if the incident light ray passes without any deviation ?



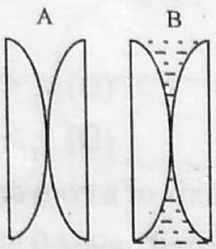

(A) –5 cm and +10 cm

(B) +5cm and +10cm

(C) –5cm and +5cm

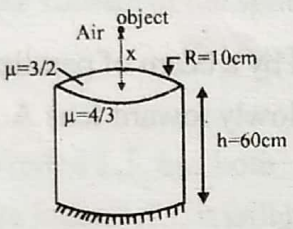
(D) +5cm and – 5cm

**52.** Figure A shows two identical plano-convex lenses in contact as shown. The combination has focal length 24 cm. Figure B shows the same with a liquid introduced between them. If refractive index of glass of the lenses is 1.50 and that of the liquid is 1.60, the focal length of the system in figure B will be :-




(A) –120 cm (B) 120 cm (C) –24 cm (D) 24 cm

**53.** In the arrangement shown given that a biconvex lens of radius of curvature equal to 10 cm and concave mirror has focal length equal to 20cm. Then find the distance 'x' such that the final image formed by the system coincides with the object :-




(A) 15 cm (B) 22.5 cm (C) 20 cm (D) 17.5 cm

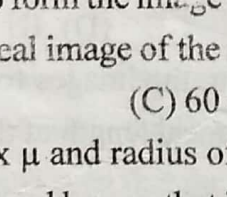
**54.** A convex lens of focal length 30 cm forms an image of height 2 cm for an object situated at infinity. If a convcave lens of focal length 20 cm is placed coaxially at a distance of 26 cm in front of convex lens then size image would be **[IIT-JEE 2003 (Scr)]**

(A) 2.5 cm (B) 5.0 (C) 1.25 (D) None

**55.** A plano-convex lens of refractive index 1.5 and radius of curvature 30 cm is silvered at the curved surface. Now, this lens has been used to form the image of an object. At what distance from this lens, an object be placed in order to have a real image of the size of the object? **[AIEEE-2004]**

(A) 20 cm (B) 30 cm (C) 60 cm (D) 80 cm

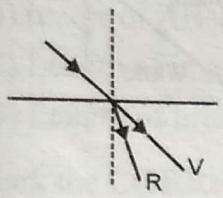
**56.** An equiconvex lens of refractive index μ and radius of curvature R has its one surface silvered. A point source O is placed before the silvered lens so that its image is coincident with it, the distance of the object from the lens is :-

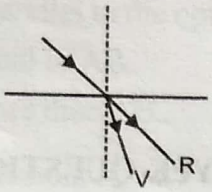


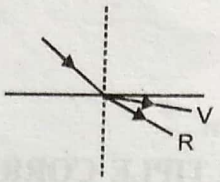

(A) $\frac{R}{(\mu-1)}$ (B) $\frac{2R}{(\mu-1)}$ (C) $\frac{R}{(2\mu-1)}$ (D) $\frac{2R}{(2\mu-1)}$

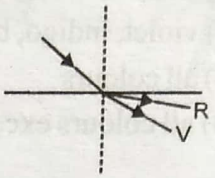
***Dispersion :***

**57.** A ray of light is coming from air to water. Which of the following figure shows correct dispersion of light ?

(A) 


(B) 


(C) 


(D) 

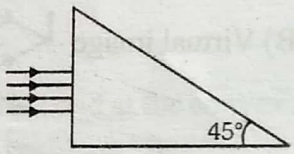

**58.** When white light passes through a glass prism, one gets spectrum on the other side of the prism. In the emergent beam, the ray which is deviating least is or deviation by a prism is lowest for :-

(A) Violet ray (B) Green ray (C) Red ray (D) Yellow ray

**59.** The angle of prism is 5° and its refractive indices for red and violet colours are 1.5 and 1.6 respectively. The angular dispersion produced by the prism is :–

(A) 7.75° (B) 5° (C) 0.5° (D) 0.17°

**60.** A beam of light consisting of red, green and blue and is incident on a right angled prism. The refractive index of the material of the prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The prism will :-




(A) separate part of the red color from the green and blue colors

(B) separate part of the blue color from the red and green colors

(C) separate all the three colors from the other two colors

(D) not separate even partially, any colors from the other two colors

**61.** Two thin prisms of flint glass, with refracting angles of 6° and 8° respectively, possess dispersive powers in the ratio :

(A) 4 : 3 (B) 3 : 4 (C) 1 : 1 (D) 9 : 16

**62.** Chromatic aberration will be absent if for two thin lenses in contact :-

(A) $(\omega_1/F_1) + (\omega_2/F_2) = 0$ (B) $(\omega_1/F_2) + (\omega_2/F_1) = 0$

(C) $(F_1/\omega_2) + (F_2/\omega_1) = 0$ (D) $(\omega_1/\omega_2) + (F_1 + F_2) = 0$

**63.** The dispersive powers of the materials of the two lenses are in the ratio 4 : 3. If the achromatic combination of these two lenses in contact is a convex lens of focal length 60 cm then the focal lengths of the component lenses are :-

(A) - 20 cm and 25 cm (B) 20 cm and - 25 cm

(C) - 15 cm and 40 cm (D) 15 cm and - 20 cm

**64.** An achromatic convergent doublet of two lenses in contact has a power of + 2D. The convex lens has a power + 5D. What is the ratio of the dispersive powers of the convergent and divergent lenses :-

(A) 2 : 5 (B) 3 : 5 (C) 5 : 2 (D) 5 : 3

**65.** It is desired to make an achromatic combination of two lenses ($L_1$ & $L_2$) made of materials having dispersive powers $\omega_1$ and $\omega_2$ ($<\omega_1$). If the combination of lenses is converging then :-

(A) $L_1$ is converging

(B) $L_2$ is converging

(C) Power of $L_1$ is greater than the power of $L_2$

(D) None of these