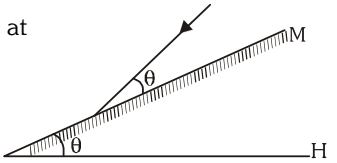
GEOMETRICAL OPTICS -LEVEL 1

1. Two plane mirrors M_1 and M_2 are inclined to each other at 70 . A ray incident on the mirror M_1 at an angle θ falls on M_2 and is then reflected parallel to M_1 for

(A) $\theta=45$ (B) $\theta=50$ (C) $\theta=55$ (D) $\theta=60$

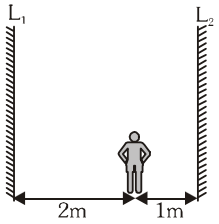
2. A mirror is inclined at an angle of θ with the horizontal. If a ray of light is incident at an angle θ as shown, then the angle made by reflected ray with the horizontal is



(A) θ (B) 2θ

(C) $\frac{\theta}{2}$ (D) zero

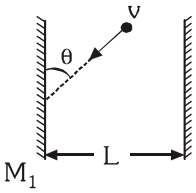
3. Two mirrors labelled L_1 for left mirror and L_2 for right mirror in the figure are parallel to each other and 3.0 m apart . A person standing 1.0 m from the right mirror (L_2) looks into this mirror and sees a series of images. The second nearest image seen in the right mirror is situated at a distance :



(A) 2.0 m from the person (B) 4.0 m from the person

(C) 6.0 m from the person (D) 8.0 m from the person

4. A bird is flying with a velocity v between two long vertical plane mirrors making an angle θ with mirror M_1 as shown. Then what will be the relative velocity of approach between the images formed by the mirrors due to the 1st reflection in each of them



(A) $v\sin\theta$ (B) $2v\sin\theta$

(C) $2(v\sin\theta+L)$ (D) zero

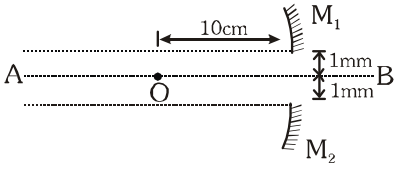
5. A plane mirror is moving with velocity $4\tilde{i}+5\tilde{j}+8\tilde{k}$ .The point object in front of the mirror moves with a velocity $3\tilde{i}+4\tilde{j}+5\tilde{k}$ .Here $\tilde{k}$ is along the normal to the plane mirror and facing towards the object. The velocity of the images is :

(A) $-3\tilde{i}-4\tilde{j}+5\tilde{k}$ (B) $3\tilde{i}+4\tilde{j}+11\tilde{k}$ (C) $-3\tilde{i}-4\tilde{j}+11\tilde{k}$ (D) $7\tilde{i}+4\tilde{j}+11\tilde{k}$

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

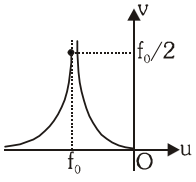
(A) must be at infinity (B) may be at infinity (C) may be at the focus (D) none

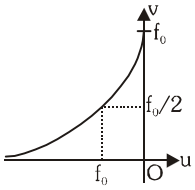
7. A concave mirror of focal length 20 cm is cut into two parts from the middle and the two parts are moved perpendicularly by a distance 1 mm from the previous principal axis AB. The distance between the images formed by the two parts is :

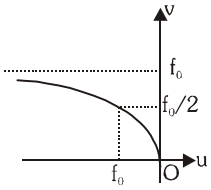


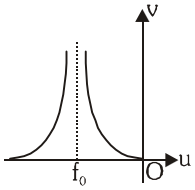
(A) 2 mm (B) 6 mm (C) 3 mm (D) 4 mm

8. A convex mirror of focal length 'f' is placed at the origin with its reflecting surface towards the negative x–axis. Choose the correct graphs between 'v' and 'u' for u < 0.

(A) 

(B) 

(C) 

(D) 

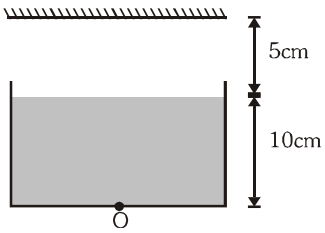
9. The x–z plane separates two media A and B of refractive indices μ_1 = 1.5 and μ_2 = 2. A ray of light travels from A to B. Its directions in the two media are given by unit vectors $\vec{u}_1=a\tilde{i}+b\tilde{j}$ and $\vec{u}_2=c\tilde{i}+d\tilde{j}$. Then–

(A) $\frac{a}{c}=\frac{4}{3}$ (B) $\frac{a}{c}=\frac{3}{4}$ (C) $\frac{b}{d}=\frac{4}{3}$ (D) $\frac{b}{d}=\frac{3}{4}$

10. A ray of light travelling in a medium of refractive index μ is incident at an angle θ on a composite transparent plate consisting of 50 plates of R.I. $1.01\,\mu$, $1.02\,\mu$, $1.03\,\mu$, ... , $1.50\,\mu$. The ray emerges from the composite plate into a medium of refractive index $1.6\,\mu$ at angle 'x' . Then :

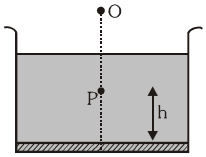
(A) $\sin x = \left(\frac{1.01}{1.5}\right)^{50} \sin\theta$ (B) $\sin x = \frac{5}{8}\sin\theta$ (C) $\sin x = \frac{8}{5}\sin\theta$ (D) $\sin x = \left(\frac{1.5}{1.01}\right)^{50} \sin\theta$

11. Consider the situation shown in figure. Water $\left(\mu_w = \frac{4}{3}\right)$ is filled in a beaker 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 of an object O at the bottom of the beaker is–



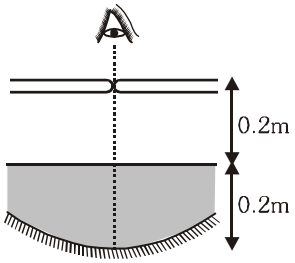
(A) 15 cm (B) 12.5 cm (C) 7.5 cm (D) 10 cm

12. 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 O–vertically above P, outside the liquid–sees P and its image in the mirror. The apparent distance between these two will be :–



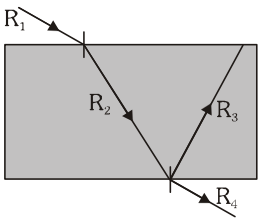
(A) $2\mu h$ (B) $\frac{2h}{\mu}$ (C) $\frac{2h}{\mu - 1}$ (D) $h\left(1 + \frac{1}{\mu}\right)$

13. When a pin is moved along the principal axis of a small concave mirror, the image position coincides with the object at a point 0.5 m from the mirror, refer figure. If the mirror is placed at a depth of 0.2 m in a transparent liquid, the same phenomenon occurs when the pin is placed 0.4 m from the mirror. The refractive index of the liquid is :–



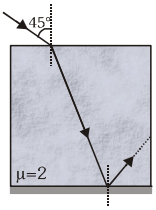
(A) 6/5 (B) 5/4 (C) 4/3 (D) 3/2

14. 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

15. Bottom face of the glass cube is silvered as shown . A ray of light is incident on top face of the cube as shown. Find the deviation of the ray when it comes out of the glass cube.



(A) 0 (B) 90
(C) 180 (D) 270

16. A ray of light travels from an optical denser medium to rarer medium . The critical angle for the two media is C. The maximum possible deviation of the refracted light ray can be :–

(A) $\pi - C$ (B) $2C$ (C) $\pi - 2C$ (D) $\frac{\pi}{2} - C$

17. A ray of light from a denser medium strike a rarer medium. The angle of reflection is r and that of refraction is r′. The reflected and refracted rays make an angle of 90 with each other. The critical angle will be:

(A) $\sin^{-1}(\tan r)$ (B) $\tan^{-1}(\sin r)$ (C) $\sin^{-1}(\tan r')$ (D) $\tan^{-1}(\sin r')$

18. An object is immersed in a fluid. In order that the object becomes invisible, it should :

(A) behave as a perfect reflection (B) absorb all light falling on it (C) have refractive index one

(D) have refractive index exactly matching with that of the surrounding fluid

19. A ray of light is incident upon an air/water interface (it passes from air into water) at an angle of 45 . Which of the following quantities change as the light enters the water?

(I) wavelength (II) frequency (III) speed of propagation (IV) direction of propagation

(A) I, III only (B) III, IV only (C) I, II, IV only (D) I, III, IV only

20. A light ray is incident on a transparent sphere of index= $\sqrt{2}$, at an angle of incidence = 45 . What is the deviation of a tiny fraction of the ray , which enters the sphere , undergoes two internal reflections and then refracts out into air ?

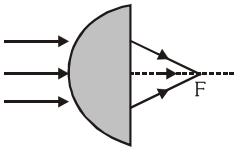
(A) 270 (B) 240 (C) 120 (D) 180

21. 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

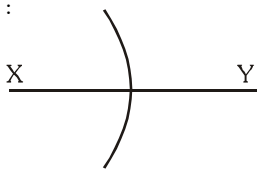
(C) 4R (D) The air bubble cannot form a real image

22. A paraxial beam is incident on a glass (n = 1.5) hemisphere of radius R=6 cm in air as shown. The distance of point of convergence F from the plane surface of hemisphere is :–



(A) 12 cm (B) 5.4 cm (C) 18 cm (D) 8 cm

23. A concave spherical surface of radius of curvature 10 cm, separates two medium X and Y of R.I. 4/3 and 3/2 respectively. If the object is placed along principal axis in medium X , then :



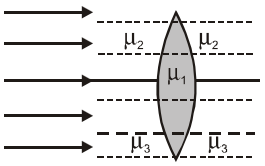
(A) image is always real

(B) image is real if the object distance is greater than 90 cm

(C) image is always virtual

(D) image is virtual if the object distance is less than 90 cm

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



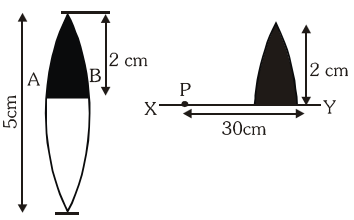
(A) a single convergent beam (B) two different convergent beams

(C) two different divergent beams (D) a convergent and a divergent beam

25. Optic axis of a thin equiconvex lens is the x–axis. The coordinates of a point object and its image are (–40 cm, 1 cm) and (50 cm, –2 cm) respectively. Lens is located at–

(A) x = + 20 cm (B) x = – 30 cm (C) x = –10 cm (D) origin

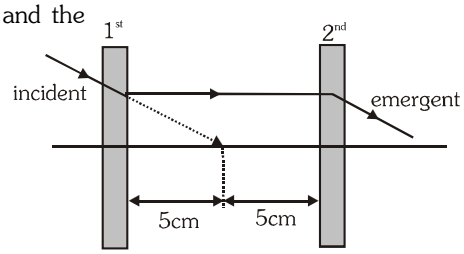
26. A converging lens of focal length 20 cm and diameter 5 cm is cut along the line AB. The part of the lens shown shaded in the diagram is now used to form an image of a point P placed 30 cm away from it on the line XY which is perpendicular to the plane of the lens. The image of P will be formed.



(A) 0.5 cm above XY (B) 1 cm below XY

(C) on XY (D) 1.5 cm below XY

27. 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 ?



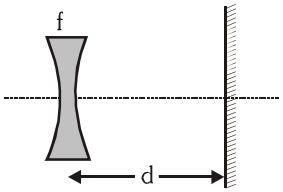
(A) –5 cm and +10 cm

(B) +5cm and +10cm

(C) –5cm and +5cm

(D) +5cm and – 5cm

28. A diverging lens of focal length 10 cm is placed 10 cm in front of a plane mirror as shown in the figure. Light from a very far away source falls on the lens. The final image is at a distance :–



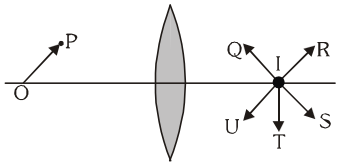
(A) 20 cm behind the mirror

(B) 7.5 cm in front of the mirror

(C) 7.5 cm behind the mirror

(D) 2.5 cm in front of the mirror

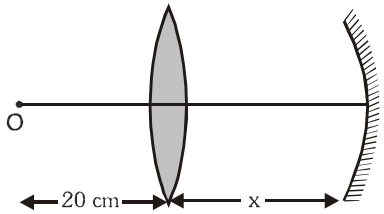
29. A point object O moves from the principal axis of a converging lens in a direction OP. I the image of O, will move initially in the direction :



(A) IQ (B) IR

(C) IS (D) IU

30. 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, be placed so that final image coincides with the object–



(A) 10 cm

(B) 15 cm

(C) 20 cm

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

31. A point source of light is placed on the principle axis between F and 2F of a concave lens. On the other side very far, a screen is placed perpendicular to principal axis. As the screen is brought close towards lens

(A) the light intensity on screen continuously decreases

(B) the light intensity on screen continuously increases

(C) the light intensity on screen first increases, then decreases

(D) the light intensity on screen first decreases, then increases

32. A man wishing to get a picture of a Zebra photographed a white donkey after fitting a glass with black streaks onto the objective of his camera.

(A) the image will look like a white donkey on the photograph

(B) the image will look like a Zebra on the photograph

(C) the image will be more intense compared to the case in which no such glass is used

(D) the image will be less intense compared to the case in which no such glass is used

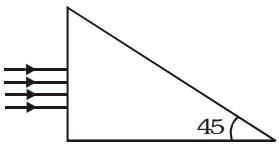
33. A lens is placed between a source of light and a wall. It forms images of area A_1 and A_2 on the wall, for its two different positions. The area of the source of light is :

(A) $\sqrt{A_1 A_2}$ (B) $\frac{A_1 + A_2}{2}$ (C) $\left(\frac{\sqrt{A_1} + \sqrt{A_2}}{2}\right)^2$ (D) None

34. In the displacement method , a convex lens is placed in between an object and a screen . If one of the magnification is 3 and the displacement of the lens between the two positions is 24 cm, then the focal length of the lens is :–

(A) 10 cm (B) 9 cm (C) 6 cm (D) 16/3 cm

35. 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–



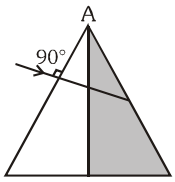
(A) separate part of the red color from the green and blue colors

(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

36. A ray of light is incident normally on the first refracting face of the prism of refracting angle A. The ray of light comes out at grazing emergence. If one half of the prism (shaded position) is knocked off, the same ray will :–



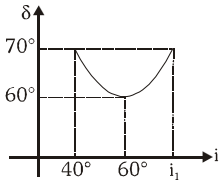
(A) Emerge at an angle of emergence $\sin^{-1}\left(\frac{1}{2}\sec A/2\right)$

(B) Not emerge out of the prism

(C) Emerge at an angle of emergence $\sin^{-1}\left(\frac{1}{2}\sec A/4\right)$

(D) None of these

37. 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 :



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

38. 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

39. A parallel beam of white light falls on a convex lens . Images of blue , red and green light are formed on other side of the lens at distances x , y and z respectively from the pole of the lens . Then :

(A) x > y > z (B) x > z > y (C) y > z > x (D) None of these

40. Which of the following quantities related to a lens does not depend on the wavelength of the incident light ?

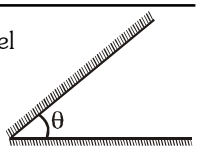
(A) Refractive index (B) Focal length (C) Power (D) Radii of curvature

ANSWER KEY — LEVEL -1

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	B	D	C	D	B	B	A	C	A	B	B	B	D	C	C	D	A	D	D	A
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	D	D	C	D	C	D	C	D	C	C	B	AD	A	B	A	A	A	B	C	D

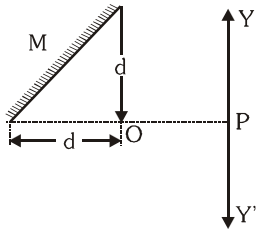
GEOMETRICAL OPTICS -LEVEL 2

1. Two mirrors are inclined at an angle θ as shown in the figure. Light ray is incident parallel to one of the mirrors. The ray will start retracting its path after third reflection if



(A) θ = 45 (B) θ = 30
(C) θ = 60 (D) all three

2. As shown in the figure a particle is placed at O in front of a plane mirror M.A man at P can move along path PY and PY' then which of the following is true?

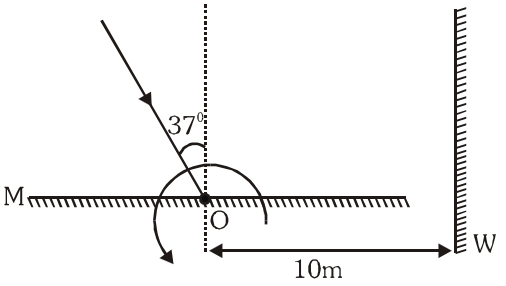


(A) For all points on PY man can see the image of O
(B) For all points on PY' man can see the image, but for no point on PY he can see the image of O
(C) For all points on PY' he can see the image but on PY he can see the image only upto distance d.
(D) He can see the image only upto a distance d on either side of P.

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

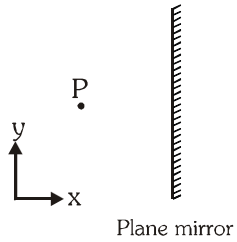
(A) 3L/2 (B) 2L/3 (C) 2L (D) None of these

4. 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 $9/\pi$ rev/s. The light reflected by the mirror is received on the wall W at a distance 10 m from the axis of rotation. When the angle of incidence becomes 37 the speed of the spot (a point) on the wall is :



(A) 10 m/s (B) 1000 m/s
(C) 360 m/s (D) none of these

5. Shown plane mirror is lying in y–z plane. A particle P has velocity $\vec{u} = 5\tilde{i} + 6\tilde{j}$ at t = 0 & acceleration $\vec{a} = 2t\tilde{j}$. Velocity of its image at t = 2s relative to it is

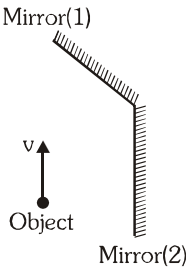


(A) $10\tilde{i}$ (B) $-10\tilde{i}$
(C) $20\tilde{j}$ (D) $-20\tilde{j}$

6. There are two plane mirror with reflecting surfaces facing each other. Both the mirrors are moving with speed v away from reach other. A point is placed between the mirrors. The velocity of the image from due to n–th reflection will be–

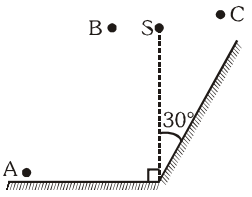
(A) nv (B) 2nv (C) 3nv (D) 4nv

7. In the diagram shown, all the velocities are given with respect to earth. What is the relative velocity of the image in mirror (1) with respect to the image in the mirror (2) ? The mirror (1) forms an angle β with the vertical.



(A) 2v sin2β (B) 2vsinβ
(C) 2v/sin2β (D) None of these

8. A point source of light S is placed in front of two large mirrors as shown. Which of the following observers will see only one image of S ?

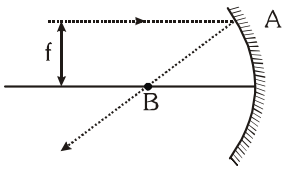


(A) only A (B) only C
(C) Both A and C (D) Both B and C

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

(A) 10 (B) 11 (C) 12 (D) 14

10. A ray of light is incident on a concave mirror. It is parallel to the principal axis and its height from principal axis is equal to the focal length of the mirror. The ratio of the distance of point B to the distance of the focus from the centre of curvature is (AB is the reflected ray)



(A) $\frac{2}{\sqrt{3}}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{2}{3}$ (D) $\frac{1}{2}$

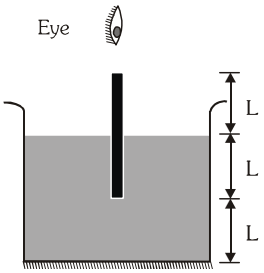
11. An infinitely long rod lies along the axis of a concave mirror of focal length f. The near end of the rod is at distance u > f from the mirror. Its image will have a length–

(A) $\frac{uf}{u-f}$ (B) $\frac{uf}{u+f}$ (C) $\frac{f^2}{u+f}$ (D) $\frac{f^2}{u-f}$

12. A short linear object of length b lies along the axis of a concave mirror of focal length f, at a distance u from the mirror. The size of the image is approximately–

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

13. What is the length of the image of the rod in mirror, according to the observer in air? (refractive index of the liquid is μ)



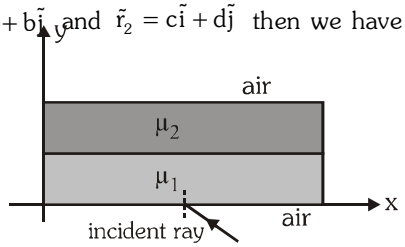
(A) μL + L

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

(C) $L\mu + \frac{L}{\mu}$

(D) None of these

14. Two thin slabs of refractive indices μ_1 and μ_2 are placed parallel to each other in the x–y plane. If the direction of propagation of a ray in the two media are along the unit vectors $\tilde{r}_1 = a\tilde{i} + b\tilde{j}$ and $\tilde{r}_2 = c\tilde{i} + d\tilde{j}$ then we have



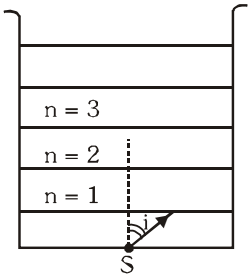
(A) $\mu_1 a = \mu_2 c$

(B) $\mu_1(a^2 + b^2) = \mu_2(c^2 + d^2)$

(C) $\mu_1 a / \sqrt{a^2 + b^2} = \mu_2 a / \sqrt{c^2 + d^2}$

(D) None of these

15. A point source S is placed at the bottom of different layers as shown in the figure. The refractive index of bottommost layer is μ_0. The refractive index of any other upper layer is $\mu(n) = \mu_0 + \frac{\mu_0}{4n-18}$ A ray of light with angle i = 30 starts from the source S. Total internal reflection takes place at the upper surface of layer having n equal to



(A) 3 (B) 5 (C) 4 (D) 6

16. A ray of light in a liquid of refractive index 1.4 approaches the boundary surface between the liquid and air at an angle of incidence whose sine is 0.8 . Which of the following statement is correct about the behaviors of the light ?

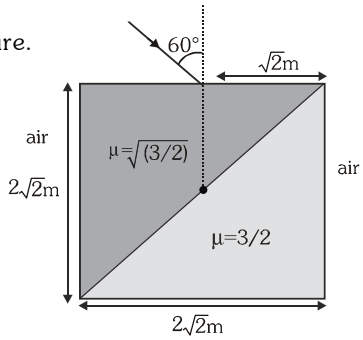
(A) It is impossible to predict the behavior of the light ray on the basis of the information supplied.

(B) The sine of the angle of refraction of the emergent ray will be less than 0.8

(C) The ray will be internally reflected

(D) The sine of the angle of refraction of the emergent ray will be greater than 0.8

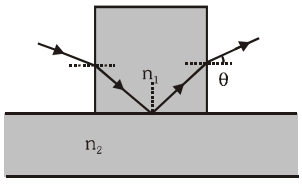
17. A ray of light strikes a cubical slab surrounded by air as shown in the figure. Then the geometrical path length traversed by the light in the slab will be :



(A) $2\sqrt{3}$ m (B) 2m

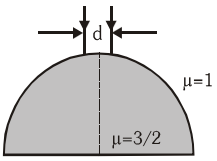
(C) 6m (D) $\left(\frac{\sqrt{3}}{2}+\frac{3}{2}\right)$ m

18. A cubical block of glass of refractive index n_1 is in contact with the surface of water of refractive index n_2. A beam of light is incident on vertical face of the block (see figure). After refraction, a total internal reflection at the base and refraction at the opposite vertical face, the ray emerges out at an angle θ. The value of θ is given by–



(A) $\sin\theta < \sqrt{n_1^2 - n_2^2}$ (B) $\tan\theta < \sqrt{n_1^2 - n_2^2}$ (C) $\sin\theta < \frac{1}{\sqrt{n_1^2 - n_2^2}}$ (D) $\tan\theta < \frac{1}{\sqrt{n_1^2 - n_2^2}}$

19. 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 :

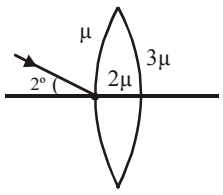


(A) $\frac{3}{4}$d (B) d (C) $\frac{d}{3}$ (D) $\frac{2}{3}$d

20. 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) $\sqrt{(u_1 + u_2)}$

21. A light ray hits the pole of a thin biconvex lens as shown in figure. The angle made by the emergent ray with the optic axis will be nearly



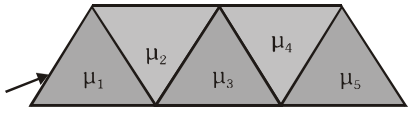
(A) 0 (B) (1/3)

(C) (2/3) (D) 2

22. A ray of light passes through a prism in a principle plane the deviation being equal to angle of incidence which is equal to 2α. It is given that α is the angle of prism and μ is the refractive index of the material of prism, then

(A) $\cos\alpha = \sqrt{\frac{\mu^2 - 1}{2}}$ (B) $\cos\alpha = \sqrt{\frac{\mu^2 - 1}{8}}$ (C) $\sin\alpha = \sqrt{\mu^2 - 1}$ (D) $\sin\alpha = \sqrt{\frac{\mu^2 - 1}{8}}$

23. The diagram shows five isosceles right angled prisms. A light ray incident at 90 at the first face emerges at same angle with the normal from the last face. Which of the following relations will hold regarding the refractive indices ?



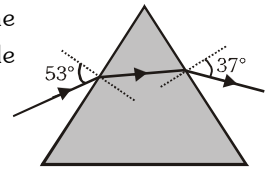
(A) $\mu_1^2 + \mu_3^2 + \mu_5^2 = \mu_2^2 + \mu_4^2$ (B) $\mu_1^2 + \mu_3^2 + \mu_5^2 = 1 + \mu_2^2 + \mu_4^2$

(C) $\mu_1^2 + \mu_3^2 + \mu_5^2 = 2 + \mu_2^2 + \mu_4^2$ (D) none of these

24. A certain prism is found to produce a minimum deviation of 38 . It produces a deviation of 44 when the angle of incidence is either 42 or 62 . What is the angle of incidence when it is undergoing minimum deviation ?

(A) 45 (B) 49 (C) 40 (D) 55

25. A ray incident at an angle 53 on a prism emerges at an angle 37 as shown. If the angle of incidence is made 50 , which of the following is a possible value of the angle of emergence?

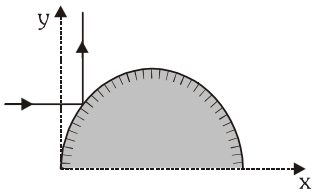


(A) 35 (B) 42
(C) 40 (D) 38

26. A man of height 170 cm wants to see his complete image in a plane mirror (while standing) . His eyes are at a height of 160 cm from the ground .
(A) Minimum length of the mirror = 80 cm
(B) Minimum length of the mirror = 85 cm
(C) Bottom of the mirror should be at a height 80 cm
(D) Bottom of the mirror should be at a height 85 cm

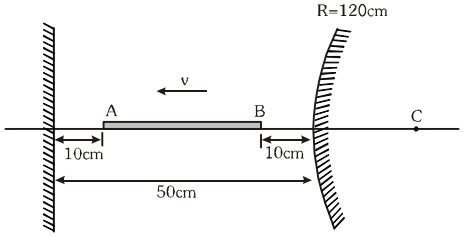
27. Two plane mirrors at an angle such that a ray incident on a mirror undergoes a total deviation of 240 after two reflections :
(A) the angle between the mirrors is 60
(B) the number of images formed by this system will be 5 , if an object is placed symmetrically between the mirrors
(C) the number of images will be 5 if an object is kept unsymmetrical between the mirrors
(D) a ray will retrace its path after 2 successive reflections, if the angle of incidence on one mirror is 60^{o}

28. If the equation of mirror is given by $y = 2/\pi \sin\pi x$ $(y > 0,\ 0 \le x \le 1)$ then find the point on which horizontal ray should be incident so that the reflected ray become perpendicular to the incident ray



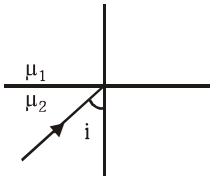
(A) $\left(\frac{1}{3}, \frac{\sqrt{3}}{\pi}\right)$ (B) $\left(\frac{\sqrt{3}}{\pi}, \frac{1}{3}\right)$ (C) $\left(\frac{2}{3}, \frac{\sqrt{3}}{\pi}\right)$ (D) (1,0)

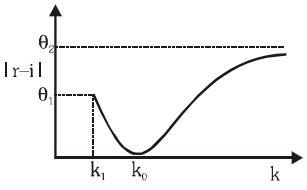
29. In the fig. shown consider the first reflection at the plane mirror and second at the convex mirror. AB is object.



(A) the second image is real and inverted with magnification 1/5
(B) the second image is virtual and erect with magnification 1/5
(C) the second image moves towards the convex mirror
(D) the second image moves away from the convex mirror

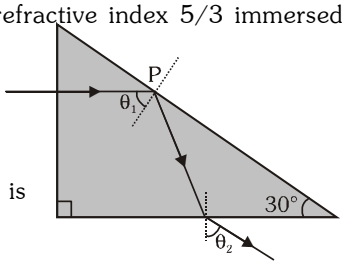
30. The figure shows a ray incident on a plane boundary at an angle $i = \pi/3$. The plot drawn shows the variation of $|r - i|$ versus $\frac{\mu_1}{\mu_2} = k$ (r = angle of refraction). Choose the correct alternative.





(A) The value of k_1 is $\frac{2}{\sqrt{3}}$
(B) The value of θ_1 is $\pi/6$
(C) The value of θ_2 is $\pi/3$
(D) The value of k_0 is 1

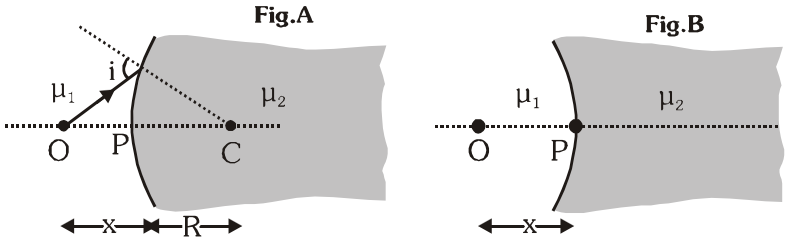
31. A ray of light is incident normally on one face of 30 – 60 – 90 prism of refractive index 5/3 immersed in water of refractive index 4/3 as shown in figure .



(A) The exit angle θ_2 of the ray is $\sin^{-1}(5/8)$
(B) The exit angle θ_2 of the ray is $\sin^{-1}\left(\frac{5}{4\sqrt{3}}\right)$
(C) Total internal reflection at point P ceases if the refractive index of water is increased to $\frac{5}{2\sqrt{3}}$ by dissolving some substance
(D) Total internal reflection at point P ceases if the refractive index of water is increased to 5/6 by dissolving some substance

Question No.32 to 34

A curved surface of radius R separates two medium of refractive indices μ_1 and μ_2 as shown in figures A and B.

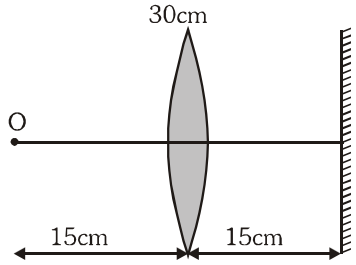


32. Choose the correct statement(s) related to the real image formed by the object O placed at a distance x, as shown in figure A.
(A) Real image is always formed irrespective of the position of object if $\mu_2 > \mu_1$
(B) Real image is formed only when x>R
(C) Real image is formed due to the convex nature of the interface irrespective of μ_1 and μ_2
(D) None of these

33. Choose the correct statement(s) related to the virtual image formed by object O placed at a distance x, as shown in figure A
(A) Virtual image is formed for any position of O if $\mu_2 < \mu_1$
(B) Virtual image can be formed if $x > R$ and $\mu_2 < \mu_1$
(C) Virtual image is formed if $x < R$ and $\mu_2 > \mu_1$
(D) None of these

34. Identify the correct statement(s) related to the formation of images of a real object O placed at x from the pole of the concave surface, as shown in figure B
(A) If $\mu_2 > \mu_1$, then virtual image is formed for any value of x
(B) If $\mu_2 < \mu_1$, then virtual image is formed if $x < \dfrac{\mu_1 R}{\mu_1 - \mu_2}$
(C) If $\mu_2 < \mu_1$, then real image is formed for any value of x
(D) None of these

35. An object O is kept infront of a converging lens of focal length 30 cm behind which there is a plane mirror at 15 cm from the lens.



(A) The final image is formed at 60 cm from the lens towards right of it
(B) The final image is at 60 cm from lens towards left of it
(C) The final image is real
(D) The final image is virtual

36. A converging lens of focal length f_1 is placed in front of and coaxial with a convex mirror of focal length f_2. Their separation is d. A parallel beam of light incident on the lens returns as a parallel beam from the arrangement–
(A) The beam diameters of the incident and reflected beams must be the same
(B) $d = |f_1| - 2|f_2|$
(C) $d = |f_1| - |f_2|$
(D) If the entire arrangement is immersed in water, the conditions will remain unaltered

37. Choose the correct alternative corresponding to the object distance 'u', image distance 'v' and the focal length 'F' of a converging lens from the following.

(i) The average speed of the image as the object moves with uniform speed from distance $\dfrac{3F}{4}$ to $\dfrac{F}{2}$ is greater than the average speed of the image as the object moves with same speed from distance $\dfrac{F}{2}$ to $\dfrac{F}{4}$

(ii) The minimum distance between a real object and its real image in case of a converging lens is 4F where F is its focal length.

(A) both are correct
(B) both are incorrect
(C) (i) is correct, (ii) is incorrect
(D) (i) is incorrect, (ii) is correct

38. An object and a screen are fixed at a distance d apart. When a lens of focal length f is moved between the object and the screen, sharp images of the object are formed on the screen for two positions of the lens. The magnifications produced at these two positions are M_1 and M_2–

(A) $d > 2f$ (B) $d > 4f$ (C) $M_1M_2 = 1$ (D) $|M_1| - |M_2| = 1$

39. A diminished image of an object is to be obtained on a large screen 1 m from it. This can be achieved by

(A) using a convex mirror of focal length less than 0.25 m

(B) using a concave mirror of focal length less than 0.25 m

(C) using a convex lens of focal length less than 0.25 m

(D) using a concave lens of focal length than 0.25 m

40. A convex lens forms an image of an object on a screen. The height of the image is 9 cm. The lens is now displaced until an image is again obtained on the screen. Then height of this image is 4 cm . The distance between the object and the screen is 90 cm.

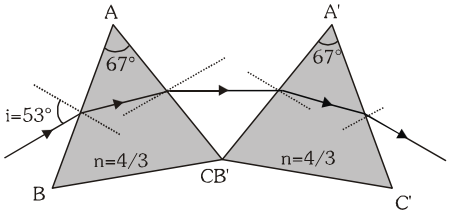
(A) The distance between the two positions of the lens is 30 cm

(B) The distance of the object from the lens in its first position is 36 cm

(C) The height of the object is 6 cm

(D) The focal length of the lens is 21.6 cm

41. A ray is incident on the first prism at an angle of incidence 53 as shown in the figure. The angle between side CA and B′A′ for the net deviation by both the prisms to be double of the deviation produced by the first prism, will be



(A) $\sin^{-1}\frac{2}{3} + 53$ (B) $\sin^{-1}\frac{2}{3} + 37$ (C) $\cos^{-1}\frac{2}{3} + 53$ (D) $2\sin^{-1}\frac{2}{3}$

42. For the refraction of light through a prism

(A) For every angle of deviation there are two angles of incidence

(B) The light travelling inside an equilateral prism is necessarily parallel to the base when prism is set for minimum deviation

(C) There are two angles of incidence for maximum deviation

(D) Angle of minimum deviation will increase if refractive index of prism (μ_p) is increased keeping the refractive index of the outside medium (μ_s) unchanged if $\mu_p > \mu_s$.

43. Two lenses in contact made of materials with dispersive powers in the ratio 2 : 1, behaves as an achromatic diverging lens of focal length 10 cm. The individual focal length of the lenses are :

(A) 5 cm, –10cm (B) –5 cm, 10 cm (C) 10 cm, –20 cm (D) –20 cm, 10 cm

ANSWER KEY — LEVEL -2

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Ans.	B	C	A	B	B	B	B	B	B	A	D	D	B	A	A	C
Que.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Ans.	C	A	D	B	C	B	B	B	D	B,C	A,B,C,D	A,C	B,C	B,C,D	A,C	D
Que.	33	34	35	36	37	38	39	40	41	42	43					
Ans.	A,B	A,B	B,C	A,B	A	B,C	C	B,C,D	A,D	B,C,D	B					