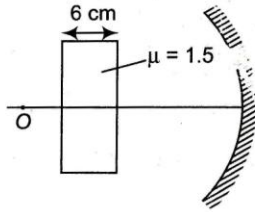


1. A ray incident at a point as an angle of incidence of  $60^\circ$  enters a glass sphere of refractive index  $n = \sqrt{3}$  and is reflected and refracted at the further surface of the sphere. The angle between the reflected and refracted rays at this surface is  
 (a)  $50^\circ$       (b)  $60^\circ$       (c)  $90^\circ$       (d)  $40^\circ$
2. A slab of glass, of thickness 6 cm and refractive index  $\mu = 1.5$  is placed in front of a concave mirror, as shown in the figure. If the radius of curvature of the mirror is 40 cm and the reflected image coincides with the object, then the distance of the object from the mirror is



- (a) 30 cm      (b) 22 cm  
(c) 42 cm      (d) 38 cm
3. An object is placed at a distance  $u$  from an equiconvex lens such that the distance between the object and its real image is minimum. The focal length of the lens is  $f$ . The value of  $u$  is  
 (a)  $\infty$       (b)  $1.5f$   
(c)  $2f$       (d)  $4f$
4. 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) 4 cm      (b)  $(\sqrt{2} + 1)$  cm  
(c)  $2\sqrt{2}$  cm      (d)  $(2 + \sqrt{2})$  cm
5. 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)  $\sqrt{xy}$       (d)  $x + y$

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6. 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) 28 cm (b) 14 cm  
(c) 18 cm (d) 16 cm

7. In a plano convex lens of the radius of curvature of the convex lens is 10 cm. If the plane side is polished, then the focal length will be (Refractive index = 1.5)

- (a) 20.5 cm (b) 10 cm  
(c) 15.5 cm (d) 5 cm

8. A thin rod of length  $f/3$  lies along the axis of a concave mirror of focal length  $f$ . One end of its magnified image touches an end of the rod. The length of the image is

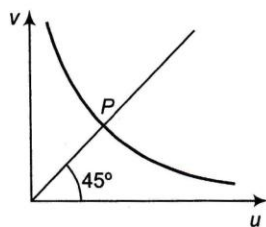
- (a)  $f$  (b)  $\frac{1}{2}f$   
(c)  $2f$  (d)  $\frac{1}{4}f$

9. A concave mirror is placed at the bottom of an empty tank with face upwards and axis vertical. When sunlight falls normally on the mirror, it is focused at distance of 32 cm from the mirror. If the tank filled with water ( $\mu = \frac{4}{3}$ ) upto a

height of 20 cm, then the sunlight will now get focused at

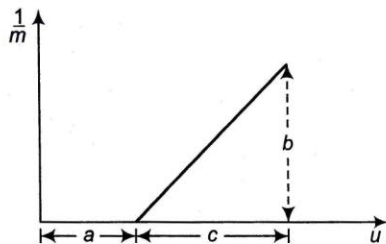
- (a) 16 cm above water level  
(b) 9 cm above water level  
(c) 24 cm below water level  
(d) 9 cm below water level

10. The graph shows part of variation of  $v$  with change in  $u$  for a concave mirror. Points plotted above the point  $P$  on the curve are for values of  $v$



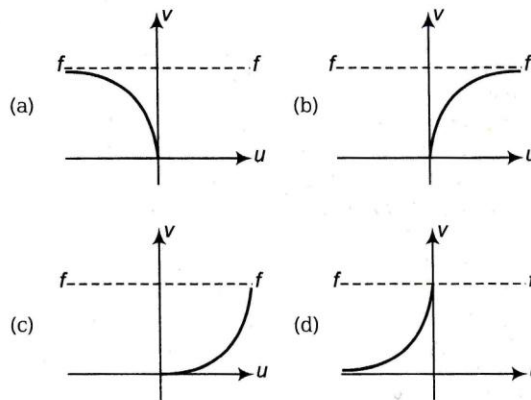
- (a) smaller than  $f$   
(b) smaller than  $2f$   
(c) larger than  $2f$   
(d) larger than  $f$  but less than  $2f$

11. The graph shows how the inverse of magnification  $\frac{1}{m}$  produced by a convex thin lens varies with object distance  $u$ . What was the focal length of the lens used?



- (a)  $\frac{b}{c}$  (b)  $\frac{b}{ca}$   
(c)  $\frac{bc}{a}$  (d)  $\frac{c}{b}$

12. The graph between  $u$  and  $v$  for a convex mirror is



13. A concave lens of focal length 20 cm placed in contact with a plane mirror acts as a

- (a) convex mirror of focal length 10 cm  
(b) concave mirror of focal length 40 cm  
(c) concave mirror of focal length 60 cm  
(d) concave mirror of focal length 10 cm

14. A convex lens produces an image of a real object on a screen with a magnification of  $\frac{1}{2}$ . When the lens is moved 30 cm

away from the object, the magnification of the image on the screen is 2. The focal length of the lens is

- (a) 30 cm (b) 60 cm  
(c) 20 cm (d) 15 cm

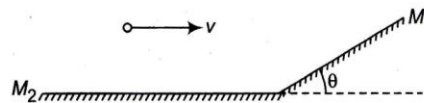
15. An infinitely long rod lies along the axis of a concave mirror of focal length  $f$ . The near end of the rod is at a distance  $u > f$  from the mirror. Its image will have a length

- (a)  $\frac{f^2}{u-f}$  (b)  $\frac{uf}{u-f}$   
(c)  $\frac{f^2}{u+f}$  (d)  $\frac{uf}{u+f}$

16. A liquid is placed in a hollow prism of angle  $60^\circ$ . If angle of the minimum deviation is  $30^\circ$ , what is the refractive index of the liquid?

- (a)  $\sqrt{2}$  (b) 1.50  
(c)  $\frac{4}{3}$  (d)  $\frac{5}{4}$

17. A point object is moving with a speed  $v$  before an arrangement of two mirrors as shown in figure.



Find the velocity of image in mirror  $M_1$  with respect to image in mirror  $M_2$

- (a)  $2v \sin \theta$  (b)  $v \sin \theta$   
(c)  $2v \cos \theta$  (d)  $v \cos \theta$

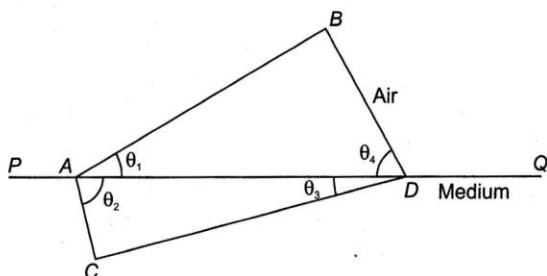
18. How much water should be filled in a container of height 21 cm, so that it appears half filled to the observer when viewed from the top of the container ( $\mu = 4/3$ )

- (a) 8 cm (b) 10.5 cm (c) 12 cm (d) 14 cm

19. Optic axis of a thin equi-convex 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

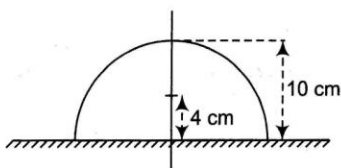
- (a)  $x = 20$  cm (b)  $x = -30$  cm  
(c)  $x = -10$  cm (d) origin

20. The adjoining figure represents a wavefront  $AB$  which passes from air to another transparent medium and produces a new wavefront  $CD$  after refraction.

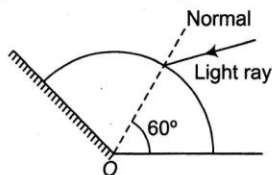


The refractive index of the medium is ( $PQ$  is the boundary between air and the medium)

- (a)  $\frac{\cos \theta_1}{\cos \theta_3}$  (b)  $\frac{\cos \theta_4}{\cos \theta_1}$  (c)  $\frac{\sin \theta_1}{\sin \theta_3}$  (d)  $\frac{\sin \theta_2}{\sin \theta_4}$
21. A hemispherical paper weight contains a small flower on its axis of symmetry at a distance of 4 cm from its flat surface. Where is the flower appears to an observer when he looks at it along the axis of symmetry from the top? (Index of refraction of glass = 1.5)



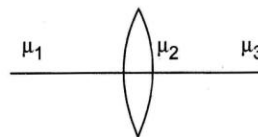
- (a) 15 cm from top (b) 20 cm from top  
(c) 5 cm from top (d) 25 cm from top
22. A thin plano convex lens acts like a concave mirror of radius of curvature 20 cm when its plane surface is silvered. The radius of curvature of the curved surface if index of refraction of its material is 1.5 will be  
(a) 40 cm (b) 30 cm (c) 10 cm (d) 20 cm
23. A ray of light, travelling in a medium of refractive index  $\mu$ , is incident at an angle  $i$  on a composite transparent plate consisting of three plates of refractive indices  $\mu_1, \mu_2$  and  $\mu_3$ . The ray emerges from the composite plate into a medium of refractive index  $\mu_4$  at angle  $x$ . Then  
(a)  $\sin x = \sin i$  (b)  $\sin x = \frac{\mu}{\mu_4} \sin i$   
(c)  $\sin x = \frac{\mu_4}{\mu} \sin i$  (d)  $\sin x = \frac{\mu_1 \mu_3}{\mu_2 \mu_2 \mu_4} \frac{\mu}{\mu} \sin i$
24. The  $xz$  plane separates two media  $A$  and  $B$  with refractive indices  $\mu_1$  and  $\mu_2$  respectively. A ray of light travels from  $A$  and  $B$ . Its directions in the two media are given by the unit vectors  $\hat{r}_A = a\hat{i} + b\hat{j}$  and  $\hat{r}_B = \alpha\hat{i} + \beta\hat{j}$  respectively, where  $\hat{i}$  and  $\hat{j}$  are unit vectors in the  $x$  and  $y$  directions. Then  
(a)  $\mu_1 a = \mu_2 \alpha$  (b)  $\mu_1 \alpha = \mu_2 a$   
(c)  $\mu_1 b = \mu_2 \beta$  (d) None of these
25. Consider the situation as shown in figure. The point  $O$  is the centre. The light ray forms an angle of  $60^\circ$  with the normal.



The normal makes an angle  $60^\circ$  with the horizontal and the mirror makes an angle  $60^\circ$  with the normal. The value of refractive index of that spherical portions so that light ray retraces its path is

- (a)  $\sqrt{2}$  (b)  $\frac{2}{\sqrt{3}}$  (c)  $\frac{3}{2}$  (d)  $\sqrt{3}$

26. The figure shows an equiconvex lens. What should be the condition on the refractive indices so that the lens becoming diverging?



- (a)  $2\mu_3 > \mu_1 - \mu_2$   
(b)  $2\mu_2 < \mu_1 + \mu_3$   
(c)  $2\mu_2 > 2\mu_1 - \mu_3$   
(d) None of the above

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

- (a) 19 cm (b) 17 cm (c) 21 cm (d) 11 cm

28. The apparent depth of water in cylindrical water tank of diameter  $2R$  cm is reducing at the rate of  $x$  cm/min when water is being drained out at a constant rate. The amount of water drained in  $cc/min$  is ( $n_1 =$  refractive index of air,  $n_2 =$  refractive index of water)

- (a)  $\frac{x\pi R^2 n_1}{n_2}$  (b)  $\frac{x\pi R^2 n_2}{n_1}$  (c)  $\frac{2\pi R n_1}{n_2}$  (d)  $\pi R^2 x$

29. A ray of light strikes a horizontal plane mirror at an angle of  $45^\circ$ . A second plane mirror is attached at an angle  $\theta$  with it. If ray after reflection from second mirror runs parallel to the first mirror, then  $\theta$  is

- (a)  $45^\circ$  (b)  $60^\circ$   
(c)  $67.5^\circ$  (d)  $135^\circ$

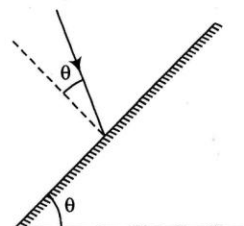
30. A ray of light makes an angle of  $10^\circ$  with the horizontal above it and strikes a plane mirror which is inclined at an angle  $\theta$  to the horizontal. The angle  $\theta$  for which the reflected ray becomes vertical is

- (a)  $40^\circ$  (b)  $50^\circ$  (c)  $80^\circ$  (d)  $100^\circ$

31. 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 3 m/s in negative  $x$ -direction. The speed of image with respect to mirror is

- (a) 8 m/s (b) 2 m/s  
(c) 4 m/s (d) 16 m/s

32. A mirror is inclined at an angle of  $\theta$  with the horizontal. If a ray of light is incident at an angle of incidence  $\theta$ , then the reflected ray makes the following angle with horizontal



- (a)  $\theta$  (b)  $2\theta$   
(c)  $\frac{\theta}{2}$  (d) None of these

33. In a lake, a fish rising vertically to the surface of water uniformly at the rate of 3 m/s, observes a bird diving vertically towards the water at the rate of 9 m/s. The actual velocity of the dive of the bird is (Given : refractive index of water = 4/3)

- (a) 3.6 m/s (b) 4.5 m/s  
(c) 6.0 m/s (d) 12.0 m/s

34. An equilateral prism deviates a ray through  $45^\circ$  for the two angles of incidence differing by  $20^\circ$ . The angle of incidence is

- (a)  $62.5^\circ$   
(b)  $42.5^\circ$   
(c) Both are correct  
(d) Both are wrong

35. A wavefront is represented by the plane  $y = 3 - x$ . The propagation of wave takes place at

- (a)  $45^\circ$  with the +ve x-direction  
(b)  $30^\circ$  with +ve x-direction  
(c)  $60^\circ$  with the +ve x-direction  
(d) No sufficient data

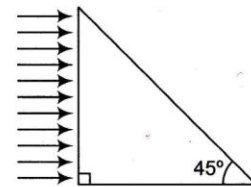
36. A short linear object of length  $b$  lies along the axis of a concave mirror of focal length  $f$  at a distance  $u$  from the pole of the mirror, what is the size of image?

- (a)  $\left(\frac{f}{u-f}\right) b$  (b)  $\left(\frac{f}{u-f}\right)^2 b$   
(c)  $\left(\frac{f}{u-f}\right) b^2$  (d)  $\left(\frac{f}{u-f}\right)$

37. A circular beam of light (diameter =  $d$ ) falls on a plane surface of a liquid. The angle of incidence is  $45^\circ$  and refractive index of the liquid is  $\mu$ . The diameter of the refracted beam is

- (a)  $d$  (b)  $(\mu - 1) d$   
(c)  $\frac{\sqrt{2\mu^2 - 1}}{d} d$  (d)  $\frac{\sqrt{\mu^2 - 1}}{\mu} d$

38. A beam of light consisting of red, green and blue colours is incident on a right angled prism. The refractive indices of the material of prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The prism will



- (a) separates part of the red colour from the green and blue colours  
(b) separates part of the blue colour from the red and green colours  
(c) separate all the three colours from one another  
(d) not separate even partially any colour from the other two colours.

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