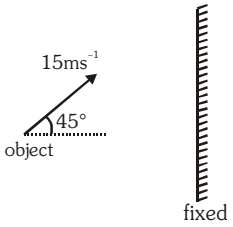
RAY OPTICS AND OPTICAL INSTRUMENTS

1. A ray of light travelling in the direction $\frac{1}{2}\left(\hat{i}+\sqrt{3}\hat{j}\right)$ is incident on a plane mirror. After reflection, it travels along the direction $\frac{1}{2}\left(\hat{i}-\sqrt{3}\hat{j}\right)$. The angle of incidence is :-

(1) 30° (2) 45° (3) 60° (4) 75°

2. An object is approaching a fixed plane mirror with speed 15 ms^{-1} making an angle of 135° with the normal to the mirror. The speed of image w.r.t. mirror is :–



(1) 15 ms^{-1} (2) $\frac{15}{\sqrt{2}}$ ms^{-1}

(3) $15\sqrt{2}$ ms^{-1} (4) 30 ms^{-1}

3. An object is placed at 100 cm from plane mirror. It approaches towards mirror with a velocity 8 cm/s. Calculate magnitude of displacement of image with respect to object in 5 sec :-

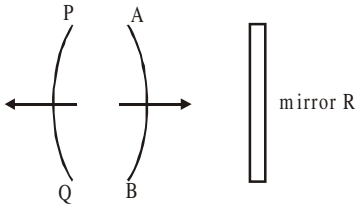
(1) 60 cm (2) 40 cm

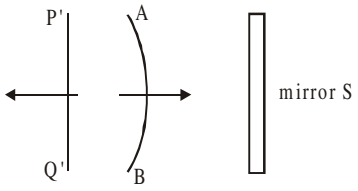
(3) 120 cm (4) 80 cm

4. If two mirrors are kept at 60° to each other, then the number of images formed by them is

(1) 4 (2) 3 (3) 5 (4) 6

5. AB is incident wavefront on mirror R and mirror S whereas PQ and P'Q' is reflected wavefront from mirror R and mirror S respectively. Choose the **CORRECT** statement





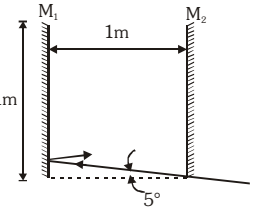
(1) mirror R is concave and mirror S is convex.

(2) mirror R is plane and mirror S is convex.

(3) mirror R is plane and mirror S is concave.

(4) mirror R is convex and mirror S is plane.

6. Refer to the figure. The number of reflections from mirrors M_1 and M_2 are



(1) 5 and 5

(2) 6 and 5

(3) 10 and 10

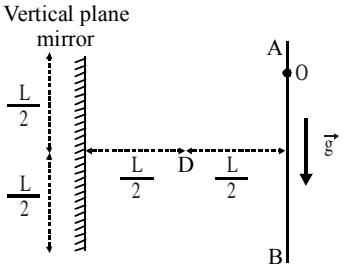
(4) 6 and 6

7. Plane mirror and an object has speeds of 5 ms^{-1} and 10 ms^{-1} respectively. If the motion of mirror and object is along the normal of the mirror then the speed of image may be :–

(1) 0 ms^{-1} (2) 10 ms^{-1}

(3) 20ms^{-1} (4) Both (1) and (3)

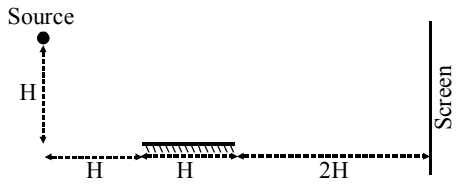
8. A point object O can move along vertical line AB as shown in figure. When image of the object is first visible to D then it is released at t = 0 from rest. The time for which image of object is visible to D is :-



(1) $\sqrt{\frac{6L}{g}}$ (2) $\sqrt{\frac{2L}{g}}$

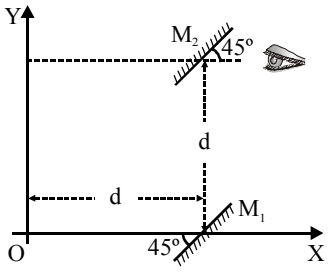
(3) $\sqrt{\frac{3L}{g}}$ (4) $t \to \infty$

9. A point source has been placed as shown in the figure. What is the length on the screen that will receive reflected light from the mirror ?



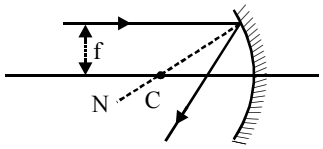
(1) 2 H (2) 3H (3) H (4) None

10. The co-ordinates of the image formed of an object placed at origin, which the eye will observe in mirror M_2 is -



(1) (0, d) (2) (d, – d)
(3) (– d, d) (4) (d, d)

11. A light ray is coming parallel to principal axis, the distance between ray and axis is equal to focal length (as shown). Find the angle of deviation after reflection :-



(1) 60° (2) 90°
(3) 120° (4) $180°-2\tan^{-1}(0.5)$

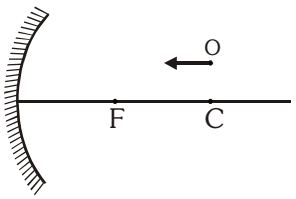
12. The image produced by a concave mirror is one quarter the size of object when the object is 12.5 cm from mirror. If the object is moved 5 cm closer to the mirror, the image will only be half the size of the object. The focal length of mirror is

(1) f = 5.0 cm (2) f = 2.5 cm
(3) f = 7.5 cm (4) f = 10 cm

13. A boy 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

(1) 0.9 m (2) 0.85 m
(3) 0.8 m
(4) Can't be determined

14. A point object O is going towards concave mirror as shown in the figure. Choose the correct option representing direction of velocity of the image (F is the focus and C is the centre of curvature)



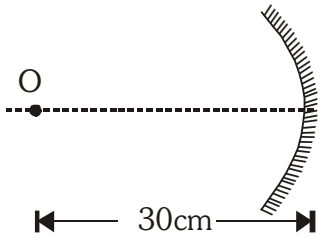
(1) 
(2)
(3)
(4) 

15. 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

(1) first decreases then increases
(2) first increases then decreases
(3) first increases then decreases and then again increases
(4) first decreases then increases and then again decreases

Paragraph for Question 16to 17

An object is present on the principal axis of a concave mirror at a distance 30 cm from it. Focal length of mirror is 20 cm.



16. Image formed by mirror is

(1) At a distance 60 cm in front of mirror
(2) At a distance 60 cm behind the mirror
(3) At a distance 12 cm in front of mirror
(4) At a distance 12 cm behind the mirror.

17. If object starts moving with 2 cms^{-1} along principal axis towards the mirror then,

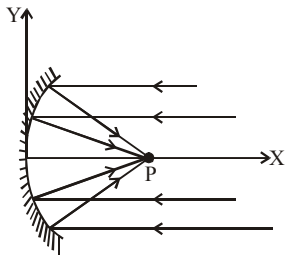
(1) Image starts moving with 8 cms^{-1} away from the mirror

(2) Image starts moving with 8 cms^{-1} towards the mirror

(3) Image starts moving with 4 cms^{-1} towards the mirror

(4) Image starts moving with 4 cms^{-1} away from the mirror

18. A broad beam of light is incident on a reflecting surface. If entire beam focuses at a single point P, then nature of reflecting surface is



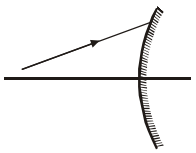
(1) Parabolic

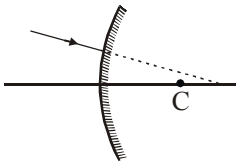
(2) Spherical

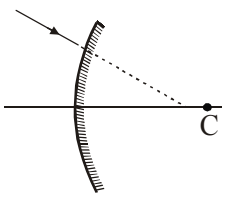
(3) elliptical

(4) hyperbolic

19. In which of the following diagrams the image formed is virtual and inverted and diminished? (Object is on principle Axis)

(1) 

(2) 

(3) 

(4) All of these

20. Assume that you are sitting in a car. 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 of the image of man in first second is :-

(1) 20 cm/s (2) 25 cm/s

(3) 10 cm/s (4) 30 cm/s

21. The image of a real object 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 may be :-

(1) 10 cm (2) 20 cm

(3) 25 cm (4) 15 cm

22. A particle is moving towards a fixed spherical mirror. The image.

(1) must move away from the mirror

(2) must move towards the mirror

(3) may move towards the mirror

(4) will move towards the mirror, only if the mirror is convex

23. A point object on the principal axis at a distance 15 cm in front of a concave mirror of radius of curvature 20 cm has velocity 2 mm/s perpendicular to the principal axis. The velocity of image at that instant will be

(1) 2 mm/s

(2) 4 mm/s

(3) 8 mm/s

(4) 16 mm/s

24. If object starts moving with 2 cms^{-1} perpendicular to principal axis above the principal axis having real image two times magnified then,

(1) Image moves with velocity 4 cms^{-1} below the principal axis

(2) Image moves with velocity 4 cms^{-1} above the principal axis

(3) Image moves with velocity 8 cms^{-1} below the principal axis

(4) Image moves with velocity 8 cms^{-1} above the principal axis

25. Find the incorrect statement for a concave mirror producing a virtual image of the object.

(1) The linear magnification is always greater than one, except at the pole

(2) The linear magnification is always less than one.

(3) The magnification tends to one as the object moves nearer to the pole of the mirror.

(4) The distance of the object from the pole of the mirror is less than the focal length of mirror.

26. A concave mirror of focal length f is separated by a plane mirror facing the former by a distance of 3.6f. Find where should a point source be kept on their common axis, so that the real image after two reflections (first from spherical mirror and then plane mirror) coincides with the object.

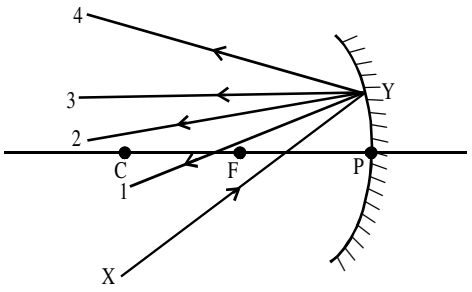
(1) 1.2 f from plane mirror

(2) 2.4 f from plane mirror

(3) 1.8 f from plane mirror

(4) none of these

27. 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 :-



(1) 1 (2) 2 (3) 3 (4) 4

28. A convex mirror gives an image three times as large as the object placed at a distance of 20 cm from it. For the image to be real, the focal length should be :-

(1) 15 cm (2) 10 cm

(3) 30 cm (4) 20 cm

29. Paraxial ray is that incident ray which is :-

(1) Any ray parallel to principle axis

(2) Any ray making small angle with principle axis

(3) Ray incident close to pole and making small angle with principle axis

(4) Ray incident at pole at any angle

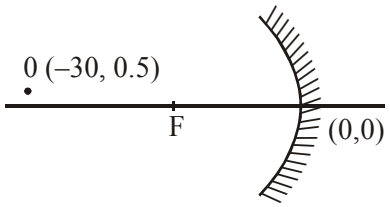
30. A mirror of radius of curvature 30 cm, forms image of size three times that of object. The position(s) of the object may be at a distance from mirror equal to :-

(i) 10 cm (ii) 20 cm (iii) 40 cm

(1) only (ii) (2) only (i)

(3) (i), (iii) (4) (i), (ii)

31. An object is placed in front of concave mirror of focal length 10 cm.



As shown in figure as if pole of mirror is at (0,0) and principle axis is along x-axis. If coordinates of object are (–30 cm, 0.5 cm) find coordinates of image in cm :-

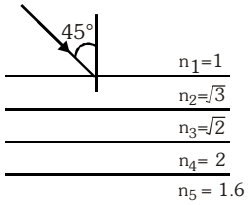
(1) (–15, –0.25)

(2) (–7.5, –0.125)

(3) (–60, –1)

(4) (30, – 0.5)

32. In the figure shown the angle made by the light ray with the normal in the medium of refractive index $\sqrt{2}$ is:

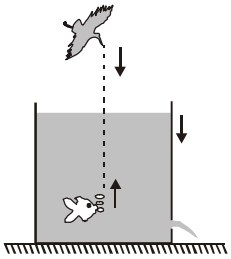


(1) 30° (2) 60°

(3) 90° (4) None of these

33. A bird in air is diving vertically over a tank with speed 5 cm/s, base of tank is silvered. A fish in the tank is rising upward along the same line with speed 2 cm/s. Water level is falling at rate of 2 cm/s. Find the speed of birds image formed in mirror as obserbed by fish.

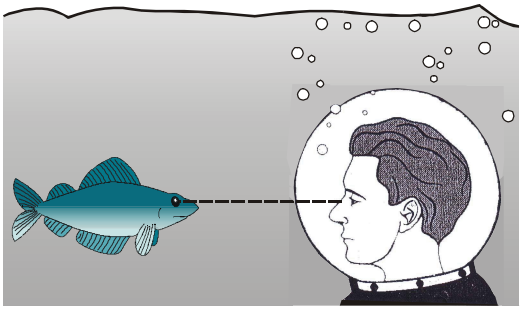
$[\mu_{water} = 4/3]$



(1) 4 cm/s (2) 5 cm/s

(3) 2 cm/s (4) 8 cm/s

34. A diver in a glass bubble helmet looks at a fish as shown. Where is the image of the fish relative to its true location ?



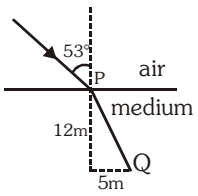
(1) Closer to the diver

(2) Farther from the diver

(3) The real distance from the diver

(4) The answer depends on the location of the fish

35. A light ray passes from air into another medium at point P. How long does it take the light ray to travel from P to Q :-



(1) 9×10^{-10} s (2) 9×10^{-7} s

(3) 9×10^{-8} s (4) 9×10^{-6}s

36. A bird in air looks at a fish directly below it inside in a transparent liquid in a tank. If the distance of the fish as estimated by the bird is h_1 and that of the bird as estimated by the fish is h_2, then the refractive index of liquid is :-

(1) $\frac{h_2}{h_1}$

(2) $\frac{h_1}{h_2}$

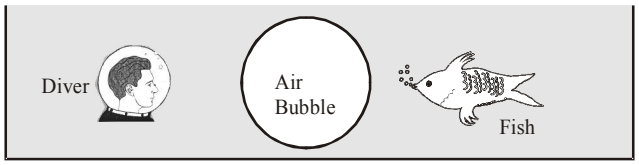
(3) $\frac{h_1 + h_2}{h_1 - h_2}$

(4) $\frac{h_1 - h_2}{h_1 + h_2}$

37. A vessel is quarter filled with a liquid of refractive index μ. The remaining part of the vessel is filled with an immiscible liquid of refractive index 1.5 μ. The apparent depth of the vessel is 50% of the actual depth. The value of μ is

(1) 1 (2) $\frac{3}{2}$ (3) $\frac{2}{3}$ (4) $\frac{4}{3}$

38. A fish sees the smiling face of a scuba diver through a bubble of air between them, as shown. Compared to the face of the diver, the image seen by the fish will be



(1) smaller and erect

(2) smaller and inverted

(3) larger and erect

(4) larger and inverted

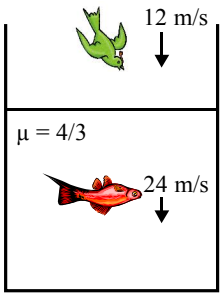
39. Deviation for a ray at the interface of two media from denser (1) to rarer (2) with angle of incidence 30° is 15°. What maximum deviation a ray of same wavelength can undergo at the interface of two media when entering from medium (2)

(1) 90° (2) 45° (3) 0° (4) 60°

40. A cylindrical bucket of depth 60 cm is partially filled with a liquid of refractive index 1.5 and with oil (on top of liquid) of refractive index 2. It appears that the volume of air, volume of liquid and volume of oil are equal, to an observer who views from top of the bucket. The apparent depth of the bucket as seen by the observer is given as α cm. Then $\left(\frac{\alpha}{5}\right)$ is :

(1) 1 (2) 8 (3) 4 (4) 10

41. A fish and a bird are moving as shown in figure. Find the velocity of bird as observed by fish.

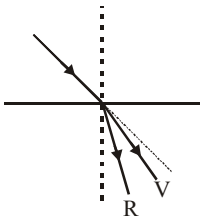


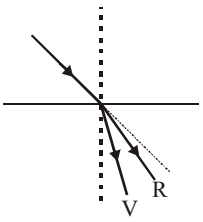
(1) 8 m/s upwards
(2) 8 m/s downwards
(3) 9 m/s upwards
(4) 9 m/s downwards

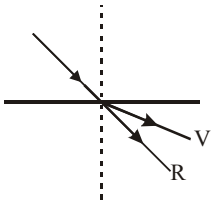
42. A person spear-fishing from a boat sees a stationary fish a few meters away in a direction about 30° below the horizontal. The index of refraction of the water is 1.34. Assume the dense spear does not change direction when it enters the water. To spear the fish, the person should :-

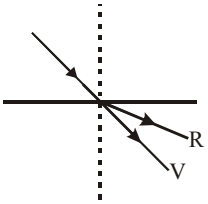
(1) aim above where he sees the fish
(2) aim precisely at the fish; or
(3) aim below the fish
(4) Can't be determined

43. A ray of light is going from air to water. Which of the following figure shows dispersion of light?

(1) 

(2) 

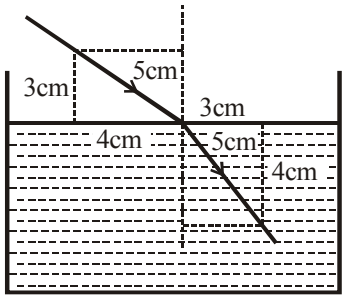
(3) 

(4) 

44. If f_1 and f_2 represent the first and second focal lengths of a single refracting surface, separating μ_1 & μ_2 then (assuming cartesian sign convention)-

(1) $\mu_2 f_2 + \mu_1 f_1 = 0$ (2) $\mu_1 f_2 + \mu_2 f_1 = 0$
(3) $\mu_1 f_1 - \mu_2 f_2 = 0$ (4) $\mu_2 f_1 - \mu_1 f_2 = 0$

45. In shown figure, a ray of light enters a liquid and is bent towards the normal. The speed of light in the liquid is :-



(1) 3×10^8 m/s (2) 2.75×10^8 m/s
(3) 2.50×10^8 m/s (4) 2.25×10^8 m/s

46. A light ray incident on interface of two media, a to b. If angle of incidence in a is $\theta_a = 45°$ & angle of refraction in medium b is $\theta_b = 60°$. If velocity of light in medium b is $\frac{c}{3}$ then find velocity of light in medium a :-

(1) $c\sqrt{\frac{2}{3}}$ (2) $\frac{c\sqrt{2}}{3}$

(3) $\frac{c}{\sqrt{3}}$ (4) $\frac{c}{3}\sqrt{\frac{2}{3}}$

47. An object is just below a combination of two slabs, one is of refractive index 1.5 & thickenss 30cm, other is of refractive index 1.2 and thickness 24cm. Find apparent depth of the object from upper surface of combination :-

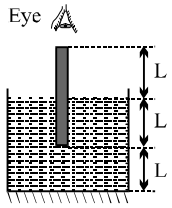
(1) 54 cm (2) 40 cm
(3) 73.8 cm (4) 14 cm

48. If thickness of a slab is $5\sqrt{3}$ cm and refractive index $\sqrt{3}$. If light incident on it at angle of incidence 60° then find lateral shift between direction of incident ray and emergent ray produced by it :-

(1) $\frac{5\sqrt{3}}{2}$cm (2) $\frac{5}{2}$cm

(3) $\frac{5}{\sqrt{3}}$cm (4) 5cm

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



(1) μL+ L (2) L+L/μ

(3) L + L (4) mL+L/μ

50. A light ray is incident at an angle 30^0 on a transparent surface separating two media. If the angle of refraction is 60^0 then critical angle is

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

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

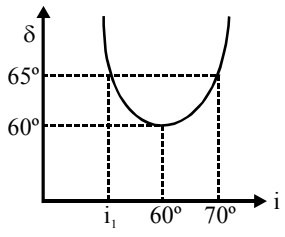
(3) $\sin^{-1}\left(\frac{2}{3}\right)$

(4) 45^0

51. A ray of light is incident normally on one of the faces of a prism of apex angle 30° and refractive index √2. The angle of deviation of the ray is :

(1) 0° (2) 12.5° (3) 15° (4) 22.5°

52. The angle of deviation (δ) vs angle of incidence is plotted for a prism.Pick up the correct statements



(1) The angle of prism is 60°

(2) The refractive index of the prism is n = √3

(3) For deviation to be 65° the angle of incidence i_1 = 55°

(4) All the above

53. The ratio of angle of minimum deviation produced by a thin prism $\left(\mu = \frac{3}{2}\right)$ in air to that in liquid of refractive index $\frac{9}{7}$ is :

(1) $\frac{1}{3}$ (2) 3

(3) $\frac{1}{4}$ (4) 4

54. If refractive index of material except vacuum for different color will be different and variation is given as $\frac{d\mu}{d\lambda} = a\lambda$ (where λ is wavelength and a is a positive constant) and wavelength increases as we go along

$V \rightarrow I \rightarrow B \rightarrow G \rightarrow Y \rightarrow O \rightarrow R$

Choose the incorrect alternative.

(1) deviation will be maximum for red through any prism

(2) white light going from air to matter will disperse in different colours

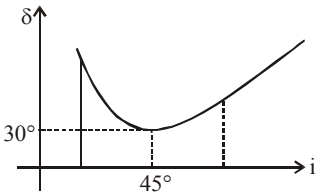
(3) white light going from air to matter then red will be closest to normal in refracted light

(4) Only two options are correct

55. Light travelling in air falls at an incidence angle of 2° on one refracting surface of a prism of refractive index 1.5 and angle of prism 4º. The medium on the other side is water (n = 4/3). The deviation produced by the prism in degree is :

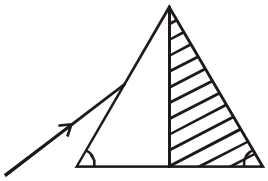
(1) 2 (2) 2.5 (3) 1 (4) 2.3

56. Variation of angle of deviation δ versus angle of incidence for a prism is given the figure. The value of refractive index of prism :-



(1) $\sqrt{3}$ (2) $\sqrt{2}$ (3) $\sqrt{\frac{3}{2}}$ (4) $\frac{2}{\sqrt{3}}$

57. A light ray is incident upon a isosceles prism in minimum deviation position and suffers a deviation of 34°. If the shaded half of the prism is knocked off, the ray will :-



(1) suffer a deviation of 34°

(2) suffer a deviation of 68°

(3) suffer a deviation of 17°

(4) not come out of the prism.

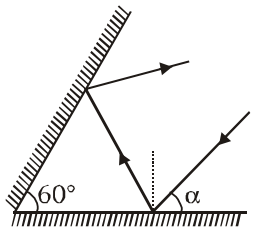
58. A light ray, incident at an angle of incidence of 60° on prism with prism angle 30°, is deviated by 30°. The refractive index of the prism is

(1) $\sqrt{3}$ (2) $\frac{2}{\sqrt{3}}$ (3) $\frac{2\sqrt{3}}{5}$ (4) $\sqrt{2}$

59. A light ray incident normally on one face of an equilateral prism and emerges out grazingly at the other face. The refractive index of the prism is

(1) $\sqrt{3}$ (2) $\frac{2}{\sqrt{3}}$ (3) $\frac{2\sqrt{3}}{5}$ (4) $\sqrt{2}$

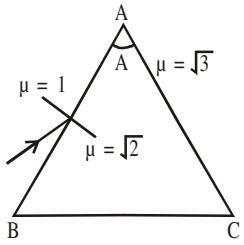
60. What is the value of α for which there are maximum 2 reflections only



(1) 35° (2) 45°

(3) 55° (4) 65°

61. What will be the angle of prism A so that any ray incident on surface AB will not emerge out from AC ?



(1) 30º (2) 45º

(3) 60º (4) None of these

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

(1) greater deviation

(2) no deviation

(3) same deviation as before

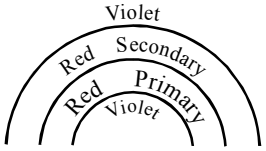
(4) Lesser deviation

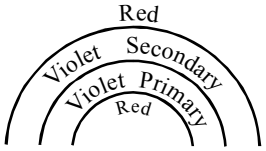
63. A prism of cross section ABC & refractive index $\sqrt{\frac{3}{2}}$ and angle ∠CAB = 8° is given. A ray of light incident on surface AB at angle of incidence 60°. The angle of emergence will be:-

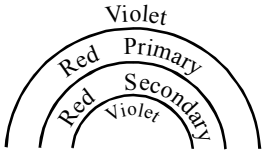
(1) $\sin^{-1}\sqrt{\frac{27}{50}}$ (2) $\sin^{-1}\left(\sqrt{\frac{9}{10}}\right)$

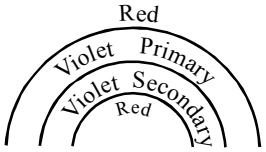
(3) $\sin^{-1}\left(\sqrt{\frac{3}{2}}\right)$ (4) $\sin^{-1}\left(\sqrt{\frac{24}{25}}\right)$

64. In a rainbow, we see two rainbows; primary and secondary. Which of the following figures approximately represent the order of colors in rainbows?

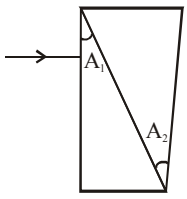
(1) 

(2) 

(3) 

(4) 

65. An achromatic combination is made by combining 2 thin prisms as shown. If $\omega_1 > \omega_2$, then :-



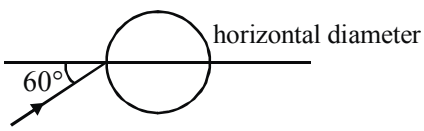
(1) Net deviation would be clockwise

(2) Net deviation would be anticlockwise

(3) Net deviation would be zero.

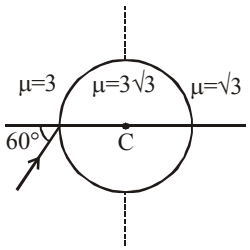
(4) Cannot be predicted on basis of given information.

66. A ray of light falls on a transparent sphere kept in air as shown in figure. If the final ray emerges from the sphere parallel to the horizontal diameter, then the refractive index of the sphere is



(1) $\sqrt{2}$ (2) $\sqrt{3}$ (3) $\frac{3}{\sqrt{2}}$ (4) 2

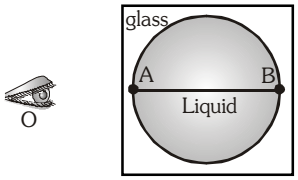
67. Left half of a glass sphere is surrounded with a medium having refractive index 3 and the right half is surrounded with medium having refractive index $\sqrt{3}$ as shown. A ray is incident at an angle of 60° as shown. Find the total deviation as the ray comes out the sphere?



(1) 60° CW (2) 60° ACW

(3) 120° CW (4) 120° ACW

68. The observer 'O' sees the distance AB as infinitely large. If refractive index of liquid is μ_1 and that of glass is μ_2, then $\frac{\mu_1}{\mu_2}$ is :



(1) 1 (2) 2 (3) 3 (4) 4

69. A parallel beam of light travelling in water (refractive index = 4/3) is refracted by a spherical air bubble of radius 2cm situated in water. Assuming the light rays to be paraxial, the position of the image due to refraction at the first surface is -

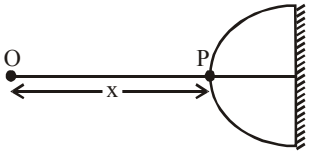
(1) 6 cm from the first surface

(2) 12 cm from the first surface

(3) 3 cm from the first surface

(4) 10 cm from the first surface

70. A hemispherical surface of radius R and refractive index μ = 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?



(1) R (2) 1.5 R

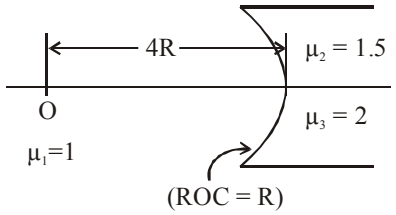
(3) 2 R (4) 3 R

71. Light from a point source in air falls on a spherical glass surface (R.I. of glass = 1.5 and r radius of curvature = 20 cm) The centre of curvature of spherical surface is in air. The distance of light source from the glass surface is 80 cm. At what position the image is formed from glass surface:-

(1) 40 cm (2) –40 cm

(3) 120 cm (4) –120 cm

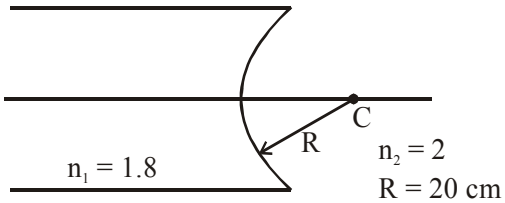
72.



As shown in diagram an object is placecd in medium of refractive index $\mu_1 = 1$ at a distance 4R from spherical surface. On other side of spherical surface there are two medium of refractive index $\mu_2 = 1.5$ & $\mu_3 = 2.0$. Two images are formed find separation between them :-

(1) 0.4 R (2) R (3) 2R (4) None

73.



Find power of the spherical surface if light source is in rarer medium :-

(1) +1D (2) –2D (3) +0.5D (4) +2D

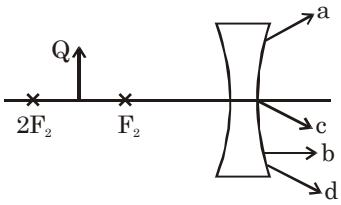
74. A converging beam of rays is incident on a diverging lens. Having passed through the lens the rays intersect at a point 10 cm from the lens. If the lens is removed, the point where the rays meet will move 20/3 cm closer to the mounting that holds. Find the focal length of the lens without sign.

(1) 10 cm (2) 20 cm (3) 5 cm (4) 6 cm

75. A plano convex lens behave as a concave mirror of focal length 30 cm when its plane surface is silvered and as a concave mirror of focal length 10 cm when its curved surface is silvered. The radius of curvature of curved surface is :-

(1) 40 cm (2) 30 cm (3) 50 cm (4) 60 cm

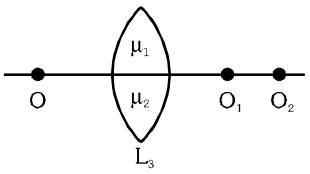
76. A diverging lens and an object are positioned as shown in figure at left. Which of the rays a, b, c and d could emanate from point Q at the top of the object ?



(1) a, b and c (2) a and c

(3) a and b (4) all

77. Consider three converging lenses L_1, L_2 and L_3 having identical geometrical construction. The indices of refraction of L_1 and L_2 are μ_1 and μ_2 respectively. The upper half of the lens L_3 has a refractive index μ_1 and the lower half has μ_2 (Fig.). A point object O forms image at O_1 by the lens L_1 and at O_2 by the lens L_2 placed in same position. If L_3 is placed at the same place,



(1) there will be an image at O_1

(2) there will be an image at O_2

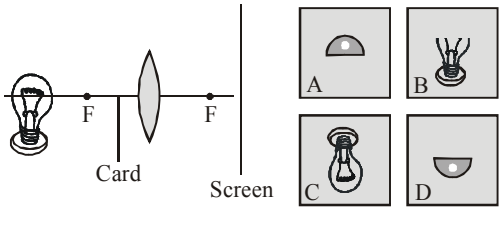
(3) the only image will form somewhere between O_1 and O_2

(4) both (1) and (2)

78. By placing a convex lens of focal length equal to 15.0 cm between an object and a screen separated by a distance of 75.0 cm, the sizes of the images obtained are 6.0 cm and 2/3 cm. The size of the object must be :-

(1) 2.0 cm (2) 4.0 cm (3) 3.0 cm (4) 1.5 cm

79. An opaque card is held over the lower half of a converging lens as shown in figure (a). Which picture in figure (b) best shows the image that appears on the screen ?



(a) (b)

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

80. Optical axis of a thin equiconvex lens is the x-axis. The co-ordinate of a point object and its image are (–20 cm, 1 cm) and (40 cm, – 4 cm) respectively

(A) The lens is located at x = 12 cm

(B) The lens is located at x = – 8 cm

(C) The focal length of the lens is 9.6 cm

(D) The focal length of the lens is 12 cm

Select Correct Options

(1) A & D (2) A & C

(3) B & D (4) B & C

81. A converging lens forms sharp image of an object on a screen. The image is real and has twice the size of the object. If the positions of the screen and the object are interchanged, leaving the lens in its original position, what is the new image size on the screen ?

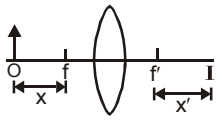
(1) Twice the object size

(2) Same as the object size

(3) Half the object size

(4) Can't say as it depends on the focal length of the lens

82. An object is placed at a point distance x from the focus of a convex lens and its image is formed at I as shown in the figure. The distance x, x' satisfy the relation



(A) $x + x' \le 2f$ (B) $f = \sqrt{xx'}$

(C) $2f \le x + x'$

Select correct alternative(s)

(1) Only B (2) Only A & B

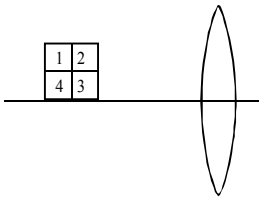
(3) Only B & C (4) Only C

83. If f_1 and f_2 represent the first and second focal lengths of a single refracting surface, then (assuming cartesian sign convention)-

(1) $f_2 + f_1 = 0$ (2) $f_2 + \mu f_1 = 0$

(3) $f_1 + \mu f_2 = 0$ (4) $f_1 f_2 = 1$

84. A convex lens is used to form a real image of the object as shown in the figure. Then the real inverted image is as shown in the following figure:–



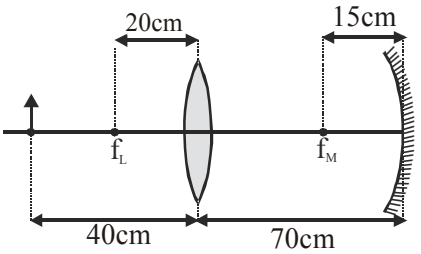
(1) 

(2) 

(3) 

(4) 

85. An upright object is placed at a distance in front of a converging lens equal to twice the focal length 20 cm of the lens. On the other side there is a concave mirror of focal length 15 cm separated from the lens by a distance of 70 cm. Then select the correct statement from the following



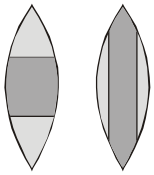
(1) Magnification for the system is $-\frac{1}{2}$

(2) Magnification for the system is –1

(3) Final image by the system will real and at distance of 60 cm from centre of curvature of spherical mirror

(4) Magnification for the system is $+\frac{1}{2}$

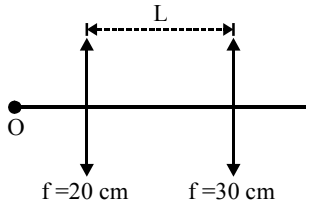
86. Figure shows two convex lenses A and B, each made up of three different transparent materials. The number of images formed, of an object kept on the principal axis of each lens will be



(1) 3 and 3 (2) 3 and 1

(3) 1 and 1 (4) 3 and 2

87. Two converging lens have focal length 20 cm & 30 cm. Optical axis of both lens coincide. This lens system is used to form an image of an object. It turn out that size of the image does not depend on the distance between the lens system & the object. If L is distance between lens & M is magnification after all possible refraction-



(1) L = 10 cm (2) L = 50 cm

(3) $|M| = \frac{2}{3}$ (4) $|M| = \frac{1}{3}$

88. In displacement method, the distance between object and the screen is 96 cm. The ratio of length of two images formed by a converging lens placed between them is 4. Then

(1) Distance between the two positions of the lens is 48 cm

(2) distance between the two positions of the lens is 32 cm.

(3) focal length of the lens is 64/3 cm.

(4) Both (2) and (3) are correct

89. In displacement method, the distance between object and the screen is 96 cm. The ratio of length of two images formed by a converging lens placed between them is 4. Then select wrong option :-

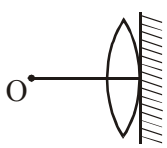
(1) ratio of the length of object to the length of shorter image is 2.

(2) distance between the two positions of the lens is 32 cm.

(3) focal length of the lens is 64/3 cm.

(4) when the shorter image is formed on screen, distance of the lens from the screen is 30 cm.

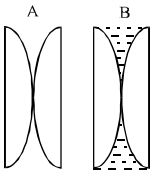
90. Behind a thin converging lens having both the surfaces of the same radius 10 cm, a plane mirror has been placed.



The image of an object at a distance 40 cm from the lens is formed at the same position. What is the refractive index of the lens ?

(1) 1.5 (2) $\frac{5}{3}$ (3) $\frac{9}{8}$ (4) None

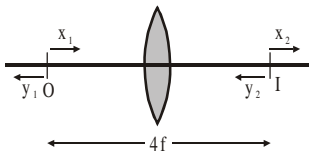
91. Figure A shows two identical plano-convex lenses in contact as shown. The combination has focal length 24 cm. Figure B shows the same with a liquid introduced between them. If refractive index of glass of the lenses is 1.50 and that of the liquid is 1.60, the focal length of the system in figure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



(1) –120 cm (2) 120 cm

(3) –24 cm (4) 24 cm

92. In a converging lens of focal length f and the distance between real object and its real image is 4*f*. 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:-



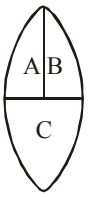
(1) $x_1 > x_2$ and $y_1 > y_2$ (2) $x_1 < x_2$ and $y_1 < y_2$

(3) $x_1 < x_2$ and $y_1 > y_2$ (4) $x_1 > x_2$ and $y_2 > y_1$

93. An object and a screen are fixed on the uprights of an optical bench. The distance between them is 100 cm. A convex lens is placed in between the object and the screen and the position of the lens is so adjusted that the image of the object is formed on the screen at two conjugate positions of the lens. The distance between these conjugate positions of the lens is 40 cm. What is the focal length of the lens :-

(1) 15 cm (2) 18 cm (3) 21 cm (4) 24 cm

94. A thin, symmetrical double-convex lens of focal length 50 cm is cut into three parts A, B and C as shown, then :



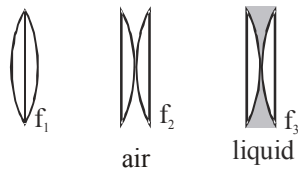
(1) Power of C is 2D

(2) Focal length of A is 100 cm

(3) Power of B is 1D

(4) All of these

95. The figure shows different arrangements of two identical pieces of plano-convex lenses. The refractive index of the liquid used is equal to that of the glass. Then, the effective focal lengths in the three cases are related as



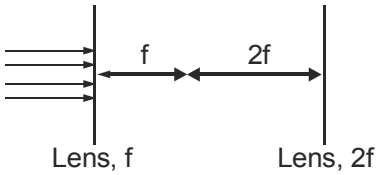
(1) $f_1 = f_2$, $f_3 = 0$

(2) $f_1 \neq f_2 \neq f_3$

(3) $f_1 = f_2 > f_3$

(4) $f_1 = f_2$, $f_3 \to \infty$

96. Two convex lenses of focal lengths *f* and *2f* are arranged to have their foci at the same point, as shown in the diagram. A circular beam of parallel light rays having 1 cm cross-section radius is incident on the first lens. The beam exiting the second lens is :



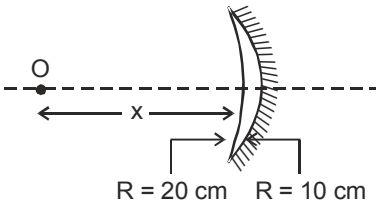
(1) diverging

(2) converging.

(3) Parallel and of 1 cm cross-section radius.

(4) Parallel and of 2 cm cross-section radius.

97. Radii of curvature of a concavo-convex lens (refractive index = 1.5) are 20 cm (concave side) and 10 cm (convex side) as shown. The convex side is silvered. The distance x on the principal axis where an object is placed so that its image is created on the object itself, is equal to :-



(1) 4 cm (2) 8 cm (3) 12 cm (4) 16 cm

98. A parallel beam of white light falls on a combination of a concave and a convex lens, both of same material. Their focal lengths are 15 cm and 30 cm respectively for the mean wavelength in white light. On the other side of the lens system, one sees

(A) a coloured pattern with red at the outer edge

(B) a coloured pattern with violet at the outer edge

(C) white light again

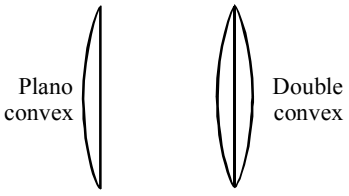
(D) that it is impossible for the lens system to converge the rays at a point

Which of the following is correct ?

(1) Only (A) (2) Only (D)

(3) (B) and (D) (4) Only (C)

99. You are given two thin identical plano-convex lenses, one of which is shown to the right. When you place an object 20 cm to the left of a single plano-convex lens, the image appears 40 cm to the right of the lens. You then arrange the two plano-convex lenses back to back to form a double convex lens. If the object is at 20 cm to the left of this new lens, what is the approximate location of the image :-



(1) 6.7 cm to the right of the lens.

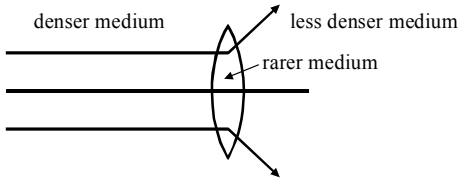
(2) 10 cm to the right of the lens.

(3) 20 cm to the right of the lens.

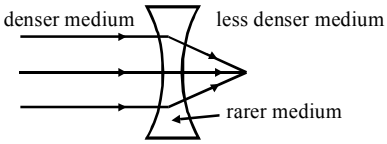
(4) 80 cm to the right of the lens.

100. When light rays pass from an optically denser medium through an optically less denser medium as shown below, which is/are possible?

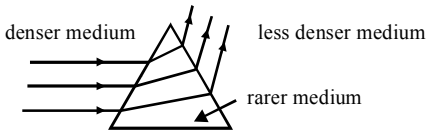
(I)



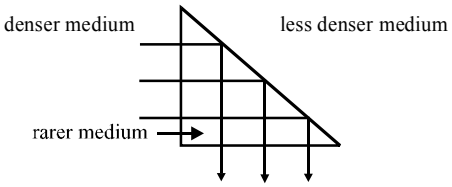
(II)



(III)



(IV)



(1) I, II only (2) III, IV only

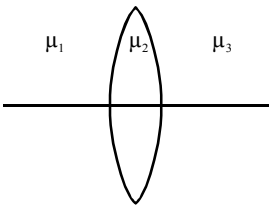
(3) I, II, III only (4) IV only

101. Parallel rays are incident on a thick plano-convex lens having radius of curvature R, refractive index μ and thickness t. When rays are incident on plane surface they converge at a distance x from plane surface. When rays are incident on curved surface then rays converge at y distance from curved surface. Then

(1) $x = y$ (2) $x < y$

(3) $x > y$ (4) data insufficient

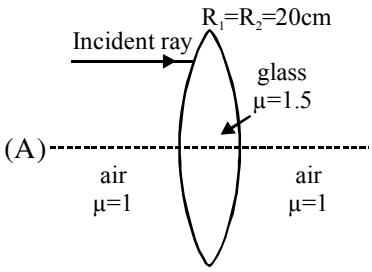
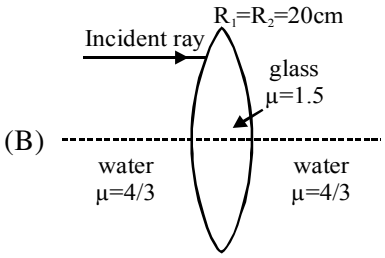
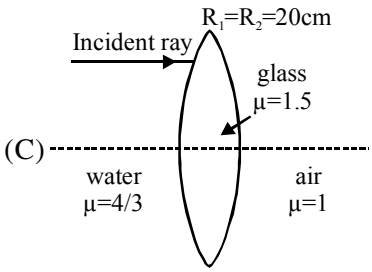
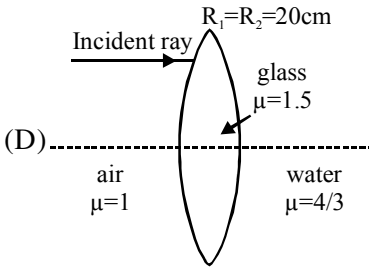
102. The diagram shows an equiconvex lens. What should be the condition on the refractive indices so that the lens becomes diverging ?



(1) $2\mu_2 > \mu_1 - \mu_3$ (2) $2\mu_2 < \mu_1 + \mu_3$

(3) $2\mu_2 > 2\mu_1 - \mu_3$ (4) $2\mu_2 > \mu_1 + \mu_3$

103.

Column I (optical system)	**Column II (focal length)**
(A) 	(P) 80 cm
(B) 	(Q) 40 cm
(C) 	(R) 30 cm
(D) 	(S) 20 cm

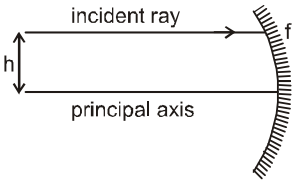
(1) A – S, B – P, C – R, D – Q

(2) A – S, B – P, C – Q, D – R

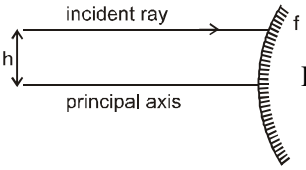
(3) A – P, B – S, C – Q, D – R

(4) A – P, B – S, C – R, D – Q

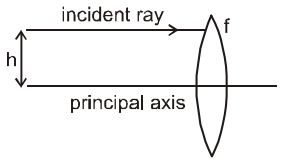
104. A ray is parallel to principal axis and at a distance h from principal axis as shown in each situation. The focal length of mirror or lens in each situation is f (h<<f). Select correct match in each situations with the magnitude of deviation of incident ray produced.

(A) 

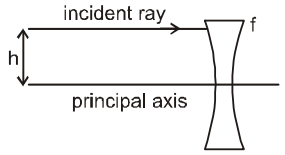
Deviation=$180^\circ-\frac{h}{f}$

(B) 

Deviation=$180^\circ-\frac{2h}{f}$

(C) 

Deviation = $\frac{h}{f}$

(D) 

Deviation = $\frac{2h}{f}$

(1) (A) and (B)

(2) (A) and (C)

(3) (A) and (D)

(4) (B) and (C)

105. A diverging lens with magnitude of focal length 25 cm is placed at a distance of 15 cm from a converging lens of magnitude of focal length 20 cm. A beam of parallel light falls on the diverging lens. The final image formed is :

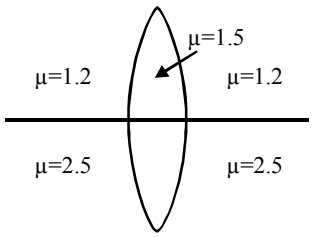
(1) real and at a distance of 40 cm from the divergent lens

(2) real and at a distance of 6 cm from the convergent lens

(3) real and at a distance of 40 cm from convergent lens

(4) virtual and at a distance of 40 cm from convergent lens.

106. A thin lens of material having refractive index $\mu = 1.5$ and focal length of 20 cm in air has two mediums of different refractive indices $\mu_1 = 1.2$ and $\mu_2 = 2.5$ covering upper and lower halves of the lens, respectively as shown in figure. If an object is placed on the principal axis, then its two images will be formed one after refraction from upper part and other after refraction from lower part. Considering the object to be at infinity the separation between two images formed would be :-



(1) 15 cm (2) 40 cm

(3) 25 cm (4) 65 cm

107. An object approaches a convergent lens from the left of the lens with a uniform speed 5 m/s and stops at the focus. The image :

(1) moves away from the lens with an uniform speed 5 m/s

(2) moves away from the lens with an uniform acceleration

(3) moves away from the lens with a non-uniform acceleration

(4) moves towards the lens with a non-uniform acceleration

108. Two point source S_1 and S_2 are 24 cm apart. Where should a convex lens of focal length 9cm be placed in between them so that the images of both sources are formed at the same place ?

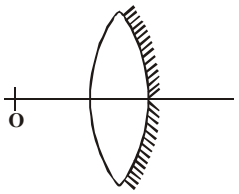
(1) 6 cm from S_1

(2) 15 cm from S_1

(3) 10 cm from S_1

(4) 12 cm from S_1

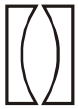
109. An equiconvex lens of refractive index μ and radius of curvature R has its one surface silvered. A point source O is placed before the silvered lens so that its image is coincident with it, the distance of the object from the lens is :-



(1) $\frac{R}{(\mu-1)}$ (2) $\frac{2R}{(\mu-1)}$

(3) $\frac{R}{(2\mu-1)}$ (4) $\frac{2R}{(2\mu-1)}$

110. Four combinations of two thin lenses are given in List I. The radius of curvature of all curved surfaces is r and the refractive index of all the lenses is 1.5. Match lens combinations in List I with their focal length in List II and select the correct answer using the code given below the lists.

List–I	**List–II**
(P) 	(A) 2r
(Q) 	(B) $\frac{r}{2}$
(R) 	(C) –r
(S) 	(D) r

Code :

(1) P-A, Q-B, R-C, S-D

(2) P-B, Q-D, R-C, S-A

(3) P-D, Q-A, R-B, S-C

(4) P-B, Q-A, R-C, S-D

111. If a convergent beam of light passes through a diverging lens, the result :-

(1) may be a converging beam

(2) may be a diverging beam

(3) may be parallel beam

(4) All of the above

112. A symmetric double convex lens is cut in two equal parts by a plane containing the principal axis. If the power of the original lens was 4 D, the power of a divided lens will be

(1) 2 D (2) 3 D (3) 4 D (4) 5 D

113. When a glass lens (μ_g=3/2) is dipped in a medium then it becomes disappear. Then that medium :-

(1) will be water (μ_w=4/3)

(2) may be water

(3) medium will not be water

(4) nothing can be said

114. A man with normal vision uses a magnifying lens of focal length 10 cm. Then,

(A) Magnification of any value is possible

(B) Maximum magnification possible is 3.5

(C) Minimum magnification possible is 2.5

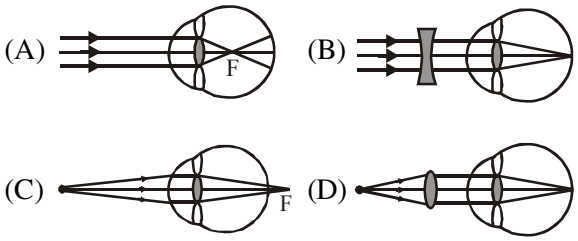
(D) Magnification depends upon the distance of the lens from the eye.

Select correct alternative.

(1) Only A, D (2) Only B, C

(3) Only B, C, D (4) Only A

115. Identify the wrong description of the given figures:-



(1) A represents far-sightedness

(2) B correction for short-sightedness

(3) C represents far-sightedness

(4) D correction for far-sightedness

116. A presbyopic patient has near point as 30 cm and far point as 40 cm. The dioptric power for the corrective lens for seeing distant objects is :-

(1) 40 (2) – 4 (3) –2.5 (4) –0.25

117. A telescope consists of two thin lenses of focal lengths 0.3 m and 3 cm, respectively. It is focussed on Moon which subtends an angle of 0.5° at the objective. Then, the angle subtended at the eye by the final image will be :

(1) 5° (2) 0.25° (3) 0.5° (4) 0.35°

118. An astronomical telescope in normal adjustment receives light from a distant source S. The tube length is now decreased slightly -

(1) A virtual image of S will be formed at a finite distance

(2) No image will be formed

(3) A small, real image of S will be formed behind the eyepiece, close to it

(4) A large, real image of S will be formed behind the eyepiece, far away from it

119. An astronomical telescope has objective and eye-piece lenses of power 0.5D and 20D, respectively. What will be its magnifying power for normal adjustment?

(1) 30 (2) 10

(3) 40 (4) 20

120. The image formed by an objective of a telescope is-

(1) virtual and diminished

(2) real and diminished

(3) real and enlarged

(4) virtual and enlarged

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	1	4	3	3	2	4	1	1	3	3	2	1	1	4	1	1	1	2	3
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	3	3	1	2	2	4	3	3	4	1	1	1	1	3	1	2	1	2	2
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	1	3	2	2	4	4	2	4	2	1	3	4	2	4	3	2	3	1	2	4
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	4	1	1	1	2	2	2	2	1	3	2	1	1	3	2	2	4	1	3	4
Que.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	3	3	2	3	2	4	2	4	4	3	1	3	3	4	4	4	2	3	2	1
Que.	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	3	2	1	2	3	4	3	1	3	2	4	3	3	3	1	3	1	1	3	2