Q.1 A ray of light traveling in water is incident on its surface open to air. The angle of incidence is θ, which is less than the critical angle. Then there will be

a) Only reflected ray and no refracted ray

b) Only a refracted ray and no reflected ray

c) A reflected ray and a refracted ray and the angle between them would be less than 180-2θ

d) A reflected ray and a refracted ray and the angle between them would be greater than 180-2θ

Q.2 When a ray of light enters a medium of RI n then it is observed that the angle of refraction is half the angle of incidence. The value of angle of incidence will be

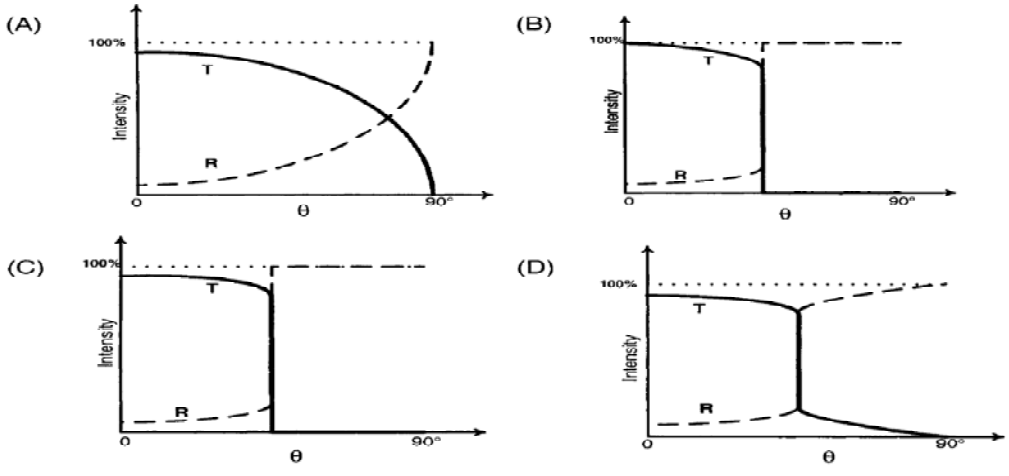
a. $2\sin^{-1}\left(\frac{n}{2}\right)$

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

c. $\cos^{-1}\left(\frac{n}{2}\right)$

d. $2\cos^{-1}\left(\frac{n}{2}\right)$

Q.3. A light ray traveling in a glass medium is incident on a glass –air interface at an angle of incidence θ. The reflected (R) and transmitted (T) intensities, both as function of θ, are plotted. The correct sketch is



Q.4 A biconvex lens of focal length 15 cm is in front of a plane mirror. The distance between the lens and the mirror is 10 cm. A small object is kept at a distance of 30 cm from the lens. The final image is

a) virtual and at a distance of 16 cm from the mirror

b) real and at a distance of 16 cm from the mirror

c) virtual and at a distance of 20 cm from the mirror

d) real and at a distance of 20 cm from the mirror

Q.5 A large glass slab (n=5/3) of thickness 8 cm is placed over a point source of light on a plane surface. It is seen that light emerges out of the top surface of the slab from a circular area of radius 'R' cm. What is value of R?

a) 4 cm

b) 6 cm

c) 8 cm

d) 5 cm

Q.6 A thin concave and a thin convex lenses are in contact. The ratio of the magnitude of power of two lenses is 2/3 and focal length of the combination is 30cm then focal lengths of individual lenses are

a. -15cm , 10cm

b. -75cm , 50cm

c. 75cm , -50cm

d. 75cm , 50cm

Q.7. A double convex lens of focal length 'f' is cut into 4 equivalent parts. One cut is perpendicular to the axis and the other is parallel to the principal axis. Focal length of each part is

a) f/2

b) 4f

c) f

d) 2f

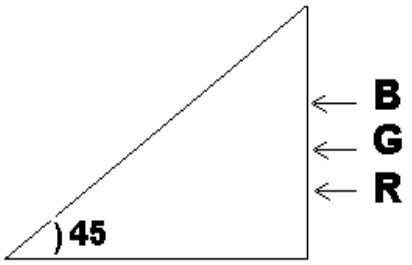
Q. 8. Fig shows a mixture of blue, green and red colour rays incident on the right angled prism. The critical angles of the material of the prim for red, green and blue colours are 46, 44 and 43 respectively. The arrangement will separate;

a) Red colour from green and blue

b) Blue colour from green and red

c) Green colour from red and blue

d) All the three colours



Q.9. An air bubble inside a glass slab (n=1.5) appears at 6cm when viewed from one side and 4 cm when viewed from opposite side. The thickness of the slab is

a) 10 cm

b) 6.67 cm

c) 15 cm

d) 12cm

Q.10. There is a dark spot just below a glass slab of refractive index 1.5 and of thickness 9cm. A beaker of water of refractive index 4/3 and containing of water of depth 12 cm is placed above the glass slab. When viewed vertically downwards, the dot appears to be at

a) 10.5 cm

b) 15 cm

c) 18 cm

d) 21 cm

Q.11. A graph of object distance *u* versus image distance *v* for a convex lens is

a) A straight line

b) a parabola

c) an ellipse

d) a rectangular hyperbola

Q.12. A convex lens of focal length f is immersed in water. Its focal length becomes (n_g=1.5 and n_w=1.33)

a) f

b) 2f

c) 4f

d) f/4

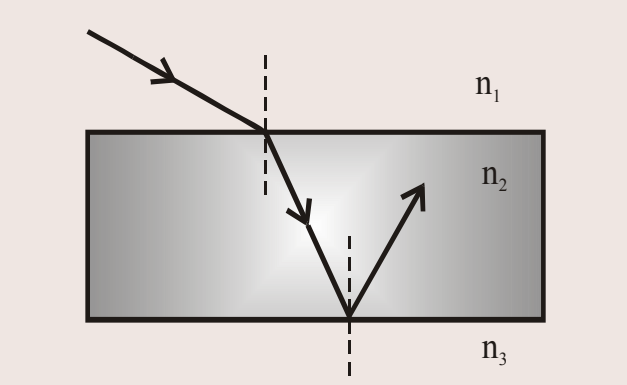
Q.13. Light travelling through three transparent substances follows the path shown in figure. Arrange the indices of refraction in order from smallest to largest. Note that total internal reflection does occur on the bottom surface of medium 2.

a) $n_1 < n_2 < n_3$

b) $n_2 < n_1 < n_3$

c) $n_1 < n_3 < n_2$

d) $n_3 < n_1 < n_2$



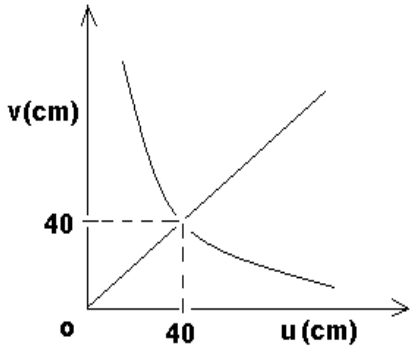
Q.14. The figure shows a graph of object distance u versus image distance v for a convex lens. The focal length of the lens is

a) 10 cm

b) 20 cm

c) 40 cm

d) 80 cm



Q.15. Suppose refractive index n is given as $n=A+B/\lambda^2$ where A and B are constants and λ is wavelength, then dimensions of B are same as that of

a) Wavelength

b) volume

c) pressure

d) area

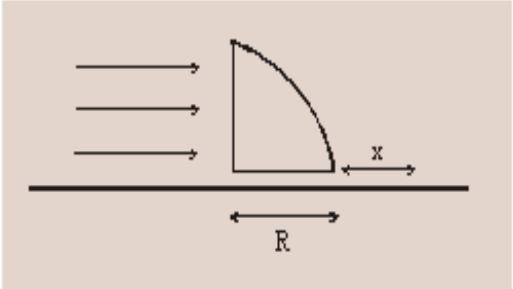
Q.16 A uniform, horizontal beam of light is incident upon a prism as shown. The prism is in the shape of a quarter cylinder, of radius R = 5 cm, and has RI n = 1.5. A patch on the table top for a distance x from the cylinder is un illuminated. The value of x is

a) 1.71 cm

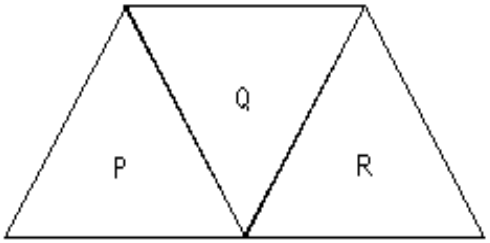
b) 2.24 cm

c) 2.50 cm

d) 10.0 cm



Q.17 A given ray of light suffers minimum deviation in an equilateral prism P. Additional prisms Q and R of identical shape and material are now added to P, as shown in the figure. The ray will suffer



a) same deviation

b) greater deviation

c) total internal reflection

d) no deviation

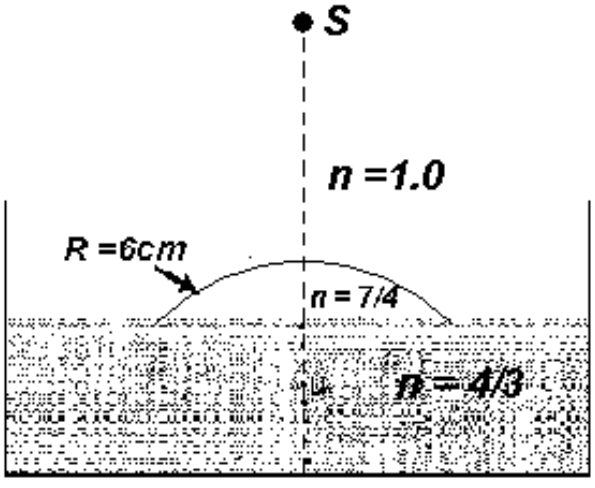
Q. 18 Water (with refractive index =4/3) in a tank is 18cm deep. Oil of refractive index (7/4) lies on water making a convex surface of radius of curvature 'R= 6cm' as shown. Consider oil to act as a thin lens. An object 'S' is placed 24cm above water surface. The location of its image is at 'x' cm above the bottom of the tank. Then 'x' is

a) 2cm

b) 18cm

c) 21cm

d) 4ccm



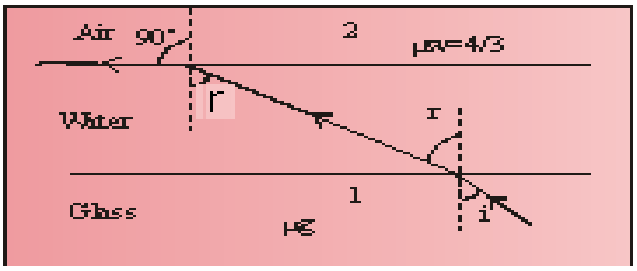
Q.19. A ray of light is incident at the glass water interface at an angle i, it emerges finally parallel to the surface of water. Then the value of n_g would be

a) $\frac{4}{3}\sin i$

b) $\frac{1}{\sin i}$

c) $\frac{4}{3}$

d) 1



Q.20 Glass has RI n with respect to air and the critical angle for a ray of light going from glass to air is θ. If a ray of light is incident from air on the glass with angle of incidence θ, the corresponding angle of refraction is

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

b) 90°

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

d) $\sin^{-1}\left(\frac{1}{n}\right)$

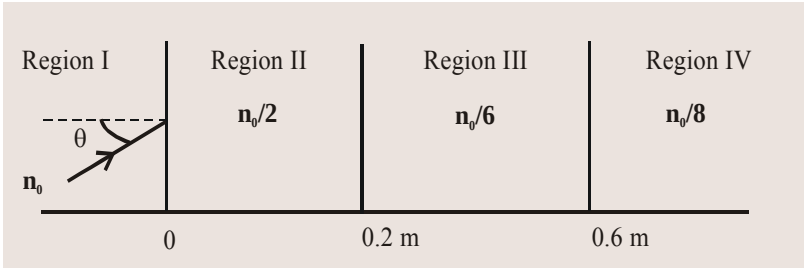
Q.21 A light beam is travelling from region I to region IV (refer fig). The R.I in regions I, II, III and IV are n_o, $\frac{n_o}{2}$, $\frac{n_o}{6}$, and $\frac{n_o}{8}$ respectively. The angle of incidence θ for which the beam just misses entering region IV is

a. $\sin^{-1}\left(\frac{3}{4}\right)$

b. $\sin^{-1}\left(\frac{1}{8}\right)$

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

d. $\sin^{-1}\left(\frac{1}{4}\right)$



Q.22. A ray of light passes normally through a slab (n = 1.5) of thickness t. If the speed of light in vacuum is c then time taken by the ray to go across the slab will be;

a) $\frac{t}{c}$ b) $\frac{3t}{2c}$

b) $\frac{2t}{3c}$ d) $\frac{4t}{9c}$

Q.23 A glass slab of thickness 4cm contains the same number of waves as 5 cm of water when both are traversed by the same monochromatic light. If the refractive index of water is 4/3, what is the refractive index of glass?

a) 5/3

b) 5/4

c) 16/15

d) 1.5

Q.24A convex lens placed at a distance of 0.1m from an object produces a magnified image on the screen. Without disturbing the object or the screen, the lens is moved by 0.2 m, towards the screen and a diminished image is formed on the screen. The focal length of the lens must be

a) 15 cm

b) 20 cm

c) 7.5 cm

d) 10 cm

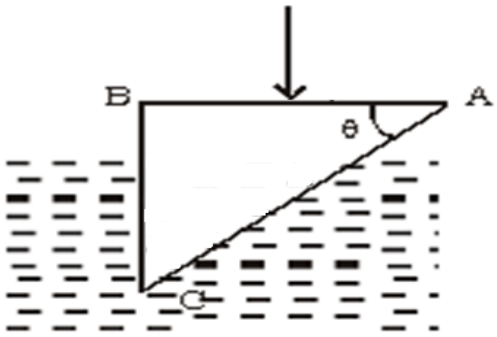
Q.25 A glass prism ABC of refractive index 1.5 is immersed in water of RI =4/3 as shown in fig. A ray of light incident normally on face AB is totally internally reflected at face AC if

a. $\sin\theta \geq \frac{8}{9}$

b. $\sin\theta \leq \frac{8}{9}$

c. $\sin\theta = \sqrt{\frac{3}{2}}$

d) $\frac{2}{3} < \sin\theta < \frac{8}{9}$



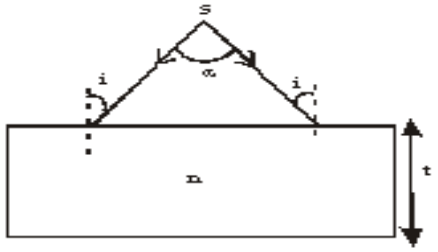
Q.26 A diverging beam of light from a point source S having divergence angle α, falls symmetrically on a glass slab as shown. The angles of incidence of the two extreme rays are equal. If the thickness of the glass slab is t and the refractive index n, then the divergence angle of the emergent beam is

a. zero

b. α

c. $\sin^{-1}\left(\frac{1}{n}\right)$

d. $2\sin^{-1}\left(\frac{1}{n}\right)$



Q.27 How much water should be filled in a container 15cm in height, so that it appears half filled when viewed from the top of the container? Given RI of water = 4/3.

6.0cm

b) 7.5 cm

c) 8.0 cm

d)10.0 cm

Q.28 If eye is kept at a depth h inside water of RI n and viewed outside, then the diameter of the circle through which the outer objects become visible, will be

a) $\frac{h}{\sqrt{n^2-1}}$

b) $\frac{h}{\sqrt{n^2+1}}$

c) $\frac{2h}{\sqrt{n^2-1}}$

d) $\frac{h}{\sqrt{n^2}}$

Q.29 A small fish, 0.4 m below the surface of a lake, is viewed through a simple converging lens of focal length 3m. The lens is kept at 0.2 m above the water surface such that the fish lies on the optical axis of the lens. Find the distance of the image of the fish as seen by the observer ($n_w = 4/3$)

a) – 0.6 m b. –1m

c. + 0.6m d. 0.2m

Q.30 A hallow double concave lens is made of very thin transparent material. It can be filled with air or either of two liquids L_1 or L_2 having refractive indices n_1 and n_2 respectively ($n_2 > n_1 > 1$). The lens will diverge a parallel beam of light if it is filled with

a. air and placed in air

b. air and immersed in L_1

c. L_1 and immersed in L_2

d. L_2 and immersed in L_1

Q.31 The sun's diameter is 1.4×10^9m and its distance from the earth is 10^{11}m. The diameter of its image, formed by a convex lens of focal length 2m will be

a) 0.7cm

b) 1.4cm

c) 2.8cm

d) Zero(i.e. point image)

Q.32 A swimmer under water observes a bird to be at a height of 0.3m above water. If the refractive index of water is 4/3, the actual distance of the bird above the water surface is

a) 0.225 m

b) 0.3 m

c) c. 0.15 m

d) 0.4 m

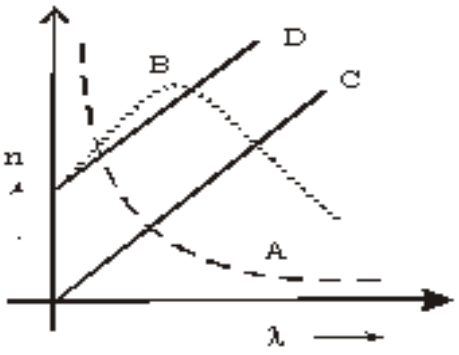
Q.33 The correct curve between refractive index n and wavelength λ will be

a) A

b) D

c) B

d) C



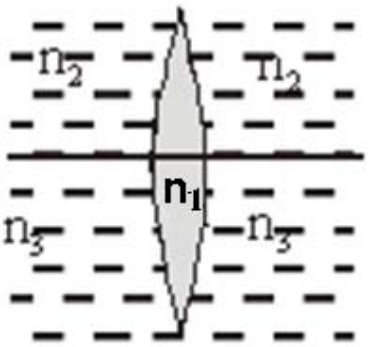
Q. 34 A double convex lens, made of a material of RI n_1, is placed inside two liquids of RI's n_2 and n_3, as shown in the figure. $n_2 > n_1 > n_3$. A wide parallel beam of light is incident on the lens from the left. The lens will give rise to

1) A single convergent beam

2) two different convergent beams

3) Two different divergent beams

4) a convergent and divergent beam



Q.35 A convex lens of refractive index n behaves as a convex lens of smaller power in a liquid of refractive index n_1 and as a concave lens in another liquid of refractive index n_2. Then relation between n , n_1, and n_2, is :

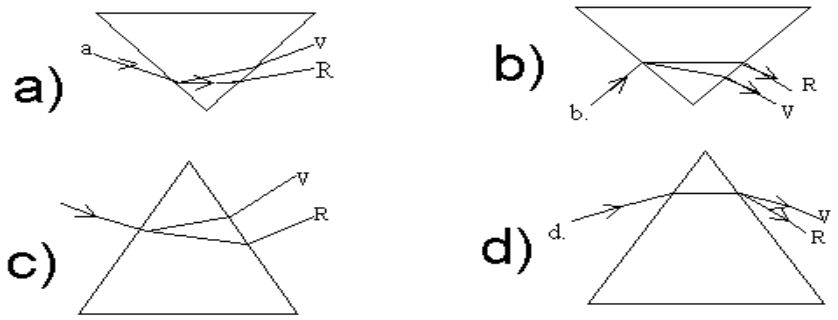
1) $n = n_1 = n_2$

2) $n > n_1 > n_2$

3) $n_2 > n > n_1$

4) $n_2 < n < n_1$

Q.36 Which of the following diagrams shows correctly the dispersion of white light by a prism?



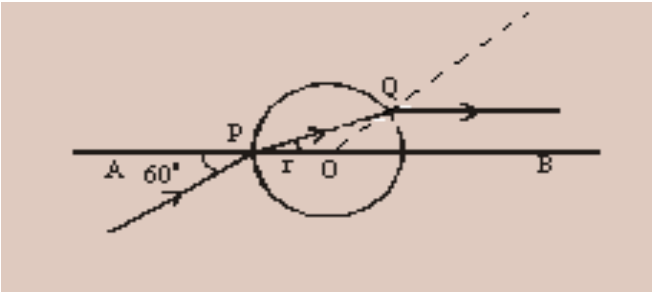
Q.37. Light is incident at 60^0 on a transparent sphere and emerges parallel to AOB. The index of refraction of the material of the sphere is

a) $2\sqrt{3}$

b) $\sqrt{3}$

c) $3\sqrt{2}$

d) $\sqrt{2}$



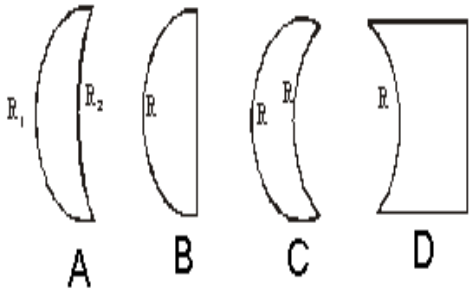
Q.38 Which one of the following spherical lenses does not exhibit dispersion? The radii of curvature of the surfaces of the lenses are as given in the diagrams.

a) A

b) B

c) C

d) D



Q.39 A water drop is placed on a glass plate. A convex lens of radii of curvature 0.2 m is placed on it. The focal length of the water lens is (RI of water = 4/3)

a) – 0.2 m

b) +0.6 m

c) – 0.6 m

d) +0.2 m

Q.40 A ray of light is incident normally on one of the faces of a prism of apex angle 30^0 and RI $\sqrt{2}$. The angle of deviation of the ray is

a) 0^0

b) 12.5^0

c) 15^0

d) 22.5^0

Q.41 Which of the following inequalities is satisfied by the angle of incidence i and RI n of the prism for total internal reflection

a. $\sin i > n$

b. $\sin i < n$

c. $n > \frac{1}{\sin i}$

d. $n < \frac{1}{\sin i}$

Q.42 A ray of light travelling in a transparent medium falls on a surface separating the medium from air, at an angle of incidence of 45^0. The ray undergoes total internal reflection. If n is the refractive index of the medium with respect to air, select the possible values of n from the following

a) 1.3

b) 1.41

c) 1.2

d) 1.6

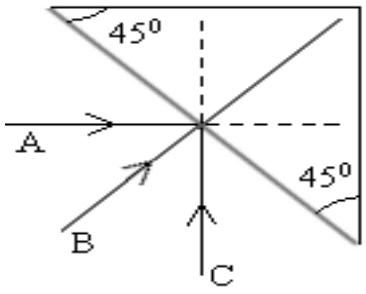
Q.43 On a right angled prism, the rays A,B and C are incident, as shown in the figure. Before emerging from the prism, which ray or rays will experience total internal reflection?

a) A

b) B

c) C

d) none of these



Q.44 If a glass rod is put in a beaker containing a colourless liquid, the glass rod immediately seems to disappear. It is so because

a) the liquid and the glass have the same colour

b) the glass and the liquid have the same refractive index

c) the glass and the liquid have the same density

d) the glass reflects the light transmitted by the liquid

Q.45 When light is refracted through a prism, maximum deviation occurs if,

a) the ray incident grazing the first face

b) the ray emerges out grazing its second face

c) either of the above happens

d) The angle of incidence is 45°

Q.46 If the RI of the material of a prism is cot(A/2)
and the angle of prism is A, then angle of minimum deviation is

a. $\pi - 2A$

b. $\pi - A$

c. $\frac{\pi}{2} - 2A$

d. $\frac{\pi}{2} - A$

Q.47 Two optical media of refractive indices n_1 and n_2 contain x and y waves of the same colour in the same thickness. Then their relative refractive index $_1n_2$ is equal to

a) (y – x) / x

b) x / (y – x)

c) x – y

d) y / x

Q.48 A convex lens produces a real image m times the size of the object. What is the distance of the object from the lens?

a. $f\frac{m+1}{m}$

b. $f\frac{m-1}{m}$

c. $f(m-1)$

d. $f(m+1)$

Q.49 A convex lens of focal length f_1 is put in contact with a concave lens of focal length f_2. The combination which will behave as a converging lens if

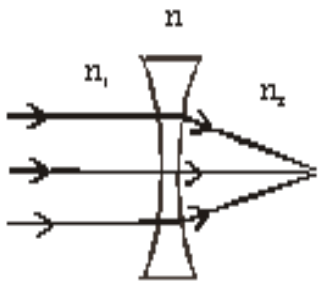
a. $f_1 > f_2$

b. $f_1 = f_2$

c. $\frac{1}{f_1} > \frac{1}{f_2}$

d. $f_1 = \frac{1}{f_2}$

Q.50 Rays of light are incident on a concave lens of refractive index n from a medium of refractive index n_1. After refraction it converges in a medium of refractive index n_2 (fig). The relation between n_1, n_2 and n is



1) $n_1 = n < n_2$
2) $n_1 = n > n_2$
3) $n_1 < n = n_2$
4) $n_1 > n = n_2$

Q 51. Two beams of red and violate colours are to pass separately through a prism (angle of prism is 60˚). In the position of minimum deviation, the angle of refraction will be

a) 30˚ for both colours
b) Greater for the violate colour
c) Greater for the red colour
d) Equal but not 30˚ for both the colours

Q.52 Light passing from air to glass is refracted, as is light passing from glass to air. However when you look out of a window at the view outside, the light does not seem to have been distorted. This is because

a) the angle of refraction is too small to observe
b) light incident upon the glass is partially reflected and this tends to mask the effect of refraction
c) the emergent ray is parallel to the incident ray and only displacement occurs
d) the window panel is too thin for refraction to occur

Q.53 A camera is focused to take the picture of a girl standing 2m away from the camera lens. If the film is 10cm from the lens, the focal length of the lens expressed in cm is

a) 20
b) 9.5
c) 200

d) 10.0

Q.54 Two Plano-convex lenses, each having focal length of 0.4 m are pressed against each other at their plane faces. This forms a double convex lens. At what distance from this lens must an object be placed to obtain a real, inverted image with magnification one?

a) 0.8 m

b) 0.4 m

c) 0.2 m

d) 1.6 m

Q.55 The velocity of light in a piece of matter is v. The thickness of the piece is t and its refractive index is n. The distance travelled by light in air in time (t/v) is

a) nt

b) nt^2

c) nt^3

d) nt^4

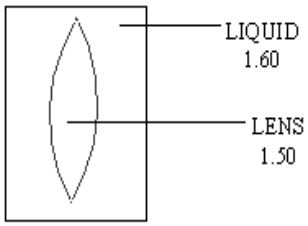
Q.56 The figure shows a convergent lens placed inside a cell filled with a liquid. The lens has a focal length +20 cm, when in air and its material has refractive index 1.5. if the liquid has a refractive index 1.6, the focal length of the system is

a) +80 cm

b) –80 cm

c) –24 cm

d) –160 cm



Q.57 A boat has green light (with wavelength λ = 500 nm) on its mast. What wavelength would be measured and what colour would be observed for this light as seen by a diver submerged in water (RI = 1.33) by the side of the boat?

a) Green λ = 500 nm

b) Red λ = 665 nm

c) Green λ = 376 nm

d) UV λ =376 nm

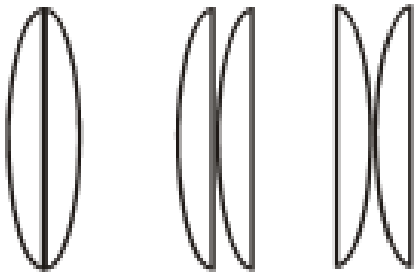
Q.58 Two similar Plano -convex lenses are combined as shown in the figure. The ratio of their focal lengths will be

a) 2 : 1 : 1

b) 1 : 1 : 1

c) 2 : 1 : 2

d) 1 : 2 : 2



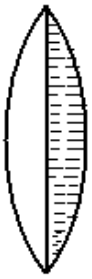
Q.59 The layered lens shown in fig. is made of two kinds of glass. A point source of light is placed on its principal axis. If reflections from the boundaries between layers are ignored, the lens will form

a) Only one image

b) Two images

c) No image at all

d) Infinite image



Q.60 A double convex lens of focal length 'f' is cut into 4 equivalent parts. Both the cuts are mutually perpendicular and parallel to the principal axis. Focal length of each part is

a) f/2

b) f

c) 2f

d) 4f

Q.61 A thin lens has focal length f, and its aperture has diameter d. It forms an image of intensity I. Now, the central part of the aperture up to diameter d/2 is blocked by an opaque paper. The focal length and image intensity will change to

a) f/2 and I/2

b) f and I/4

c) 3f/4 and I/2

d) f and 3I/4

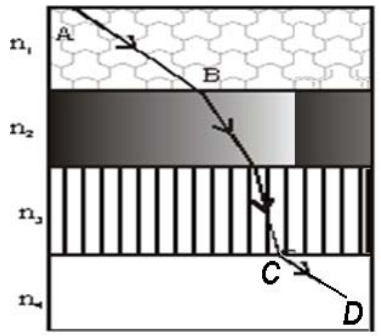
Q.62 A ray of light passes through four transparent media with refractive indices n_1, n_2, n_3 and n_4 as shown in the figure. The surfaces of all media are parallel. If the emergent ray CD is parallel to the incident ray AB, we have

a) $n_1 = n_2$

b) $n_2 = n_3$

c) $n_3 = n_4$

d) $n_4 = n_1$



Q.63 For which of the following dispersive power is zero?

1) lens

2) slab

3) prism

4) none of these

Q.64 A ray of light is incident on a glass slab of thickness t, at an angle i, r is the angle of refraction in the glass slab. Distance travelled in the glass slab is

a) tcosr

b) t tanr

c) t / cosr

d) t / sinr