Q1. 21 January Shift 1

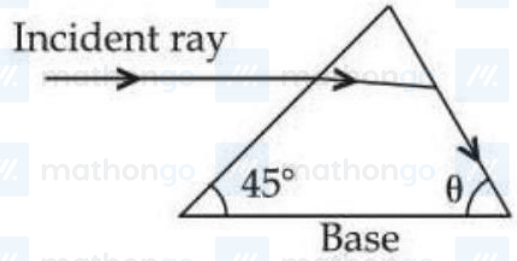
A collimated beam of light of diameter 2 mm is propagating along x-axis. The beam is required to be expanded in a collimated beam of diameter 14 mm using a system of two convex lenses. If first lens has focal length 40 mm, then the focal length of second lens is ____ mm.

Q2. 21 January Shift 1

In a microscope the objective is having focal length $f_o = 2$ cm and eye-piece is having focal length $f_e = 4$ cm. The tube length is 32 cm. The magnification produced by this microscope for normal adjustment is ____.

Q3. 21 January Shift 2

As shown in the diagram, when the incident ray is parallel to base of the prism, the emergent ray grazes along the second surface.



If refractive index of the material of prism is $\sqrt{2}$, the angle θ of prism is.

(1) 60° (2) 45° (3) 90° (4) 75°

Q4. 22 January Shift 1

Consider an equilateral prism (refractive index $\sqrt{2}$). A ray of light is incident on its one surface at a certain angle i. If the emergent ray is found to graze along the other surface then the angle of refraction at the incident surface is close to ____.

(1) 20° (2) 15° (3) 40° (4) 30°

Q5. 22 January Shift 1

A thin convex lens of focal length 5 cm and a thin concave lens of focal length 4 cm are combined together (without any gap) and this combination has magnification m_1 when an object is placed 10 cm before the convex lens. Keeping the positions of convex lens and object undisturbed a gap of 1 cm is introduced between the lenses by moving the concave lens away, which lead to a change in magnification of total lens system to m_2. The value of $\left|\frac{m_1}{m_2}\right|$ is ____.

(1) $\frac{5}{9}$ (2) $\frac{5}{27}$ (3) $\frac{3}{2}$ (4) $\frac{25}{27}$

Q6. 22 January Shift 1

A parallel beam of light travelling in air (refractive index 1.0) is incident on a convex spherical glass surface of radius of curvature 50 cm. Refractive index of glass is 1.5. The rays converge to a point at a distance x cm from the centre of the curvature of the spherical surface. The value of x is ____ cm.

Q7. 22 January Shift 2

In parallax method for the determination of focal length of a concave mirror, the object should always be placed:

(1) between the focus (F) and the centre of curvature (C) of the mirror ONLY

(2) between the pole(P) and the focus (F) of the concave mirror ONLY

(3) beyond the centre of the curvature (C) of the mirror ONLY

(4) at any point beyond the focus (F) of the mirror

Q8. 22 January Shift 2

The wavelength of light, while it is passing through water is 540 nm. The refractive index of water is $4/3$. The wavelength of the same light when it is passing through a transparent medium having refractive index of $3/2$ is ____ nm.

(1) 540 (2) 480 (3) 840 (4) 380

Q9. 23 January Shift 1

A thin prism with angle 5° of refractive index 1.72 is combined with another prism of refractive index 1.9 to produce dispersion without deviation. The angle of second prism is ____.

(1) 6° (2) 4.5° (3) 4° (4) 5°

Q10. 23 January Shift 1

Consider light travelling from a medium A to medium B separated by a plane interface. If the light undergoes total internal reflection during its travel from medium A to B and the speed of light in media A and B are 2.4×10^8 m/s and 2.7×10^8 m/s, respectively, then the value of critical angle is :

(1) $\cos^{-1}\left(\frac{8}{9}\right)$ (2) $\sin^{-1}\left(\frac{9}{8}\right)$ (3) $\cot^{-1}\left(\frac{3}{\sqrt{13}}\right)$ (4) $\tan^{-1}\left(\frac{8}{\sqrt{17}}\right)$

Q11. 23 January Shift 2

A prism of angle 75° and refractive index $\sqrt{3}$ is coated with thin film of refractive index 1.5 only at the back exit surface. To have total internal reflection at the back exit surface the incident angle must be ____

($\sin 15^\circ = 0.25$ and $\sin 25^\circ = 0.43$)

(1) 15° (2) $> 25^\circ$

(3) between 15° and 20° (4) $< 15^\circ$

Q12. 23 January Shift 2

The size of the images of an object, formed by a thin lens are equal when the object is placed at two different positions 8 cm and 24 cm from the lens. The focal length of the lens is ____ cm.

Q13. 24 January Shift 1

The exit surface of a prism with refractive index n is coated with a material having refractive index $\frac{n}{2}$. When this prism is set for minimum angle of deviation, it exactly meets the condition of critical angle. The prism angle is ____ .

(1) 30° (2) 15° (3) 45° (4) 60°

Q14. 24 January Shift 1

In a microscope of tube length 10 cm two convex lenses are arranged with focal length of 2 cm and 5 cm. Total magnification obtained with this system for normal adjustment is $(5)^k$. The value of k is ____.

(1) 3.5 (2) 2 (3) 4 (4) 5

Q15. 24 January Shift 2

Distance between an object and three times magnified real image is 40 cm. The focal length of the mirror used is ____ cm.

(1) $-15/2$ (2) -15 (3) -10 (4) -20

Q16. 24 January Shift 2

Five persons P_1, P_2, P_3, P_4 and P_5 recorded object distance (u) and image distance (v) using same convex lens having power +5 D as $(25, 96), (30, 62), (35, 37), (45, 35)$ and $(50, 32)$ respectively. Identify correct statement

(1) Readings recorded by P_3 and P_2 persons are incorrect

(2) Readings recorded by P_4 and P_5 persons are incorrect

(3) Readings recorded by all persons are correct

(4) Readings recorded by P_3 person are incorrect

Q17. 28 January Shift 1

The magnitudes of power of a biconvex lens (refractive index 1.5) and that of a plano-concave lens (refractive index $= 1.7$) are same. If the curvature of planoconcave lens exactly matches with the curvature of back surface of the biconvex lens, then ratio of radius of curvature of front and back surface of the biconvex lens is ____.

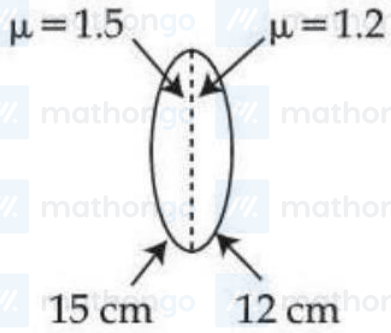
(1) 5 : 12 (2) 12 : 5 (3) 5 : 2 (4) 2 : 5

Q18. 28 January Shift 1

A convex lens of refractive index 1.5 and focal length $f = 18$ cm is immersed in water. The difference in focal lengths of the given lens when it is in water and in air is $\alpha \times$ f. The value of α is ____.
(refractive index of water $= 4/3$)

Q19. 28 January Shift 2

A biconvex lens is formed by using two thin planoconvex lenses, as shown in the figure. The refractive index and radius of curved surfaces are also mentioned in figure. When an object is placed on the left side of lens at a distance of 30 cm from the biconvex lens, the magnification of the image will be :



(1) -2 (2) +2.5 (3) -2.5 (4) +2

Q20. 28 January Shift 2

For a transparent prism, if the angle of minimum deviation is equal to its refracting angle, the refractive index n of the prism satisfies.
(1) $1 < n < 2$ (2) $\sqrt{2} < n < 2\sqrt{2}$ (3) $\sqrt{2} < n < 2$ (4) $n \geqslant 2$

ANSWER KEYS

1. 280	**2.** 100	**3.** (1)	**4.** (2)	**5.** (Dropped)	**6.** 100	**7.** (4)	**8.** (2)
9. (2)	**10.** (4)	**11.** (1, 3, 4)	**12.** 16	**13.** (4)	**14.** (2)	**15.** (2)	**16.** (4)
17. (3)	**18.** 3	**19.** (1)	**20.** (3)				