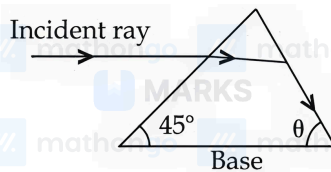


Q1. JEE Main 2026 (21 January Shift 2)

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°

Q2. JEE Main 2026 (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°

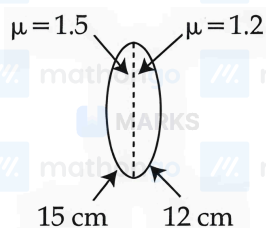
Q3. JEE Main 2026 (23 January Shift 1)

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) $\tan^{-1}\left(\frac{8}{\sqrt{17}}\right)$

Q4. JEE Main 2026 (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

Q5. JEE Main 2026 (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) $n \geq 2$

Q6. JEE Main 2026 (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

Q7. JEE Main 2026 (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

Q8. JEE Main 2026 (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

Q9. JEE Main 2026 (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

Q10. JEE Main 2026 (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°

Q11. JEE Main 2026 (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) None of the above

Q12. JEE Main 2026 (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.

Q13. JEE Main 2026 (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) Both (1) & (3)

Q14. JEE Main 2026 (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.

Q15. JEE Main 2026 (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.

Q16. JEE Main 2026 (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 ____.

Q17. JEE Main 2026 (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. JEE Main 2026 (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. JEE Main 2026 (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°

Q20. JEE Main 2026 (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

ANSWERS AND SOLUTIONS

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

1. (1) From the geometry of the prism, the angle of the prism is $A = 180^\circ - (45^\circ + \theta)$.

The incident ray is parallel to the base, so the angle of incidence i at the first surface is equal to the base angle 45° . Thus, $i = 45^\circ$.

Applying Snell's law at the first surface: $1 \cdot \sin(45^\circ) = \mu \sin(r_1)$.

Given $\mu = \sqrt{2}$, we have $\frac{1}{\sqrt{2}} = \sqrt{2} \sin(r_1) \implies \sin(r_1) = \frac{1}{2} \implies r_1 = 30^\circ$.

At the second surface, the emergent ray grazes the surface, so the angle of emergence $e = 90^\circ$.

Applying Snell's law at the second surface: $\mu \sin(r_2) = 1 \cdot \sin(90^\circ)$.

$\sqrt{2} \sin(r_2) = 1 \implies \sin(r_2) = \frac{1}{\sqrt{2}} \implies r_2 = 45^\circ$.

The relation between prism angle and internal angles is $A = r_1 + r_2$.

$A = 30^\circ + 45^\circ = 75^\circ$.

Substituting A in the first equation: $75^\circ = 180^\circ - (45^\circ + \theta)$.

$75^\circ = 135^\circ - \theta \implies \theta = 135^\circ - 75^\circ = 60^\circ$.

2. (3) For dispersion without deviation, the condition is $(\mu_1 - 1)A_1 + (\mu_2 - 1)A_2 = 0$.

Substituting values: $(1.72 - 1) \times 5 + (1.9 - 1) \times A_2 = 0$

$0.72 \times 5 + 0.9 \times A_2 = 0$

$3.6 + 0.9A_2 = 0$

$A_2 = -4^\circ$

The magnitude of the second prism angle is 4° .

3. (4) The refractive index of a medium is inversely proportional to the speed of light in that medium, given by

$$n = \frac{c}{v}.$$

For light travelling from medium A to medium B , the critical angle θ_c is defined when light travels from a denser to a rarer medium.

Given speeds are $v_A = 2.4 \times 10^8$ m/s and $v_B = 2.7 \times 10^8$ m/s.

The refractive indices are $n_A = \frac{c}{v_A}$ and $n_B = \frac{c}{v_B}$.

The critical angle θ_c is given by $\sin \theta_c = \frac{n_B}{n_A} = \frac{v_A}{v_B}$.

Substituting the values: $\sin \theta_c = \frac{2.4 \times 10^8}{2.7 \times 10^8} = \frac{24}{27} = \frac{8}{9}$.

To find the value in terms of $\tan^{-1}$, we use the trigonometric identity for a right-angled triangle where perpendicular $p = 8$ and hypotenuse $h = 9$.

The base $b = \sqrt{h^2 - p^2} = \sqrt{9^2 - 8^2} = \sqrt{81 - 64} = \sqrt{17}$.

$$\text{Thus, } \tan \theta_c = \frac{p}{b} = \frac{8}{\sqrt{17}}.$$

$$\text{Therefore, } \theta_c = \tan^{-1}\left(\frac{8}{\sqrt{17}}\right).$$

4. (1) The biconvex lens is a combination of two thin plano-convex lenses in contact.

For the first plano-convex lens: $\mu_1 = 1.5$, $R_1 = 15$ cm, $R_2 = \infty$.

Using lens maker's formula:

$$\frac{1}{f_1} = (\mu_1 - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$= (1.5 - 1) \left(\frac{1}{15} - \frac{1}{\infty} \right)$$

$$= 0.5 \times \frac{1}{15} = \frac{1}{30} \text{ cm}^{-1}.$$

For the second plano-convex lens:

$$\mu_2 = 1.2, R_1 = \infty, R_2 = -12 \text{ cm}.$$

Using lens maker's formula:

$$\frac{1}{f_2} = (\mu_2 - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$= (1.2 - 1) \left(\frac{1}{\infty} - \frac{1}{-12} \right)$$

$$= 0.2 \times \frac{1}{12} = \frac{1}{60} \text{ cm}^{-1}.$$

The equivalent focal length F of the combination is given by:

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{30} + \frac{1}{60}$$

$$= \frac{2+1}{60} = \frac{3}{60} = \frac{1}{20} \text{ cm}^{-1}.$$

Thus, $F = 20$ cm.

Given object distance $u = -30$ cm. Using the lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{F}$:

$$\frac{1}{v} - \frac{1}{-30} = \frac{1}{20}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{20} - \frac{1}{30} = \frac{3-2}{60} = \frac{1}{60}.$$

So, $v = 60$ cm.

$$\text{Magnification } m = \frac{v}{u} = \frac{60}{-30} = -2.$$

5. (3) At minimum deviation, $\delta_m = A$ (angle of minimum deviation equals prism angle). The refractive index formula becomes:

$$n = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin\left(\frac{2A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin A}{\sin\left(\frac{A}{2}\right)}$$

$$\text{Using } \sin A = 2 \sin\left(\frac{A}{2}\right) \cos\left(\frac{A}{2}\right):$$

$$n = \frac{2 \sin\left(\frac{A}{2}\right) \cos\left(\frac{A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = 2 \cos\left(\frac{A}{2}\right)$$

For a physical prism, $0 < A < 90^\circ$, so $45^\circ < \frac{A}{2} < 90^\circ$, giving $0 < \cos\left(\frac{A}{2}\right) < \frac{1}{\sqrt{2}}$.

Therefore, $1 < n < \sqrt{2} \cdot 2 = 2\sqrt{2}$. However, more precisely, $\sqrt{2} < n < 2$.

6. (2) For a mirror with magnification $m = -3$ (real image), object and image distances satisfy $|u| + |v| = 40$ cm.

Since $m = v/u = -3$, we have $v = -3u$, giving $u + 3u = 40$, so $u = 10$ cm and $v = -30$ cm.

Using mirror formula: $\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = \frac{1}{10} + \frac{1}{-30} = \frac{3-1}{30} = \frac{1}{15}$

Hence $f = -15$ cm.

7. (4) For a convex lens with power $P = +5$ D, the focal length is $f = 20$ cm.

The lens formula is $\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = 0.05 \text{ cm}^{-1}$. Checking each measurement:

$$P_1: \frac{1}{25} + \frac{1}{96} = 0.0504 \text{ Correct;}$$

$$P_2: \frac{1}{30} + \frac{1}{62} = 0.0494 \text{ Correct;}$$

$$P_3: \frac{1}{35} + \frac{1}{37} = 0.0556 \text{ Incorrect;}$$

$$P_4: \frac{1}{45} + \frac{1}{35} = 0.0508 \text{ Correct;}$$

$$P_5: \frac{1}{50} + \frac{1}{32} = 0.0512 \text{ Correct.}$$

Only P_3 's readings do not satisfy the lens formula.

8. (4) In the parallax method for determining the focal length of a concave mirror, we use an object pin and its real image formed by the mirror.

The method of 'no parallax' involves aligning the tip of the object pin with the tip of its real image. This is only possible if the image formed is real.

For a concave mirror, a real image is formed only when the object is placed at any position beyond the focus (F), i.e., $u > f$.

If the object is placed between the pole (P) and the focus (F), the image formed is virtual, and it cannot be caught on a screen or used for the standard parallax alignment with a physical pin in front of the mirror.

Therefore, the object should be placed at any point beyond the focus (F) of the mirror to ensure a real image is formed.

9. (2) Frequency of light is constant in all media.

In water with refractive index $4/3$, wavelength is 540 nm.

The wavelength in vacuum is $\lambda_0 = 540 \times \frac{4}{3} = 720$ nm.

In a medium with refractive index $3/2$, the wavelength is $\lambda = \frac{720}{3/2} = 720 \times \frac{2}{3} = 480$ nm.

10. (2) Given an equilateral prism, the angle of the prism is $A = 60^\circ$.

The refractive index of the prism is $\mu = \sqrt{2}$.

The emergent ray grazes the second surface, which means the angle of emergence is $e = 90^\circ$.

Applying Snell's law at the second surface: $\mu \sin(r_2) = 1 \cdot \sin(e)$.

$$\sqrt{2} \sin(r_2) = \sin(90^\circ) = 1.$$

$$\sin(r_2) = \frac{1}{\sqrt{2}}, \text{ which gives } r_2 = 45^\circ.$$

For a prism, we know the relation $r_1 + r_2 = A$.

Substituting the values: $r_1 + 45^\circ = 60^\circ$.

$$r_1 = 60^\circ - 45^\circ = 15^\circ.$$

The angle of refraction at the incident surface is $r_1 = 15^\circ$.

11. (4) This question has been dropped by NTA.

12. (100) For refraction at a single spherical surface, we use the formula: $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$

Given data:

Refractive index of air $\mu_1 = 1.0$

Refractive index of glass $\mu_2 = 1.5$

Radius of curvature $R = +50$ cm (convex surface)

Object is at infinity for a parallel beam, so $u = -\infty$

Substituting the values:

$$\frac{1.5}{v} - \frac{1.0}{-\infty} = \frac{1.5 - 1.0}{50}$$

$$\frac{1.5}{v} - 0 = \frac{0.5}{50}$$

$$\frac{1.5}{v} = \frac{1}{100}$$

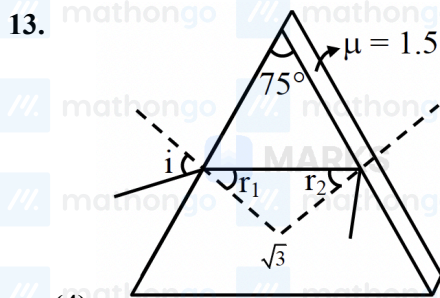
$$v = 1.5 \times 100 = 150 \text{ cm}$$

The image is formed at a distance of 150 cm from the pole (vertex) of the spherical surface.

The question asks for the distance x from the centre of curvature.

Distance from centre of curvature $x = |v - R|$

$$x = 150 - 50 = 100 \text{ cm}$$



(4)

$$r_1 + r_2 = 75^\circ$$

For T I R at back surface

$$\sqrt{3} \sin r_2 = \frac{3}{2} \sin 90^\circ$$

$$r_2 \geq 60^\circ$$

$$r_1 \leq 15^\circ$$

$$1 \cdot \sin i = \sqrt{3} \sin 15^\circ$$

$$\sin i = 1.73 \times 0.25$$

$$\sin i = 0.433$$

$$i = 25^\circ \Rightarrow i < 25^\circ$$

14. (16) The magnification of a thin lens is given by $m = \frac{f}{f+u}$.

Given that the size of the images is equal for two different object positions, the magnitudes of the magnifications must be equal: $|m_1| = |m_2|$.

For a single lens to produce images of the same size at two different object distances, one image must be real and the other must be virtual.

Let $u_1 = -8$ cm and $u_2 = -24$ cm.

Then, $m_1 = -m_2$ (since one is real and one is virtual).

$$\frac{f}{f+u_1} = -\frac{f}{f+u_2}$$

$$\frac{1}{f-8} = -\frac{1}{f-24}$$

$$f - 24 = -(f - 8)$$

$$f - 24 = -f + 8$$

$$2f = 32$$

$$f = 16 \text{ cm.}$$

The focal length of the lens is 16 cm.

15. (280) For beam expander using two convex lenses:

$$\text{Magnification} = \frac{d_2}{d_1} = \frac{f_2}{f_1}$$

$$\frac{14}{2} = \frac{f_2}{40}$$

$$f_2 = 7 \times 40 = 280 \text{ mm}$$

16. (100) For microscope at normal adjustment:

$$M = \frac{L}{f_o} \times \frac{D}{f_e}$$

where $L = 32$ cm, $f_o = 2$ cm, $f_e = 4$ cm, $D = 25$ cm

$$M = \frac{32}{2} \times \frac{25}{4} = 16 \times 6.25 = 100$$

17. (3) Let R_1 and R_2 be the radii of the front and back surfaces of the biconvex lens. The power of the biconvex lens is $P_1 = (1.5 - 1) \left(\frac{1}{R_1} + \frac{1}{R_2} \right) = 0.5 \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$.

The plano-concave lens has a flat surface and a concave surface of radius R_2 (matching the back surface of the biconvex lens). Its power is $P_2 = (1.7 - 1) \left(\frac{1}{R_2} \right) = \frac{0.7}{R_2}$.

Since the magnitudes of power are equal: $0.5 \left(\frac{1}{R_1} + \frac{1}{R_2} \right) = \frac{0.7}{R_2}$

Simplifying: $\frac{0.5}{R_1} + \frac{0.5}{R_2} = \frac{0.7}{R_2}$, which gives $\frac{0.5}{R_1} = \frac{0.2}{R_2}$

Therefore: $\frac{R_1}{R_2} = \frac{0.5}{0.2} = \frac{5}{2}$

18. (3) Using the lensmaker's equation, in air:

$$\frac{1}{f_{\text{air}}} = (n - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \text{ where } (n - 1) = 0.5 \text{ for glass with } n = 1.5.$$

In water:

$$\frac{1}{f_{\text{water}}} = \left(\frac{n}{n_{\text{water}}} - 1 \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$= \left(\frac{1.5}{4/3} - 1 \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$= \frac{1}{8} \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

Since $\left(\frac{1}{R_1} - \frac{1}{R_2} \right) = \frac{2}{f_{\text{air}}} = \frac{2}{18}$,

We get $\frac{1}{f_{\text{water}}} = \frac{1}{8} \cdot \frac{2}{18} = \frac{1}{72}$, so $f_{\text{water}} = 72$ cm.

The difference is $f_{water} - f_{air} = 72 - 18 = 54$ cm.

Therefore $\alpha = \frac{54}{18} = 3$.

19. (4) Let the refractive index of the prism be $n_1 = n$ and the refractive index of the coating on the exit surface be

$$n_2 = \frac{n}{2}.$$

At the condition of minimum deviation, the angle of refraction at the first surface r_1 and the angle of incidence at the second surface r_2 are equal, i.e., $r_1 = r_2 = \frac{A}{2}$, where A is the prism angle.

The problem states that at the exit surface, the light meets the condition of critical angle. Therefore, $r_2 = \theta_c$.

The critical angle θ_c for the interface between the prism and the coating is given by $\sin \theta_c = \frac{n_2}{n_1}$.

Substituting the values, $\sin \theta_c = \frac{n/2}{n} = \frac{1}{2}$.

Thus, $\theta_c = 30^\circ$.

Since $r_2 = \theta_c$, we have $r_2 = 30^\circ$.

Using the relation $r_1 = r_2 = \frac{A}{2}$ for minimum deviation, we get $\frac{A}{2} = 30^\circ$.

Therefore, $A = 60^\circ$.

20. (2) For a microscope in normal adjustment, magnification is given by $M = \frac{L}{f_o} \times \frac{D}{f_e}$

where L is tube length (10 cm), f_o is objective focal length (2 cm), f_e is eyepiece focal length (5 cm), and D is least distance of distinct vision (25 cm).

$$M = \frac{10}{2} \times \frac{25}{5} = 5 \times 5 = 25 = 5^2$$

Therefore, $k = 2$