Ultimate KCET Crash Course 2026

PHYSICS

Ray optics and optical instruments

DPP: 1

Q1 A prism of refractive index $\sqrt{2}$ has a refracting angle of 60°. At what angle must a ray be incident on it so that it undergoes minimum deviation?

(A) 30° (B) 45°

(C) 60° (D) 90°

Q2 A convex lens of focal length $20\ \text{cm}$ produces images of the same magnification 2 when an object is kept at two distances x_1 and x_2 $(x_1 > x_2)$ from the lens. The ratio of x_1 and x_2 is

(A) 4: 3 (B) 2:1

(C) 5:3 (D) 3:1

Q3 A convex lens and a concave lens, each having same focal length of 25 cm, are put in contact to form a combination of lenses. The power in diopters of the combination is :

(A) 25 (B) 50

(C) Infinite (D) zero

Q4 The distance travelled by a ray of light in two media in the same time are in the ratio 2:3. Refractive index of first medium with respect to second medium is

(A) $\frac{3}{2}$ (B) $\frac{2}{3}$

(C) $\frac{4}{9}$ (D) $\frac{9}{8}$

Q5 A light ray is propagating from a denser to a rarer medium. Angle of incidence is equal to critical angle. Value of angle of refraction will be:-

(A) 45° (B) 90°

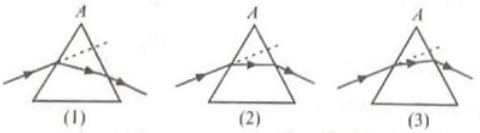
(C) 0° (D) 135°

Q6 In a simple microscope, if the final image is located at infinity then its magnifying power is

(A) $\frac{25}{f}$ (B) $\frac{D}{26}$

(C) $\frac{f}{25}$ (D) $\frac{f}{D+1}$

Q7 The given figure shows three cases of a ray passing through a prism of refracting edge A. The case corresponding to minimum deviation is



(A) 1 (B) 2

(C) 3 (D) None of these

Q8 If the critical angle for the material of a prism is C, and the angle of the prism is A, then there will be no emergent ray when

(A) A < 2 C

(B) A = 2 C

(C) A > 2 C

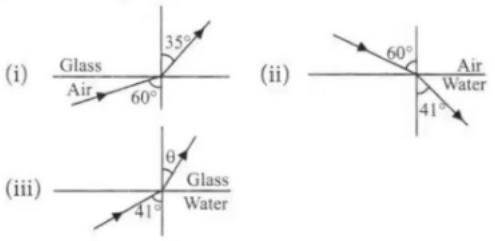
(D) A $\leq$ 2 C

Q9 The angle of incidence for an equilateral prism of refractive index √3 so that the ray is parallel to the base inside the prism is

(A) 30° (B) 20°

(C) 60° (D) 45°

Q10 Refraction on of light from air to glass and from air to water are shown in figure (i) and (ii) given below. The value of the angle θ in the case of refraction as shown in figure (iii) will be



(A) 30° (B) 35°

(C) 60° (D) 41°

Q11 At what distance from a convex lens of focal length 30 cm an object should be placed so that the size of image be 1/4th of the object :-

(A) 30 cm (B) 60 cm

(C) 15 cm (D) 150 cm

Q12 The ratio of resolving powers of an optical microscope for two wavelengths λ_1 =4000 Å and λ_2 = 6000 Å is

(A) 9 : 4 (B) 3 : 2

(C) 16 : 81 (D) 8 : 27

Q13 If the ratio of magnifications produced by a simple microscope in near point adjustment and far point adjustment is 6/5, then the focal length of the lens is (Take D = 25 cm)

(A) 5 cm (B) 0.2 cm
(C) 55 cm (D) 10 cm

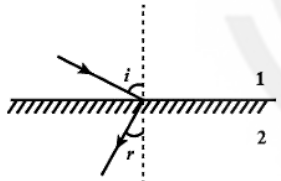
Q14 The sun's diameter is 1.4×10^9 m and its distance from the earth is 10^{11} m The diameter of its image, formed by a convex lens of focal length 2m will be

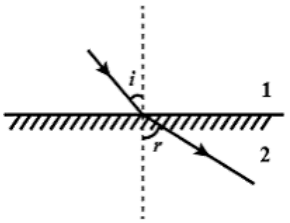
(A) 0.7 cm (B) 1.4 cm
(C) 2.8 cm (D) Zero

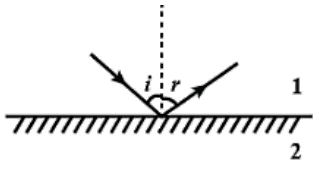
Q15 A ray of light is incident normally on a glass slab of thickness 5 cm and refractive index 1.6 . The time taken to travel by a ray from source to surface of slab is same as to travel through glass slab. The distance of source from the surface is

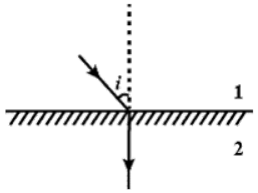
(A) 4 cm (B) 8 cm
(C) 12 cm (D) 16 cm

Q16 There are certain material developed in laboratories which have a negative refractive index. A ray incident from air (medium 1) into such a medium (medium 2) shall follow a path given by

(A)


(B)


(C)


(D)


Q17 Light of wavelength \(5000 \overset{0}{A} \) falls on a plane reflecting surface, the reflected wavelength is:-

(A) $4500 \overset{0}{A}$ (B) $5000 \overset{0}{A}$
(C) $5500 \overset{0}{A}$ (D) $6000 \overset{0}{A}$

Q18 What is the frequency of light that has a wavelength in water of 6.00×10^2 nm if the refractive index for this light is 1.33?

(A) 3.76×10^{14} Hz
(B) 6.65×10^{14} Hz
(C) 5.00×10^{14} Hz
(D) 7.25×10^{14} Hz

Q19 The distance travelled by a ray of light in two media in the same time are in the ratio 2:3. Refractive index of first medium with respect to second medium is

(A) $\frac{3}{2}$ (B) $\frac{2}{3}$
(C) $\frac{4}{9}$ (D) $\frac{9}{8}$

Q20 A prism is made up of material of refractive index $\sqrt{2}$. The angle of the prism is A. If the angle of minimum deviation is equal to the angle of the prism, the value of A is

(A) 30°
(B) 45°
(C) 60°
(D) 90°

Q21 A concave lens is in constant with convex lens. The ratio of the magnitude of their power is 2/3. Their equivalent focal length is 30cm. What are their individual focal length is cm?

(A) –75, 50 (B) –10, 15
(C) 75, 50 (D) –15,10

Q22 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

(A) moves away from the lens with a uniformacceleration
(B) moves away from the lens with a uniformspeed 5 m/s
(C) moves towards the lens with a non-uniformacceleration
(D) moves away from the lens with a nonuniformacceleration

Q23 The focal length of a convex mirror is 20 cm its radius of curvature will be

(A) 10 cm (B) 30 cm
(C) 20 cm (D) 40 cm

Q24 A plane glass plate is placed over a various coloured letters (violet, green, yellow, red). The letter which appears to raised least is

(A) Red (B) Yellow
(C) Green (D) Viole

Q25 A telescope, when in normal adjustment, has a magnifying power of 6 and the objective and the eye-piece are 14 cm apart The focal lengths of the eye-piece and the objective respectively are

(A) 2 cm and 14 cm (B) 3 cm and 12 cm
(C) 2 cm and 12 cm (D) 3 cm and 14 cm

Q26 If the focal length of objective lens is increased then magnifying power of

(A) Microscope will decrease but that of telescope will increase.
(B) Microscope and telescope both will decrease.
(C) Microscope and telescope both will increase.
(D) Microscope will increase but that of telescope decrease.

Q27 The focal lengths of the objective and the eyepiece of the telescope are 225 cm and 5 cm respectively. The magnifying power of the telescope will be

(A) 49 (B) 45
(C) 35 (D) 60

Q28 An equiangular glass prism of refractive index 1.6 is kept fully immersed in water of refractive index 4/3, for a certain ray of monochromatic light. What is the closest value for the angle of minimum deviation of the light ray in this setup? (Take sin 37° = 0.6)

(A) 10° (B) 14°
(C) 18° (D) 22°

Q29 An object is placed at a distance of $f/2$ from a convex lens of focal length f. The image will be

(A) At one of the foci, virtual and double its size
(B) Is greater than 1.5 f but less than 2.0 f
(C) At 2f, virtual and erect
(D) None of the above

Q30 A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror. The length of the image is

(A) 2.5 cm
(B) 10 cm
(C) 5 cm
(D) 15 cm

Q31 The angle of a prism is 60° and the angle of minimum deviation for a ray of light refracted through it is 60°. Then the refractive index of the material of the prism is

(A) $\sqrt{2}$ (B) 2
(C) 3/2 (D) $\sqrt{3}$

Answer Key

Q1	B
Q2	D
Q3	D
Q4	A
Q5	B
Q6	A
Q7	B
Q8	C
Q9	C
Q10	B
Q11	D
Q12	B
Q13	A
Q14	C
Q15	B
Q16	A
Q17	B
Q18	A
Q19	A
Q20	D
Q21	D
Q22	D
Q23	D
Q24	D
Q25	C
Q26	A
Q27	B
Q28	B
Q29	A
Q30	C
Q31	D

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

$$\mu = \frac{\sin\left(\frac{A+d_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$\sqrt{2} = \frac{\sin\left(\frac{60+d_m}{2}\right)}{\sin\left(\frac{60}{2}\right)}$$

$$\sin^{-1}\frac{1}{\sqrt{2}} = \left(\frac{60+d_m}{2}\right) = i$$

$$\therefore\ i = \frac{60+d_m}{2} = 45^\circ$$

Video Solution:

Q2 Text Solution:

$$m = \frac{v}{u} = 2 \Rightarrow v = 2u$$

$$for\ first\ case,\ u = -x_1 \quad v = 2x_1$$

$$\Rightarrow \frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{f} + \frac{1}{2x_1} + \frac{1}{x_1} = \frac{3}{2x_1}$$

$$\Rightarrow \frac{2x_1}{3} = f \Rightarrow x_1 = \frac{3f}{2}$$

$$for\ second\ case,\ u = -x_2 \quad v = -2x_2$$

$$\Rightarrow \frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-2x_2} + \frac{1}{x_2} = \frac{1}{2x_2}$$

$$\Rightarrow 2x_2 = f \Rightarrow x_2 + \frac{f}{2}$$

$$Ratio\frac{x_1}{x_2} = \frac{3\frac{f}{2}}{\left(\frac{f}{2}\right)} = 3 \Rightarrow 3:1$$

Video Solution:

Q3 Text Solution:

Focal length of combination of lenses placed in contact is

For convex lens, $f_1 = 25$ cm

For concave, lens, $f_2 = -25$ cm

Hence, $\frac{I}{F} = \frac{1}{25} + \frac{1}{-25}$

$= \frac{1}{25} - \frac{1}{25} = 0$

$\therefore \quad F = \frac{1}{0} = \infty$

Hence, power of combination

$P = \frac{I}{F} = 0D$

Note: As a convex and a concave lens of same focal lens are placed in contact, so we get achromatism i.e., combination is free from chromatic aberriation.

Video Solution:

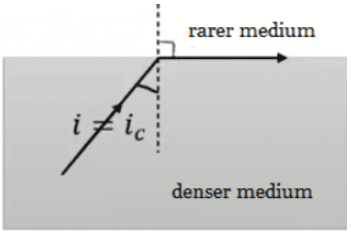
Q4 Text Solution:

$$\mu_{12} = \frac{\mu_1}{\mu_2} = \frac{d_2}{d_1} = \frac{3}{2}$$

Video Solution:

Q5 Text Solution:

The figure formed from the given information is,



Hence, the correct option is (b) i.e., 90°

Video Solution:

Q6 Text Solution:

$\frac{25}{f}$

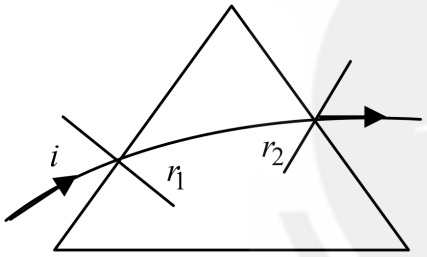
Video Solution:

Q7 Text Solution:

When deviation is minimum, refracted ray inside the prism is parallel to base of prism. Therefore, (2) is correct

Video Solution:

Q8 Text Solution:



$r_1 + r_2 = A$ for emergent ray,

For no emergent ray, $r_2 > C$,

Maximum value of r_1 is when i = 90 or

$\sin r_1 = \frac{1}{\mu} = \sin C$ or

Or $r_1 = C$

$r_1 + r_2 = A > (C + C)$

OR A > 2C is the condition for no emergent ray as per option (3).

Video Solution:

Q9 Text Solution:

60^o

Video Solution:

Q10 Text Solution:

$n_g = \frac{\sin(60°)}{\sin(35°)}$

$n_W = \frac{\sin(60°)}{\sin(41°)}$

For light travelling from water to glass we can write,

$_W n_g = \frac{n_g}{n_W} = \frac{\sin(41°)}{\sin(\theta)}$

$On\ solving\ we\ get,\ \theta = 35°$

Video Solution:

Q11 Text Solution:

Mage formed is diminished, When object lies betwen 2 F and infinity.

Magnificant

$\left(M\right) = \frac{\text{image size}}{\text{object size}} = \frac{1}{4} = \frac{v}{u} \ldots$ (i)

From lens formulsa,

$\left(M\right) = \frac{\text{image size}}{\text{object size}} = \frac{1}{4} = \frac{v}{u} \ldots$ (i)

where is focal length, v the image distance and u the object distance.

=rom Eqs. (i) and (ii),

ve get $\frac{1}{f} = -\frac{1}{u} + -\frac{4}{u}$

$\frac{1}{30} = \frac{-5}{u}$

$u = -150$

Video Solution:

Q12 Text Solution:

$\lambda_1 = 4000\mathring{A}$

$\lambda_2 = 6000\mathring{A}$

$\Delta KT = R.P \propto \frac{1}{\lambda}$

$\frac{(R.P)_1}{(R.P)_2} = \frac{\lambda_2}{\lambda_1} = \frac{6}{4} = \frac{3}{2}$

Video Solution:

Q13 Text Solution:

Given $\frac{6}{5} = \frac{\left(1+\frac{D}{f}\right)}{(D/f)}$ or $\frac{6}{5} = \left(\frac{f}{D}+1\right)$

or $\frac{f}{D} = \frac{6}{5} - 1 = \frac{1}{5}$ or $f = \frac{D}{5} = 5$ cm

Video Solution:

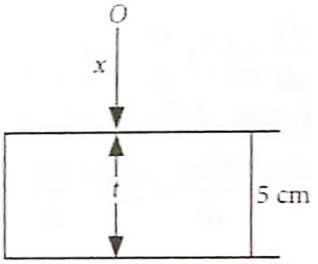
Q14 Text Solution:

2.8 cm

Video Solution:

Q15 Text Solution:

Velocity of light in this slab



$v = \frac{5}{t} \Rightarrow t = \frac{5}{v}$

$\Rightarrow \frac{x}{c} = \frac{5\mu}{c} \left(\because t = \frac{x}{c} \text{ and } v = \frac{c}{\mu}\right)$

$x = 5\mu = 5 \times 1.6 \Rightarrow x = 8$ cm

Video Solution:

Q16 Text Solution:

: Using Snell's law $\mu = \frac{\sin i}{\sin r} \Rightarrow \sin r = \frac{\sin i}{\mu}$

According to question, μ is negative $\therefore$ sin r is negative hence, r is negative, therfore option (a) is correct.

Video Solution:

Q17 Text Solution:

Correct option is B) $5000\ \mathring{A}$

The wavelength of reflected light and incident light does not change. The wavelength of reflected light and incident light remains the same, ie $5000\ \mathring{A}$.

Video Solution:

Q18 **Text Solution:**

$f = \frac{C}{\lambda_{air}} = \frac{C}{n\,\lambda_W} = \frac{3\times10^8}{1.33\times6\times10^{-7}}$

f = 3.76 × 10^{14} Hz

Video Solution:

Q19 **Text Solution:**

$\mu_{12} = \frac{\mu_1}{\mu_2} = \frac{d_2}{d_1} = \frac{3}{2}$

Video Solution:

Q20 **Text Solution:**

The refractive index of the material of a prism is

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

where δ_m is the angle of minimum deviation.

Here, $\mu = \sqrt{2}, A = \delta_m$

$\therefore \sqrt{2} = \frac{\sin\left(\frac{A+A}{2}\right)}{\sin\frac{A}{2}} = \frac{\sin\frac{A}{A}}{\sin\frac{A}{2}}$

$= \frac{2\sin\frac{A}{2}\cos\frac{A}{2}}{\sin\frac{A}{2}} = 2\cos\frac{A}{2}$

or $\cos\frac{A}{2} = \frac{1}{\sqrt{2}}$ or $\cos\frac{A}{2} = \cos45^\circ$ or $A = 90^\circ$

Video Solution:

Q21 **Text Solution:**

Let f_v be the focal length of concave lens and be the focal length of convex lens. The power of lens is negative for concave lens and positive for convex lens i.. P_1 is negative and P_2 positive.

As power $(P) = \frac{1}{f}$

As per equation,

$\frac{P_1}{P_2} = \frac{f_2}{f_1} = -\frac{2}{3}$ or $f_2 = -\frac{2}{3}f_1$

and $\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{30}$ or $\frac{1}{f_1} - \frac{3}{2f_1} = \frac{1}{30}$

$-\frac{1}{2f_1} = \frac{1}{30}$

On Solving we get, $f_1 = -15cm$ and $f_2 = 10cm$

Video Solution:

Q22 **Text Solution:**

When an object approaches a lens with uniform speed, its image moves away from the lens to infinity with non-uniformacceleration.

Video Solution:

Q23 **Text Solution:**

$R = \frac{f}{2}$

Video Solution:

Q24 Text Solution:

shift in the image of letter due to glass plate,

$s = \left(d - \frac{d}{\mu}\right) = d\left(1 - \frac{1}{\mu}\right)$

Since, $\lambda_v < \lambda_g < \lambda_y < \lambda_r$; so, $\mu_v > \mu_g > \mu_y > \mu_r$

$\therefore \quad s_v > s_g > s_y > s_r$

Hence minimum shift appears for red letters.

Video Solution:

Q25 Text Solution:

2 cm and 12 cm

Explanation:

In normal adjustment, m = f_o/f_e = 6. Therefore

f_o = 6 fe Now, $f_o + f_e$ = 14

or 7f_e = 14 or f_e = 2 cm Hence, f_o = 12 cm

Video Solution:

Q26 Text Solution:

(a) Microscope will decrease but that of telescope will

Explanation:

Microscope will decrease but that of telescope will increase.

Video Solution:

Q27 Text Solution:

Magnifying power of telescope for relaxed eye,

$M = \frac{f_0}{f_e} = \frac{225}{5} = 45$

Video Solution:

Q28 Text Solution:

Here, angle of prism, $A = 60°$

Refractive index of prism, $\mu_p = 1.6$

Refractive index of water, μ_w =

Angle of minimum deviation, δ_m =?

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

$\frac{1.6}{\frac{4}{3}} = \frac{\sin\left(\frac{60°+\delta_m}{2}\right)}{\sin\left(\frac{60°}{2}\right)}$

$1.2 = 2\sin\left(30° + \frac{\delta_m}{2}\right) \Rightarrow \sin 37°$

$= \sin\left(30° + \frac{\delta_m}{2}\right)$

$37° = 30° + \frac{\delta_m}{2}$

$\Rightarrow \frac{\delta_m}{2} = 7° \quad \Rightarrow \delta_m = 14°$

Video Solution:

Q29 Text Solution:

$\frac{1}{v} - \frac{1}{-f/2} = \frac{1}{f}$

$\frac{1}{v} = \frac{1}{f} - \frac{2}{f} = -\frac{1}{f}$

or

$v = -f$

again

$m = \frac{v}{u} = \frac{-f}{-f/2} = 2$

Clearly, the image is virtual and double the size

Video Solution:

Q30 Text Solution:

Here, f = –10 cm, For end A, u_A = – 20cm

image position v_A of end A is given by

$\frac{1}{v_A} + \frac{1}{(-20)} = \frac{1}{(-10)}$ or $\frac{1}{v_A} = \frac{1}{-10} + \frac{1}{20} = -\frac{1}{20}$

$v_A = -20cm$

For end B, uB = – 30 cm

Image position v_B of end B is given by

$\frac{1}{v_B} + \frac{1}{(-30)} = \frac{1}{(-10)}$ or $\frac{1}{v_B} = \frac{1}{-10} + \frac{1}{30} = -\frac{2}{30}$

$v_B = -15cm$

Length of the image

$= |v_A| - |v_B| = 20cm - 15cm = 5cm$

Video Solution:

Q31 **Text Solution:**

For minimum deviation,

$$n = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\frac{A}{2}} \Rightarrow n = \frac{\sin 60^\circ}{\sin 30^\circ}$$

$$= \frac{\sqrt{3}}{2} \times 2 = \sqrt{3}$$

Video Solution: