

DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 1

Topic :- RAY OPTICS AND OPTICAL INSTRUMENTS

1

(d)

Let focal length of convex lens is $+f$ then focal length of concave lens would be $-\frac{3}{2}f$.

From the given condition,

$$\frac{1}{30} = \frac{1}{f} - \frac{2}{3f} = \frac{1}{3f}$$

$$\therefore f = 10 \text{ cm}$$

Therefore, focal length of convex lens = $+10$ cm and that of concave lens = -15 cm.

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(d)

Semi-vertical angle = critical angle

$$\text{Hence, } i_c = \sin^{-1} \left(\frac{1}{1.33} \right) = 48.75 \approx 49^\circ$$

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(c)

$$\text{As } \frac{1}{f} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\therefore \frac{1}{20} = (1.5 - 1) \left(\frac{1}{\infty} - \frac{1}{R} \right)$$

$$\frac{1}{20} = \frac{-1}{2R}, R = -10 \text{ cm}$$

Refraction from rarer to denser medium

$$-\frac{\mu_1}{u} + \frac{\mu_2}{v} = \frac{\mu_2 - \mu_1}{R}, \text{ where } u = \infty, v = f$$

$$\therefore 0 + \frac{1.5}{f} = \frac{1.5 - 1}{10} = \frac{1}{20}, f = 30 \text{ cm}$$

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(c)

$$\frac{I_1}{o} = \frac{v}{u} \text{ and } \frac{I_2}{o} = \frac{u}{v} \Rightarrow O^2 = I_1 I_2$$

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(a)

The focal length of combination is

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

Given, $f_1 = 50 \text{ cm}, f_2 = 50 \text{ cm}$

$$\therefore \frac{1}{F} = \frac{1}{50} + \frac{1}{50} = \frac{2}{50}$$

$$\Rightarrow F = \frac{50}{2} = 25 \text{ cm}$$

Object when placed at center of curvature forms a real, inverted image of same size as object = $(2 \times 25 = 50 \text{ cm})$

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(c)

Given, the power of objective lens,

$$P_o = 0.5 \text{ D}$$

The power of eye-piece lens,

$$P_e = 20 \text{ D}$$

The magnifying power of an astronomical telescope



$$M = \frac{f_o}{f_e}$$

$$\text{or } M = \frac{P_e}{P_o} \quad \left(\because P = \frac{1}{f} \right)$$

$$= \frac{20}{0.5} = 40$$

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(d)

$$L = v_o + f_e \Rightarrow v_o = L - f_e$$

$$\text{Or } v_o = 19.2 \text{ cm}$$

$$\frac{1}{19.2} - \frac{1}{u_o} = \frac{1}{1.6}$$

$$\text{Or } -\frac{1}{u_o} = \frac{10}{16} - \frac{10}{192}$$

$$\text{Or } -\frac{1}{u_o} = \frac{120-10}{192} = \frac{100}{192}$$

$$\text{Or } u_o = -\frac{192}{100} \text{ cm} = -1.92 \text{ cm}$$

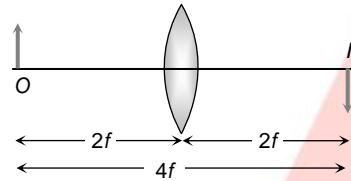
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(c)

$$m = \frac{f_o}{f_e} \left(1 + \frac{f_e}{D} \right)$$

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(d)



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(a)

Biconvex lens is cut perpendicularly to the principle axis, it will become a plano-convex lens.

Focal length of biconvex lens

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

$$\frac{1}{f} = (n-1) \frac{2}{R} \quad (\because R_1 = R, R_2 = -R)$$

$$\Rightarrow f = \frac{R}{2(n-1)} \dots \dots (i)$$

For plano-convex lens

$$\frac{1}{f_1} = (n-1) \left(\frac{1}{R} - \frac{1}{\infty} \right)$$

$$f_1 = \frac{R}{(n-1)} \dots \dots \dots (ii)$$

Comparing Eqs. (i) and (ii), we see that focal length becomes double.

Power of lens $P \propto \frac{1}{\text{focal length}}$

Hence, power will become half.

$$\text{New power} = \frac{4}{2} = 2D$$

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(c)

After critical angle reflection will be 100% and transmission is 0%. Options (b) and (c) satisfy this condition. But option (c) is the correct option. Because in option (b) transmission is given 100% at $\theta = 0^\circ$, which is not true

\therefore Correct answer is (c).

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(a)

Given that, the refractive index of the lens wrt air,

$${}_a\mu_w = 1.60$$

And the refractive index of water wrt air ${}_a\mu_w = 1.33$

The focal length of the lens in air, $f = 20\text{cm}$

We know that for a lens

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

When the lens is in the air

$$\frac{1}{20} = ({}_a\mu_g - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\text{or } \frac{1}{20} = (1.60 - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\text{or } \frac{1}{20} = 0.60 \times \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \quad \dots (i)$$

When the lens is in the water

$$\frac{1}{f'} = ({}_w\mu_g - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\text{or } \frac{1}{f'} = \left(\frac{{}_a\mu_g}{{}_a\mu_w} - 1 \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\text{or } \frac{1}{f'} = \left(\frac{{}_a\mu_g - {}_a\mu_w}{{}_a\mu_w} \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\therefore \frac{1}{f'} = \left(\frac{1.60 - 1.33}{1.33} \right) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\text{or } \frac{1}{f'} = \frac{27}{133} \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \quad \dots \dots \dots (ii)$$

On dividing Eq. (i) by Eq. (ii), we get

$$\frac{f'}{20} = \frac{0.60 \times 1.33}{27}$$

$$\text{or } f' = 20 \times 2.95 \text{ cm} \approx 60\text{cm}$$

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(c)

Frequency remain unchanged

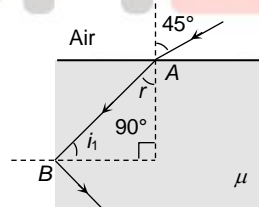
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(b)

At point A, by Snell's law

$$\mu = \frac{\sin 45^\circ}{\sin r} \Rightarrow \sin r = \frac{1}{\mu\sqrt{2}} \quad \dots (i)$$

At point B, for total internal reflection $\sin i_1 = \frac{1}{\mu}$



From figure, $i_1 = 90^\circ - r$

$$\therefore \sin(90^\circ - r) = \frac{1}{\mu}$$

$$\Rightarrow \cos r = \frac{1}{\mu} \quad \dots (ii)$$

$$\text{Now } \cos r = \sqrt{1 - \sin^2 r} = \sqrt{1 - \frac{1}{2\mu^2}}$$

$$= \sqrt{\frac{2\mu^2 - 1}{2\mu^2}} \quad \dots (iii)$$

From equation (ii) and (iii), $\frac{1}{\mu} = \sqrt{\frac{2\mu^2-1}{2\mu^2}}$

Squaring both side and then solving, we get $\mu = \sqrt{\frac{3}{2}}$

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(c)

$\mu_{air} < \mu_{lens} < \mu_{water}$ i. e., $1 < \mu_{lens} < 1.33$

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(c)

In minimum deviation position $\angle i_1 = \angle i_2$ and $\angle r_1 = \angle r_2$

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(a)

$$I = \frac{L}{r^2}$$

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(d)

$$\frac{{}_a\mu_r}{{}_w\mu_r} = \frac{\mu_r/\mu_a}{\mu_r/\mu_w} = \frac{\mu_w}{\mu_a} = {}_a\mu_w$$

ANSWER-KEY

Q.	1	2	3	4	5	6	7	8	9	10
A.	D	D	C	C	A	D	C	D	C	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	C	B	A	C	B	C	C	A	D