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,

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

$\therefore\ f=10$ cm

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

2 **(d)**

Semi-vertical angle = critical angle

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

3 **(c)**

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

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

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

Refraction from rarer to denser medium

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

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

4 **(c)**

$\frac{I_1}{O}=\frac{v}{u}$ and $\frac{I_2}{O}=\frac{u}{v}\Rightarrow O^2=I_1I_2$

5 **(a)**

The focal length of combination is

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

Given, $f_1=50\ cm, f_2=50\ cm$

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

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

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

7 **(c)**

Given , the power of objective lens,

$P_0\ =\ 0.5\ D$

The power of eye-piece lens,

$P_e =\ 20\ D$

The magnifying power of an astronomical telescope

$M = \frac{f_0}{f_e}$

$or\ M = \frac{P_e}{P_0} \qquad \left(\therefore P = \frac{1}{f}\right)$

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

8 **(d)**

$L = v_0 + f_e \Rightarrow v_0 = L - f_e$

Or $v_0 = 19.2$ cm

$\frac{1}{19.2} - \frac{1}{u_0} = \frac{1}{1.6}$

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

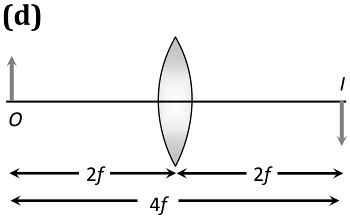
Or $-\frac{1}{u_o} = \frac{120 - 10}{192} = \frac{100}{192}$

Or $u_o = -\frac{192}{110}$ cm $= -1.75$ cm

9 **(c)**

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

10 **(d)**



11 **(a)**

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

Focal length of biconvex lens

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

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

$\Rightarrow f = \dfrac{R}{2(n-1)}$ ....(i)

For plano-convex lens

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

$f^1 = \dfrac{R}{(n-1)}$ ....(ii)

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

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

Hence, power will become half.

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

12 **(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 $\theta = 0°$, which is not true

$\therefore$ Correct answer is (c).

14 **(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, $f = 20cm$

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

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

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

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

When the lens is in the water

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

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

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

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

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

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

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

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

15 **(c)**

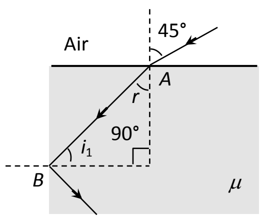
Frequency remain unchanged

16 **(b)**

At point A, by Snell's law

$\mu = \frac{\sin 45}{\sin r} \Rightarrow \sin r\ = \frac{1}{\mu\sqrt{2}}$ ...(i)

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



From figure, $i_1 = 90 - r$

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

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

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

$= \sqrt{\frac{2\mu^2 - 1}{2\mu^2}}$ ...(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 $\mu = \sqrt{\frac{3}{2}}$

17 **(c)**

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

18 **(c)**

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

19 **(a)**

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

20 **(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