DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

**Solutions**

Subject : PHYSICS
DPP No. : 7

## Topic :- RAY OPTICS AND OPTICAL INSTRUMENTS

1 **(a)**

Shift $= t\left(1-\frac{1}{\mu}\right)$

$1 = 3\left(1-\frac{1}{\mu}\right)$ or $\frac{1}{3} = 1-\frac{1}{\mu}$

Or $\frac{1}{\mu} = 1-\frac{1}{3} = \frac{2}{3}$ or $\mu = \frac{3}{2} = 1.5$

2 **(a)**

$A(\mu_v - \mu_r) + A'(\mu'_v - \mu'_r) = 0° \Rightarrow A' = 5°$

3 **(d)**

$P_1 = \frac{100}{20} = 5\ D, P_2 = \frac{100}{25} = 4D$

Effective power $P = P_1 + P_2$

$= 5 + 4 = 9$ D

4 **(b)**

Lens-maker's formula is given by

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

If the lens is immersed in a liquid of refractive index $\mu_1$ then

$\frac{1}{f_1} = ({}_l\mu_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ...(ii)

Here, ${}_l\mu_g$ is refractive index of glass w.r.t liquid

Dividing Eq. (i) by Eq. (ii), we have

$\frac{f_1}{f} = \frac{({}_a\mu_g - 1)}{({}_l\mu_g - 1)}$

$\Rightarrow \frac{f_1}{f} = \left(\frac{1.5-1}{\frac{1.5}{1.25}-1}\right)$

$\Rightarrow \frac{f_1}{f} = \frac{0.5 \times 1.25}{0.25} = 2.5$

Hence, focal length increases by a factor of 2.5.

5 **(d)**

$v = -15cm, u = -300cm$

From lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \frac{1}{f} = \frac{1}{-15} - \frac{1}{-300} = \frac{-19}{300}$

$\Rightarrow f = \frac{-300}{19} = -15.8\ cm$

and power $P = \frac{100}{f_{in\ cm}} = \frac{-100 \times 19}{300}$

$= -6.33\ D$

6 **(b)**

$E_0 = \frac{I}{r^2} = \frac{I}{(4)^2} = \frac{I}{16}$

$E_p = \frac{I\cos\theta}{r'^2} = \frac{I \times (415)}{(5)^2}$

$= \frac{4I}{125}$

$\therefore \frac{E_0}{E_p} = \frac{I}{16} \times \frac{125}{4I} = \frac{125}{64}$

9 **(a)**

$\mu = \frac{h}{h'} \Rightarrow h' = \frac{8}{4/3} = 6\ m$

10 **(a)**

As there is no deflection between medium 1 and 2. Therefore, $\mu_1 = \mu_2$

11 **(d)**

$\frac{I'}{I} = \frac{40 \times 40}{50 \times 50} = \frac{16}{25}$

$1 - \frac{I'}{I} = 1 - \frac{16}{25} = \frac{9}{25}$

or $\frac{I - I'}{I} \times 100 = \frac{9}{25} \times 100 = 36\%$

12 **(b)**

According to Cartesian sign convention

$u = -40$ cm, $R = -20$ cm

$\mu_1 = 1, \mu_2 = 1.33$

Applying equation for refraction through spherical surface, we get

$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$

$\frac{1.33}{v} - \frac{1}{-40} = \frac{1.33}{-20}$

After solving, $v = -32$ cm

The magnification is $m = \frac{h_2}{h_1} = \frac{\mu_1 v}{\mu_2 u}$

$\therefore \frac{h_2}{1} = -\frac{1(32)}{1.33(-40)}$

Or $h_2 = 0.6$ cm

The positive sign shows that the image is erect

13 **(c)**

Power of spectacles, $P = 2\ D$

Since, power is positive so lens used is convex which is used for the purpose of removing hypermetropia.

14 **(a)**

Refractive index of diamond is

$$\mu = \frac{\text{velocity of light in air}}{\text{velocity of light in diamond}}$$

$$2 = \frac{3.0 \times 10^{10}}{\text{velocity of light in diamond}}$$

So, velocity of light in diamond is

$$= \frac{3.0 \times 10^{10}}{2} = 1.5 \times 10^{10} \text{cms}^{-1}$$

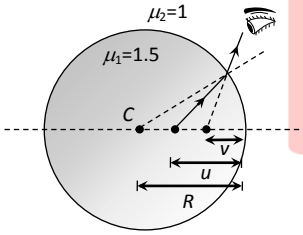
15 **(c)**

$\mu_1 = 2, \mu_2 = \frac{3}{2}$

$2 \sin i \geq \frac{3}{2} \sin 90° \Rightarrow \sin i \geq \frac{3}{4} \Rightarrow i \geq \sin^{-1}\left(\frac{3}{4}\right)$

16 **(a)**

$v = 1\ cm, R = 2\ cm$




By using

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

$$\frac{1}{-1} - \frac{1.5}{u} = \frac{1 - 1.5}{-2}$$

$\Rightarrow u = -1.2\ cm$

17 **(a)**

Lens maker's formula

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

Where , $R_2 = \infty, R_1 = 0.3$ m

$$\therefore \frac{1}{f} = \left(\frac{5}{3} - 1\right)\left(\frac{1}{0.3} - \frac{1}{\infty}\right)$$

$$\Rightarrow \frac{1}{f} = \frac{2}{3} \times \frac{1}{0.3}$$

Or $f = 0.45$ m

18 **(b)**

For an equilateral prism, angle of prism of refracting angle $A = 60°$

Here, $\delta_m = A = 60°$

$\therefore$ Refractive index,

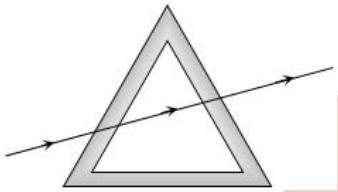
$$\mu = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin\frac{A}{2}} = \frac{\sin\left(\frac{60° + 60°}{2}\right)}{\sin\left(\frac{60°}{2}\right)}$$

$$= \frac{\sin 60°}{\sin 30°} = \frac{\sin 60°}{\cos 60°}$$

$$= \tan 60° = \sqrt{3}$$

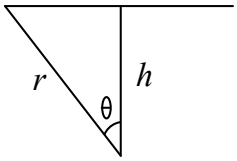
19 **(a)**

Effectively there is no deviation or dispersion



20 **(c)**

$$E = \frac{I\cos\theta}{r^2} \Rightarrow E = \frac{Ih}{r^3}$$




Or $E \propto \frac{1}{r^3}$

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