DPP
DAILY PRACTICE PROBLEMS

Class : XIIth **Solutions** **Subject : PHYSICS**
Date : **DPP No. : 5**

Topic :- RAY OPTICS AND OPTICAL INSTRUMENTS

1 **(b)**

$m = 1 + \frac{D}{f} = 1 + DP$ [m increases with P]

2 **(d)**

For first lens, $\mu_1 = -30cm, f_1 = 10cm$

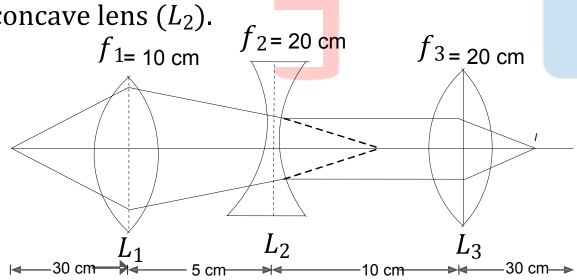
$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$or\ \frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$or\ \frac{1}{v} = \frac{1}{10} - \frac{1}{30} = \frac{1}{15}$

$or\ v = 15\ cm$

Therefore, image formed by convex lens (L_1) is at point I_1 and acts as virtual object for concave lens (L_2).



The image I_1 is formed at focus of concave lens (as shown) and so emergent rays will be parallel to the principle axis. For lens L_2 , μ_2 =15-5=10 cm, f_2=-10cm. These parallel rays are incident on the third convex lens (L_3) and will be brought to convergence at the focus of the lens (L_3)

Hence , distance of final image from third lens L_3

$v_2 = f_3 = 30\ cm$

3 **(c)**

For no deviation,

$(\mu - 1)A + (\mu' - 1)A' = 0$

$$\Rightarrow A' = -\frac{(\mu-1)A}{(\mu'-1)} = \frac{(1.54-1)4°}{(1.72-1)} = -3°$$

Negative sign implies that two prisms should be connected in opposition.

4 **(b)**

When an object is placed in front of such a lens, the rays are first of all refracted from the convex surface and again refracted from convex surface.

Let f_1,f_m be focal lengths of convex surface and mirror (plane polished surface) respectively, then effective focal length is

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_m} + \frac{1}{f_1} = \frac{2}{f_1} + \frac{1}{f_m}$$

Since,

$$f_m = \frac{R}{2} = \infty$$

$$\therefore \frac{1}{F} = \frac{2}{f_1}$$

From lens formula

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

$$\therefore \frac{1}{F} = \frac{2(\mu-1)}{R}$$

$$\Rightarrow F = \frac{R}{2(\mu-1)}$$

$$or\ \ R_{eq} = 2F = \frac{R}{(\mu-1)}$$

5 **(b)**

When a ray of light passes from glycerine (denser, $\mu = 1.47$) to water (rarer, $\mu = 1.33$) the angle of refraction (r) is greater than angle of incidence (i), then from Snell's law

$$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1} < 1$$

When $r = 90°$, corresponding angle of incidence is known as critical angel, ie, $i = \theta_C$

$$\therefore \frac{\sin\theta_C}{\sin 90°} = \frac{\mu_2}{\mu_1}$$

$$\Rightarrow \sin\theta_C = \frac{\mu_2}{\mu_1}$$

$$\Rightarrow \theta_C = \sin^{-1}\left(\frac{\mu_2}{\mu_1}\right)$$

$$= \sin^{-1}\left(\frac{1.33}{1.47}\right)$$

$\theta_C = 64°48'$

6 **(b)**

Note that two refractive indices are involves. Therefore, two images will be formed

9 **(a)**

Image formed by convex mirror is virtual for real object placed anywhere

10 **(a)**

Wavelength in vacuum,

$$\lambda = \frac{3 \times 10^8}{5 \times 10^{14}} \times 10^{10}\text{Å} = 0.6 \times 10^4\text{Å}$$

$$= 6000\text{Å}$$

Now, $\mu = \frac{\lambda}{\lambda'}$

Or $\lambda' = \frac{\lambda}{\mu} = \frac{6000}{1.5}\text{Å} = 4000\ \text{Å}$

11 **(a)**

When two lenses are separated by some distance x, then equivalent power

$P = P_1 + P_2 - xP_1P_2$

$\therefore P = 5 + 5 - x \times 5 \times 5$

$or\ P = 10 - 25x$

Power P will be negative, if 10-25x will be negative

$ie,\quad 25x > 10$

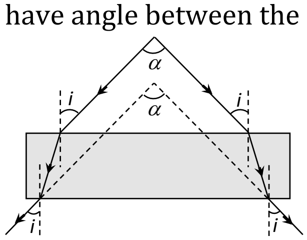
$$or\ \ x > \frac{10}{25}$$

$$or\ \ x > \frac{10}{25} \times 100\ cm$$

$or\ \ x > 40\ cm$

14 **(b)**

Since rays after passing through the glass slab just suffer lateral displacement hence we have angle between the emergent rays as α



15 **(c)**

$\delta \propto (\mu - 1) \Rightarrow \mu_R$ is least so δ_R is least

16 **(a)**

The combined focal length of plano-convex lens

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

Given, $f_1 = \infty (for\ plane\ surface), f_2 = f(say)$

$$\therefore \frac{1}{F} = \frac{1}{\infty} + \frac{1}{f}$$

$\Rightarrow F = f$

Now when concave lens of same focal length is joined to first lens , then combined focal length

$\frac{1}{F'} = \frac{1}{F_1} + \frac{1}{F_2}$

$= \frac{1}{f} - \frac{1}{f} \quad (\because F_1 = f, F_2 = -f)$

$= 0$

$F' = \infty$

Thus, the image can be focused on infinity (∞) or focus shifts to infinity.

17 **(b)**

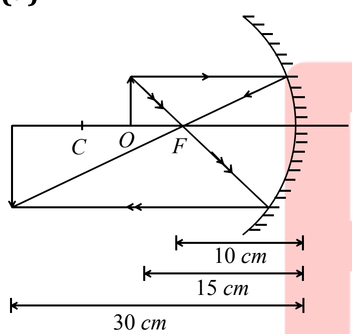
In compound microscope objective forms real image while eye piece forms virtual image

18 **(a)**

For viewing far objects, concave lenses are used and for concave lens

$u =$ wants to see $= -60 cm; v =$ can see $= -15\ cm$ so from $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow f = -20\ cm$

19 **(a)**



According to New Cartesian sign convention,

Object distance $u = -15\ cm$

Focal length of a concave lens, $f = -10\ cm$

Height of the object $h_o = 2.0\ cm$

According to mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-10} - \frac{1}{-15} \Rightarrow v = -30\ cm$

This image is formed 30 cm from the mirror on the same side of the object. It is a real image

Magnification of the mirror, $m = \frac{-v}{u} = \frac{h_I}{h_O}$

$\Rightarrow \frac{-(-30)}{-15} = \frac{h_I}{2} \Rightarrow h_I = -4\ cm$

Negative sign shows that image is inverted

The image is real, inverted, of size 4 cm at a distance 30 cm in front of the mirror

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