WS-11 → T task → 9th foundation

(1) Acc to given data $V_1 = 15 cm$: $V_2 = 100 cm$

$P = 0.8 D$ ⇒ $f = \frac{1}{P} = \frac{1}{0.8} = 125 cm.$

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

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

$$\Rightarrow \frac{1}{u} = -\frac{1}{15} + \frac{1}{125}$$

$$\Rightarrow \frac{1}{u} = \frac{-25 + 3}{15 \times 125} \Rightarrow \frac{1}{u} = \frac{-22}{15 \times 25} \Rightarrow u = -\frac{15 \times 25}{22}$$

$$\Rightarrow u = -17 cm$$

For $V_2 = 100 cm$

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

$$\Rightarrow \frac{1}{u} = -\frac{1}{100} - \frac{1}{125} = \frac{4-5}{500} \Rightarrow u = -500 cm.$$

(2) According to given data $v = -1.5 m$; $u = \infty$

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

$$\Rightarrow \frac{1}{f} = \frac{1}{v} - \frac{1}{\infty} = \frac{1}{v}$$

$$\Rightarrow \frac{1}{f} = \frac{1}{v}$$

$$\Rightarrow P = \frac{1}{v} = -\frac{1}{1.5} = \frac{-2}{3} = -0.67 D$$

(3)

$V = F.P = 83\ cm$ From $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$u = \infty$

$\Rightarrow \frac{1}{f} = -\frac{1}{83} - \frac{1}{\infty} = -\frac{1}{83}$

$\Rightarrow P = -\frac{1}{83} = -\frac{100}{83} = -1.25\ D$

(5)

Given $N.P = 50\ cm = x$

$D = 25\ cm$

For seeing distant objects the focal length of lens required is $f = \frac{xD}{x-D} = \frac{50 \times 25}{50-25}$

$f = 50\ cm$; $P = \frac{100}{f} = \frac{100}{50} = 2\ D$

If $F.P = 1.5\ m$

Focal length $f = F.P = -1.5\ m$

$P = +\frac{1}{f} = \frac{-1}{1.5} = -\frac{2}{3}\ D$

(6)

$F.P = 250\ cm$. He cannot see distant object i.e $= u = \infty$

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

$\Rightarrow \frac{1}{f} = -\frac{1}{250} - \frac{1}{\infty} = -\frac{1}{250}$

$\Rightarrow f = -250\ cm \rightarrow$ diverging or concave lens

(7)

Clearly the person can not see an object placed beyond 50 cm. He is suffering from myopia.

$F.P = 50\,cm \; ; \; u = \infty.$

$\therefore \frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\Rightarrow \frac{1}{f} = -\frac{1}{50}$

$\Rightarrow \frac{1}{f} = -\frac{1}{50} - \frac{1}{\infty}$

$\Rightarrow P = \frac{100}{f} = -\frac{100}{50} = -2\,D$

(8)

when $u < 100$ cm he can not see object clearly.

that is he is suffering from hypermetripia.

To see object at 25 cm i.e. N.P

$x = 100\,cm \; ; \; V = D = 25\,cm$

The focal length of lens required $f = \frac{xD}{x-D} = \frac{100 \times 25}{100-25}$

$f = \frac{100 \times 25}{75} = \frac{100}{3}\,cm.$

$\Rightarrow P = \frac{100}{f} = 100 \times \frac{1}{f} = 100 \times \frac{3}{100} = 3\,D$

(9)

$u = 2m$ very far away from eye, image is formed at ∞

$V = \infty$

$\therefore$ From $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\Rightarrow \frac{1}{f} = \frac{1}{\infty} - \frac{1}{2}$ $\Rightarrow f = -2$

$P = \frac{1}{f} = -\frac{1}{2}\,m = -0.5\,D$

(14)

F.P = Far point : 5 m

$v = -5$ m

$\therefore$ From $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = -\frac{1}{5} - \frac{1}{\infty} = -\frac{1}{5}$

$P = \frac{1}{f}$ D $= -\frac{1}{5}$ D

$= -0.2$ D

(15)

Nearsighted → Myopia → $P = -5.5$ D

To overcome long sight he is using lens of focal length $f = 1.5$ D

So the person is suffering from Presbiopia

$f = \frac{1}{P} = \frac{100\ cm}{P} = \frac{100}{-5.5} = -18.2$ cm

lens is concave

For Near vision

$f = \frac{100}{P} = \frac{100}{1.5} = \frac{200}{3} = 66.7$ cm

(17)

clearly $v = -1$ m

$u = -3$ m

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

$= -\frac{1}{1} - \frac{1}{(-3)}$

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

$P = \frac{1}{f} = -\frac{2}{3} = -0.67$ D

lens is concave.

(18)

$v = -10\ cm$; $u = -25\ cm$

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = -\frac{1}{10} - \frac{1}{-25}$

$\frac{1}{f} = -\frac{1}{10} + \frac{1}{25} = \frac{-5+2}{50}$

$\Rightarrow \frac{1}{f} = \frac{-3}{50} \Rightarrow f = -\frac{50}{3} = -16.67cm$

lens is concave lens.

(4)

option A correct.

For $v = 2m$; $u = \infty$

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

$\Rightarrow P = \frac{1}{2} = 0.5\ D$

For $v = 1m$; $u = 25cm$

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{100} - \frac{1}{25} = \frac{1-3}{100} = -\frac{3}{100}$

$\Rightarrow P = -3D$.

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

$\Rightarrow P = 1D$

$v = 2m$ $u = 25\ cm = \frac{25}{100} m$ $\frac{1}{f} = \frac{1}{2} - \frac{100}{25}$

$P = 3.5\ D$

So extra $-0.5D$ and addition $3.5D$ of bifocal lens required

1. Task

SAQ's

①

$u = \infty$; $v = F.P$
$= -25m$

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

$\Rightarrow \frac{1}{f} = -\frac{1}{25} - \frac{1}{\infty}$

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

$P = \frac{1}{f} = -\frac{1}{25} D$

$P = -0.04 D$

②

$u = -23cm$; $v = -69cm$

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

$\Rightarrow \frac{1}{f} = -\frac{1}{69} - (-\frac{1}{23})$

$= -\frac{1}{69} + \frac{1}{23}$

$= \frac{-1+3}{69}$

$\Rightarrow \frac{1}{f} = \frac{2}{69}$

$\Rightarrow f = \frac{69}{2} = 34.5cm$

③

The concave lens should form the image of the object at ∞ at a distance of 50cm

$v = \infty$; $u = -50cm$

From $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\Rightarrow \frac{1}{f} = \frac{1}{\infty} + \frac{1}{50}$ $\Rightarrow \frac{1}{f} = \frac{1}{50}$

$\Rightarrow P = 100 \frac{1}{50} = 0.02 cm$

$= 2D$

(4)

The person cannot see objects clearly beyond 200 cm

so far point = 200 cm; for the distant object $u = \infty$

Hence, he should use a lens of which form an virtual image of the distant object.

Using lens formula

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

$$\Rightarrow \frac{1}{f} = P = \frac{1}{-200} - \frac{1}{\infty} = \frac{-1}{200}$$

$$P = -0.5\,D$$

(5)

Given $u = -50$ cm; $v = -25$ cm

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

$$\Rightarrow \frac{1}{f} = \frac{-1}{50} - \frac{1}{(-25)} = \frac{-1}{50} + \frac{1}{25} =$$

$$\Rightarrow f = 50\,cm$$

Power $P = \frac{1}{f} = \frac{100}{50} = 2D$

(6)

Given $v = -2.5$ m; $u = \infty$

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

$$\Rightarrow \frac{1}{f} = -\frac{1}{2.5} - \frac{1}{\infty}$$

$$\Rightarrow \frac{1}{f} = \frac{-10}{25}$$

$$\Rightarrow P = \frac{1}{f} = -0.4\,D$$

(8)

$u = -25\,cm$; $P = 3D \Rightarrow f = \frac{3}{100}$ ~~cm~~ $\frac{100}{3}$ cm

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

$\Rightarrow \frac{3}{100} = \frac{1}{v} - \left[\frac{-1}{25}\right]$

$\Rightarrow \frac{3}{100} = \frac{1}{v} + \frac{1}{25}$

$\Rightarrow \frac{1}{v} = \frac{3}{100} - \frac{1}{25}$

$\Rightarrow \frac{1}{v} = \frac{3-4}{100} = \frac{-1}{100}$

$\Rightarrow v = -100\,cm = -1\,m$

(9)

$V = N \cdot P = -100\,cm$

$U = D = -25\,cm$

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

$\therefore \frac{1}{f} = -\frac{1}{100} - \left[-\frac{1}{25}\right]$

$\frac{1}{f} = -\frac{1}{100} + \frac{1}{25}$

$\frac{1}{f} = \frac{-1+4}{100} = \frac{3}{100}$ cm

$\Rightarrow f = \frac{100}{3}$ cm.

Power $= \frac{1}{f}$ m $= \frac{100}{\frac{100}{3}}$

$P = 3D$

(10)

$F \cdot P = -80\,cm$

$\frac{1}{f} = \frac{1}{F \cdot P} \Rightarrow \frac{-1}{80\,cm}$

$P = \frac{100}{f} = \frac{100}{-80} = -\frac{5}{4}$

$P = -1.25D$

concave lens

(7)

we know $P = \frac{1}{f}$: $P = -0.8D$

$\Rightarrow \frac{1}{f} = -0.8 \Rightarrow f = -\frac{1}{0.8} \times m = \frac{-100}{0.8}$

$\Rightarrow f = -125\,cm$

For Near point $v_1 = -15\,cm$; $u_1 = ?$

$\therefore \frac{1}{f} = \frac{1}{v_1} - \frac{1}{u_1} \Rightarrow \frac{-1}{125} = \frac{-1}{15} - \frac{1}{u_1}$

$\Rightarrow u_1 = -17\,cm$

For distant point $V_2 = -100\,cm$; $u_2 = ?$

$\therefore \frac{1}{f} = \frac{1}{V_2} - \frac{1}{u_2} \Rightarrow \frac{-1}{125} = \frac{-1}{100} - \frac{1}{u_2}$

$\Rightarrow u_2 = -500$ cm

Range is $17 \rightarrow 500$ cm

(16)

$f = -70\,cm$ → concave lens → so the person is suffering from myopia

$u = \infty$

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\qquad v = f = -70\,cm$

$\Rightarrow \frac{1}{f} = \frac{1}{v} - \frac{1}{\infty}$

$\Rightarrow \frac{1}{f} = \frac{1}{v}$

(17)

Given $f = 60\,cm$; $D = 25\,cm$; $N.P = x = ?$

$f = \frac{xD}{x-D}$

$\Rightarrow 60 = \frac{x \times 25}{x-25}$

$\Rightarrow 12 = \frac{5x}{x-25}$

$\Rightarrow 12(x-25) = 5x$

$\Rightarrow 12x - 12 \times 25 = 5x$

$\Rightarrow 12x - 5x = 12 \times 25$

$\Rightarrow 7x = 12 \times 25$

$\Rightarrow x = \frac{12 \times 25}{7} = 43\,cm$