Name: Nidhi Saran John Subject: Physics Reg. No.: .....

Light - Numericals.

Date: 12/11/20

1. $f = 25\,cm$
$= 0.25\,cm$
Power of a lens $= \frac{1}{f\,(in\ meters)}$

$\therefore$ power $= \frac{1}{-0.25}\,D$ //

2. $r = 30\,cm$
$h_o = 5\,cm$
$u = -10\,cm$

$f = \frac{r}{2}$

$= \frac{30}{2} = -15\,cm$

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

$\frac{1}{-15} = \frac{1}{v} + \frac{1}{-10}$

$\Rightarrow \frac{1}{-15} + \frac{1}{10} = \frac{1}{v}$

$= \frac{10-15}{-150} = \frac{1}{v} \Rightarrow \frac{-5}{-150} = \frac{1}{v}$

$\Rightarrow \frac{1}{30} = \frac{1}{v}$

$\therefore v = 30\,cm.$

$m = \frac{-v}{u} = \frac{h_i}{h_o}$

$= \frac{+(30)}{+(10)} = \frac{h_i}{5}$

$= h_i = \frac{150}{10}$

$\therefore h_i = 15\,cm$

$\therefore$ the positio is 30 cm from the mirror and the size is 15cm, of the image.

3. Given: power(x) + power(y) = 5D

focal length of x = 15cm = 0.15m

$P = \frac{1}{f}$ (in m)

∴ power of $x = \frac{1}{-0.15}$ D //

∴ power (x) +

$\Rightarrow \frac{1}{-0.15} + y = 5D$

$= y = 5 + \frac{1}{0.15}$

$= \frac{0.75 + 1}{0.15} \Rightarrow \frac{1.75}{0.15} = \frac{0.35 \times 100}{0.3 \times 100}$ 1.16 D

$= \frac{35}{30} \Rightarrow \frac{7}{6} \Rightarrow 1.16D$

∴ power of y = 1.16D

$f = \frac{1}{P}$

∴ focal length of $y = \frac{1}{1.16}$ m //

- done in the end.

4. Convex lens: $P_1 = 6D$

Concave lens: $P_2 = 10D$

∴ Power of combination = $P_1 + P_2$

= 6D + 10D

= 16D

focal length of convex lens = $\frac{1}{6}$ m

focal length of concave lens = $\frac{1}{10}$ m $\{\because f = \frac{1}{P}\}$

∴ focal length of combination = $\frac{1}{6} + \frac{1}{10} = \frac{10+6}{60} = 0.267$ m

= 26.7 cm

5. m = 3

u = -15 cm

f = ?

$m = \frac{v}{u}$

$-3 = \frac{v}{-15}$

∴ v = 45 cm

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

$= \frac{1}{45} + \frac{1}{15}$

$\frac{1}{f} = \frac{1+3}{45}$

∴ f = 4/4 cm

∴ $f = \frac{45}{4}$

= 11.25 cm

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6. $u = -2m = -200\,cm$

$m = \frac{1}{4} = 0.25$

$m = \frac{v}{u}$

$0.25 = \frac{v}{-200}$

$v = 0.25 \times -200$

$\therefore v = -50\,cm$

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

$\frac{1}{f} = \frac{1}{-50} + \frac{1}{200}$

$= \frac{-4+1}{200} \Rightarrow \frac{-3}{200}$

$\therefore f = \frac{-200}{3}$

$= -66.67\,cm$

25 × 2 = 50.00

6.66
3) 20
18
2

7. $f = 5cm$

$v = +20cm$

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

$\frac{1}{+20} - \frac{1}{u} = \frac{1}{5}$

$\frac{1}{+20} - \frac{1}{5} = \frac{1}{u} \Rightarrow \frac{5-20}{-100} \Rightarrow \frac{5-20}{-100} \Rightarrow \frac{15}{-100} = \frac{3}{-20}$

$\therefore u = -6.66 = -6.67\,cm$

∴ the object should be placed 4 cm from the lens.

8. $f = -10cm$

$h_o = 2cm$

$h_i = 6cm$

$m = \frac{h_i}{h_o} = \frac{-v}{u}$

$= \frac{6}{2} = 3$

$\frac{-v}{u} = 3$

$\therefore v = -3u$

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

$= \frac{1}{-10} = \frac{1}{-3u} + \frac{1}{u}$

$\Rightarrow \frac{1}{10} = \frac{-u+3u}{3u^2}$

$= \frac{1}{10} = \frac{-2u}{3u^2}$

$= \frac{1}{10} = \frac{-2}{3u}$

$= 3u = -20$

$\Rightarrow u = \frac{-20}{3}$

$\therefore u = -6.67\,cm$

9. $v = -50\ cm$

$u = -20\ cm$

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

$= \frac{1}{-50} - \frac{1}{-20} \Rightarrow \frac{1}{-50} + \frac{1}{20}$

$= \frac{-2+5}{100} \Rightarrow \frac{3}{100}$

$\therefore f = \frac{100}{3}$

$\therefore f = 33.34\ cm$

10. $f = +10cm$

$u = -5cm$

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

$= \frac{1}{10} = \frac{1}{v} + \frac{1}{-5}$

$= \frac{1}{v} = \frac{1}{10} + \frac{1}{5} \Rightarrow \frac{1}{v} = \frac{1+2}{10} = \frac{3}{10}$

$\therefore v = \frac{10}{3}$

$= 3.3cm$.

$m = \frac{-v}{u}$

$= \frac{-3.33}{-5} = \frac{3.33}{5}$

$\therefore m = 0.61$

11. $h_o = 2.5cm$

$u = 25cm$

$f = 20cm$

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

$\Rightarrow \frac{1}{20} = \frac{1}{v} + \frac{1}{(-25)}$

$= \frac{1}{v} = \frac{1}{20} + \frac{1}{25}$

$\Rightarrow \frac{1}{v} = \frac{5+4}{100}$

$= \frac{9}{100}$

$v = \frac{100}{9}$

$\therefore v = 11.12\ cm$

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$$m = \frac{h_i}{h_o} = \frac{(-v)}{u}$$

$$\Rightarrow \frac{h_i}{2.5} = \frac{-11.12}{-25}$$

$$h_i = \frac{+11.12 \times 2.5}{+25}$$

$$\therefore h_i = 11.12 \text{ cm}$$

∴ the position, the image is placed 11.12 cm from the mirror and has the size of 11.12 cm, the nature of the image is virtual and erect.

12. Convex lens:

$f = 10$ cm

$m = 2$

$$\rightarrow m = \frac{v}{u}$$

$v = 2u$ (∵ given)

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

$$\frac{1}{10} = \frac{1}{2u} - \frac{1}{u} \Rightarrow \frac{1}{10} = \frac{u - 2u}{2u^2}$$

$$\Rightarrow \frac{1}{10} = \frac{-u}{2u^2}$$

$$= 2u = -10$$

$$\Rightarrow \therefore u = -5 \text{ cm}$$

$$\therefore v = 2(-5)$$

$$= -10$$

∴ the object should be placed at a distance of -5 cm.

13. $f = 5cm = 0.05m$

power of lens $= \frac{1}{f \text{ (in meter)}}$

$\therefore P = \frac{1}{0.05} D$

$\therefore$ power of the lens is $\frac{1}{0.05} D$ and the lens is a converging or a convex lens.

14. $P_1 = -5D$

$P_2 = +7.5D$

Power of combination $= P_1 + P_2$

$= (-5D) + 7.5D$

$= \underline{2.5D}$.

$\therefore$ the combination acts as a convex lens.

15. $h_o = 10cm$

$u = -36cm$

$f = -12cm$

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

$\frac{1}{-12cm} = \frac{1}{v} + \frac{1}{(-36cm)} \Rightarrow \frac{1}{v} = \frac{1}{-12} + \frac{1}{36}$

$= \frac{-3+1}{36}$

$= -2/36$

$= -1/18$

$\therefore v = -18cm$

$m = \frac{hi}{ho} = \frac{-v}{u}$

$= \frac{hi}{10} = \frac{-(-18)}{-12}$

$\Rightarrow hi = \frac{18 \times 10}{-36} = -5$

$\therefore hi = -5cm$

$\longrightarrow$ $\therefore$ the position of the image is $-18cm$ from the mirror, it's size is $-5cm$ and its real and inverted.

3. power (x) + power (y) = 5D

$f(x) = 15\text{cm} = 0.15\text{m}$

$\therefore$ power of lens $x = \frac{1}{-0.15}$ D

→ focal length of combination $= \frac{1}{5}$ m

$f = f_1 + f_2$

$\frac{1}{5} = 0.15 + f_2$

$\Rightarrow -f_2 = 0.15 - \frac{1}{5}$

$-f_2 = 0.15 - 0.2$

$\therefore f_2 = 0.05$

$\therefore$ power of lens $y = \frac{1}{0.05}$ D

$\therefore$ the focal length of y is 0.05 m or 5cm.