ASSIGNMENT

1) $u = (-45\text{cm})$

$v = 90\text{cm}$

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

$$\Rightarrow \frac{1}{90} - \frac{(-1)}{45} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{90} + \frac{1}{45} = \frac{1}{f}$$

$$\Rightarrow \frac{1+2}{90} = \frac{1}{f}$$

$$\Rightarrow \frac{3}{90_{30}} = \frac{1}{f}$$

$$\Rightarrow f = 30\text{ cm}$$

$\therefore$ focal length of the convex lens is 30 cm.

$$m = \frac{v}{u} = \left(\frac{-2}{\cancel{-90}\ -45}\right) = (-2)$$

$$m = \frac{h'}{h}$$

$$\frac{h'}{h} = (-2) \Rightarrow \frac{h'}{5} = (-2) \Rightarrow h' = (-10\,cm)$$

$\therefore$ height of img. is (-10 cm) and img. is real and inverted.

$u = (-45\ cm)$ $v = 90cm$, $f = 30cm$

when the object is moved 5cm away, from the lens.

$u = -(45 + 5)cm = (-50\,cm)$

$$\frac{1}{v'} = \frac{1}{f} + \frac{1}{u'} = \frac{1}{30} + \frac{1}{(-50)} = \frac{1}{30} - \frac{1}{50}$$

$$= \frac{5 - 3}{150} = \frac{2}{150} = \frac{1}{75}$$

$v' = 75\ cm.$

2) $P_1 = 3D \qquad P_2 = (-1.5D)$

$P_n = P_1 + P_2 = 3D + (-1.5D) = (+1.5D)$

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

$\Rightarrow 1.5D = \frac{1}{f}$

$\Rightarrow \frac{15}{10} = \frac{1}{f} \Rightarrow f = \frac{10}{15} \Rightarrow f = \left[\left(\frac{2}{3}\right)100\right] cm$

$\Rightarrow f = \frac{200}{3} cm$

∴ convex lens as power is positive.
focal length is $(200/3)$ cm.

Combined power $= (+1.5D)$

3) Concave lens, focal length $= (-25cm) = 0.25 m$

Power $= \frac{1}{f} = \frac{-1}{25cm}$

$= \left(\frac{-1}{0.25}\right) m = \frac{-1}{\frac{25}{100}} = -4D$

In Combination,

Object distance = (-20 cm)

Image distance = v

$$\text{magnification} = \frac{\text{height of image}}{\text{height of object}} = \frac{v}{u}$$

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

$$5 = \frac{v}{(-20)}$$

$$\Rightarrow \quad v = (-100\ \text{cm})$$

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

$$m = \frac{v}{u} \Rightarrow m = \frac{f}{f+u}$$

$$\Rightarrow \quad (-5) = \frac{f}{f-0.2}$$

$$\Rightarrow \quad f = = 1-5f$$

$$\Rightarrow \quad 6f = 1$$

$$\Rightarrow \quad f = 1/6$$

$P_{comb} = P_1 + P_2$

$\Rightarrow \frac{1}{(1/6)} = \frac{1}{0.25} + \frac{1}{f_2}$

$\Rightarrow 6 = 4 + \frac{1}{f_2}$

$\Rightarrow 1/f_2 = 2$

$\Rightarrow f_2 = 1/2 = 0.5\,m$

Convex lens as f is (+ve).

focal length = 0.5m

4) Total power = (Power 1) + (Power 2)

$P_{net} = P_1 + P_2$

(i) focal length = 20cm = 0.2m = $\frac{2}{10}$

$= \frac{1}{5}\,m$

$P = \frac{1}{f} = \frac{1}{(1/5)} = 5\,D$

So $P_1 = 10\,D$ and $P_2 = (-5D)$.

(ii) focal length = (-10cm) = (-0.1m)

$= \left(\frac{-1}{10}\right)m$

$P = \frac{1}{f} = \frac{1}{-\left(\frac{1}{10}\right)} = (-10)\,D$

So $P_1 = (-20)D$ and $P_2 = (+10D)$

(iii) focal length = (-20cm) = (-0.2m)

$= \left(\frac{-2}{10}\right)m = \left(\frac{-1}{5}\right)m$

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

So $P_1 = (-10D)$ and $P_2 = (+5D)$

(iv) focal length = $(20/3\ cm) = \left(\frac{20}{300}\right)m$

$= \left(\frac{2}{30}\right)m$

$P = 1/f = \left(\frac{\frac{15}{30}}{2}\right)D = 15D$

Either $P_1 = 20D$, $P_2 = (-5D)$

Or $P_{0.1} = 10D$; $P_2 = 5D$