

Short Answer type question

11) b) $f = -15 \text{ cm}$
 $u = -10 \text{ cm}$
 $v = ?$

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

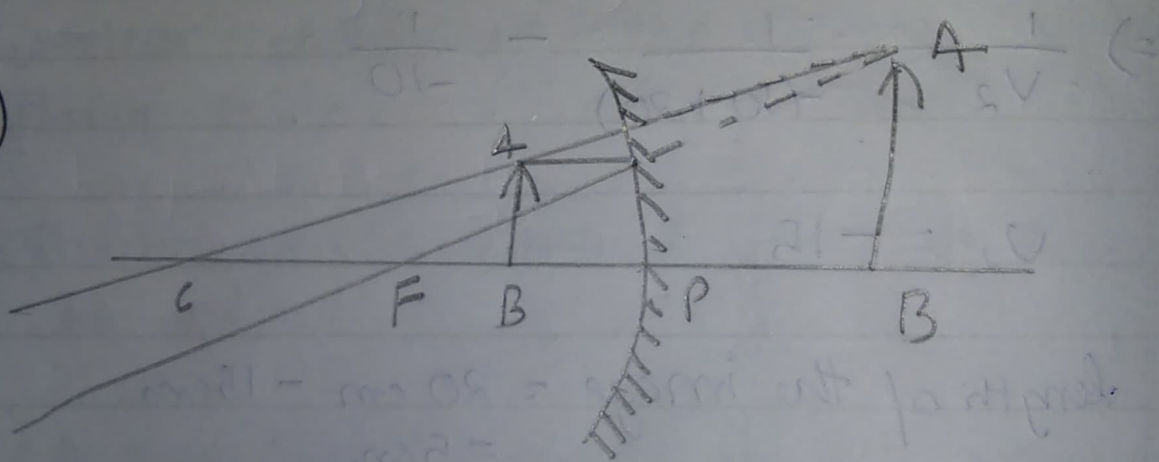
$$\frac{1}{v} + \frac{1}{-10} = \frac{1}{-15}$$

$$\frac{1}{v} = \frac{1}{15} + \frac{1}{10} = \frac{1}{30}$$

$$v = 30 \text{ cm}$$

c) Characteristics of image formed is virtual and erect.

a)



12) $h_1 = 10 \text{ cm}$

$u = 24 \text{ cm}$

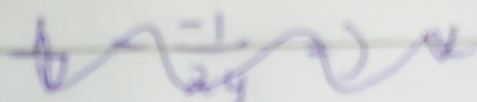
$f = 12 \text{ cm}$

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

$$\frac{1}{v} + \frac{1}{-24} = \frac{1}{-12}$$

$$\frac{1}{v} = \frac{-1}{24} \Rightarrow v = -24 \text{ cm}$$

$$m = \frac{h_2}{h_1} = \frac{-v}{u} = \frac{-(-24)}{-24} = \frac{24}{-24} = -1$$


$$\frac{-1}{24}$$

$$\frac{h_2}{h_1} = -1$$

$$h_2 = -1 \times h_1$$

$$h_2 = -10 \text{ cm}$$

13) $f = -10 \text{ cm}$

$$h_1 = 2 \text{ cm}$$

$$h_2 = 6 \text{ cm}$$

$$u = ?$$

$$m = \frac{h_2}{h_1} = \frac{6}{2} = 3$$

$$m = -\left(\frac{v}{u}\right) = 3$$

$$3u = -v$$

$$v = (-3u)$$

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

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

$$\frac{1}{u} \left(1 - \frac{1}{3}\right) = \frac{1}{-10}$$

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

$$u = -6.66 \text{ cm}$$

$$14) u = 15 \text{ cm}$$

$$v = 10 \text{ cm}$$

$$f = ?$$

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

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

$$\frac{1}{f} = \frac{1}{10} + \frac{1}{15} = \frac{-3-2}{30}$$

$$= \frac{-5}{30} = \frac{-1}{6}$$

$$f = -6 \text{ cm}$$

15)

Given,

$$h_1 = -3 \text{ cm}$$

$$u = -8 \text{ cm}$$

$$h_2 = 6 \text{ cm}$$

$$M = \frac{h_2}{h_1} = \frac{-v}{u}$$

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

$$M = \frac{h_2}{h_1} = \frac{4.5}{3} = 1.5$$

$$M = \frac{-V}{U} = 1.5$$

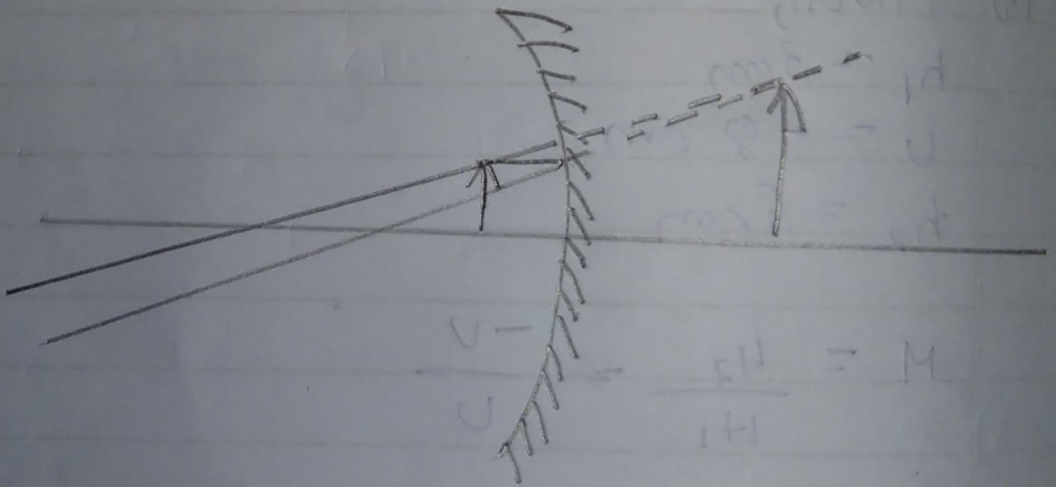
$$W = 1.5 \times U$$

$$= 1.5 \times -8$$

$$= -12 \text{ cm}$$

$$\frac{1}{f} = \frac{1}{12} - \frac{1}{8} = \frac{2-3}{24} = -\frac{1}{24}$$

$$f = -24 \text{ cm}$$



$$16) \quad h_2 = -4 \text{ cm}$$

$$h_1 = 2 \text{ cm}$$

$$U = -20 \text{ cm}$$

$$i) \quad v = ?$$

$$m = \frac{h_2}{h_1} = -\frac{v}{u}$$

$$\Rightarrow \frac{-4}{2} = \frac{-v}{-20}$$

$$v = -40 \text{ cm}$$

ii) $f = ?$

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

$$\frac{1}{-40} + \frac{1}{-20} = \frac{1}{f}$$

$$\frac{1}{f} = \frac{1}{-40} - \frac{1}{20} = \frac{1}{f}$$

$$\frac{1}{f} = \frac{1}{-40} - \frac{1}{20} = \frac{-1-2}{40} = \frac{-3}{80}$$

$$f = -26.6 \text{ cm}$$

17) $h_1 = 9 \text{ cm}$

$$u = 20 \text{ cm}$$

$$f = 18 \text{ cm}$$

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

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$
$$= \frac{1}{-18} - \frac{1}{-27}$$

$$-\frac{1}{18} + \frac{1}{27} = \frac{-3+2}{54} = -\frac{1}{54}$$

$$v = -54 \text{ cm}$$

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

$$\frac{-54}{-27} = \frac{h_2}{9}$$

$$h_2 = -18 \text{ cm}$$

18) $u = 10 \text{ cm}$

$$f = 20 \text{ cm}$$

$$H \text{ height} = 3 \text{ cm}$$

By formula we get

$$v = 20 \text{ cm}$$

∴ The image formed is behind the converging mirror; virtual & erect; 6cm high.

$$19) \quad f = 4\text{cm}$$

$$u = 2\text{cm}$$

$$v = 9\text{cm}$$

By formula we get that, $v = -2.2\text{cm}$

Height we get = 1.6cm

$$20) \quad \text{Given}$$

$$u = 20\text{cm}$$

$$m = -4$$

$$a) \quad m = \frac{-v}{u}$$

$$= 4 = \frac{-v}{-20}$$

$$v = -80\text{cm}$$

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

$$\frac{1}{-80} + \frac{1}{-20} = \frac{1}{f}$$

$$\frac{1}{f} = -\frac{1}{80} - \frac{1}{20} = \frac{-1-4}{80} = -\frac{1}{16}$$

$$f = -16 \text{ cm}$$

b) $m = 4 \text{ cm}$

$$f = 15 \text{ cm}$$

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

$$4 = \frac{-v}{u} \Rightarrow v = -4u$$

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

$$\frac{1}{-4u} + \frac{1}{u} = \frac{1}{-15}$$

$$\frac{-1 + 4}{4u} = -\frac{1}{15}$$

$$u = 11.25 \text{ cm}$$

21) $R = 3 \text{ cm}$

$$m = ?$$

$$f = \frac{R}{2} = \frac{-3}{2} = -1.5 \text{ (m)}$$

$$m = 6 = \frac{-v}{u} \Rightarrow v = -6u$$

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

$$\frac{1}{-6u} + \frac{1}{u} = \frac{1}{-1.5}$$

$$\frac{5}{6u} = \frac{-1}{1.5}$$

$$u = \frac{5 \times 1.5}{6} = -1.25$$

22) $v = -10 \text{ m}$
 $f = 0.75 \text{ m}$

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

$$\frac{1}{v} + \frac{1}{-10} = \frac{1}{-0.75}$$

$$\frac{1}{v} = \frac{1}{10} - \frac{1}{0.75} = \frac{1}{10} - \frac{100}{75}$$

$$\frac{1}{10} - \frac{4}{3} = \frac{3-40}{30} = -\frac{37}{30}$$

$$v = \frac{-30}{37} \approx -0.81 \text{ m}$$

23) Radius of curvature = 30 cm

$$R = \frac{R}{2} = \frac{30}{2} = 15 \text{ cm}$$

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

$$\frac{1}{v} + \frac{1}{-20} = \frac{1}{-15}$$

$$\frac{1}{v} = \frac{1}{20} - \frac{1}{15}$$

$$\frac{1}{v} = \frac{-5}{300}$$

$$v = -60 \text{ cm}$$

$$m = \frac{h_2}{h_1} = \frac{-v}{u}$$

$$\frac{h_2}{5} = \frac{-60}{-20}$$

$$h_2 = -15 \text{ cm}$$

24) $m = -3$

$$u = 10 \text{ cm}$$

$$R = ?$$

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

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

$$v = -30 \text{ cm}$$

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

$$\frac{1}{30} + \frac{1}{-10} = \frac{1}{f}$$

$$\frac{-20}{300} = \frac{1}{f}$$

$$f = -15 \text{ cm}$$

$$25) \frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$$\frac{1}{v} + \frac{1}{-300} = \frac{1}{-100}$$

$$\frac{1}{v} = \frac{1}{300} - \frac{1}{100}$$

$$\frac{1}{v} = \frac{-200}{30000}$$

$$\frac{1}{v} = \frac{-2}{300}$$

$$v = -150 \text{ mm}$$

$$m = \frac{-v}{u} = \frac{h_2}{h_1}$$

$$\frac{-150}{-300} = \frac{h_2}{100}$$

26) Radius of curvature = 40 cm

$$F = \frac{R}{2} = \frac{40}{2} = 20 \text{ cm}$$

$$f = -20 \text{ cm}; \quad m = \frac{-1}{4}$$

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

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

$$u = 4v$$

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

$$\frac{1}{v} + \frac{1}{4v} = \frac{1}{-20}$$

$$\frac{5}{4v} = \frac{-1}{20}$$

$$v = \frac{-100}{4} = -25 \text{ cm}$$

$$u = 4v$$

$$= 4 \times -25$$

$$= -100 \text{ cm}$$

27) $u = -50 \text{ cm}$

$$m = \frac{-1}{2}$$

$$m = \frac{-v}{u} \Rightarrow \frac{-1}{2} = \frac{v}{-50}$$

$$v = -25 \text{ cm}$$

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

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

$$\frac{-3}{50} = \frac{1}{f}$$

$$f = -\frac{50}{3} \text{ cm}$$

$$m = -\frac{1}{8}$$

$$f = -\frac{50}{3} \text{ cm}$$

$$m = -\frac{1}{8} = -\frac{v}{u}$$

$$v = \frac{6}{8}$$

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

$$\frac{8}{v} + \frac{1}{u} = \frac{-3}{50}$$

$$\frac{9}{v} = \frac{-3}{50}$$

$$v = -150 \text{ cm}$$

28) a) The image distance from the pole is -30 cm, the nature and position of the image formed in each case is that image is formed at a distance of 30 cm in front of mirror; Real & inverted.

b) The image distance from the pole is $+6$ cm, the nature and position of the image formed in each case is that image is formed at a distance of 6 cm behind the mirror; Virtual & erect.

29) $h_2 = 1 \text{ cm} = 10 \text{ mm}$
 $h_1 = 2.5 \text{ mm}$
 $u = -5 \text{ cm} = -50 \text{ mm}$

$$m = \frac{h_2}{h_1}$$

$$m = \frac{-10}{2.5} \Rightarrow m = -4$$

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

$$-4 = \frac{v}{-50}$$

$$v = -200 \text{ mm}$$

$$u = -20 \text{ cm}$$

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

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

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

$$f = -4 \text{ cm}$$

$$\text{Radius of curvature} = 2f = -8 \text{ cm}$$

$$30) \text{ Radius of curvature } \cdot R = -60 \text{ cm}$$

$$R = \frac{R}{2} = \frac{60}{2} = 30 \text{ cm}$$

$$f = -30 \text{ cm}, u = -15 \text{ cm}$$

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

$$\frac{1}{v} + \frac{1}{-15} = \frac{1}{-30}$$

$$\frac{1}{v} = \frac{1}{15} + \frac{1}{-30}$$

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

$$v = 30 \text{ cm}$$

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

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