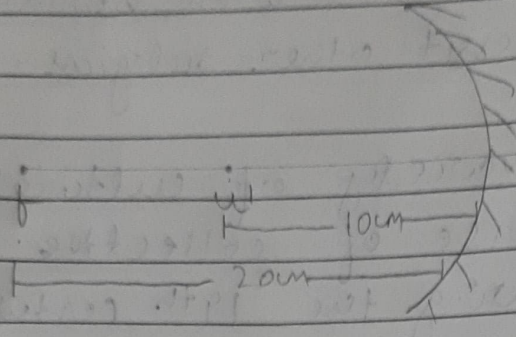


19/5/21

PHYSICS : LIGHT - Reflection and Refraction.

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11) a)



b) object distance (u) = -10 cm

focal length (f) = -20 cm

image distance (v) = ?

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

$$\frac{1}{v} = \frac{1}{-20} - \frac{1}{-10}$$

$$\Rightarrow \frac{-1+2}{20}$$

$$\Rightarrow \frac{1}{20}$$

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

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

c) i) virtual and erect

ii) magnified.

12) object dis (u) = -36 cm

(f) = -12 cm

(v) = ?

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{-12} - \frac{1}{-36} \Rightarrow \frac{-3+1}{36} \Rightarrow \frac{-2}{36}$$

$$\frac{1}{v} = \frac{-1}{18}$$

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

→ The position of image is 18 cm in front of concave mirror

→ nature - real and inverted

$$\text{height of image} = u$$

$$\Rightarrow \frac{u}{10} = \frac{18}{-36}$$

$$\Rightarrow -36u = 18 \times 10, \Rightarrow u = \frac{18 \times 10}{-36} = -5 \text{ cm}$$

13) height of image = ~~10 cm~~ 6 cm

height of object = ~~20 cm~~ 2 cm

$$\text{magnification} = \frac{h_i}{u_o} = \frac{6}{2} = 3 \text{ cm}$$

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

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

$$f = ?$$

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

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

$$\frac{-2-3}{30}$$

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

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

$$15) \quad u = -8 \text{ cm}$$

$$\text{height of object} = 3 \text{ cm}$$

$$\text{height of image} = 4.5 \text{ cm}$$

$$m = \frac{4.5}{3} = 1.5 \text{ cm}$$

$$i) \quad \text{let } u = u$$

$$\text{so } -\frac{u}{-8} = 1.5$$

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

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

$$ii) \quad f = ?$$

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

$$= \frac{1}{12} + \frac{1}{8}$$

$$= \frac{2+3}{24}$$

$$= \frac{5}{24} \Rightarrow f = \frac{24}{5} = 4.8 \text{ cm}$$

$$16) \quad \text{height of image} = 4 \text{ cm}$$

$$\text{height of object} = 1 \text{ cm}$$

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

$$m = \frac{h_i}{h_o} = \frac{-4}{1} = -4 \text{ cm}$$

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

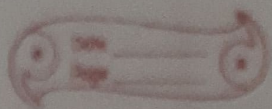
$$u = -80 \text{ cm}$$

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

$$17) \quad \text{height of object} = 4 \text{ cm}$$

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

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



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

$$= \frac{1}{18} + \frac{1}{-27}$$

$$= \frac{-3 + 2}{54}$$

$$= \frac{-1}{54} = -54 \text{ cm}$$

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

$$M = \frac{-v}{u} = \frac{-(-54)}{-27} = -2 \text{ cm}$$

$$\frac{h_i}{h_o} = M$$

$$-2 = \frac{h_i}{7}$$

$$h_i = -14 \text{ cm}$$

14 cm in front of mirror.

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

$$h_o = 3 \text{ cm}$$

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

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

$$= \frac{1}{-20} + \frac{1}{-10}$$

$$= \frac{-1 + 2}{20} = \frac{1}{20}$$

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

$$M = \frac{-v}{u} = \frac{-20}{-10} = 2 \text{ cm}$$

$$\frac{h_i}{h_o} = 2 \Rightarrow h_i = 6 \text{ cm} = \text{virtual and erect.}$$

19)

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

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

$$u = -9 \text{ cm}$$

$$v = ?$$

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

$$= \frac{1}{4} + \frac{1}{9}$$

$$= \frac{-9+4}{36}$$

$$= \frac{-5}{36}$$

$$v = \frac{-36}{5} = -7.2 \text{ cm}$$

The image formed is 7.2 cm in front of mirror.

$$h_i = u$$

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

$$\frac{u}{2} = \frac{-7.2}{-9}$$

$$9u = -7.2 \times 2$$

$$u = -0.8 \times 2$$

$$u = -1.6 \text{ cm}$$

so the size of image is 1.6 cm long.

~~21) $u = 20 \text{ cm}$~~

~~21) $u = 30 \text{ cm}$~~

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

$m = -3$

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

$\frac{-v}{-20} = -3$

$-v = 60$

$v = -60 \text{ cm}$

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

$= \frac{-1}{60} + \frac{1}{20}$

$= \frac{-1+3}{60}$

$= \frac{-2}{60} = \frac{-1}{30}$

$f = -30 \text{ cm}$

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

$f = -1.5 \text{ cm}$

$\frac{-v}{u} = 5$

$-v = 5u$

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

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

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

$u = -1.2 \text{ cm}$

$$22) R = 1.5M$$

$$f = 0.75M$$

$$u = -10M$$

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

$$= \frac{-4}{3} + \frac{1}{10}$$

$$= \frac{-40+3}{30}$$

$$= \frac{-37}{30}$$

$$= -1.2M$$

$$v = -1.2M$$

$$23) u = -20cm$$

$$f = 15cm$$

$$v =$$

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

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

$$= \frac{-4+3}{60} = \frac{-1}{60}$$

$$v = -60cm$$

$$m = \frac{v}{u} = \frac{60}{-20} = -3cm$$

$$h_o = 5cm$$

$$h_i = u$$

$$\frac{h_i}{5} = -3$$

$$h_i = -15cm \quad h_i = 15cm$$

24) $u = -10 \text{ cm}$
 $m = 3$
 $-\frac{v}{-10} = 3$

$v = 30 \text{ cm}$

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

$= -15 \text{ cm}$

$R = 2f = 2 \times 15 = 30 \text{ cm}$

25) $u = -30 \text{ cm}$
 $f = 10 \text{ cm}$
 $v =$

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

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

$= -15 \text{ cm}$

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

$$\frac{h_i}{5} = \frac{-(-15)}{-30}$$

$$\frac{h_i}{5} = -\frac{15}{30}$$

$3h_i = -75$

$h_i = -25$

so height of image = 25 cm.

$$28) a) u = -20 \text{ cm}$$

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

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

$$= \frac{-1}{12} + \frac{1}{20}$$

$$= \frac{-5+3}{60}$$

$$\Rightarrow \frac{-2}{60} = -30 \text{ cm}$$

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

Nature - Real and Inverted

$$b) u = -4 \text{ cm}$$

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

$$\frac{1}{v} = \frac{-1}{12} + \frac{1}{4}$$

$$= \frac{-1+3}{12} = \frac{2}{12} = 6 \text{ cm}$$

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

Nature - ~~virtual~~ virtual and erect

$$29) \text{ height of image} = 1 \text{ cm}$$

$$\text{height of object} = 0.25 \text{ cm}$$

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

$$1 \text{ cm} \propto v \text{ cm}$$

$$> 0 \quad \frac{-u}{-5} = \frac{-1}{0.25}$$

$$-0.25u = 5$$

$$-25u = 500$$

$$u = \frac{5 \times 100}{25} = -20 \text{ cm}$$

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

The image formed is 20 cm in front of mirror.

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

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

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

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

30) $u = -15 \text{ cm}$

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

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

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

$$= \frac{-1+2}{30}$$

$$= \frac{1}{30} = 30 \text{ cm}$$

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

$$M = \frac{v}{u} = \frac{30}{-15} = -2$$