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Q1.

u=-5cm, f=10cm
We know that

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

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

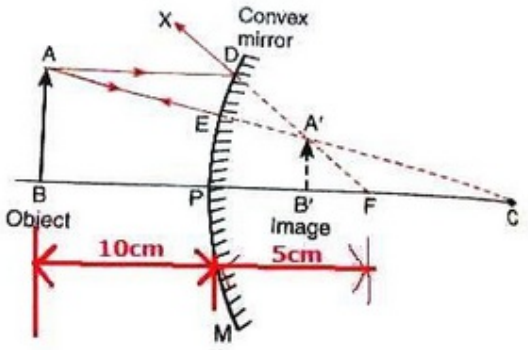
$$\Rightarrow \quad \frac{1}{v}=\frac{1}{10}+\frac{1}{5}=\frac{3}{10}$$

$$\therefore \quad v=\frac{10}{3}\text{cm}=3.33\text{cm}$$

The position of the image is 3.33 cm behind the convex mirror.
Magnification, m= -v/u = -3.33/-5 = 0.66
The image is virtual and erect.

Q2.

(i)



(ii) The image formed is diminished and erect.

(iii) u=-10cm, f=5cm

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

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

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

$$\therefore \quad v=\frac{10}{3}\text{cm}=3.33\text{cm}$$

Q3.

u=-6cm, f=12cm, v=?
We know that

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

$$\Rightarrow \quad \frac{1}{v}+\frac{1}{-6}=\frac{1}{12}$$

$$\Rightarrow \quad \frac{1}{v}=\frac{1}{12}+\frac{1}{6}=\frac{3}{12}=\frac{1}{4}$$

$$\therefore \quad v = 4\,cm$$

Image will be formed 4 cm behind the mirror.
Since the image is formed behind the convex mirror, it is virtual and erect.

Q4.

(a) u=-20cm, v=-15cm

We know that

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

$$\Rightarrow \quad \frac{1}{-15}+\frac{1}{-20}=\frac{1}{f}$$

$$\Rightarrow \quad \frac{1}{f}=-\frac{1}{15}-\frac{1}{20}=\frac{-4-3}{60}=-\frac{7}{60}$$

$$\therefore \quad f=-\frac{60}{7}\,cm$$

The mirror is a concave mirror.

(b) u=-20cm, v=15cm

We know that

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

$$\Rightarrow \quad \frac{1}{15}+\frac{1}{-20}=\frac{1}{f}$$

$$\Rightarrow \quad \frac{1}{f}=\frac{1}{15}-\frac{1}{20}=\frac{4-3}{60}=\frac{1}{60}$$

$$\therefore \quad f = 60\,cm$$

The mirror is a convex mirror.

Q5.

h_1=2.5cm, u=-25cm, f=20cm
We know that

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

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

$$\Rightarrow \quad \frac{1}{v}=\frac{1}{25}+\frac{1}{20}=\frac{4+5}{100}=\frac{9}{100}$$

$$\therefore \quad v=\frac{100}{9}\text{cm}=11.1\text{ cm}$$

The image is formed 11.1 cm behind the convex mirror.
Now,

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

$$\Rightarrow -\frac{11.1}{(-25)}=\frac{h_2}{2.5}$$

$$\Rightarrow h_2=\frac{11.1\times 2.5}{25}=1.11\text{ cm}$$

The image is virtual, erect and 1.11 cm tall.

Q6.

R=3m, u=-5m,

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

We know that

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

$$\Rightarrow \quad \frac{1}{v}+\frac{1}{-5}=\frac{1}{1.5}$$

$$\Rightarrow \quad \frac{1}{v}=\frac{1}{5}+\frac{2}{3}=\frac{3+10}{15}=\frac{13}{15}$$

$$\therefore \quad v=\frac{15}{13}\text{m}=1.15\text{m}$$

The image is formed 1.15 m behind the mirror.
The image is virtual and erect.

Q7.

R=40cm
f=R/2=40/2=20cm
Image is half the height of the object.

i.e. $m=-\frac{v}{u}=\frac{h_2}{h_1}=\frac{1}{2}$

$\Rightarrow u=-2v$

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

$\Rightarrow \quad \frac{1}{v}+\frac{1}{(-2v)}=\frac{1}{20}$

$\Rightarrow \quad \frac{1}{v}-\frac{1}{2v}=\frac{1}{20}$

$\Rightarrow \quad \frac{1}{2v}=\frac{1}{20}$

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

u=-2v=-2 x10=-20cm

So, the object is placed 20 cm in front of the mirror and the image is formed 10 cm behind the mirror.

Q8.

R=2m,

$f = \frac{R}{2} = 1\ m$

u=-3.5m

We know that

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

$\Rightarrow \quad \frac{1}{v} + \frac{1}{(-3.5)} = \frac{1}{1}$

$\Rightarrow \quad \frac{1}{v} = 1 + \frac{1}{3.5} = 1 + \frac{10}{35} = 1 + \frac{2}{7} = \frac{9}{7}$

$\therefore \quad v = \frac{7}{9} = 0.77\ m$

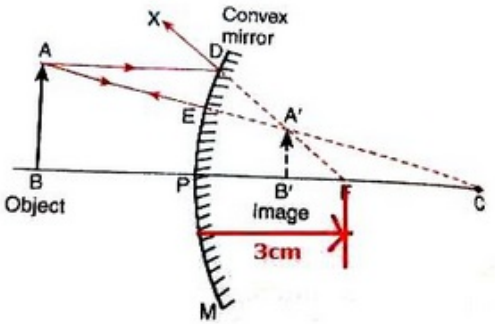
So, the image is formed 0.77m behind the mirror.

(b) Now, $m = -\frac{v}{u} = -\frac{0.77}{(-3.5)} = \frac{7/9}{3.5} = \frac{1}{4.5}$

As m is positive, so image formed is virtual and erect

Q9.

(a)



(b) h_1=1cm, u=-30cm, f=20cm, h_2=?, v=?

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

$\frac{1}{v} + \frac{1}{-30} = \frac{1}{20}$

$\frac{1}{v} = \frac{1}{30} + \frac{1}{20}$

v = 12cm

The image is formed 12 cm behind the mirror.

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

$m = -\frac{12}{-30} = \frac{h_2}{1}$

$h_2 = 0.4cm$

Q10.

(a) The mirror is of convex type.

(b)u=-5cm, m=1/10

We have

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

$$\Rightarrow \quad \frac{1}{10} = -\frac{v}{(-5)}$$

$$\Rightarrow \quad v = \frac{5}{10} = \frac{1}{2}m$$

Therefore,

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

$$\Rightarrow \quad \frac{1}{\frac{1}{2}} + \frac{1}{(-5)} = \frac{1}{f}$$

$$\Rightarrow \quad \frac{1}{f} = 2 - \frac{1}{5} = \frac{9}{5}$$

$$\therefore \quad f = \frac{5}{9}\ m$$

So, radius of curvature = $2f = \frac{10}{9}m$

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Q11.

(a)

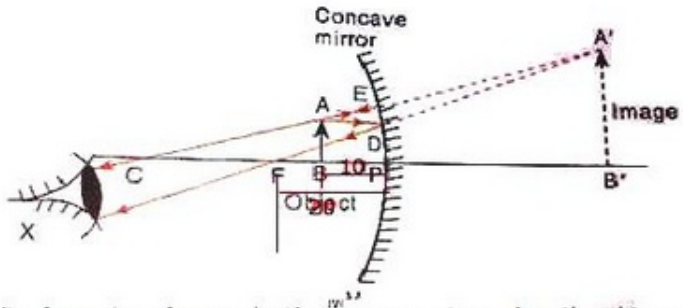

fig. formation of image by the concave mirror when the object is palced between its pole and focus.

(b) f=-20cm, u=-10cm, v=?
We know that

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

$$\Rightarrow \quad \frac{1}{v}+\frac{1}{(-10)}=\frac{1}{(-20)}$$

$$\Rightarrow \quad \frac{1}{v}=-\frac{1}{20}+\frac{1}{10}=\frac{1}{20}$$

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

(c) Characteristics of image formed
(i) Image is virtual.
(ii) Image is erect.

Q12.

u=-20cm
v=15cm (virtual image)
We know that

$$m=-\frac{v}{u}=-\frac{15}{(-20)}=0.75$$

The mirror used is of convex type.

********** END **********