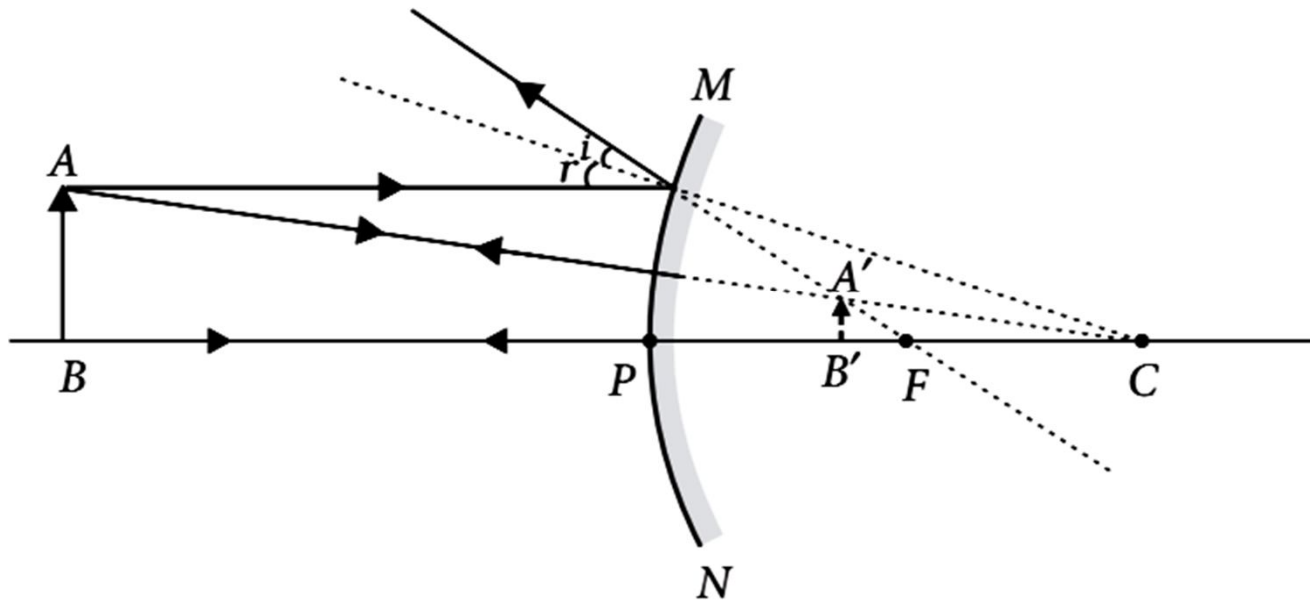


## CASE STUDY QUESTION 17

Read the following and answer any four questions from (i) to (v)

Convex mirrors are used as rear-view mirrors in vehicles. The image formed in a convex mirror is diminished (ray diagram is shown here) due to which it gives a wide field of view of the traffic behind the vehicle. Consider a convex mirror used on a moving automobile with radius of curvature 2 m and a truck is coming from behind it by maintaining a constant distance of 3.5 m.



(i) The distance behind the mirror where the image is formed is

- (a) 0.28 m                      (b) 1.5 m                      (c) 0.78 m                      (d) 7.8 m

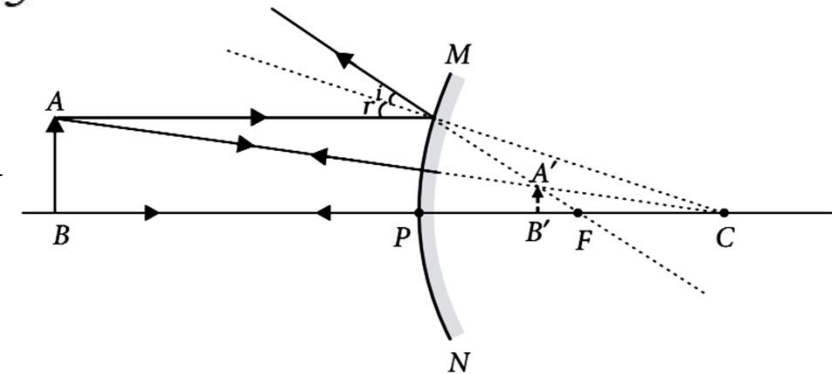
Radius of curvature,  $R = 2 \text{ m}$

$$\text{As } \frac{1}{f} = \frac{1}{v} + \frac{1}{u} \text{ and } R = 2F \Rightarrow \frac{2}{R} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{2}{2} = \frac{1}{v} + \frac{1}{-3.5}$$

$$\Rightarrow \frac{1}{v} = 1 + \frac{1}{3.5} \Rightarrow \frac{1}{v} = \frac{4.5}{3.5} \Rightarrow v = \frac{3.5}{4.5} \Rightarrow v = 0.78 \text{ m}$$

(ii) The nature of the image formed is

- (a) virtual and erect                      (b) real and inverted  
(c) real, erect and enlarged                      (d) none of these



**Ans: (a) virtual and erect**

(iii) The size of the image relative to the size of the truck is

(a) 0.30

(b) 0.5

(c) 0.78

(d) 0.22

$$\begin{aligned}\text{Magnification, } m &= -\frac{v}{u} = -\frac{0.78 \text{ m}}{(-3.5 \text{ m})} \\ &= 0.22\end{aligned}$$

(iv) The focal length of the mirror is

(a) 0.5 m

(b) 1 m

(c) 1.5 m

(d) 2 m

$$\begin{aligned}\text{Focal length of the mirror, } f &= \frac{R}{2} \\ &= \frac{2}{2} = 1 \text{ m.}\end{aligned}$$

(v) If instead of 3.5 m, truck maintains a distance of 2 m, the image formed will be

- (a) real, erect and diminished
- (b) virtual, inverted and diminished
- (c) real, erect and enlarged
- (d) virtual, erect and diminished

A convex mirror always produces a virtual, erect and diminished image.

**Ans: (d) virtual, erect and diminished**