

Question no 3

Car A and car B start moving simultaneously in the same direction along the line joining them. Car A moves with a constant acceleration  $a = 4 \text{ m/s}^2$ , while car B moves with a constant velocity  $v = 1 \text{ m/s}$ . At time  $t = 0$ , car A is 10 m behind car B. Find the time when car A overtakes car B.

**Solution** Given,  $u_A = 0$ ,  $u_B = 1 \text{ m/s}$ ,  $a_A = 4 \text{ m/s}^2$  and  $a_B = 0$

Assuming car B to be at rest, we have

$$u_{AB} = u_A - u_B = 0 - 1 = -1 \text{ m/s}$$

$$a_{AB} = a_A - a_B = 4 - 0 = 4 \text{ m/s}^2$$

-ve ← → +ve

Fig. 6.42

Now, the problem can be assumed in simplified form as shown below.

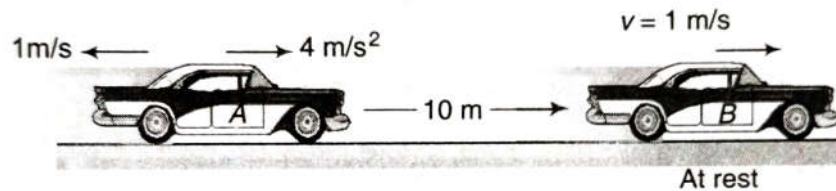


Fig. 6.43

Substituting the proper values in equation  $s = ut + \frac{1}{2} at^2$ ,

we get

$$10 = -t + \frac{1}{2} (4) (t^2)$$

or

$$2t^2 - t - 10 = 0$$

or

$$\begin{aligned} t &= \frac{1 \pm \sqrt{1 + 80}}{4} \\ &= \frac{1 \pm \sqrt{81}}{4} \\ &= \frac{1 \pm 9}{4} \end{aligned}$$

or

$$t = 2.5 \text{ s and } -2 \text{ s}$$

Ignoring the negative value, the desired time is 2.5 s.