Approximately, the stopping distance of a car travelling at v km/h is given by the expression 5/24(v +(v^2)/32)m (v is measured in km/h), the 1st term representing the `reaction' distance of the driver and the second the distance through which the brakes are actually applied. Two cars are 35 m apart when the 1st car, travelling at 45 km/h, makes an emergency stop. The driver of the second car has no prior warning of this hazard. Show that a collision must occur if the speed of a second car exceeds 71 km/h.

Solution

the stopping distance of the 1st car

$$S = \frac{5}{24}\left(45 + \frac{(45^2)}{32}\right) = 22{,}5 \text{ m}$$

on the other side

$$S = vt - \frac{at^2}{2}; v = at \gg S = vt - \frac{vt}{2} = \frac{vt}{2} \gg t = \frac{2S}{v}$$

time of stopping

$$t = \frac{2 * 22{,}5 * 3.6}{45} = 3.6 \text{ s}$$

So if the speed of a second car exceeds 71 km/h

$$S_2 = Vt = \frac{71}{3.6} * 3.6 = 71 \text{ m}$$

total distance of two cars for 3.6 s

$$S = S + S_2 = 22{,}5 + 71 = 93{,}5 \text{ m} > 35 \text{ m}$$

So a collision must occur if the speed of a second car exceeds 71 km/h.