



Initial velocity $u = 20 \text{ m/s}$

Final velocity $v = 0$ (\because car is brought to rest)

$t = 6 \text{ sec.}$

(1) Retardation (-ve acceleration)

$$v = u + at$$

$$0 = 20 + (a \times 6)$$

$$a = -3.33 \text{ m/s}^2$$

$$\text{retardation} = 3.33 \text{ m/s}^2$$

(2) Distance travelled.

$S =$ Distance travelled by the car after applying the brakes

$$S = ut + \frac{1}{2}(at)^2$$

$$S = (20 \times 6) + \frac{1}{2}(-3.33 \times 6^2) = 60 \text{ m.}$$

(P) A Train starts from rest and attains a velocity of 45 kmph. in 2 min with uniform acceleration. Calculate

(1) acceleration (2) Distance travelled in this time, 2 min

(3) Time required to reach a velocity of 36 kmph

$$u = 0 \quad v = 45 \text{ kmph}$$

$$v = \frac{45 \times 1000}{3600} \text{ m/s} = 12.5 \text{ m/s}$$

$$t = 2 \text{ min} = 2 \times 60 = 120 \text{ sec}$$

(1) Acceleration (a)

$$v = u + at$$

$$12.5 = 0 + (a \times 120)$$

$$a = 0.104 \text{ m/s}^2$$



(2) Distance travelled (s) in 2 mins.

$$s = ut + \frac{1}{2}at^2 = (0 \times 120) + \left(\frac{1}{2} \times 0.104 \times 120^2\right) \\ = 748.8 \text{ m.}$$

(3) Time required to attain velocity of 36 kmph

$$u = 0$$

$$v = 36 \text{ kmph} = \frac{36 \times 1000}{3600} = 10 \text{ m/s}$$

$$v = u + at$$

$$10 = 0 + (0.104 \times t)$$

$$t = 96.15 \text{ sec}$$

(P) A Burglar's car had a start with an acceleration of 2 m/s^2 . A police vigilant party came after 5 sec and continued to chase the burglar's car with a uniform velocity of 20 m/s . Find the time taken in which the police van will overtake the burglar's car?

Soln:

Initial velocity of Burglar's car = 0

acceleration of Burglar's car = 2 m/s^2

Police van came after 5 seconds of the start of Burglar's car

uniform velocity of police van = 20 m/s .

To find.

→ Time taken in which by the police van to overtake the Burglar's car

→ let $t \Rightarrow$ time taken by police to overtake the Burglar's car.



Motion of Burglar's car

$$u = 0 \quad a = 2 \text{ m/s}^2 \quad t = (t+5)$$

$$s = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2} \times 2 \times (t+5)^2$$

$$s = (t+5)^2$$

Motion of police van vigilant Party

$$\text{Uniform velocity} = 20 \text{ m/s}$$

⇒ Distance travelled by police van from the starting point of Burglar's car and to overtake it

$$s = \text{uniform velocity} \times \text{time taken} \\ = 20t$$

Police van overtakes the Burglar's car, hence the distance travelled by Burglar's car and police van should be equal

$$(t+5)^2 = 20t$$

$$t^2 + 25 + 10t - 20t = 0$$

$$t^2 - 10t + 25 = 0$$

$$t = \frac{10 \pm \sqrt{10^2 - (4 \times 1 \times 25)}}{2 \times 1} = \frac{10}{2} = 5 \text{ sec}$$



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