QUESTION:

A car is traveling at 13 m/s. The driver hits the brakes slowing down at the constant rate of 0.20 m/s2. How far does the car travel before it comes to a stop? How long did it take the car to stop after the brakes were pressed?

SOLUTION:

As a car moves with constant acceleration

$$\upsilon_{car} = \upsilon_0 - a \cdot t$$

Here $\upsilon_0 = 13 \ m/s$ is the initial speed of the car. When car comes to stop, its speed $\upsilon_{car} = 0$ and $t = t_{stop}$. Hence

$$0 = \upsilon_0 - a \cdot t_{stop}$$

$$t_{stop} = \frac{\upsilon_0}{a}$$

$$t_{stop} = \frac{13}{0.2} = 65 \ s$$

And the car travels

$$s = \upsilon_0 t_{stop} - \frac{a \cdot t_{stop}^2}{2}$$

$$s = 13 \cdot 65 - \frac{0.2 \cdot 65^2}{2} = 422.5 \ m$$

Another way to find the distance traveled by car is

$$s = \frac{\upsilon_{finall}^2 - \upsilon_0^2}{2a}$$

$$s = \frac{0 - 13^2}{-0.2} = 422.5 \ m$$

ANSWER:

422.5 meters

65 seconds