The driver of a car travelling at a constant speed of 72 kmph, seeing a procession ahead of him moving in the same direction, decelerates at a constant rate of 1m/s² until his speed is reduced to 3 kmph. He moves at this speed for 2 minutes until the procession takes a left turn. He then accelerates at a constant rate of 0.5 m/s² to his normal speed. Determine the total distance travelled during this time and the time lost.

Solution

72 km/h = 20 m/s

3 km/h = 0.83 m/s

Deceleration stage

$$t_1 = \frac{0.83 - 20}{-1} = 19.17\,s;$$

$$d_1 = \frac{0.83^2 - 20^2}{2 \times (-1)} = 199.66\,m$$

Motion at constant speed

$$t_2 = 120\,s;$$

$$d_2 = 120 \times 0.83 = 99.6\,m$$

Acceleration stage

$$t_3 = \frac{20 - 0.83}{0.5} = 38.34\,s;$$

$$d_1 = \frac{20^2 - 0.83^2}{2 \times 0.5} = 399.31\,m$$

Total distance

$$d = 199.66 + 99.6 + 399.31 = 698\,m$$

Time to move same distance at normal speed

$$t = \frac{698}{20} = 34.9\,s$$

Time lost

$$\Delta t = 19.17 + 120 + 38.34 - 34.9 = 142.61\,s = 2.4\,min$$

Answer: 698 m; 2.4 min.