Problem 12-11

A particle travels along a straight-line path such that in 4 s it moves from an initial position $s_A = -8$ m to a position $s_B = +3$ m. Then in another 5 s it moves from s_B to $s_C = -6$ m. Determine the particle's average velocity and average speed during the 9-s time interval.

Solution

The average velocity is the ratio of the net displacement to the time taken.

$$v_{\text{avg}} = \frac{s_{\text{final}} - s_{\text{initial}}}{t_{\text{final}} - t_{\text{initial}}} = \frac{-6 - (-8)}{9 - 0} \ \frac{\text{m}}{\text{s}} = \frac{2}{9} \ \frac{\text{m}}{\text{s}} \approx 0.222 \ \frac{\text{m}}{\text{s}}$$

The average speed is the ratio of the total distance to the time taken.

$$\frac{s_T}{\Delta t} = \frac{s_{A\to B} + s_{B\to C}}{t_{\text{final}} - t_{\text{initial}}} = \frac{(8+3) + (3+6)}{9 - 0} \ \frac{\text{m}}{\text{s}} = \frac{20}{9} \ \frac{\text{m}}{\text{s}} \approx 2.22 \ \frac{\text{m}}{\text{s}}$$