

Chapter 3 Problem 51 †

Given

$$\vec{r}_1 = \{2.2\hat{i} + 3.7\hat{j} - 1.2\hat{k}\} \mu m$$

$$\vec{r}_2 = \{4.6\hat{i} + 1.9\hat{k}\} \mu m$$

$$\Delta t = 6.2 \text{ s}$$

Solution

Find the average velocity of the bacterium.

$$\vec{v} = \frac{\Delta \vec{r}}{\Delta t} = \frac{\vec{r}_2 - \vec{r}_1}{\Delta t}$$

$$\vec{v} = \frac{\{4.6\hat{i} + 1.9\hat{k}\} \mu m - \{2.2\hat{i} + 3.7\hat{j} - 1.2\hat{k}\} \mu m}{(6.2 \text{ s})}$$

$$\vec{v} = \{0.387\hat{i} - 0.597\hat{j} + 0.500\hat{k}\} \mu m/s$$

The magnitude is then

$$\bar{v} = \sqrt{(\bar{v}_x)^2 + (\bar{v}_y)^2 + (\bar{v}_z)^2}$$

$$\bar{v} = \sqrt{(0.387)^2 + (-0.597)^2 + (0.500)^2} \mu m/s$$

$$\bar{v} = 0.87 \mu m/s$$

†Problem from Essential University Physics, Wolfson