

Name:

Date:

Lab 3 - Brownian Motion: Prelab

1. One of the main goals in this lab is to collect data to determine Boltzmann's constant, k_B . The equations describing how to do this are given in sections 3.3.2 and 3.3.3. The raw data that you will collect will be the x - and y -positions of suspended beads that you will track, i.e., you will have data of the form

$$x_{\text{data}} = [x_{t=0\text{s}}, x_{t=5\text{s}}, x_{t=10\text{s}}, \dots] \quad , \quad y_{\text{data}} = [y_{t=0\text{s}}, y_{t=5\text{s}}, y_{t=10\text{s}}, \dots].$$

The following is meant to help you with your data analysis. How will each of the following intermediary steps in calculating k_B be populated or calculated? You can fill out each entry symbolically, or simply give descriptions of how it will be found from previous steps.

$$\Delta x = [\quad \quad \quad],$$

$$\Delta y = [\quad \quad \quad],$$

$$\overline{(\Delta x)^2} =$$

$$\overline{(\Delta y)^2} =$$

$$\overline{(\Delta r)^2} =$$

$$D =$$

$$k_B =$$

2. Explain the purpose of the calibration slide in the lab. When you take your video capture data of bead position, what units do you think the raw data will be in? What units do you need your data to be in for your analysis? How is the calibration slide used to go from one set of units to the other?

3. In section 3.6.4, you will be making a scatter plot. What is the scatter plot of, i.e., what is on the scatter plot's x -axis and what is on the scatter plot's y -axis? What do the values on the x -axis represent in terms of your original data?