

MCDB 4550/5550
Molecular and Cellular Biophysics
Perkins
Assignment #4
Due Thursday, Feb 29th at end of class

Homework problems based on PHET simulation and Questions on paper

<https://phet.colorado.edu/en/simulations/optical-tweezers>

Click on the bead and pull it to the left and release. Neatly sketch the resulting position of the bead in the trap with respect to time (position vs time) with the simulation set to water and to vacuum.

Describe the two main qualitative differences between these cases and why.

1. Calibrating an optical trap. Click on the Histogram to make measurements. Measure the full width at half maximum value (FWHM) of the bead motion at 200, 400, 600 and 800 mW. Make sure you use enough points to have an accurate measurement. Using the equipartition theorem, calculate and then graph the trap stiffness as a function of laser power using units of pN/nm vs mW. Either use a graphing program or make a clearly labeled graph on graph paper. What curve best describes the data?

Neatly sketch the potential energy curve at these four different laser powers.

2. Set the trap to 200 mW. Turn on fluid controls. Measure the displacement of the bead from the center of the trap at 200, 400, and 600 microns/sec and then graph the displacement versus applied fluid flow and graph the answers. What curve best describes this data.

Questions on Paper:

1. Bring in three (3) well thought out question on about literature paper to class and hand them in.
2. Why wasn't limping seen in prior optical tweezer measurements?
3. What is limping?
4. Are the conclusions of the Hua et al paper from last week wrong? Be precise in your wording.