

Lab 4 Brownian Motion Tasks

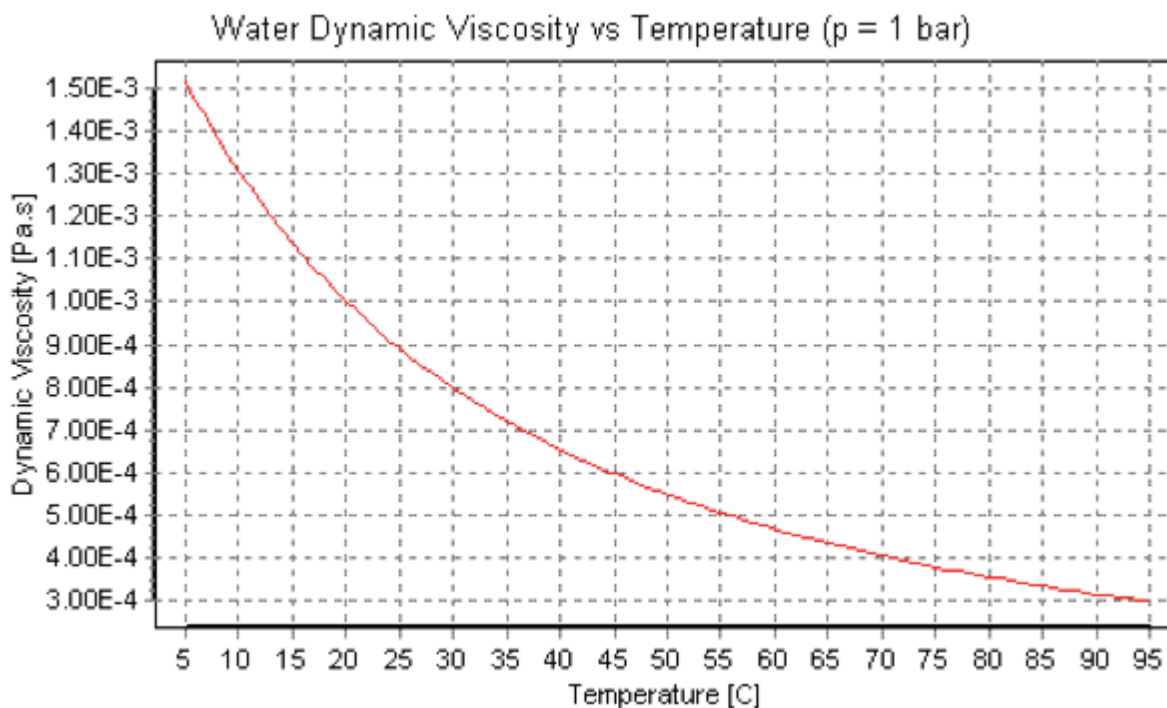
Lab report due Saturday, October 10th at 5pm

Read the whole of Ch. 1 in your Lyons text again (pp 1-39)

Equipment note: Please treat the microscope with utmost care. The higher magnification lenses are longer and you want to rotate them into position carefully and without striking the slide or its cover slip.

By taking 30 displacement measurements over 60 second intervals, determine the diffusion constant D of $d = 903 \text{ nm} \pm 12 \text{ nm}$ diameter polystyrene spheres in water using the formula $D = \frac{(\Delta x)^2}{2t}$, where Δx is the distance traveled by a sphere in one dimension in time t . Use your diffusion constant, Einstein's formula for Brownian motion diffusion of spherical particles $D = \frac{kT}{3\pi\eta d}$, and the graph below of water's viscosity η vs. temperature to determine Boltzmann's constant.

Separate from your lab report; collaborate with your peers in the time and space groups to collect all of the data that you take into one big data set and repeat the analysis for this data set. Does this improve your measurement of Boltzmann's constant? Why?



Used pipettes and cover slips can be discarded.

After completing your measurements, clean off your depression slide with alcohol over the sink. Remove excess alcohol with a Kim wipe and replace the depression slide in the blue box to dry.