BMC Prelab

1) Masses:
Based on Colloid data sheet

# of colloid	masses [g]	# of atoms in 1 pcl
5623	7.3329×10^{-11}	1.000209
6955	5.330×10^{-10}	0.9999694
5749	5.6643×10^{-13}	0.99976229
6082	4.2476×10^{-12}	0.1004592

$$\frac{\#\text{ of atoms}}{\text{pcl}} = \frac{\#\text{ of microspheres}}{\text{grams}} \left(\frac{\text{mass}}{\text{pcl}}\right) = \frac{\#\text{ of microspheres}}{\text{pcl}}$$

$$\text{mass} = \rho V = \rho \frac{4}{3}\pi r^3 = \rho \frac{4}{3}\pi \left(\frac{d \times 10^{-7}}{2}\right)^3$$

$$\text{mass} = 1.662 \frac{g}{cm^3} \quad \frac{4}{3}\pi \left(\frac{d \times 0.0001\ cm}{2}\right)^3$$

Gold 40 nm	2.988×10^{-12}
Gold 100 nm	3.2359×10^{-12}

Concentration to density conversion.

gold chloride mass = $303.3259 \frac{g}{mol}$

0.01% concentration

$\left(\frac{1}{100}\right) \cdot 100g = 1g$ (assume)

$\frac{1g}{303.325 \frac{g}{mol}} = 0.003296\ mol$

② Get simulated D

by $D = \frac{\langle |r(t+\tau) - r(t)|^2 \rangle}{2d\tau}$

from simulation

input a from q. given (N, pdf, τ, k

③ if N = 50 $\rightarrow$ $D = 4.1548 \times 10^{-13} \pm 1.8652 \times 10^{-14}$

we just substitute the N obtained from ②

④

N	10	100	1000
uncertainty	1.9166×10^{-15}	1.3308×10^{-15}	3.8537×10^{-16}

for the same d.

as N increase ∴ uncertainty increase

Additional sources of error: measurement & systematic instrumentation. (bulk flow)

~~Prelab~~

Mid lab #1 [signature] 1-28-2016

(2) BMC

Mid lab #2 [signature] 1-25-2016

Donald A. Glaser
Advanced Lab

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BMC Pre-Lab

PDF version

INCLUDE THIS SHEET AS THE FIRST PAGE OF YOUR REPORT.

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Partner's Name: Sissi Wong (Xiyue)

Before the 1st Day of Lab

Pre-lab Discussion Questions

t is your responsibility to discuss this lab with an instructor before your first day of your scheduled lab period. This signed sheet must be included as the first page of your report. Without it you will lose grade points. You should be prepared to discuss at least the following before you come to lab:

1. What are the masses of the various nanoparticles you will be observing in the lab? How many atoms are in a single particle? What is the uncertainty in these numbers? Data sheets for the nanoparticles are available on the **BMC Reprint List.**
2. Using the microscope, you will observe a minimum of two different size particles in at least four different viscosity solvents. Choose the conditions you plan to observe and simulate them in Matlab. (You should choose at least one particle 1 μm or larger and one smaller.)
3. Use your simulated data to calculate the diffusion coefficient, D in each case. Explain how you arrived at your answer.
4. What is the uncertainty of your estimate of D? How does it vary with the number of simulated data points? Explain your strategy for making observations in the lab. What additional sources of error (these are significant) will come in to play? How will you account for them?

Keep these scripts. When analyzing your data you can create artificial data sets on which to test your analysis techniques.

Staff Signature _____ Date 1/21/2016

Completed on *before the first* day of lab? (circle) Yes / No

Mid-lab Questions

On day 3 of this lab, you should have completed the following; Show them to an instructor and ask for a signature.

1. Mid-lab Questions Part I

2. Using a slide with a combination of 10μm and 0.44μm polystyrene spheres, show how to set up Köhler illumination.
3. How many nanometers per pixel are captured at 10x, 20x, and 40x?
4. Draw diagram of darkfield illumination. Explain how it is possible to see 40 nm objects with visible light (400-750 nm wavelengths).
5. Set up dark-field illumination.

Staff Signature _____ Date _____

Completed by the *second* day of lab? (circle) Yes / No

see next page for signature

Mid-lab Questions Part II

By day three of this lab, you should have collected some particle tracks and made several movies. Show one of the particle tracks to an instructor. What value of D did you calculate from the track? How close is this to the theoretical value? You can do this either with the BMC application or with the Matlab scripts. Show and explain your averaging and centroiding code. How do they work?

Staff Signature _____ Date _____

Completed by the *third* day of lab? (circle) Yes / No

Please also fill out the Student Evaluation of Experiment.

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